

Nervous control

Revision notes · The central and peripheral nervous systems, types of neurone, reflex arcs and how synapses pass impulses between neurones.

For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

Nervous control Spec 14.1

The nervous system and neurones Spec 14.1.1, 14.1.2, 14.1.3, 14.1.4

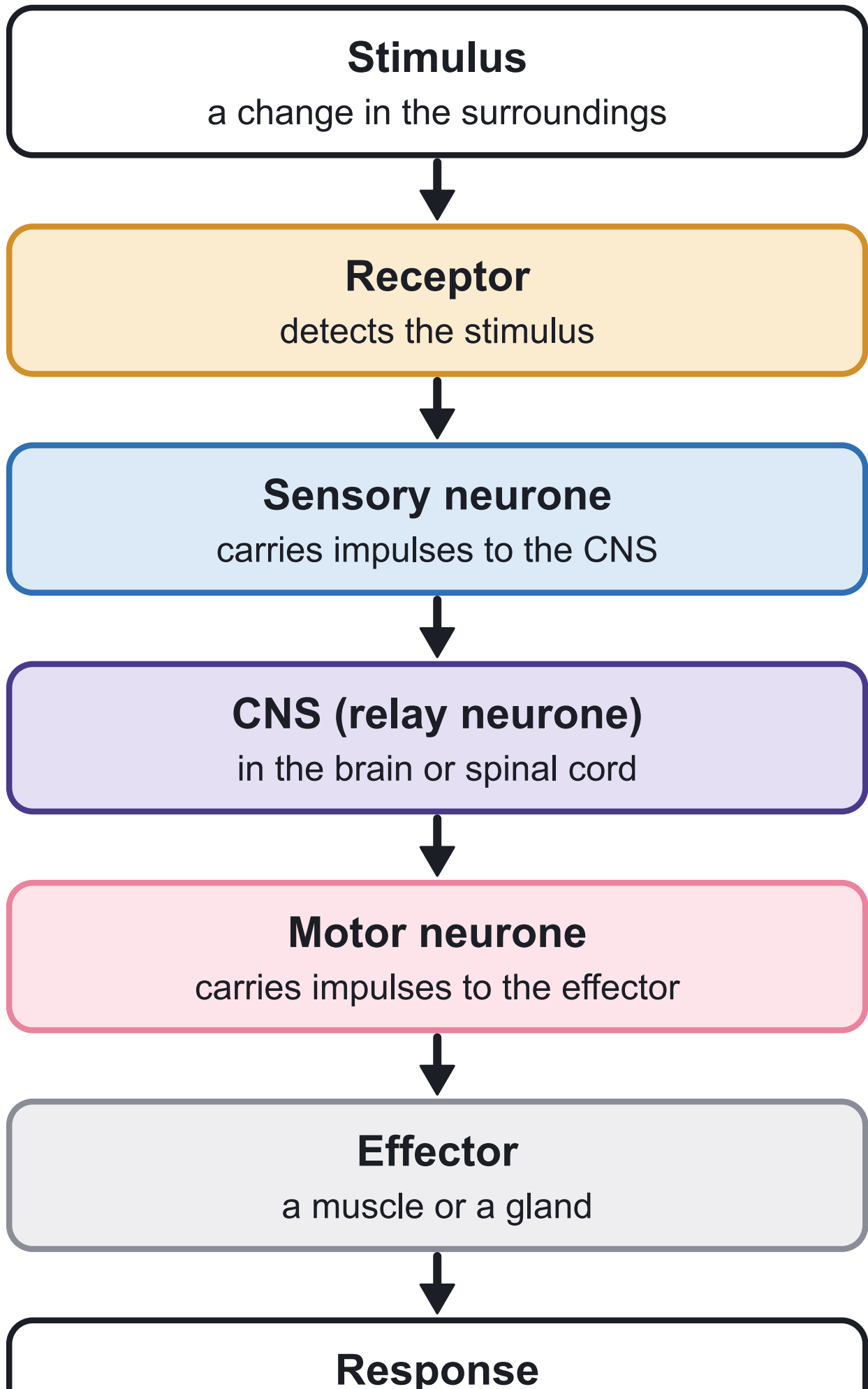
Electrical impulses travel along cells called **neurones**. Neurones carry information quickly between the parts of the body.

The mammalian nervous system has two parts.

- The **central nervous system (CNS)** consists of the **brain and the spinal cord**.
- The **peripheral nervous system (PNS)** consists of the **nerves outside of the brain and spinal cord**.

The role of the nervous system is the **coordination and regulation of body functions**. Receptors detect a change (a stimulus), impulses pass along neurones to the CNS, and the CNS sends impulses to effectors (muscles and glands), which produce a response.

