Nervous System: GCSE Biology

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1. Introduction

- The quick information-processing network of our body is the **nervous system**.
- It enables organisms to **sense changes, interpret** them, and **coordinate appropriate actions.**
- The **brain, spinal cord, neurons, receptor cells,** and **synapses** are all parts of this system.
- The nervous system = the **Central Nervous System** + the **Peripheral Nervous System**.

Examples:

Covering of the nose to avoid bad smell

Hearing

Walking

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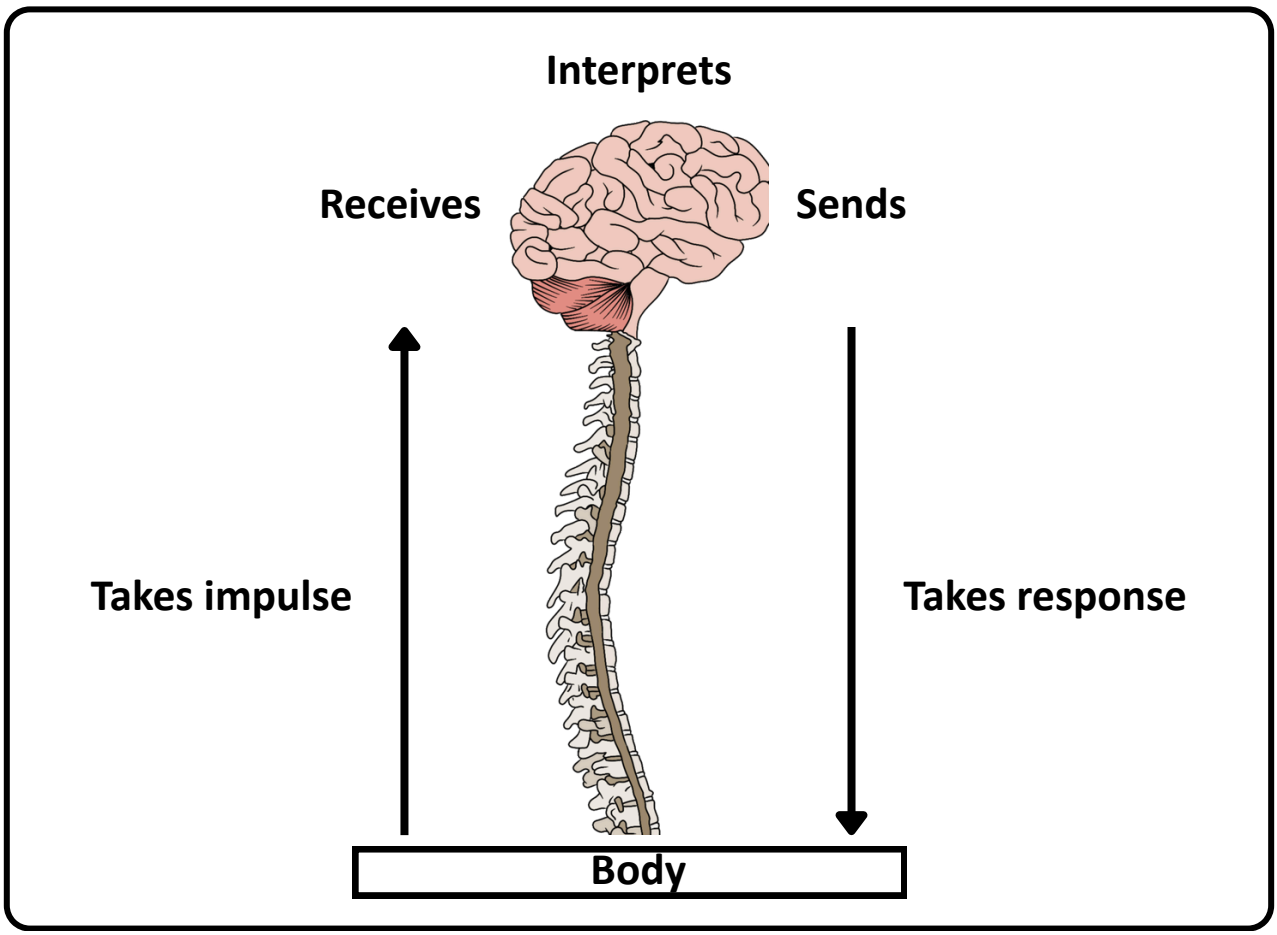
2. Central Nervous System and Peripheral Nervous System

