

The Nervous System

Divided into two sections: **CNS** and **PNS**

- Central nervous system - brain and spinal cord.
- Peripheral nervous system - nerves that carry messages

Response

1. **Reception:** Stimulus is detected by neurons and sense organs (receptors).
2. **Transmission:** Message passes along neurons to CNS.
3. **Integration:** Incoming messages are processed and a response decided by the brain.
4. **Response:** Carried out by effectors (muscles, glands) stimulated by neurons.

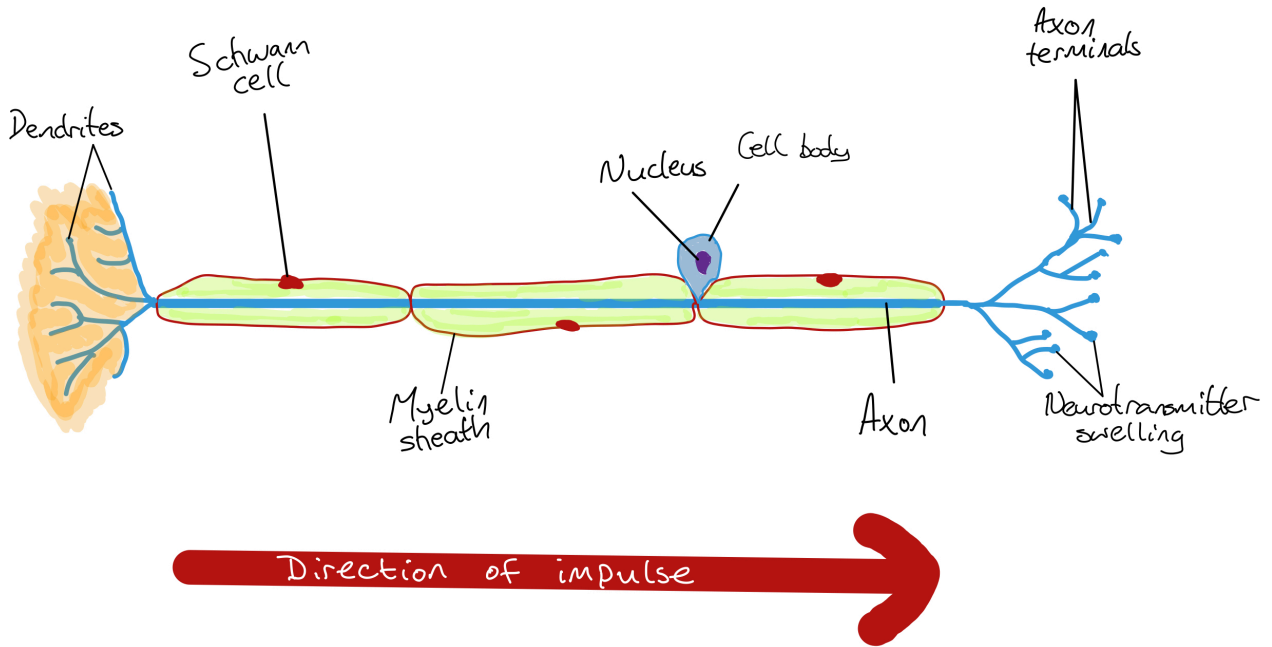
Neurons “Nerve cells”

There are three types of neuron:

