

Mö[bius]

Incredible Body



The Brain



QuébecAmérique

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THE HUMAN BODY includes all the structures and organs that make you a living being. The organs are part of specialized teams called “apparatus” or “system.” All play a specific role that is essential to the proper functioning of the body.

THE BRAIN is your command centre. At the head of the **nervous system**, it gathers, sorts, and analyzes the information coming from both inside and outside your body. It also makes you breathe, move, think, and grow...

Your brain is working every minute, day and night! What exactly does it do? What does it need to function well?

The words in **mauve** are defined in the glossary on the last page!



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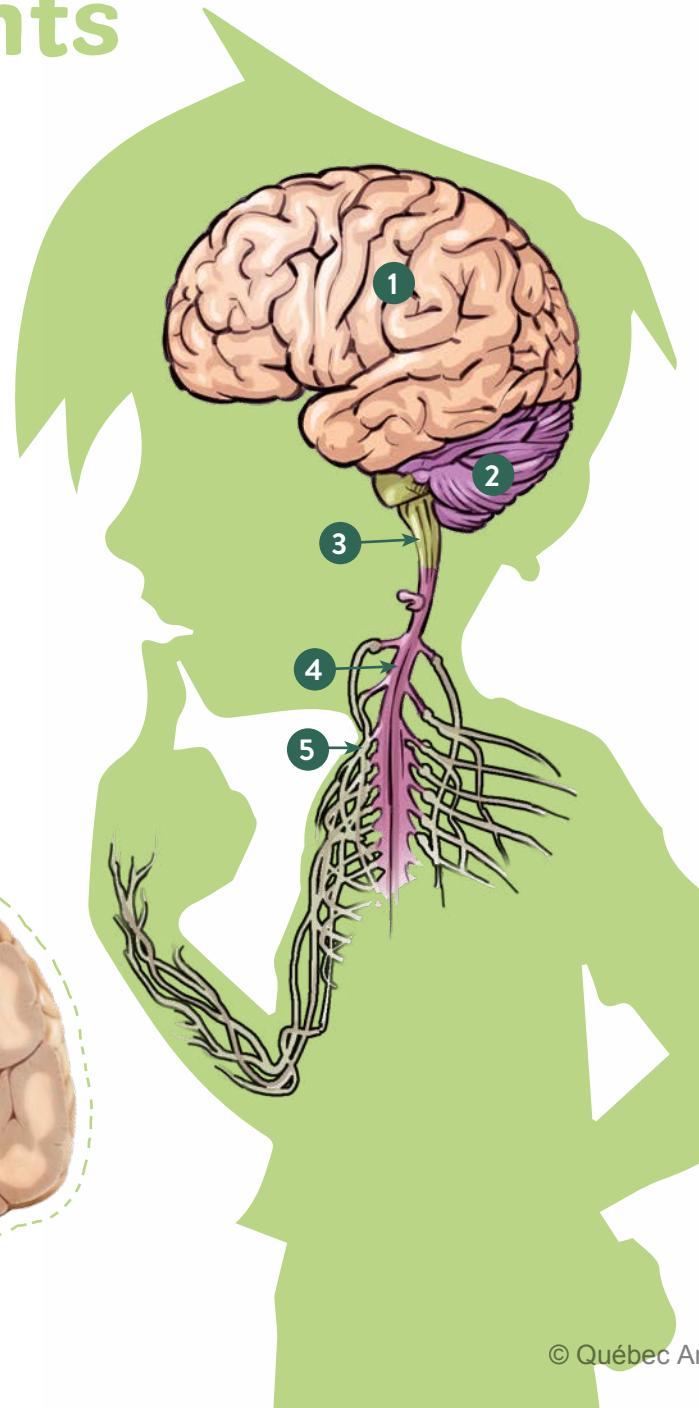
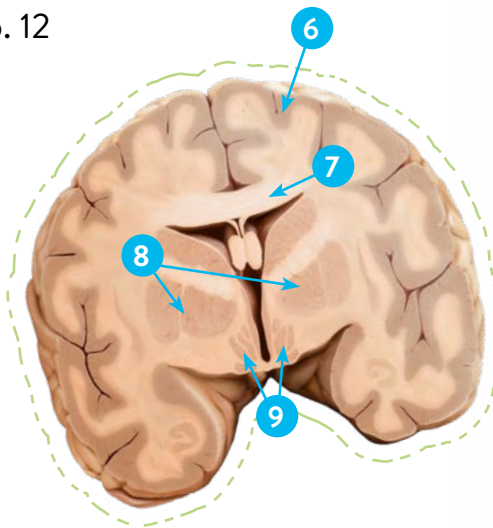
The brain is part of the **nervous system**.

