4 The Nervous System

Before We Start, Let's Check

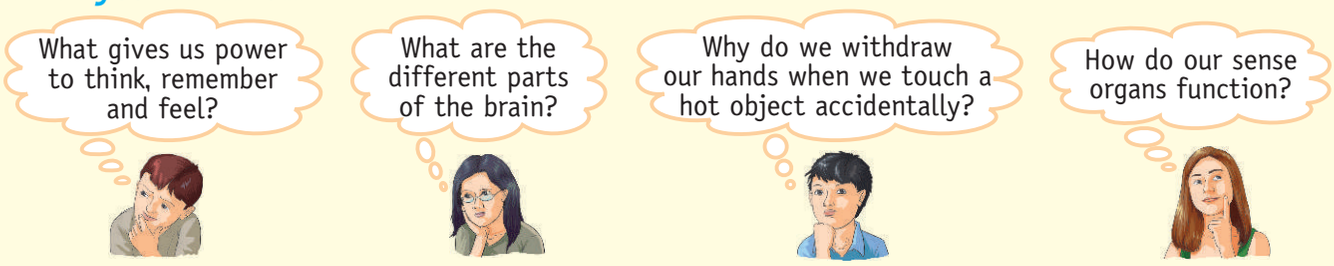
What you already know

Match each picture with the function the organ performs.

1. 
2. 
3. 
4. 
5. 
6. 

(a) thinking (b) smelling (c) hearing (d) seeing (e) tasting (f) touching

What you will know



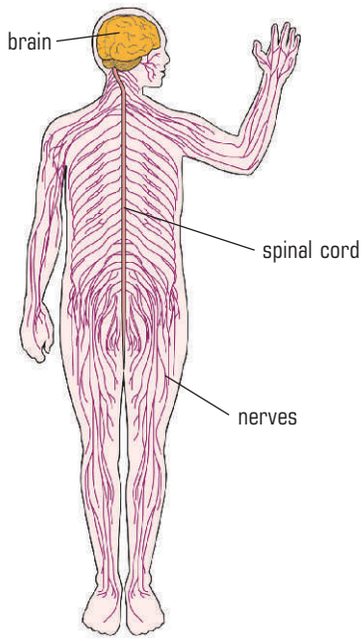
In the previous chapter, you have read about the various organ systems in our body. Out of these, the nervous system is perhaps the most important system as it controls all the other organ systems.

Everything we do is controlled by the nervous system. It stores information, controls feelings and makes us aware of our surroundings.

The nervous system is made up of the **brain** and **spinal cord**. Together, they make the central nervous system (**CNS**). Along with them, there is a network of **nerves** that extends from the CNS to all parts of the body.

This network of nerves is like roads by which the brain sends and receives information about what is happening in the body and around it.

Let us know more about the various parts of the nervous system.



nervous system

BRAIN

The brain is the main organ of the nervous system. It is the most complicated organ too.

The brain is like a super computer, it receives various pieces of information from different parts of the body. It stores all the information received as memory. Next, it processes that information using the past experiences. Then, it takes a decision and finally sends instructions to different parts about what to do.

Humans are superior to all other animals because of their highly developed brains.

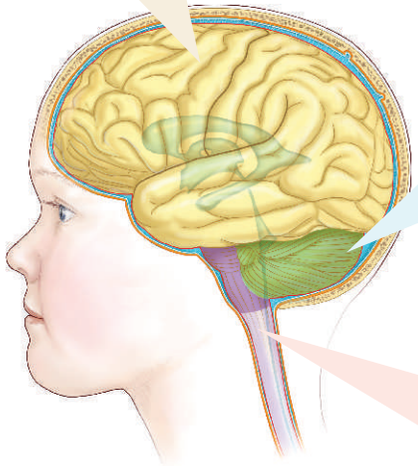
The brain is very soft and delicate. On the outside, it is protected by the hard, bony skull. Inside the skull, it is wrapped in three layers of tissues and floats in a special shock-proof fluid. This fluid prevents the brain from getting bumped on the inside of the skull as your body moves around.

The brain has many different parts that work together. We shall study only three major parts here.