- The **brain** and **spinal cord** make up the **Central Nervous System (CNS)**. It controls our body.
- The CNS and other parts of the body are linked by multiple branches of nerves, known as the Peripheral Nervous System.
- Body sends signals that travel through the Peripheral Nervous System and reach the CNS.
- The brain **receives** a signal, **interprets** it, and then sends a **response** to the relevant body part.
- The **body sends a signal to the brain** by the **spinal cord** in the form of an impulse, and **the brain sends to the body** as response.



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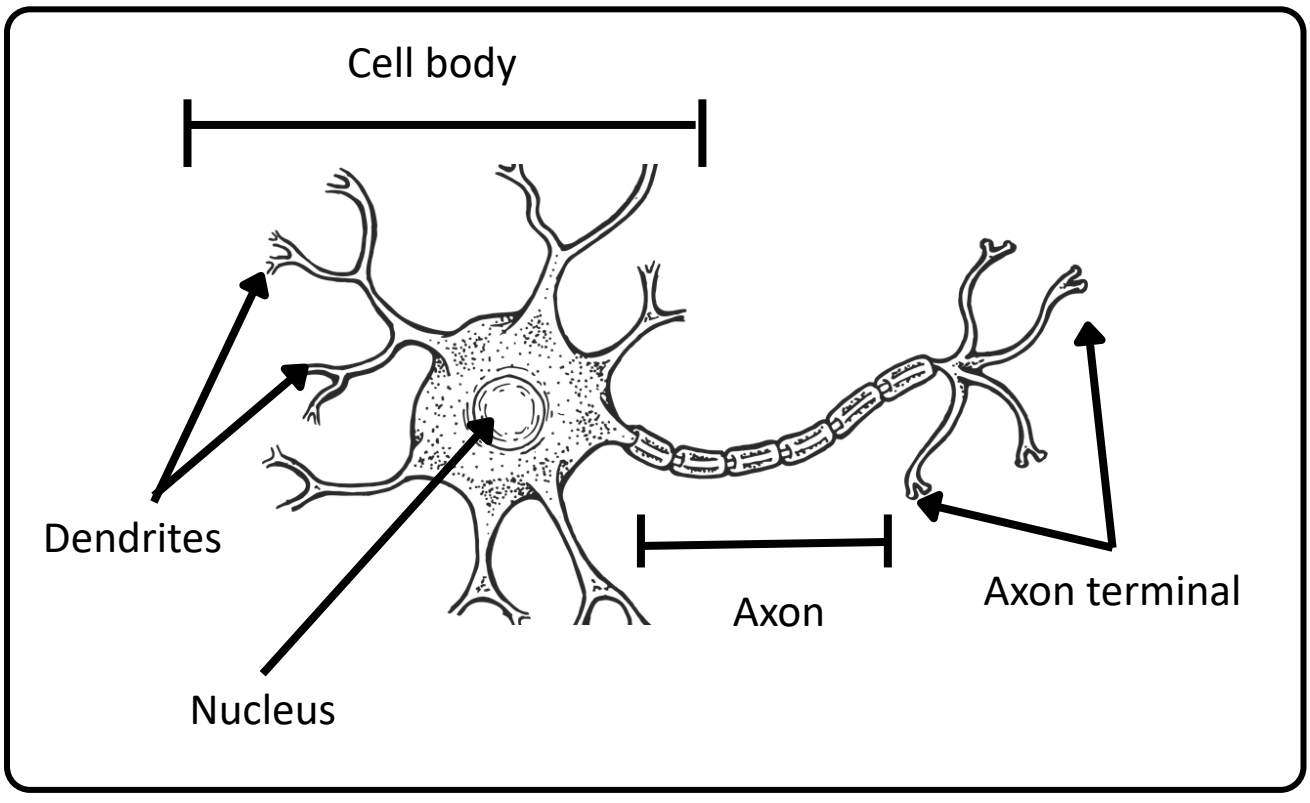
3. What are Neurons?