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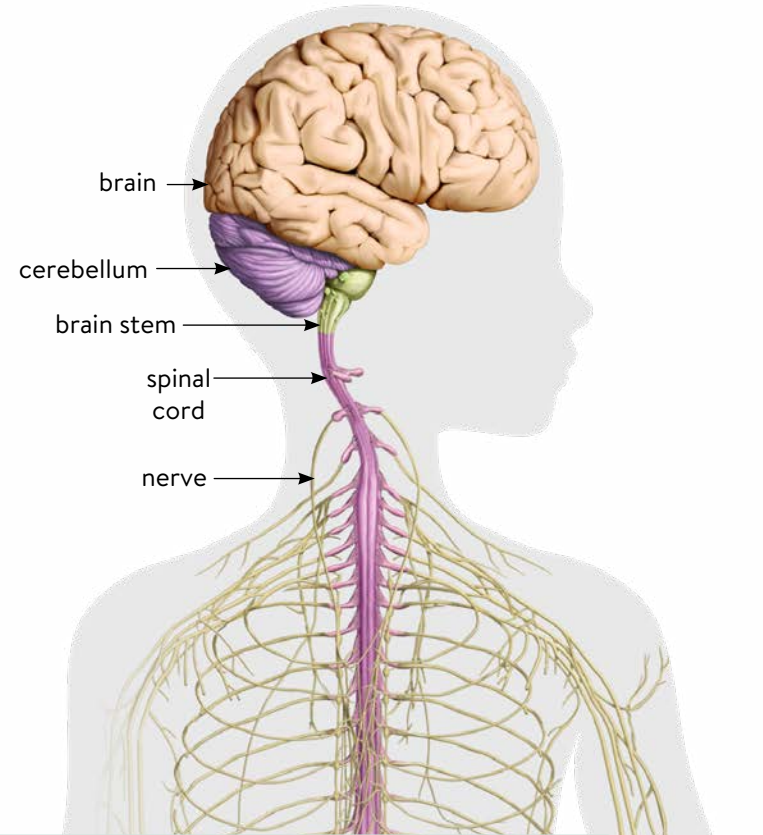
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What is the *brain*?

Located in your head, the brain is an organ the size of a cauliflower. Protected by a group of bones called the cranium or skull, it acts as your body's control tower or its orchestra conductor.

You are always using your brain: to think, play, move, see, hear, learn, calculate, and read. The brain is the seat of the emotions, dreams, and intelligence. In short, your brain makes you the unique individual that you are!



THE BRAIN DOESN'T WORK ALONE

To help do its work, the brain relies on the **cerebellum**, which is the balance control centre, and on the **brain stem**, which relays information to the rest of the body. This trio is called the “**encephalon**.” Along with the **spinal cord** and the **nerves**, it forms the vast network of information paths and highways known as the “**nervous system**.” Its role is to carry messages between the brain and the different parts of the body.

An amazing team

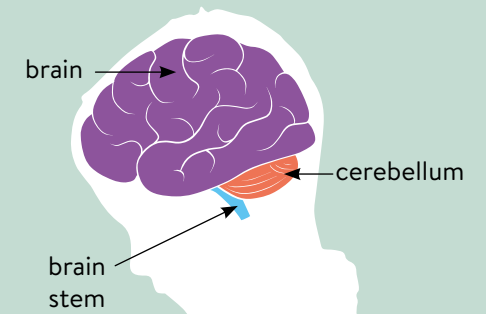
The brain, the cerebellum, and the brain stem form an inseparable trio...

Solving the mystery of balance

Have you ever wondered how you can walk or ride a bicycle without falling? It's thanks to the **cerebellum**, which helps you maintain your balance and coordinate your movements! The cerebellum is located under the brain and the two work in tandem. When you walk, for example, the brain tells your feet to move. The cerebellum makes sure that your two feet advance one after the other, thus keeping you from stumbling.