Cerebrum: It is the biggest part of the brain and makes up about 85% of the brain's weight. It has many grooves and folds on its surface so that it can fit into the skull.

The cerebrum is responsible for memory, learning, intelligence and reasoning. It helps us to make all the decisions and control emotions.

The cerebrum has two halves. The right half controls the left side of the body and the left half controls the right side of the body.



Cerebellum: It is at the back of the head, below the cerebrum. It is much smaller than the cerebrum at only $\frac{1}{8}$th of its size.

The cerebellum controls balance, movement and muscle coordination. It is because of the cerebellum that we can stand upright, maintain our balance and move around.

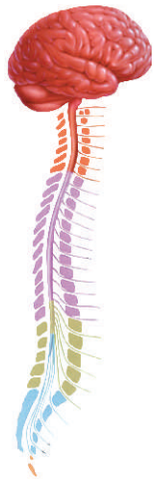
Medulla: The medulla, also known as the **brainstem**, is the lowermost part of the brain. It connects the rest of the brain to the spinal cord.

The medulla controls all the functions that your body needs to perform to stay alive, for example like breathing, digesting food and circulating blood.

Part of brain	Functions
Cerebrum	control thought, movement, reasoning, language
Cerebellum	control movement, balance, posture
Medulla	control breathing, heart rate, blood pressure, digestion

SPINAL CORD

The spinal cord is a bundle of nerves that connects the brain to other parts of the body. It extends from the medulla to almost the end of the spine. It is surrounded and protected by the backbone.


spinal cord

The spinal cord is about 43-45 cm long and approximately as thick as a human finger.

It is through the spinal cord that messages travel to and fro between the brain and the rest of the body. It also controls certain actions that do not involve the brain. Such actions are called **reflex actions**.

If the spinal cord is damaged, the brain cannot share information with the body properly.

NERVES

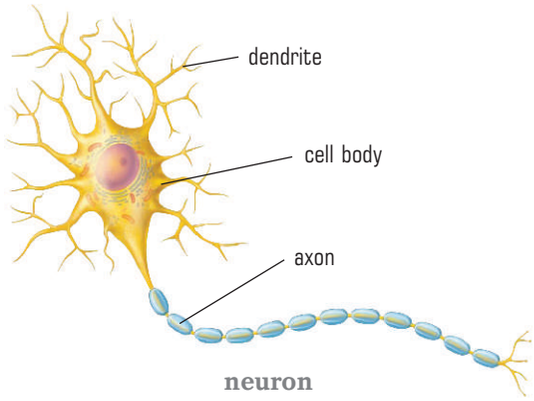
Nerves are the messengers of the body. They carry messages from the brain and spinal cord to all other body parts and vice versa.

Nerves from the head and neck join the brain directly. Nerves from the rest of the body join the spinal cord.

Inside each nerve, there is a bundle of nerve fibres. Some nerves are really long, for example the ones that go all the way from the feet to the spinal cord.

Neurons: Nerves are made up of **neurons** or nerve cells. There are billions of neurons in the nervous system.

All neurons have a **cell body** and one or more fibres. There are two kinds of nerve fibres: fibres that carry information towards the cell body, called **dendrites**, and fibres that carry information away from it, called **axons**.



neuron

Types of nerves

There are three types of nerves:

Sensory nerves: They carry messages from the sense organs to the brain or the spinal cord.

Motor nerves: They carry messages from the brain to the muscles and glands.

Association nerves: They connect sensory nerves and motor nerves and pass messages between them.

ACTIONS OF THE BODY

In our day-to-day lives, we do many activities. For that, our body has to perform many actions. These actions can be categorised into two main types: voluntary actions and involuntary actions.