1. Sensory neurons
2. Motor neurons
3. Interneurons

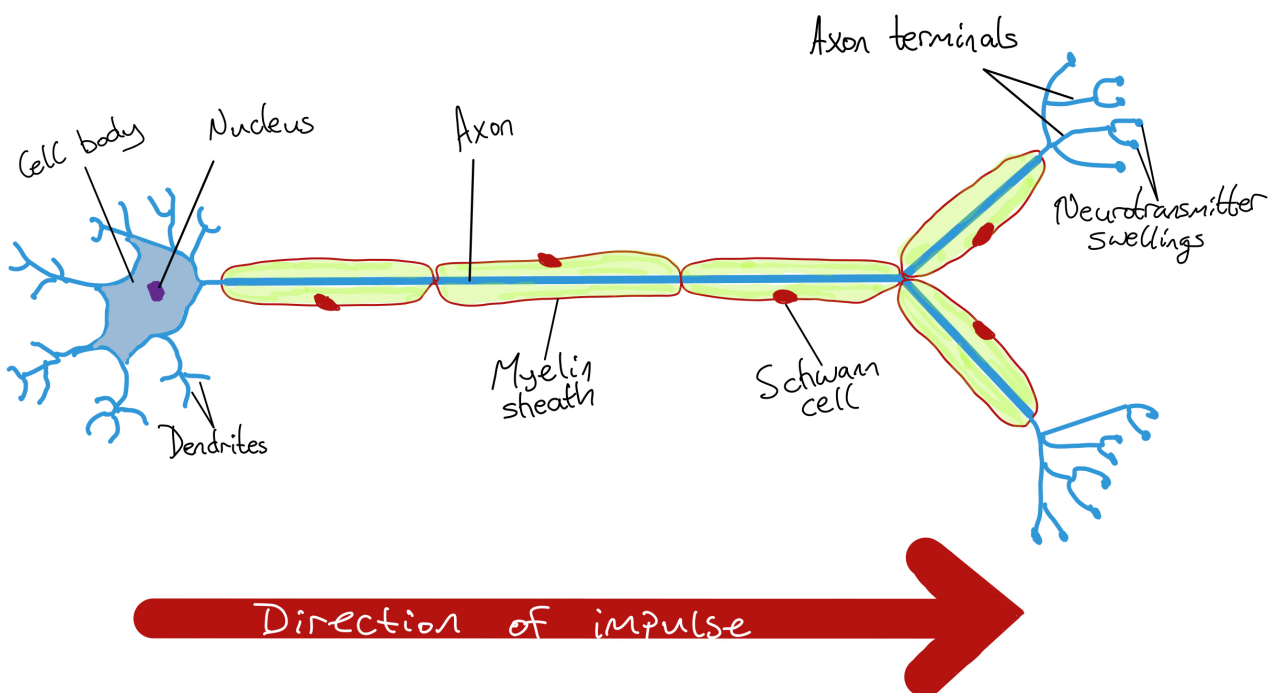
Sensory neurons

- Carries impulse from sense organ to CNS



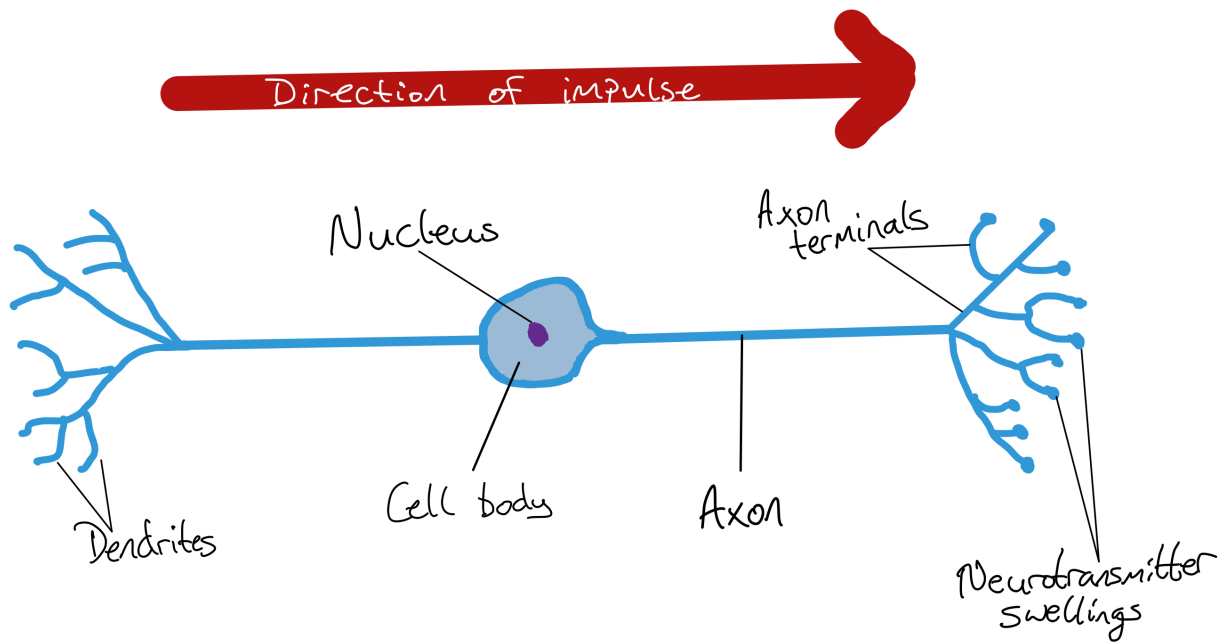
Motor neurons

- Carries impulse from CNS to muscles.



Interneurons

- Carry messages between sensory and motor neurons.



Part:	Function:
Cell body	<ul style="list-style-type: none"> • Contains the nucleus and mitochondria. • Produces neurotransmitters
Nucleus	<ul style="list-style-type: none"> • Control centre
Dendrites	<ul style="list-style-type: none"> • Fibres that receive and carry impulses to the cell body.
Axons	<ul style="list-style-type: none"> • Carry the impulse away from cell body.