1. Stimulus (a change in the surroundings)
2. Receptor detects the stimulus
3. Impulses travel along a sensory neurone to the CNS
4. The CNS coordinates the response
5. Impulses travel along a motor neurone to an effector
6. Effector (muscle or gland) produces the response

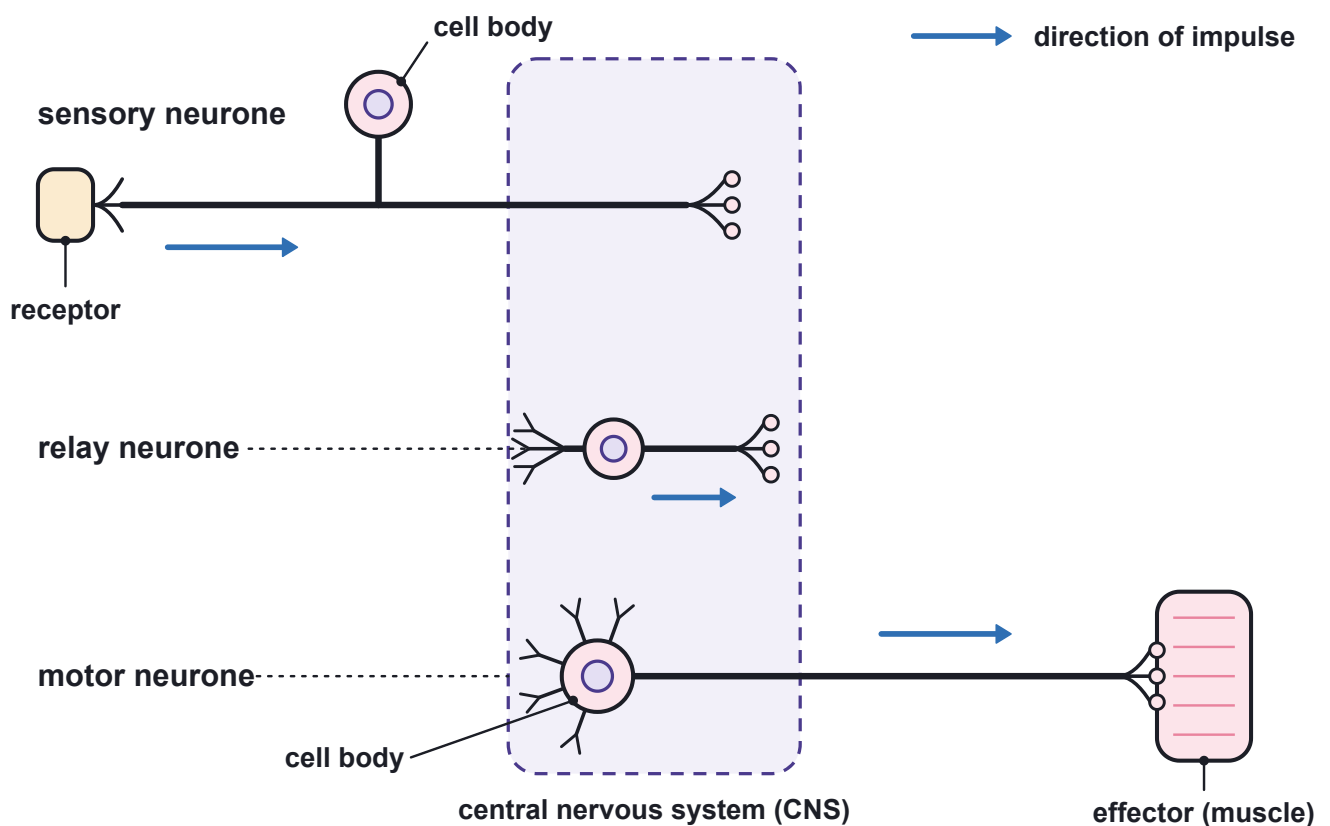


e.g. a muscle contracts

The pathway from **stimulus** to **response**.

Three types of neurone

Sensory, relay and motor neurones		
Neurone	Where it carries impulses	How to identify it in a diagram
Sensory neurone	From a receptor to the CNS	Receptor at one end; the cell body is off to the side of the long fibre; the fibre enters the CNS
Relay neurone	Within the CNS, from the sensory neurone to the motor neurone	Short; found entirely inside the CNS; connects the other two types
Motor neurone	From the CNS to an effector (a muscle or a gland)	Cell body inside the CNS at one end; long fibre leaving the CNS to the effector



The three types of neurone. Only the **relay neurone** lies wholly inside the CNS.

Exam tip: To identify a neurone, ask where it is and which way the impulse goes. Only the relay neurone sits wholly inside the CNS. Remember the PNS is the nerves, not the brain or spinal cord.