- Neurons are the **fundamental component** of the nervous system.
- Neurons **carry the impulses** from the body to the CNS and from the CNS to the body, which is known as **neurotransmission**.

Structure:

- A **cell body, dendrites, dendron, axon,** and **axon terminals** together constitute a neuron**.**
- The cell body has the **nucleus** and other **organelles**.
- Dendrites include a **tiny**, **branch-like** structure.



- A **layer** of **fat** surrounds the dendron and axon, and is known as the **myelin sheath**.
- A**t the end** of a neuron, axon terminals are present.

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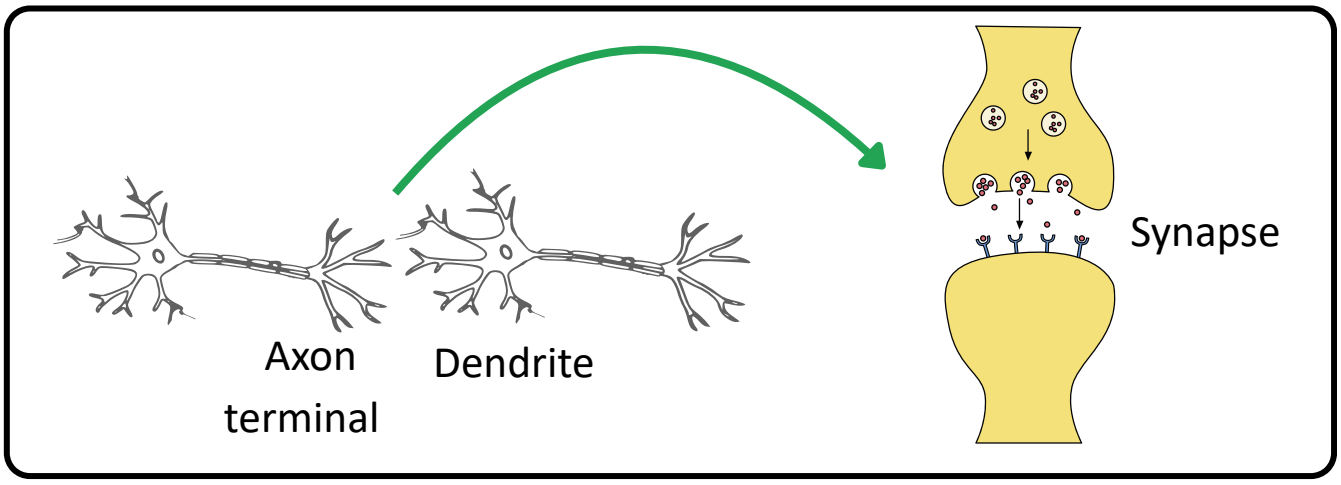
Mechanism of a neuron:

- **Electrical impulse** is taken by the branch-like **dendrites**.
- From the dendrites, it is **passed on** to the **dendron** and the **axon**.
- Both of these are **long** so that the neurotransmission is **quicker**.
- The myelin sheath allows an impulse to travel more rapidly as it can jump between gaps to **speed up** this transmission.
- Axon ends in axon terminals that transfer the impulses to the relevant surrounding neurons.

4. Synapse

- A neuron passes on information to the next neuron so that it reaches either the CNS or the body.
- There is a **tiny gap** between two neurons, known as a **synapse**.
- At the synapse, there is an **axon terminal** of one neuron and **dendrites** of another.
- In a neuron, a signal runs in the form of an electrical impulse.
- The electrical impulse triggers the chemical messengers to release.
- From the axon terminal, the signal is sent in the form of **chemical messengers**.
- The chemical messengers cover the tiny gap and reach the dendrites of the next neuron and generate an electrical impulse.



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5. Types of Neurons

- On the basis of their functions, neurons are classified into three types: Sensory Neurons, Relay Neurons, and Motor Neurons.