Controlling vital functions

The **brain stem** connects the brain to the spinal cord. In addition to carrying information between the brain, cerebellum, and various parts of the body, the brain stem controls several critical functions, including breathing and heart rate. It adjusts your respiration and heartbeat according to your activity (running, sleeping), so that they either speed up or slow down.



Neurons forming pathways

Neurons are specialized **cells** found in every part of the **nervous system**. There are about 100 billion of them in the human body, almost as many as there are stars in our galaxy! In the nervous system, the neurons can connect to each other, thanks to their elongated shape. They create many “bridges” that allow information to move along a path.



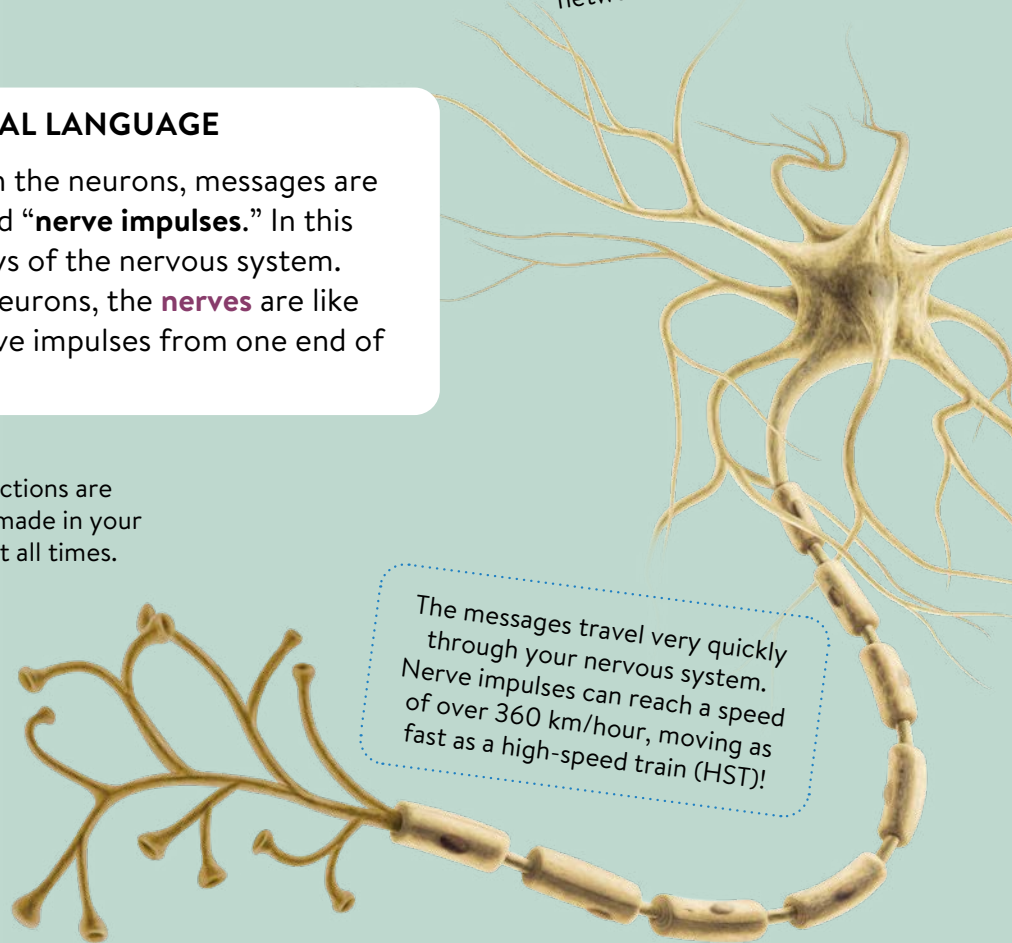
The brain's neurons resemble an immense jungle where each tree (neuron) communicates with the others through a vast network of roots and branches.

A VERY SPECIAL LANGUAGE

So that they can pass through the neurons, messages are coded in electric signals called “**nerve impulses**.” In this form, they travel the pathways of the nervous system. Made up of long bundles of neurons, the **nerves** are like electric cables that carry nerve impulses from one end of the body to the other.



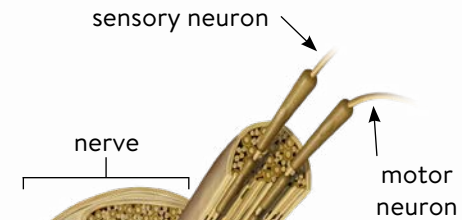
Connections are being made in your brain at all times.