Voluntary actions

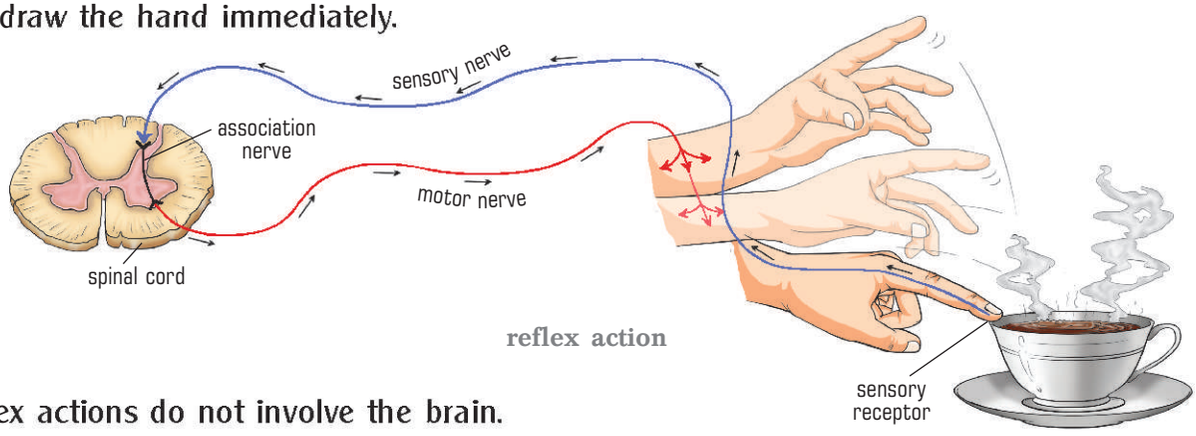
These are actions which we do out of our will. Our brain controls these actions. For example, when you feel thirsty, you pick a glass of water and drink it.

Involuntary actions

These are actions which happen without our will or choice. Our brain does not control these actions. Most of the involuntary actions take place inside our body. For example, the beating of heart, gulping down of food, etc.

Reflex action: Reflex action is also a kind of involuntary action as the brain is not involved in it. Moreover, the outer organs of our body are engaged in it. What happens when you accidentally touch a hot cup of tea? You immediately draw your hand back without even thinking. How does it happen?

When your finger touches the hot cup, the sensory nerves immediately pass a message to the spinal cord that the object is hot and it can damage the skin. So even before this message goes all the way to the brain, the spinal cord sends another message through the motor nerves to withdraw the hand immediately.



reflex action

So reflex actions do not involve the brain.

Some other examples of reflex actions are:

- Blinking of your eyes on sudden exposure to the bright light.
- Secretion of saliva in your mouth when you see a hot pizza.
- Your jumping from the bed when you see a cockroach near you.
- Withdrawing your hand immediately when it is pricked with a thorn.
- Sneezing when dust particles or chilli powder enter your nose.
- Raising your arm if a ball is thrown your way.

SENSE ORGANS

Some organs of our body help us to feel or sense the world around us. They are called the sense organs. We have five sense organs: eyes, ears, the nose, the tongue and skin.

Eyes

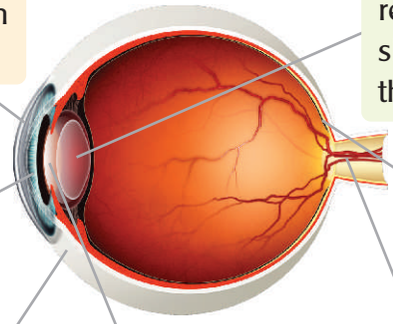
Eyes help us to see the world around us. Eyes are very delicate part of the body. So most of the eye is hidden inside a socket in the skull. The eye is covered by eyelids. They protect the eyes from dust, strong light, sweat and injury. Eyelashes and eyebrows give extra protection.

Structure of the eye: The eyes are shaped like balls.

Cornea: It is the transparent skin that covers the front of the eye.

Iris: It is the coloured part of the eye. The colour is due to pigments. The eyes of different people sometimes have different colours.

Sclera: It is the tough skin that covers the outside of the eyeball. We call it the white of the eye.



Lens: The lens focuses light on the retina. It is made up of tissues. It changes shape to make sure that the picture on the retina is as clear as possible.

Retina: This is like a movie screen, which shows the picture you are seeing. It has special cells that can sense light and colour.

Pupil: It is a small opening in the iris through which the light enters. It becomes very small in bright light, and bigger in dim light.