Schwann cells	<ul style="list-style-type: none"> • Make the myelin sheath.
Myelin sheath	<ul style="list-style-type: none"> • Fat rich membrane that insulates the electrical impulses. • Speeds up the impulse.
Neurotransmitter swellings	<ul style="list-style-type: none"> • Releases neurotransmitters to carry impulse across the synapse.

Transmission of impulses within the neuron

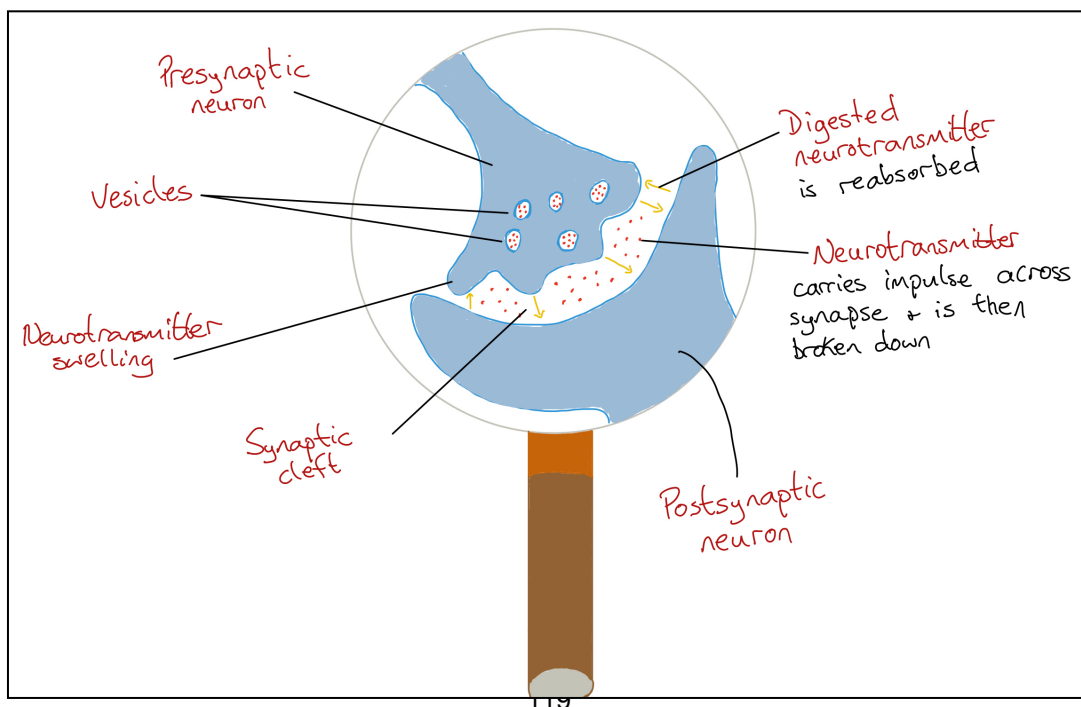
- An impulse is an electrical message.
- Only when a neuron receives a stimulus of sufficient strength (**threshold**) does the impulse move along the neuron.
- **N.B.** The electrical impulse moves by means of **ions** (charged particles).
- If the threshold isn't met then nothing happens - "all or nothing rule"