The messages travel very quickly through your nervous system. Nerve impulses can reach a speed of over 360 km/hour, moving as fast as a high-speed train (HST)!

Adapting to the environment

At any given time, your senses are sending information to your brain. For example, when you're walking in a forest, your nose detects the smell of plants. You hear the birds singing and feel the wind on your skin. Your eyes find the trail and note the dangers it presents. Your legs can thus follow the trail... and avoid the obstacles!



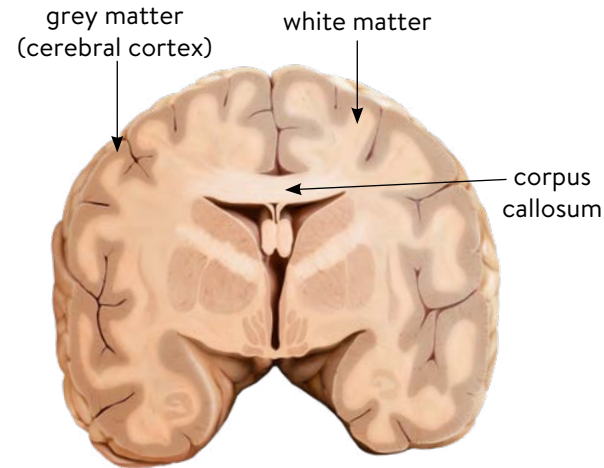
SENSORY OR MOTOR MESSAGE?

Two types of nerve impulses contribute to the transmission of information throughout your body. **Sensory** nerve impulses leave the sense organs (skin, eyes, ears, nose, tongue) and deliver the information to the brain with the help of the sensory neurons. Your brain then decodes the message and sends orders to different parts of your body using **motor** neurons and nerve impulses.

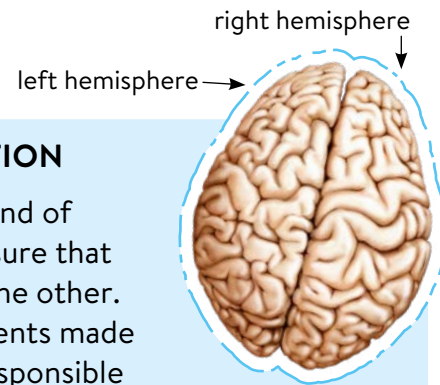
Travelling through the brain

Grey matter and white matter

The outer layer of the brain, known as the “**cerebral cortex**,” is made up of **grey matter**. It is formed by the **neural nuclei**, which act like tiny computers whose job is to decode and store information. The **white matter** is found under the cortex. Its job is to connect the different parts of the brain, a bit like the role played by computer wires.



The grey matter interprets messages from the senses and calls for voluntary movements. It is responsible for the most highly developed brain functions, such as thought and language.



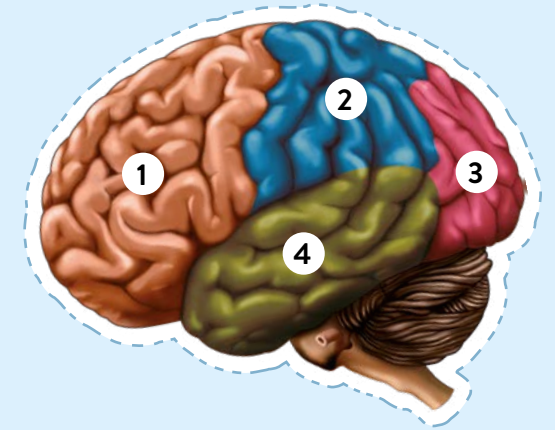
TWO HEMISPHERES IN CONSTANT COMMUNICATION

Your brain is divided into two **hemispheres** connected by a band of white matter called the “**corpus callosum**.” Its job is to make sure that the information is properly carried from one hemisphere to the other. Did you know that the right hemisphere controls the movements made by the left side of the body and that the left hemisphere is responsible for the right side?

The brain's many functions

The cerebral cortex of each hemisphere is divided into four main areas called “**lobes**.”

