

# BODY COORDINATION





Our interaction and coordination function includes:

- Obtaining information from the world around us.
- Making decisions.
- Responding by moving or secreting substances.
- Maintaining homeostasis.

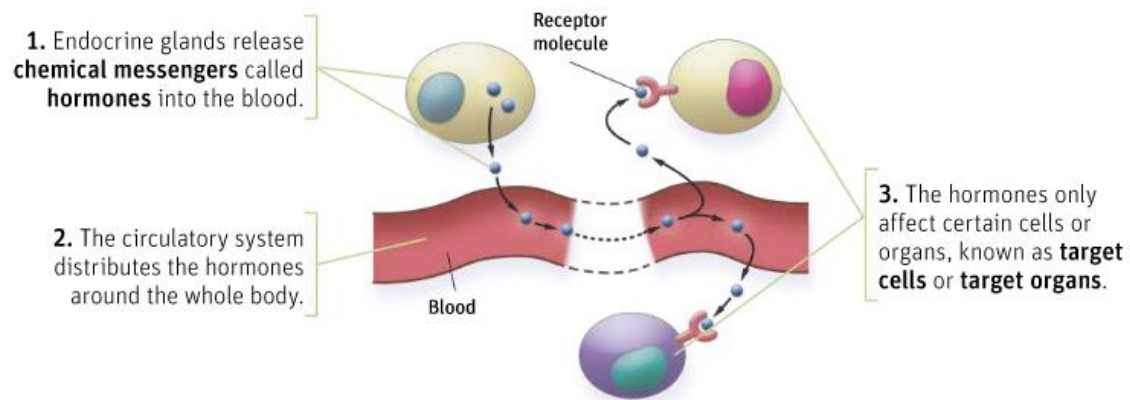
In our body, there are two interconnected systems involve in this function:

- Endocrine system.
- Nervous system.



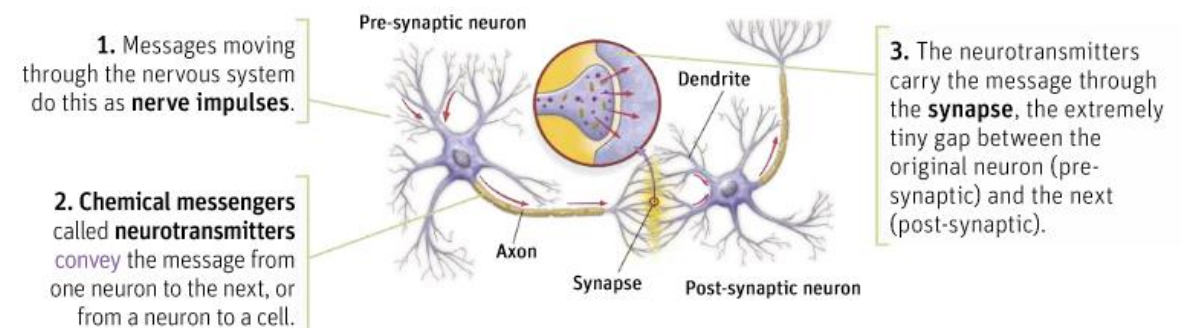
## ★ Endocrine system

This is a network made up of glands that secrete chemical messengers, **hormones**, into the blood.



## ★ Nervous system

This is an extensive network of nerves made up of interconnected, highly specialised cells called **neurons** that are found all around the body. They can form organs such as the brain and the spinal cord





	Endocrine system	Nervous system
<b>Movement of messages</b>	Chemical messenger through the bloodstream	By chemical impulse within neuron, by chemical messenger between neurons or from a neuron to a cell
<b>Transfer to target cell</b>	Chemical	Chemical
<b>Chemical messenger</b>	Hormones	Neurotransmitters
<b>Distance covered by chemical messenger</b>	Very large (Whole body)	Very small (synapses)
<b>Effect (speed and duration)</b>	Slow, long-lasting	Immediate, short-lived
<b>Speed of transmission</b>	Slow (bloodstream)	Fast (electrical impulse)
<b>Effector</b>	Target cells	Muscle cells or glands



## THE ENDOCRINE SYSTEM

It's formed by a group of organs and glands that work together to regulate our body functions.

### ★ Endocrine glands

1. **Hypothalamus (Hipotálamo):** Produces the **releasing hormones (factores liberadores)**, neurohormones which control the activity of the **pituitary gland or hypophysis (glándula pituitaria o hipófisis)**.
2. **Pineal gland (Glándula pineal):** Controls the daily sleep-wake cycle using the hormone **melatonin (melatonina)**
3. **Pituitary gland or hypophysis:** Directs the activity of other endocrine glands with a variety of hormones:
  - . **Gonadotropic hormones (Gonadotropa)** to act on the sex organs.
  - . **Thyrotropic hormone (Tirotrropa)** or thyroid stimulating hormones.
  - . **Oxytocin (Oxitocina)** to stimulate uterine contractions during childbirth.
  - . **Growth hormones (hormona somatotropa o del crecimiento)** to control de elongation of bones.
  - . **Adrenocorticotropic hormone (adrenocorticotropa)** which stimulates the adrenal glands.