Types of Neurons	Information pathway	Functions
Sensory Neurons	From sensory organs to the CNS	Touch, taste, smell, sight, and hearing
Relay Neurons	Connects sensory neurons to motor neurons	Information processing and communication within the nervous system
Motor Neurons	From the CNS to muscles and glands	Walking, talking, breathing, digestion etc.

6. Types of Nerves

- Nerves, based on their functions, are of three types:
- **Sensory Nerves** are made up of a collection of axons from sensory neurons and send signals to the CNS.
- Axons from motor neurons constitute **Motor Nerves.** Their signal follows the same pathways.
- **Mixed Nerves** have both sensory and motor fibers, thus serve both functions.

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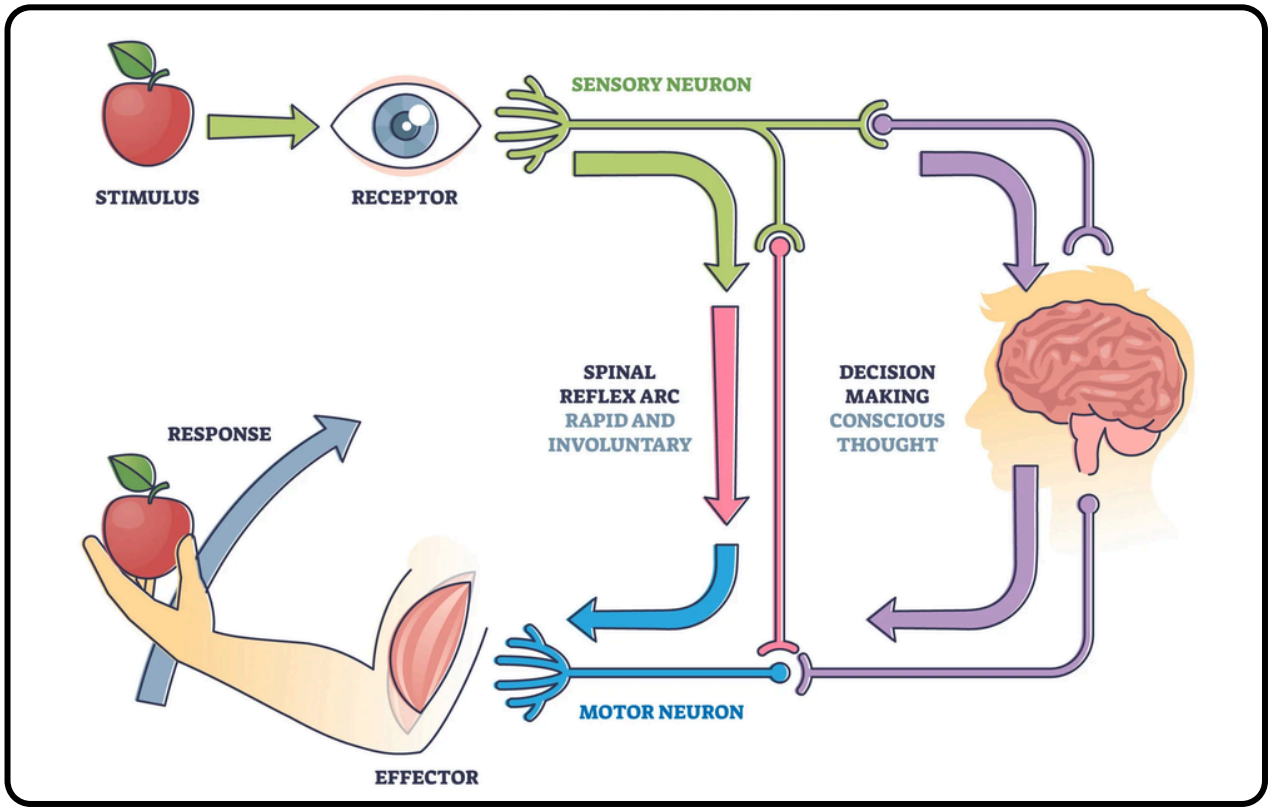
7. Receptor Cells and Reaction to Stimuli

- Our body can detect any internal or external change, which is known as a **stimulus.**
- Sense organs in our body have cells that identify various kinds of changes. These cells are **receptor cells.**
- When receptor cells **detect** a **stimulus**, they **generate impulses**.
- From the sense organs, these impulses are usually carried to the brain by the nerves.
- After processing the information received, the **brain** sends impulses to the relevant part of the body.
- This causes an **action**, known as a **response**.