Optic nerve: It is a sensory nerve that carries messages from the retina to the brain, which tells you what you are seeing.

Taking care of the eyes:

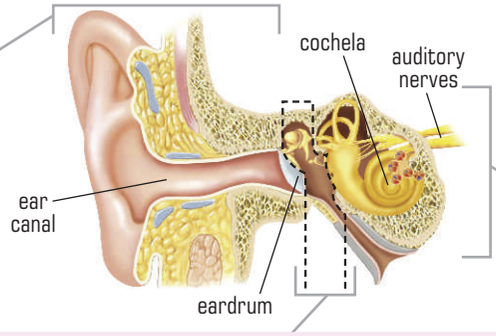
- Wash the eyes regularly with clean water.
- Do not read in dim or very bright light.
- Read with correct posture. Do not read lying down.
- Do not read in a moving vehicle as it strains the eyes.
- Wear sunglasses and a hat on a bright day.
- Looking at the sun directly can damage your eyes.
- Do not rub your eyes if they are itching. Wash them with clean, cold water and see a doctor.
- Don't watch TV or play computer games for long periods. Take breaks at regular intervals.

Ears

Ears help us to hear various sounds. They also help us to maintain our balance.

Structure of the ear:

Outer ear: It is the part that we see. It acts like a funnel to catch sound waves. It also has the **ear canal**, which is a pathway of sounds.



Inner ear: The inner ear has a snail-shaped tube, called the **cochlea**. The tiny bones pass on the vibrations to the cochlea. From here, the vibrations travel to the brain along with the **auditory nerves**.

Middle ear: It is separated from the outer ear by a thin sheet-like structure called the **eardrum**. There are three tiny bones behind the eardrum. When sound passes through the eardrum, the eardrum starts vibrating. The vibrations then pass along the tiny bones.

Taking care of the ears:

- Avoid loud music or a loud noise as it can damage your ears.
- Keep your ears clean by washing them when you wash your face.
- Never poke anything into your ear canal – not even a cotton bud.
- Consult a doctor in case of an earache.

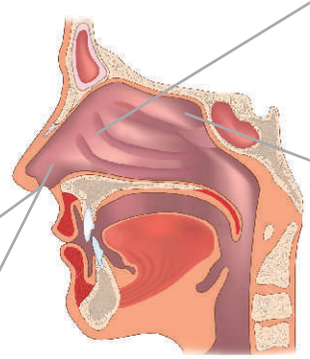
Nose

The nose makes us aware of things around us using the sense of smell. It tells us that a rose has a sweet smell. We also breathe through the nose.

Structure of the nose:

Nostrils: The nose has two holes called nostrils. We breath through them. It has tiny hair that prevent dust and germs from entering the body.

Septum: Between the nostrils, there is a very thin wall of bone and cartilage, called the septum.



Nasal cavity: Behind the nose, in the middle of the face, there is an empty space called the **nasal cavity**.

Olfactory area: The olfactory area is up on the roof of the nasal cavity. It has many special receptors that pick up smells from the air that enters the nose. These cells send signals to the brain, which identifies the source of the smell.

Taking care of the nose:

- Never pick your nose. It is unhygienic as well as bad manners.
- Keep your nose clean. But never clean it by putting any object inside it. Blow it gently.
- Breathe through your nose, and not your mouth. The hair inside the nose stops the dust in the air from entering the lungs.
- Never use a dirty handkerchief to blow your nose as it may cause an infection.

Tongue

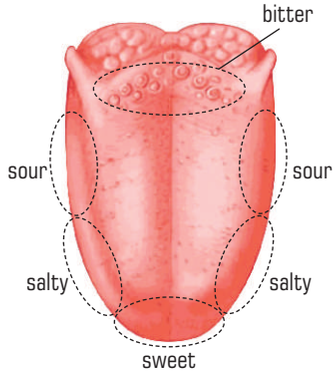
The tongue is the organ of taste. It is made up of many groups of muscles. Besides tasting food, it also helps in chewing and swallowing it. The tongue is also needed for speaking.

Structure of the tongue:

The top of the tongue is rough because it is covered with hundreds of tiny bumps called **papillae**.