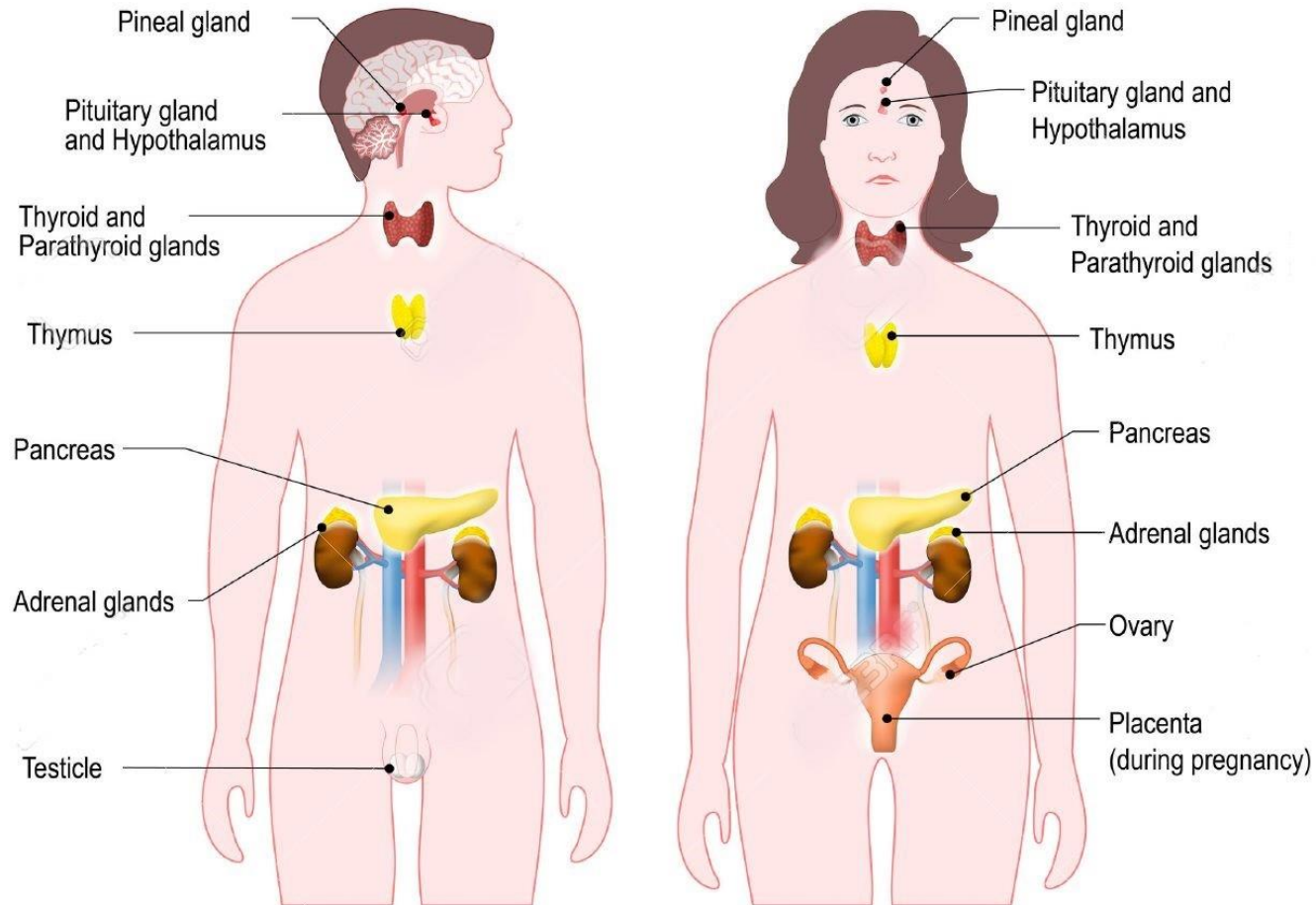
## THE ENDOCRINE SYSTEM

### ★ Endocrine glands

4. **Thyroid gland (Tiroides):** Regulate the body's overall metabolic rate with **thyroxin (Tiroxina)**. It also produces **calcitonin (calcitonina)**, which increases the blood calcium levels.
5. **Adrenal glands (glándulas suprarrenales):** Produces:
  - . **Cortisol** that regulate metabolism.
  - . **Aldosterone (aldosterona)** to regulate kidney function.
  - . **Adrenaline (adrenalina)** to prepare the organism for high-stress situations.
6. **Pancreatic islets (islotos pancreáticos):** Control blood glucose levels with two antagonistic hormones; **glucagón** (increase glucose in the bloodstream) and **insulin** (reduce glucose levels in the bloodstream).
7. **Gonads (Gónadas):** Contribute to the development of the sex organs and secondary sexual characteristics by producing the sex hormones. The testes produce **testosterone (testosterona)** and the ovaries produce **oestrogen (estrógenos)** and **progesterone (progesterona)**