Reflex actions and reflex arcs Spec 14.1.5, 14.1.6

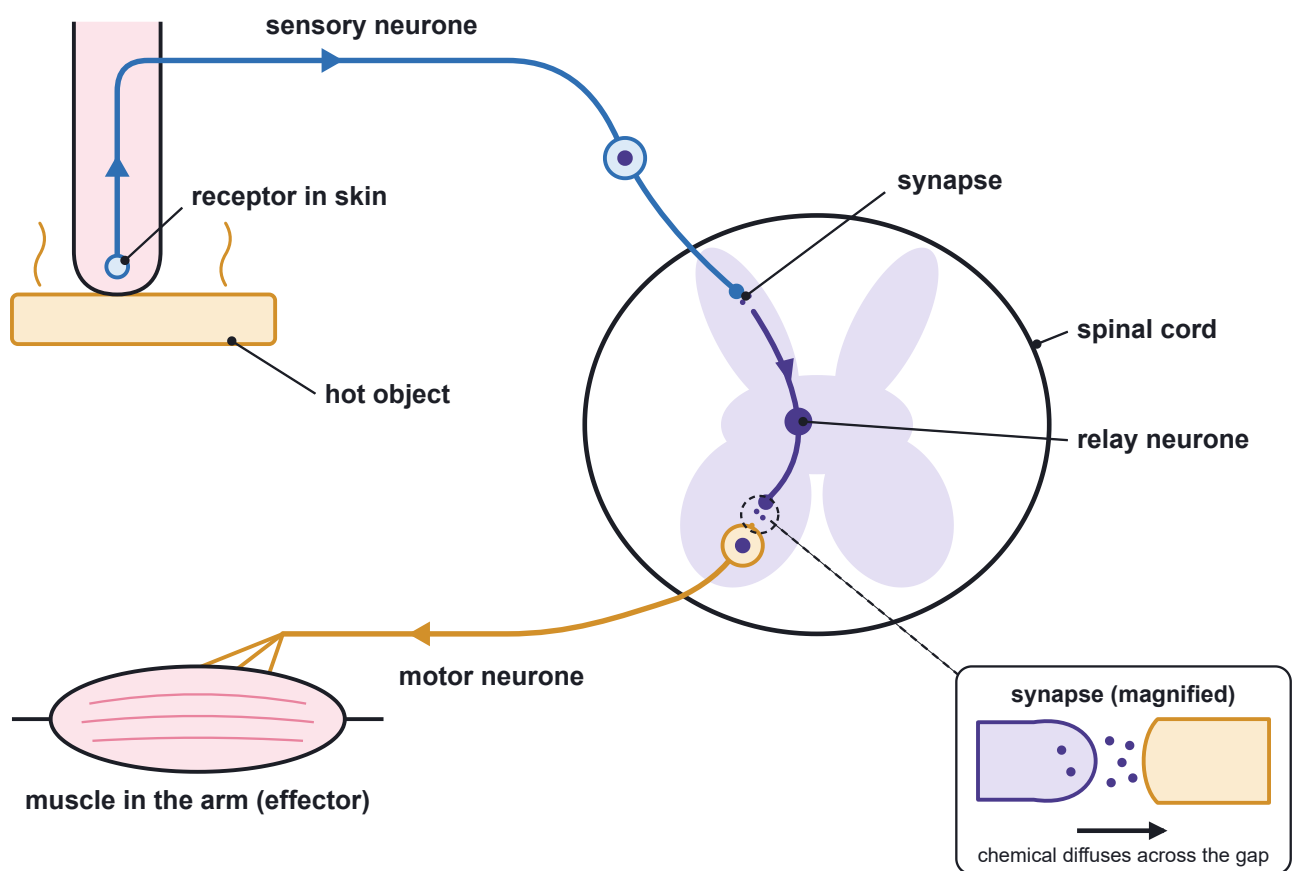
Reflex action

A means of automatically and rapidly integrating and coordinating stimuli with the responses of effectors (muscles and glands).

A reflex action is **automatic** and **rapid**. You do not have to think about it first. Reflexes protect the body from harm, for example pulling your hand away from something hot.

A **simple reflex arc** is the pathway that the impulses follow. It has five parts: **receptor**, **sensory neurone**, **relay neurone**, **motor neurone** and **effector**.

Parts of a simple reflex arc	
Part	Function
Receptor	Detects the stimulus and starts an impulse
Sensory neurone	Carries impulses from the receptor to the CNS
Relay neurone	Carries impulses within the CNS from the sensory neurone to the motor neurone
Motor neurone	Carries impulses from the CNS to the effector
Effector	A muscle (contracts) or a gland (secretes) that produces the response



A reflex arc. The impulse goes **receptor** → **sensory neurone** → **relay neurone** → **motor neurone** → **effector**.

Exam tip: Describe the pathway in order and name each part. If asked why a reflex is useful, use the words 'rapid', 'automatic' and 'protects the body from harm'.