- For example, we see an apple with our eyes. The receptor cells detect a stimulus, produce an impulse, and sensory neurons take it to the brain. It processes, makes decision and transmits a signal to the muscles (effector) that carry out the response by picking up the apple.

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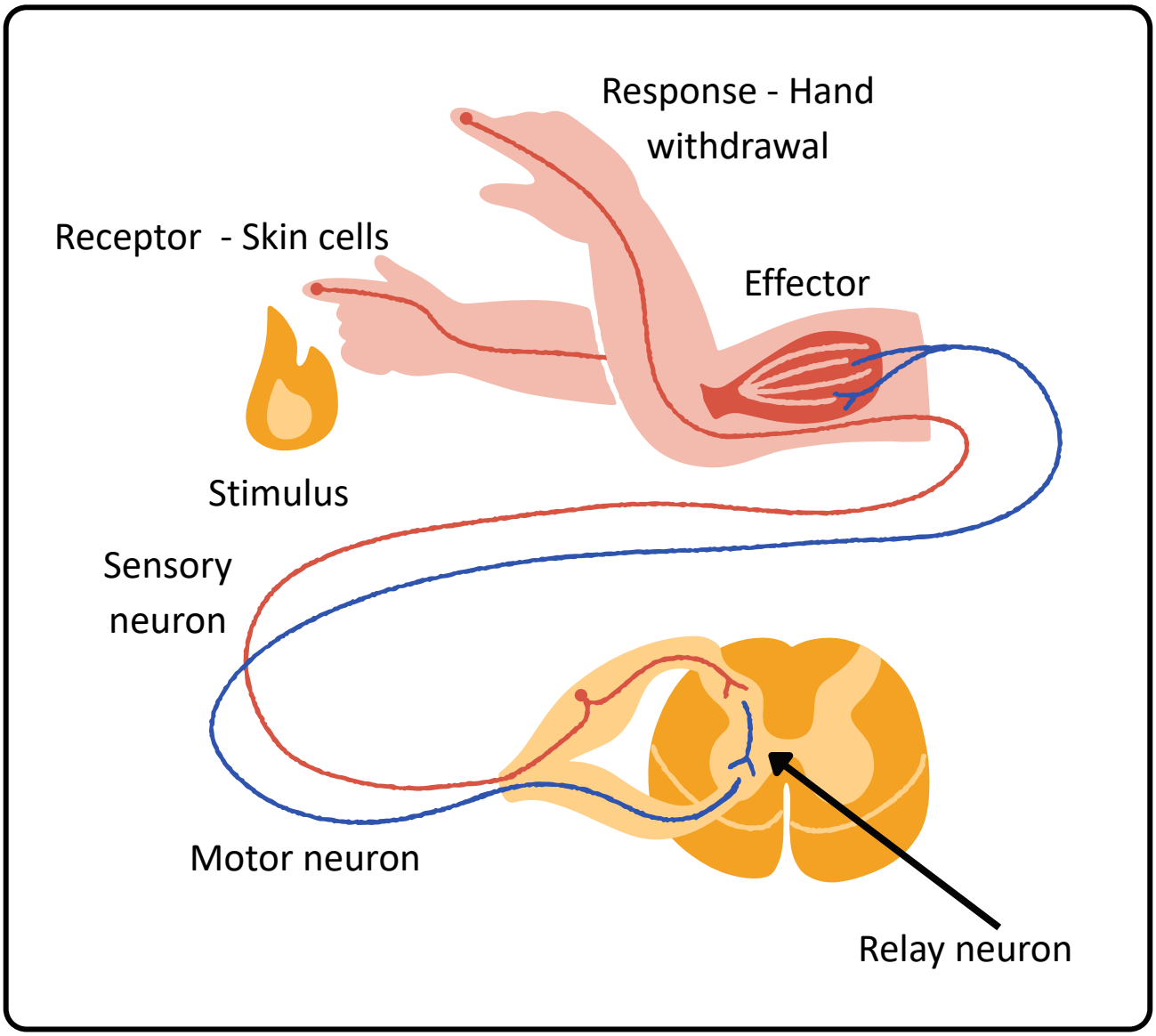
8. Reflex Arc