# THE ENDOCRINE SYSTEM

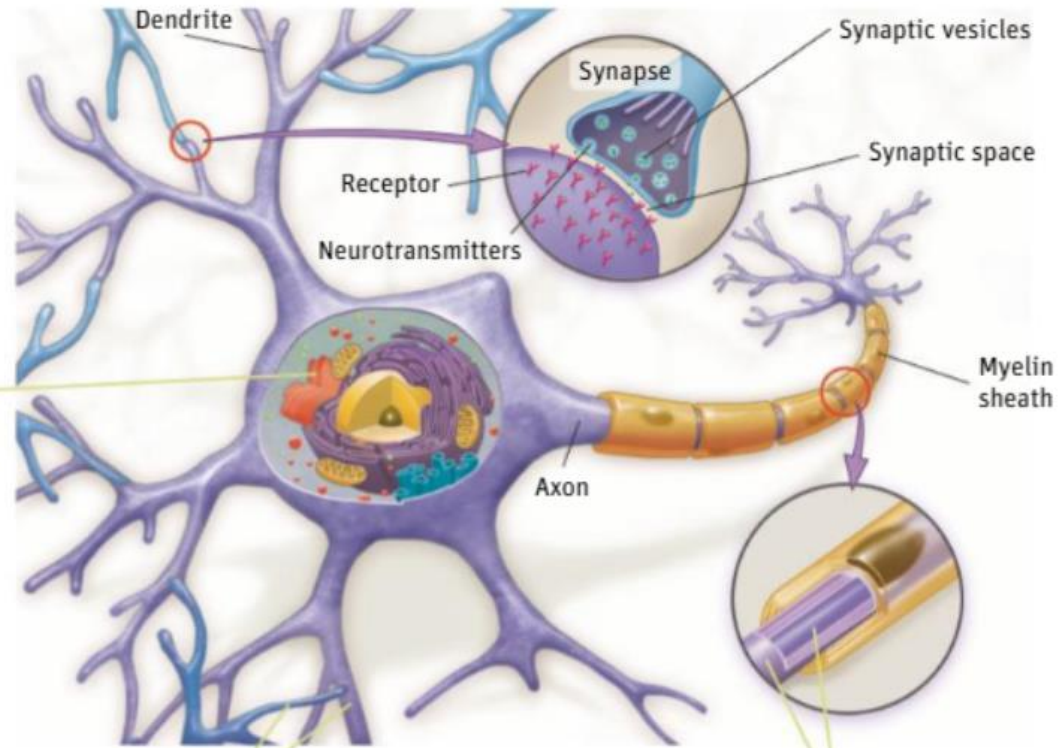


# THE NEURONS

## BODY COORDINATION



**Cell body.** This is where the **nucleus** is located. It also contains most of the neuron's cytoplasm and organelles. Cell bodies form part of the **grey matter** found in the brain and spinal cord.



**Dendrites.** These branched projections of the cell body connect to other neurons and receive information from them.

**Axon.** This is the long tail-like structure extending from the cell body, the information passes from here to the next neuron or cell. Groups of axons are called **nerves**. The axon is covered with a **myelin sheath**, which increases the speed of nerve impulses.

In the brain and the spinal cord, axons form the **white matter**.



# SYNAPTIC TRANSMISSION



The impulse along the neuron is a electrical signal that travels rapidly through a neuron from the dendrites to the axon.

When the nerve impulse comes to the end of an axon, it reaches a junction called a synapse. The signal passes across the **synapse** to the dendrite in the next cell through chemical messengers called **neurotransmitters**. This process is known as **synaptic transmission**.