Synapses Spec 14.1.7, 14.1.8, 14.1.9, 14.1.10

Synapse A junction between two neurones.

There is a tiny gap between one neurone and the next. The electrical impulse cannot cross this gap, so a chemical is used instead.

Supplement

Structure of a synapse

Supplement

- Vesicles in the first neurone contain neurotransmitter molecules.
- The synaptic gap separates the two neurones.
- The membrane of the next neurone has receptor proteins.

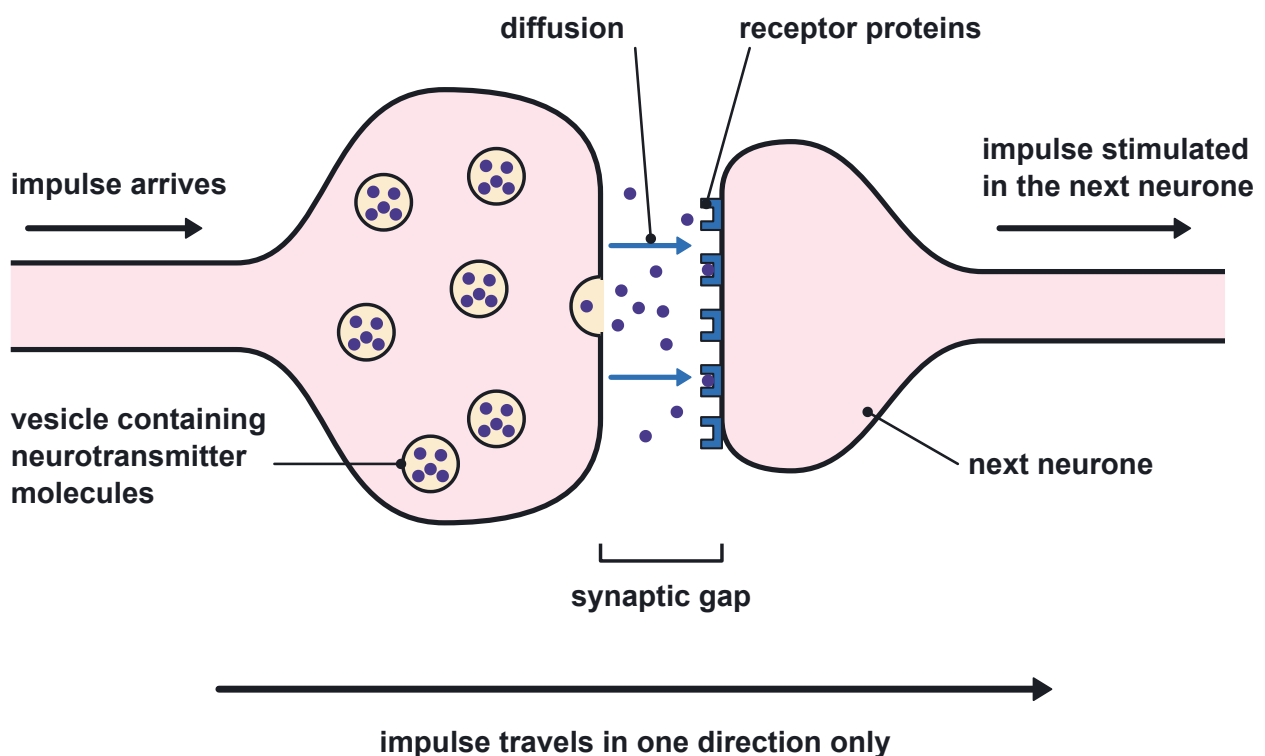
Supplement

Events at a synapse

Supplement

1. An impulse arriving at the end of the first neurone stimulates the release of neurotransmitter molecules from vesicles into the synaptic gap.
2. The neurotransmitter molecules diffuse across the gap.
3. The neurotransmitter molecules bind with receptor proteins on the next neurone.
4. An impulse is then stimulated in the next neurone.

Supplement



At a synapse, neurotransmitter molecules diffuse across the synaptic gap and bind to receptor proteins on the next neurone.

Supplement

Synapses ensure that **impulses travel in one direction only**. Neurotransmitter is released from only one side of the gap, and the receptor proteins are only on the next neurone.

Supplement

Common mistake: The impulse itself does not cross the gap. The neurotransmitter diffuses across and starts a new impulse in the next neurone.

Quick check

1. What does the central nervous system consist of?
2. Which neurone is found entirely within the CNS?
3. Name the five parts of a simple reflex arc in order.
4. What is a synapse?
5. **Supplement** What diffuses across the synaptic gap?

Quick check answers

Nervous control

1. The brain and the spinal cord.
2. The relay neurone.
3. Receptor, sensory neurone, relay neurone, motor neurone, effector.
4. A junction between two neurones.
5. Neurotransmitter molecules.