- Our body has a system that saves it from a harmful stimulus.
- When a sudden, harmful change comes into contact with our body, we tend to take quick action to **protect** ourselves.
- For example, withdrawal of the hand immediately when it touches a hot pan.
- This **quick** and **involuntary response** to a stimulus is a **reflex action.**
- The neural pathway that is followed for reflex action to complete is called the **Reflex Arc.**



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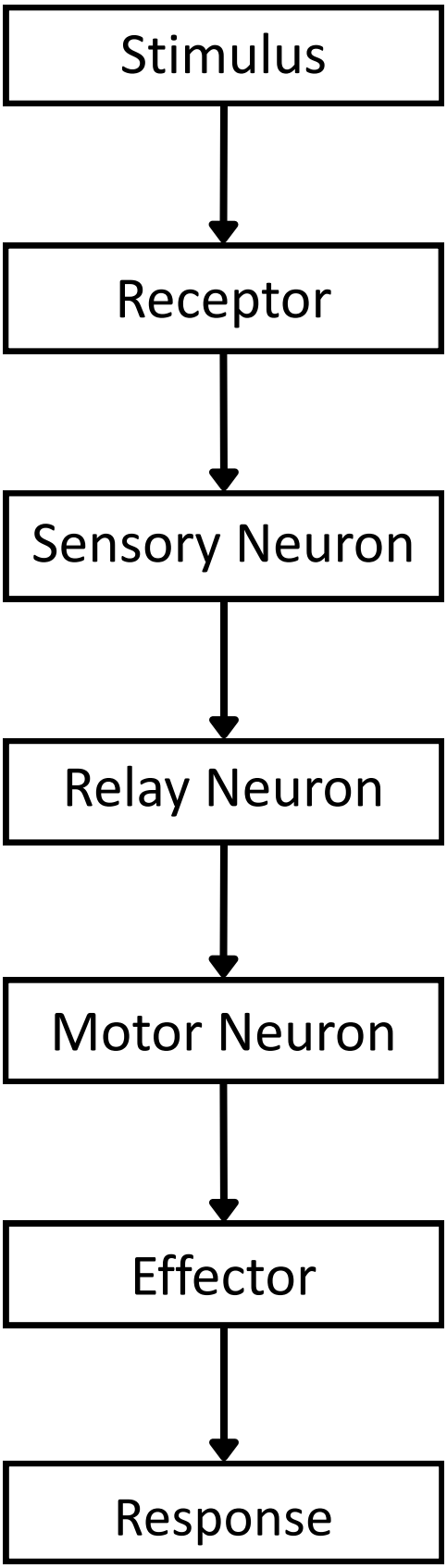
The Reflex Arc Pathway:



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9. FAQs

1. **What are the main parts of the nervous system?**
Two main parts of the nervous system include the Central Nervous System and the Peripheral Nervous System.

2. **What is a stimulus?**
A stimulus is a change inside the body or in the surroundings, interpreted by receptor cells.

3. **What is a synapse?**
A synapse is the gap between neurons where impulses cross via chemical messengers called neurotransmitters.

4. **What is the reflex arc?**
The nerve pathway followed for the rapid and automatic response to a harmful stimulus is called the reflex arc.

5. **Is reflex action and the reflex arc the same?**
No, reflex action and the reflex arc are not the same. Reflex action is the sudden and involuntary response to a stimulus, whereas the reflex arc is the pathway.

6. **What is the difference between sensory and motor neurons?**
Sensory neurons take signals from the body to the Central Nervous System. However, motor neurons transmit signals from the CNS to the muscles and glands to respond.