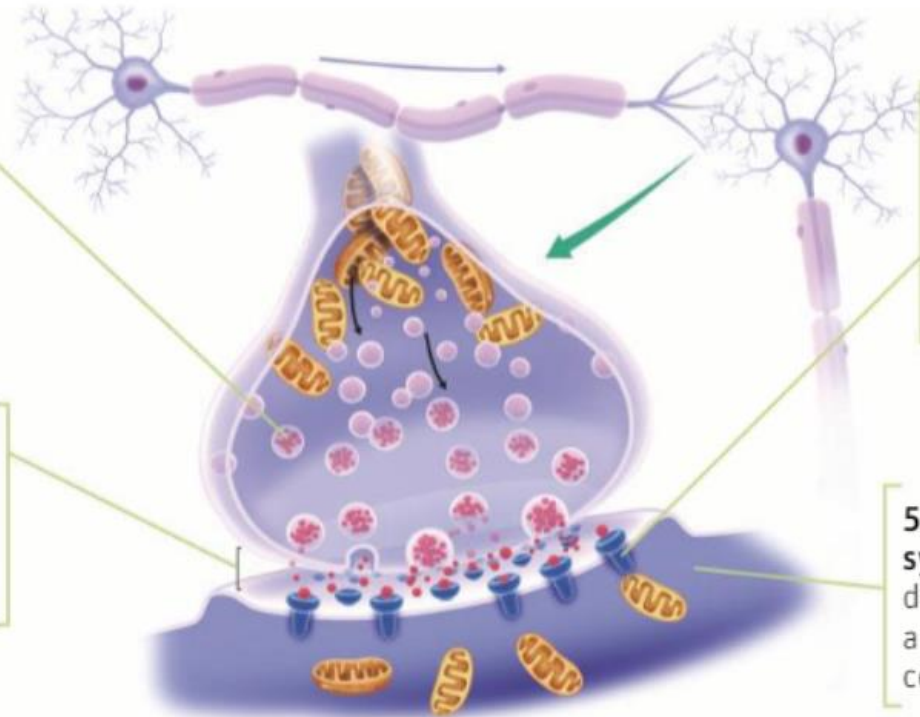
1. The nerve impulse travels from the dendrite to the end of the axon.

2. At the end of the axon there are many vesicles containing **neurotransmitters**. This is the **pre-synaptic** neuron.

3. The impulse releases the neurotransmitters into the space between the two cells. This junction is what we call the **synapse**.

4. The neurotransmitters interact with the **receptors** on the other side of the synapse. This is the **post-synaptic** neuron or cell.

5. The receptors in the **post-synaptic** cell react. This is a dendrite of the next neuron or a cell, for example, an effector cell in a muscle.



# ORGANISATION OF THE NERVOUS SYSTEM

BODY COORDINATION



## 1. Central Nervous system

Neurons that are entirely confined within the brain and spinal cord

Encephalon or brain

- Cerebrum
- Cerebellum
- Brainstem

Spinal Cord

## 2. Peripheral Nervous system

Neurons that are at least partially outside of CNS

Somatic nervous system

Receives information from sensory organs and sends responses to the skeletal muscles, which contract voluntarily

Autonomic nervous system

Regulates the function of organs and systems involuntarily

- Sympathetic
- Parasympathetic

# THE CENTRAL NERVOUS SYSTEM

## BODY COORDINATION



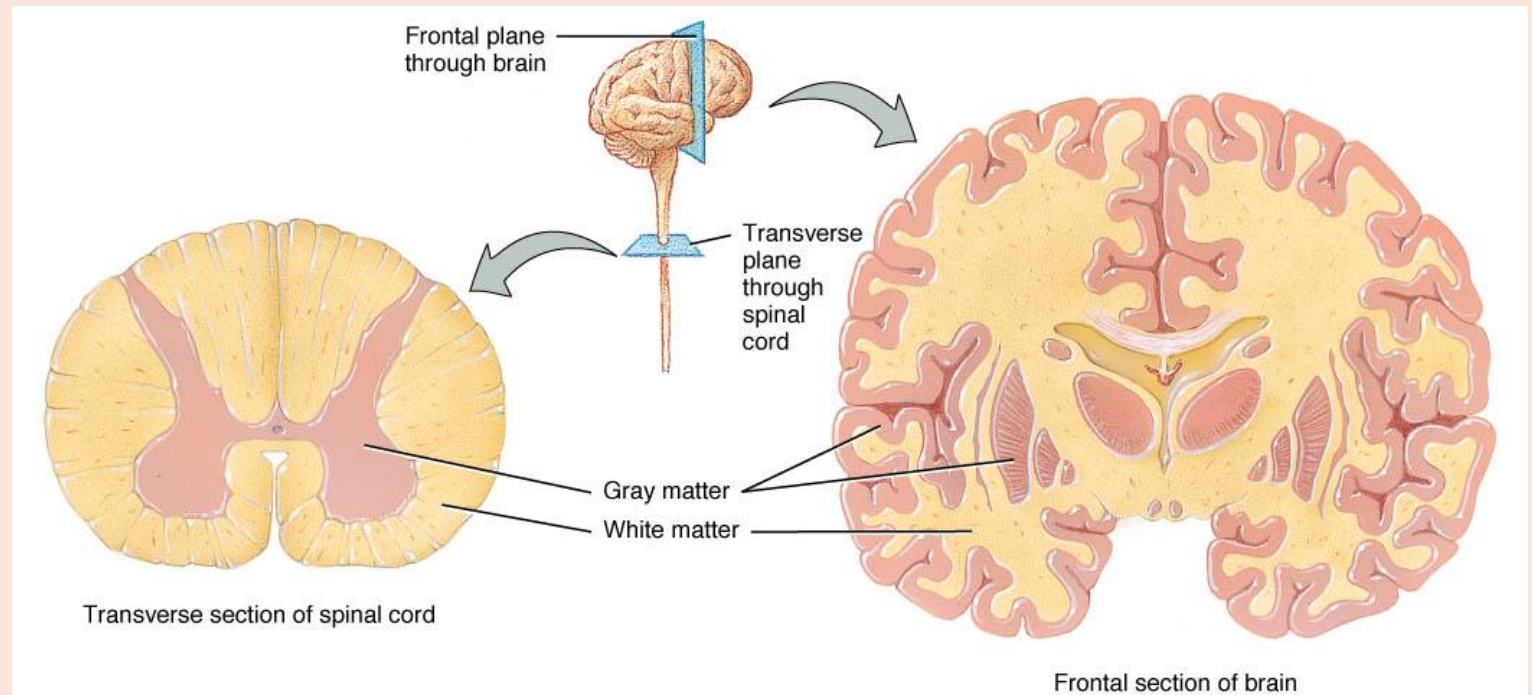
It's comprised of the **brain** and the **spinal cord**. Both are covered by 2 protective layers:

- ❖ The **cranium** and **vertebral column**. Outer hard layer made of bone. They protect the brain and the spinal cord.
- ❖ **Meninges**. Interior soft layer. They are 3 distinct membranes: the **dura mater** (duramadre), **arachnoid mater** (aracnoides) and the **pia mater** (piamadre)

The fluid within these organs and between these membranes is called the **cerebrospinal fluid**. It protects against traumatic injuries

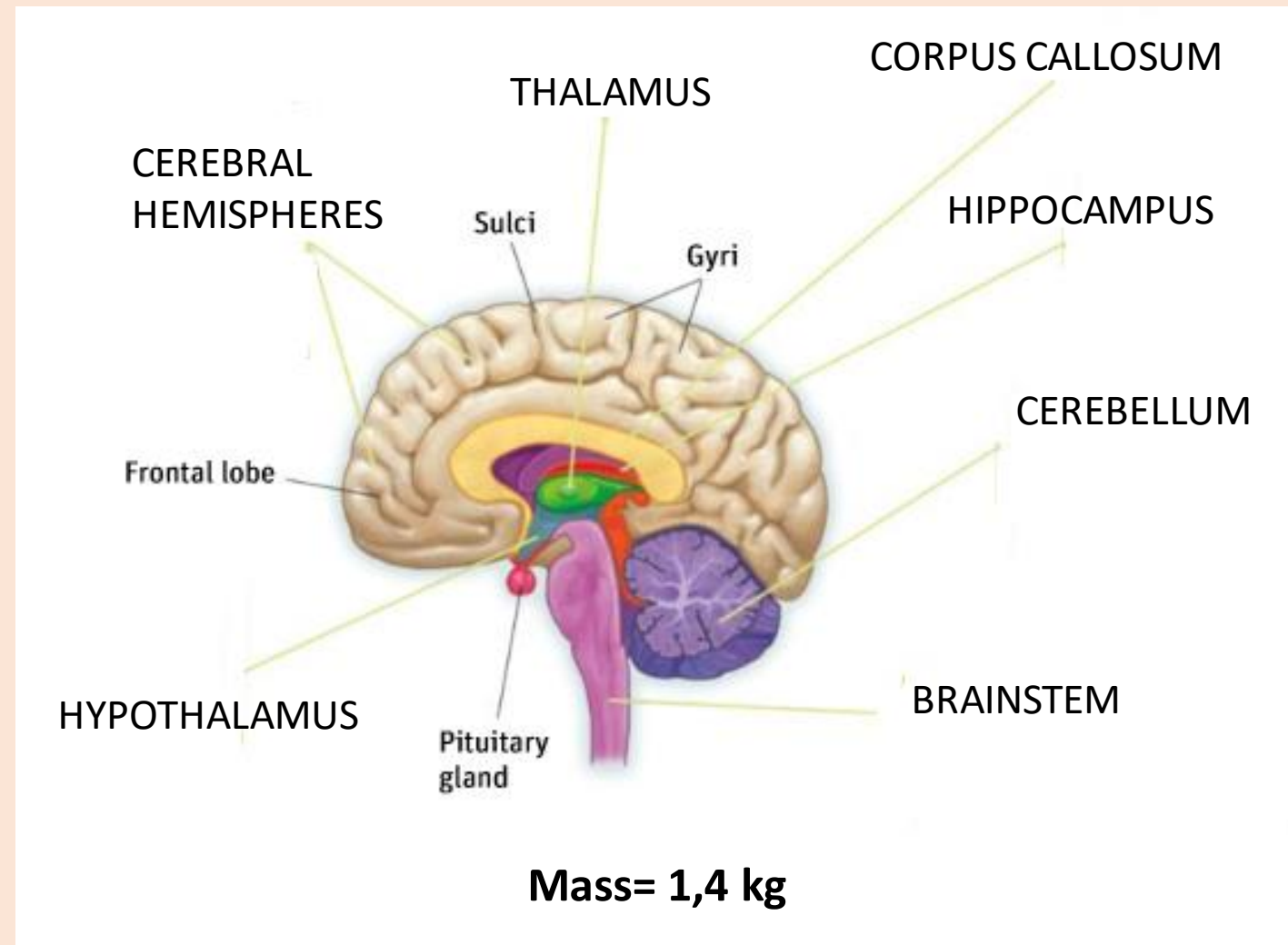
In the brain and the spinal cord we distinguish 2 regions:

- ❖ **Grey matter** is formed by the cell bodies and the dendrites of neurons. These are the control centres where neurological messages are processed.
- ❖ **White matter** is formed by neuron's axons. These are the connections between the control centres.