Transmission of impulses between neurons

- The region between neurons is known as the **synapse**.
- The minuscule gap is called the **synaptic cleft**.
- Electrical impulses cannot cross the synapse.
- Chemicals (neurotransmitters) pass across instead.

Activation of Neurotransmitter

1. The electrical impulse travels to the neurotransmitter swellings and cause the vesicles to secrete neurotransmitters (e.g. ACh)
2. Neurotransmitters are made in the cell body.
3. The neurotransmitters 'diffuse' across the synaptic cleft.



Inactivation of Neurotransmitter

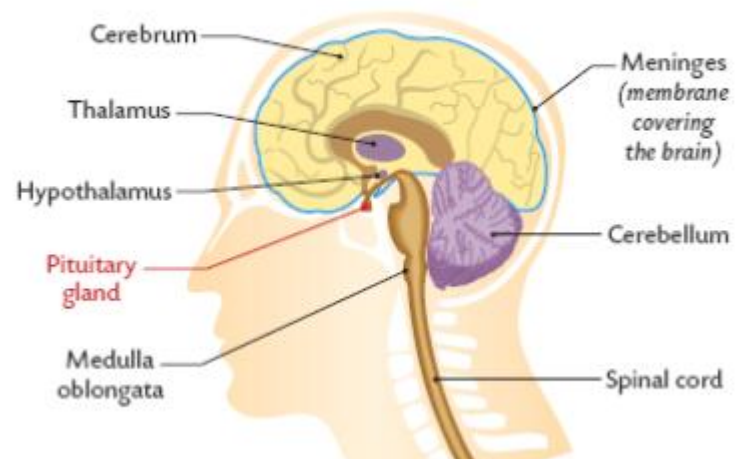
4. The neurotransmitter combines with receptors (post synaptic cleft) in the dendrite.
5. This causes an electrical impulse to be generated and pass on towards the cell body.
6. The neurotransmitters are then digested by enzymes to be recycled and used again.

Synapse functions

1. To ensure the direction of impulse can only go in one direction.
2. To prevent over stimulation of effectors.
3. Impulses can be blocked by certain chemicals at the synapse - useful for treating pain.

The Brain

- Protected by the skull.
- Has 3 membrane tissues surrounding it called the **meninges**.
- Cerebrospinal fluid is located in between the meninges which act as a shock absorber.