1. The **frontal lobe** controls voluntary movements and a number of complex human behaviours: language, thought, concentration, planning, decision-making, reasoning...
2. The **parietal lobe** is, in particular, responsible for detecting the body's position and for processing the sensations of touch.
3. The **occipital lobe** is involved in the processing of visual information (coming from the eyes).
4. The **temporal lobe** is responsible for hearing (processing sounds) and is also the centre of memory, emotions, and language comprehension.



When you build new connections (bridges) between the neurons and various areas of your brain, you learn and create memories!



RIGHT- OR LEFT-HANDED?

Being right- or left-handed has nothing to do with using one hemisphere more than the other. In fact, we don't know why people use one hand rather than the other, but we do know that there are far more right-handed people than left-handed. There are also people who are **ambidextrous** and use both hands equally.

Working in the shadows

Other areas located under the **cerebral cortex** serve a critical function, but their help sometimes goes unnoticed.

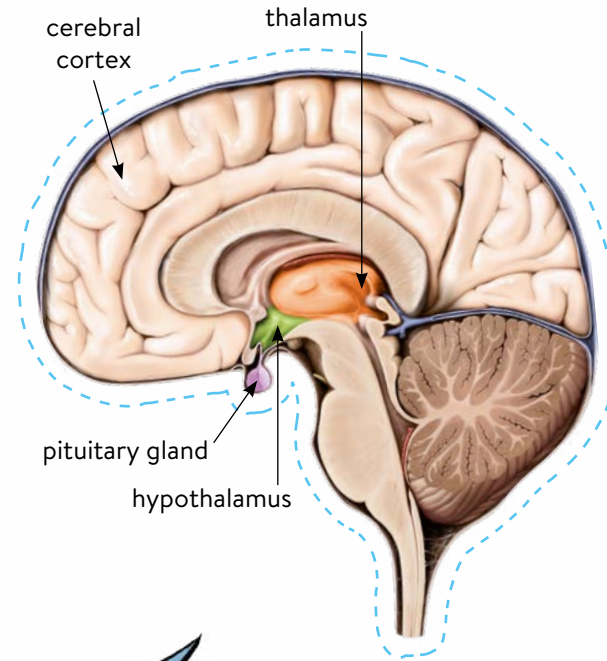
A sorting centre

Located in the centre of the brain is a structure called the “**thalamus**.” Its function is to sort all the information (sounds, images, odours, etc.) that the senses receive and to send it to the correct part of the brain.

An autopilot system

Although you're completely unaware of it, the **hypothalamus**, which is found under the thalamus, regulates several of your body's “automatic” functions, such as its temperature.

For example, if you're cold, the hypothalamus sends a message to your muscles telling them to tremble or shiver... to warm you up. The hypothalamus works with the **pituitary gland** to form a team that releases **hormones**, substances that are essential to your growth and to your body's proper functioning.



The brain evolves

Like the rest of your body, your brain grows, develops, and ages over time.

During **pregnancy**, the baby's brain develops rapidly and can create up to 3,000 **neurons** per second.

Adolescence is the time when information circulates the fastest between the neurons. The brain also does a cleanup of its connections. It reinforces the most frequently used bridges and eliminates those that are used the least.

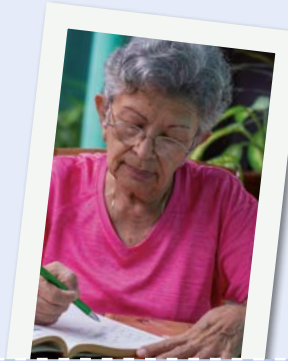
After the age of 65, the brain enters an **aging** phase. The bridges between the neurons wear out, and information circulates more slowly. But you can keep your brain on its toes by exercising it!



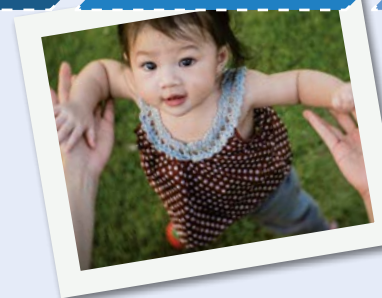
pregnancy



childhood



aging



During **childhood**, the brain begins its growth and learning phase. Billions of connections (bridges) form between the neurons when you learn to walk and talk.



During **adulthood**, the brain has all it needs to adapt to its environment. The neurons continue to build new bridges to preserve memories and knowledge.