# THE CENTRAL NERVOUS SYSTEM. THE BRAIN

BODY COORDINATION



# THE CENTRAL NERVOUS SYSTEM. THE BRAIN

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## ❖ CEREBRUM

The largest part of the brain . It includes **two cerebral hemispheres**, the **corpus callosum**, the **hippocampus**, the **thalamus** and the **hypothalamus**.

The main functions on the cerebrum are:

- Receives information from the sensory organs except for balance and produces sensations.
  - Elaborates the answers and orders for the effector organs.
  - Coordinates and controls the functioning of the nervous system.
  - Houses the intellectual faculties such as memory, intellect, conscience and the will.
- 
- **Cerebral hemispheres:** Their surfaces are known as the cerebral cortex and they are comprised of grey matter- This folded structure is made of rounded gyri (circunvoluciones) and recessed sulci (surcos) which divide the lobes.
  - **Corpus callosum:** It bridges the two hemispheres.
  - **Hippocampus:** It's part of the limbic system surrounds the corpus callosum. It's responsible for long term memory, emotions and human instincts.
  - **Hypothalamus:** The master gland of the endocrine system, controlling most of its activity

# THE CENTRAL NERVOUS SYSTEM. THE BRAIN

BODY COORDINATION

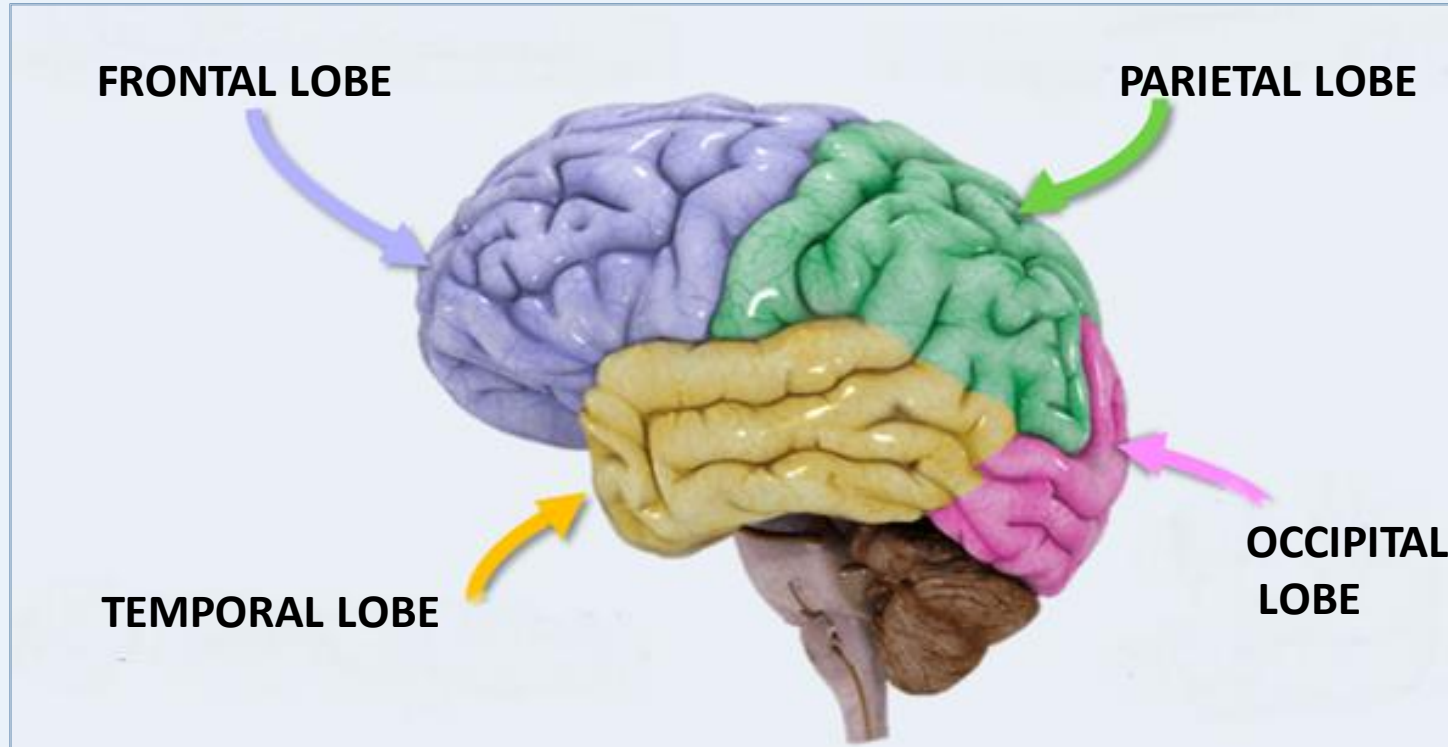


## FRONTAL LOBE

Behaviour  