There are taste buds on top of these papillae. Each papilla may contain from a few to a hundred taste buds. These taste buds can sense sweet, sour, salty and bitter tastes.

Most of the taste buds that sense sweet or salty tastes are at the front of the tongue. The taste buds for a sour taste are mainly along the sides of the tongue, and the ones for a bitter taste are at the back of the tongue.



Taking care of the tongue:

- When brushing your teeth, scrape your tongue gently with a tongue cleaner.
- Don't sip extremely hot soup or beverages.
- Always rinse your mouth after eating.
- Avoid eating too spicy food.

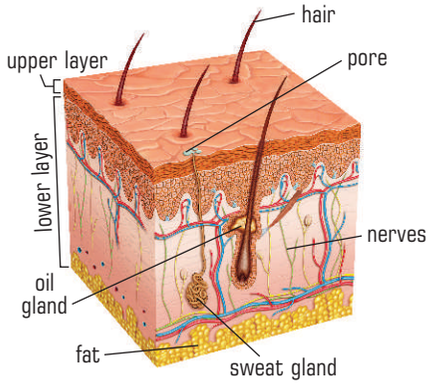
Skin

Skin helps us to feel things. The sense of touch helps us to know about different objects even with our eyes closed. While all the other four sense organs are located in specific parts of the body, skin covers the whole body. It is, in fact, the largest organ in the body.

Structure of skin:

Skin has two layers. The upper layer has cells that make skin waterproof and tough. Some cells are responsible for the colouring of skin.

The lower layer has a network of nerves which help us to feel heat, pain, pressure and cold. It also has sweat glands that convert body wastes into sweat. Sweat is then eliminated from the body through millions of tiny pores on the skin.



Taking care of skin:

- Germs grow very fast on dirty, warm and moist skin. So, clean your skin with soap and water every day.
- After having a bath, dry your skin well by rubbing gently with a towel.
- In case of a cut in the skin, apply antiseptic lotion or cream.

Words to Remember

cerebrum	–	the biggest part of the brain, responsible for memory, intelligence and learning
cerebellum	–	part of the brain responsible for balance and movement
medulla	–	part of the brain responsible for carrying out actions necessary for life
reflex action	–	an action that does not involve the brain and is performed by the outer organs of the body
neurons	–	nerve cells, responsible for carrying messages from the brain and spinal cord to other body parts and vice versa
pupil	–	a small opening in the eye through which light enters
retina	–	the screen at the back of the inner eye where the picture of what we see is formed
eardrum	–	a sheet-like structure in the middle ear, which vibrates when the sound waves hit it
olfactory area	–	a place at the upper back of the inner nose, having receptors that detect smells
papillae	–	tiny bumps on top of the tongue

Points to Recall

- The nervous system controls all other organ systems.
- The brain, spinal cord and nerves are the major parts of the nervous system.
- The brain is like a super computer with intelligence and feelings.
- Different parts of the brain have different functions.
- The spinal cord is a bundle of nerves that connects the brain to the different parts of the body.
- Nerves are messengers that carry messages back and forth between the brain and the other parts of the body.
- There are three types of nerves: sensory nerves, motor nerves and association nerves.
- Involuntary actions like reflexes do not involve brain.
- Our eyes are very delicate and are protected by eyelids, eyelashes and eyebrows.
- Light enters eyes through the pupil and the picture is formed on the retina.
- There is an eardrum inside the ear which vibrates when sound waves hit it.
- There are receptors on the roof of the inner nose that pick up smells from the air.
- We have many taste buds on top of our tongue, which can sense sweet, sour, salty and bitter tastes.
- A network of nerves is attached to skin, which helps us to detect various things through touch.
- Our sense organs are precious, we should take care of them.