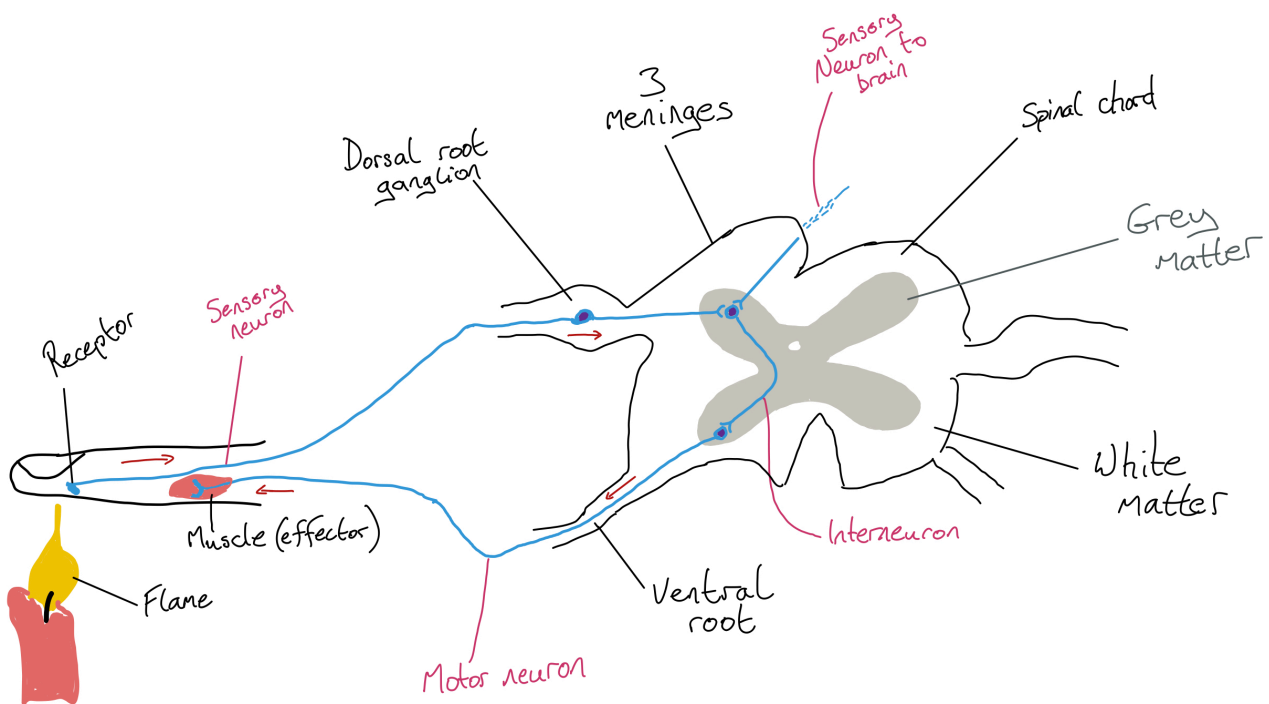


Name:	Information:	Controls:
Cerebrum	<ul style="list-style-type: none"> • Largest part of the brain • Divided into two halves; the left and right cerebral hemispheres. • Each hemisphere controls one side of the body. 	<ul style="list-style-type: none"> • Thinking • Intelligence • Language • Emotions • Memory
Cerebellum	<ul style="list-style-type: none"> • Heavily folded • Responses are involuntary once learned 	<ul style="list-style-type: none"> • Muscular coordination • Balance
Medulla oblongata	<ul style="list-style-type: none"> • Connects spinal cord with brain. • Involuntary actions 	<ul style="list-style-type: none"> • Breathing • Coughing • Sneezing
Thalamus	<ul style="list-style-type: none"> • Located below cerebrum 	<ul style="list-style-type: none"> • Sorting centre for the brain
Hypothalamus	<ul style="list-style-type: none"> • Link between the mind and the brain? 	<ul style="list-style-type: none"> • Homeostasis - temperature, blood pressure.

- **Note:** Please mention the word control when stating the function. e.g. The cerebrum controls memory.

The Spine

- The spine consists of vertebrae and cartilage and its function is to protect the spinal cord (nerves).
- The spinal cord is located in the neural canal.
- Almost all neuron impulses must go through the spinal cord to get to the brain.
- **Grey matter** contains: Cell bodies & no myelin.
- **White matter** contains: Axons & myelin.



Nervous system disorder: Parkinson's disease

- **Cause:** Failure to produce dopamine.
- **Symptoms:** Trembling, stiff or rigid muscles.
- **Prevention:** No known prevention.
- **Treatment:** Exercise, physiotherapy and drugs that stimulate dopamine.

Reflex Action

“An automatic, involuntary, unthinking response to a stimulus.”

Examples:

- Blinking of eyes for protection
- The knee jerk
- Breathing
- Protective actions

Reflex action process

1. Receptors in fingers are stimulated by hot flame.
2. Sensory neurons carry impulse towards spinal cord.
3. In spinal cord - the interneuron carries impulse to the motor neuron.
4. The motor neuron passes the message to the effectors (muscle in finger) to pull back from the hot flame.
5. The impulse still reaches the brain simultaneously.

Advantage:

- Such fast responses can protect the body from damage.