Intelligence  
Memory  
Movement

## TEMPORAL LOBE

Behaviour  
Hearing  
Memory  
Speech  
Vision



## PARIETAL LOBE

Intelligence  
Language  
Reading  
Sensation

## OCCIPITAL LOBE

Vision

# THE CENTRAL NERVOUS SYSTEM. THE BRAIN

BODY COORDINATION



## ❖ CEREBELLUM

Its exterior is grey matter and the interior is white matter. It's responsible for:

- Balance
- New learning
- Precise movements and coordination (go cycling, walk, play instruments)

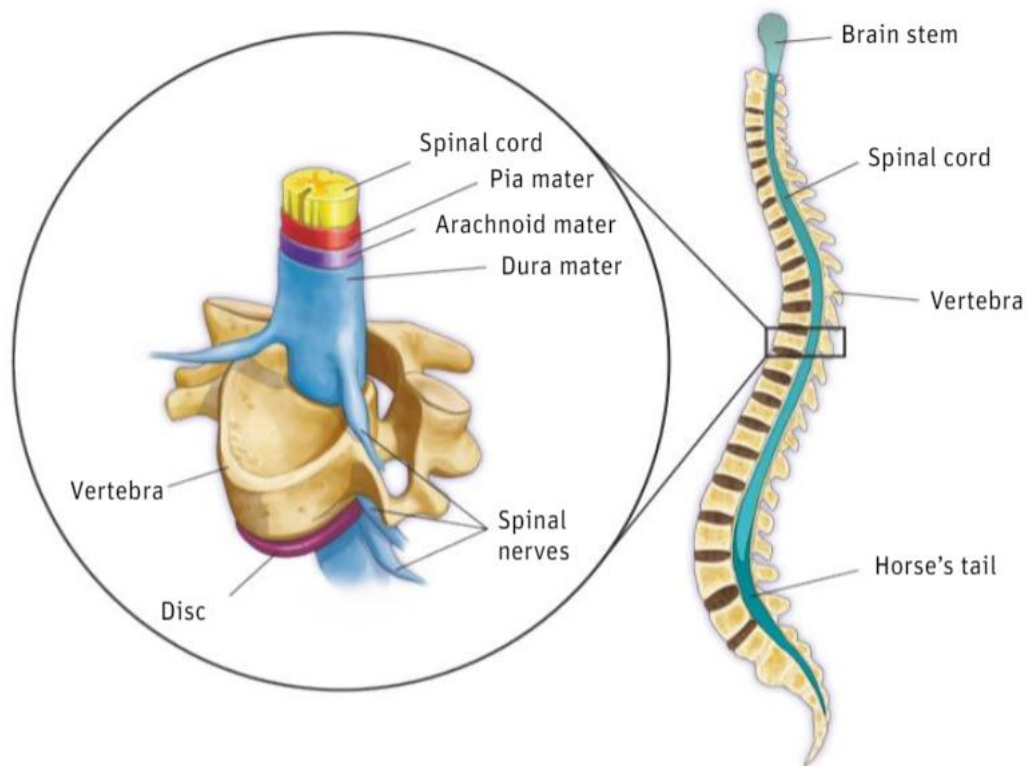
## ❖ BRAINSTEM

Is subdivides into several regions including the medulla oblongata, the region that elongates into the spinal column. It is the location of several centres of involuntary nervous control (heartbeat, pulmonary breathing, consciousness, swallowing, blood pressure.)



## THE CENTRAL NERVOUS SYSTEM. THE SPINAL CORD

In the spinal core the grey matter is in the interior and the white matter in the exterior. In the very centre of the cord, surrounded by this grey matter is an open tube called the **central canal** or **ependymal**, which is full of cerebrospinal fluid.



The main role of the spinal cord is to bring messages back and forth between the brain and the body. Sensory information going to the brain and motor responses coming from the brain.

The spinal cord is also capable of rapid and automatic responses known as **reflex arcs**.