Exercises

A. Tick (✓) the correct option.

1. Which of the following is not a part of the central nervous system (CNS)?
   (a) brain ☐ (b) spinal cord ☐ (c) nerves ☐ (d) all of these ☐
2. Which part of your brain is involved when you are walking?
   (a) cerebrum ☐ (b) cerebellum ☐ (c) medulla ☐ (d) brainstem ☐
3. Which of the following is not a part of the eye?
   (a) cochlea ☐ (b) sclera ☐ (c) cornea ☐ (d) iris ☐
4. The ear canal is located in the _____ ear.
   (a) outer ☐ (b) middle ☐ (c) inner ☐ (d) none of these ☐
5. The taste buds that sense a _____ taste are mostly at the back of the tongue.
   (a) sweet ☐ (b) sour ☐ (c) salty ☐ (d) bitter ☐

B. Fill in each blank choosing the correct word.

1. The right half of the cerebrum controls the _____ side of the body. (*left* / *right*)
2. The nerve fibres, called _____, carry information towards the cell body. (*dendrites* / *axons*)
3. Tying your shoelaces is _____ action. (*a voluntary* / *an involuntary*)
4. The coloured part of the eye is called the _____. (*pupil* / *iris*)
5. The _____ is a very thin wall between the nostrils. (*septum* / *nasal cavity*)

C. Answer in one or two words only.

1. What is another name for nerve cells? _____
2. What do we call the nerves that carry messages from the brain to the muscles? _____
3. Do ears help us to maintain our balance? _____
4. What are the tiny bumps on top of the tongue called? _____
5. Name the largest organ of our body. _____

D. Answer in one sentence only.

1. What is the difference between the medulla and the brainstem?
2. Where is the spinal cord located in the body?
3. Write an example of a reflex action.
4. Why should we breathe through the nose, and not through the mouth?
5. What sort of food should be avoided to protect the tongue?

E. Answer in a few sentences.

1. What are the similarities and dissimilarities between the human brain and a computer?
2. Using a diagram, explain the structure of a neuron.
3. With the help of an example, explain how a reflex action takes place.
4. Write four ways of protecting eyes.
5. Explain the working of the ear with the help of a diagram.

Creative Skills

BRAINSTORM

1. Why do our eyes close, if we suddenly come out in the bright light from a dark room?
2. Why do some people have brown, green or grey colour eyes?

Tell Your Teacher

Some people do not have all the sense organs. We call them differently abled people. We should always treat them with love and respect.

Read the following activities and tell your teacher what right or wrong thing each child did.

- One day, when Rohit went to the park to play, he saw a deaf and mute girl with his friends. When Rohit asked about her, he was informed that she was his new neighbour. Rohit told his friends not to include take her in their play group as she could not hear or tell anything.
- Yesterday, Sapna stopped his younger brother from using a matchstick to remove ear wax.
- Dipti, Raja and Vasu are classmates. Yesterday, Dipti saw Vasu using the handkerchief of Raja for blowing his nose. Dipti stopped Vasu from doing so.

FIND OUT

Why do we find food so tasteless when our nose is blocked due to cold?

_____

What is Braille? How is it useful? Who invented it?

_____

Project

Many people have achieved great success in their lives even after being differently abled. They are our sources of inspiration.

Write brief bio-sketches of any two of the following personalities and show them to your teacher.

- L V Beethoven
- Helen Keller
- Stephen Hawking
- Ravindra Jain

You can take the help of books, magazines, encyclopedias, the Internet, etc.

Experiment

1. To check the sense of smell.

Choose a friend.

Blindfold him.

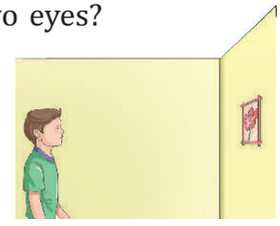
Collect some items that have a specific smell.

Ask him to sniff them one by one and guess their names.

Items that can be taken: a newly printed book, a mint leaf, coffee powder, a jasmine flower, a leather belt, a mosquito-repellent cream, a garlic clove, etc.

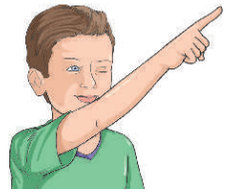
2. Why do we have two eyes?

Hang a picture of a flower on a wall.



Stand about 10 steps away from the wall.

Point your finger at the flower and shut your right eye only.



Now, without moving your finger, shut the left eye only.

What do you observe? Discuss with your teacher.