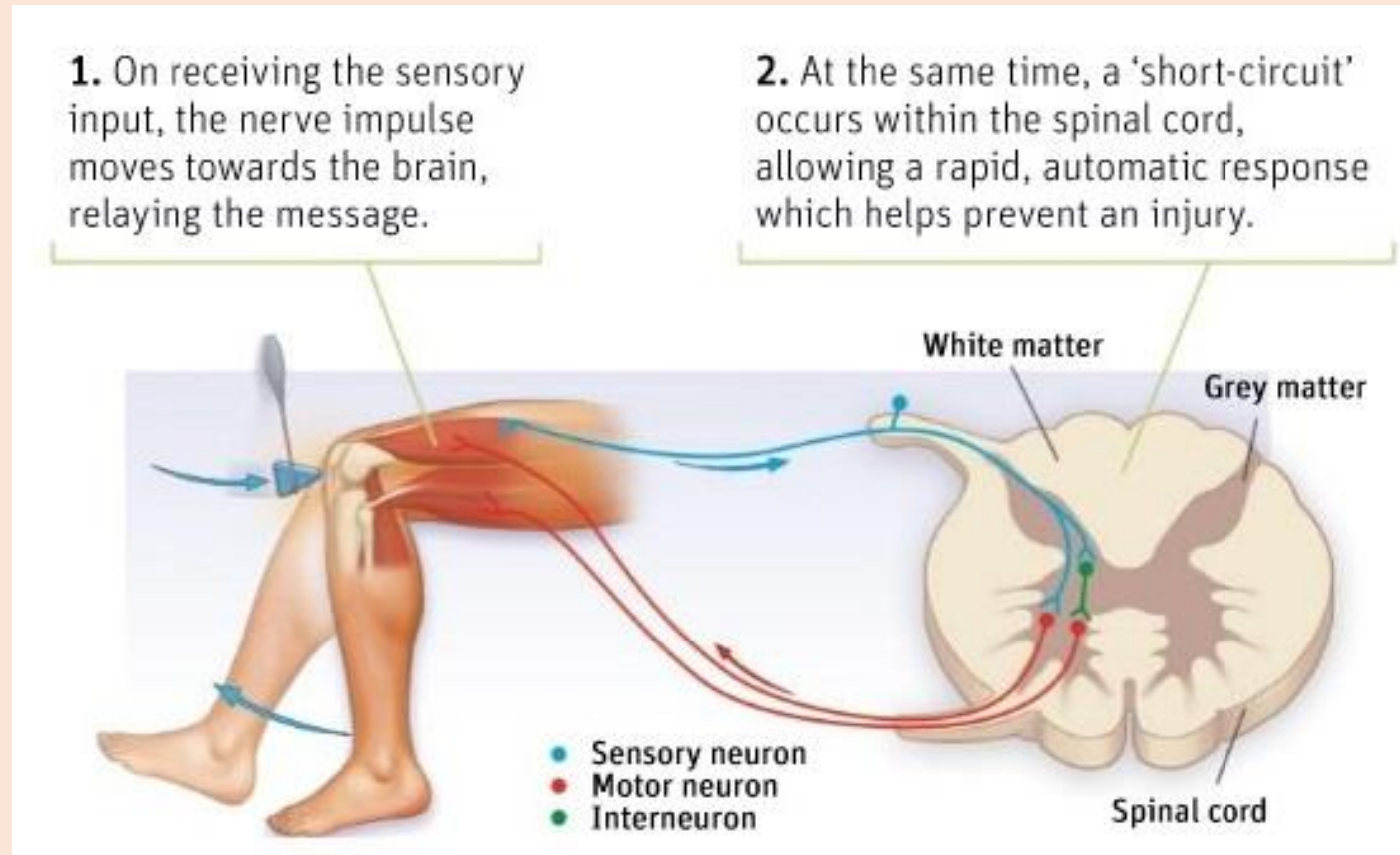




## THE CENTRAL NERVOUS SYSTEM. THE SPINAL CORD

### Reflex arcs

A **reflex arc** is a neural pathway that controls a reflex.





## THE PERIPHERAL NERVOUS SYSTEM

There are two categories of nerves in the peripheral nervous system.

- **Cranial nerves:** They are 12 pairs of nerves emerging from different regions of the brain. They send messages to, and receive messages from, different parts of the head and neck. They innervate the organs responsible for sensory detection (sight, smell, taste, hearing), the facial muscles, the tongue, the neck, etc
- **Spinal nerves:** They are 31 pairs of nerves that emerge from the spinal cord sequentially, from the different regions: cervical, thoracic, lumbar, sacral. Each individual nerve has two root-like connections to the spinal cord. While one of the roots contains sensory neurons, the other contains motor neurons



## THE PERIPHERAL NERVOUS SYSTEM

### ★ Somatic subdivision

It receives information from the body's sensory organs and sends responses to the somatic effectors or skeletal muscles, which contract voluntarily or as reflex arcs.

### ★ Autonomic subdivision

This division regulates the function of organs and system in an involuntary manner. This system is continuously receiving information from internal organs .

The autonomic division is subdivided into:

- **Parasympathetic branch:** This is associated with actions such as relaxation, tranquility, and low energy expenditure.
- **Sympathetic branch:** This is associated with situations of stress and increased energy demand. It leads to heightened awareness.