



natural science

The organisation
of living things



5 primary

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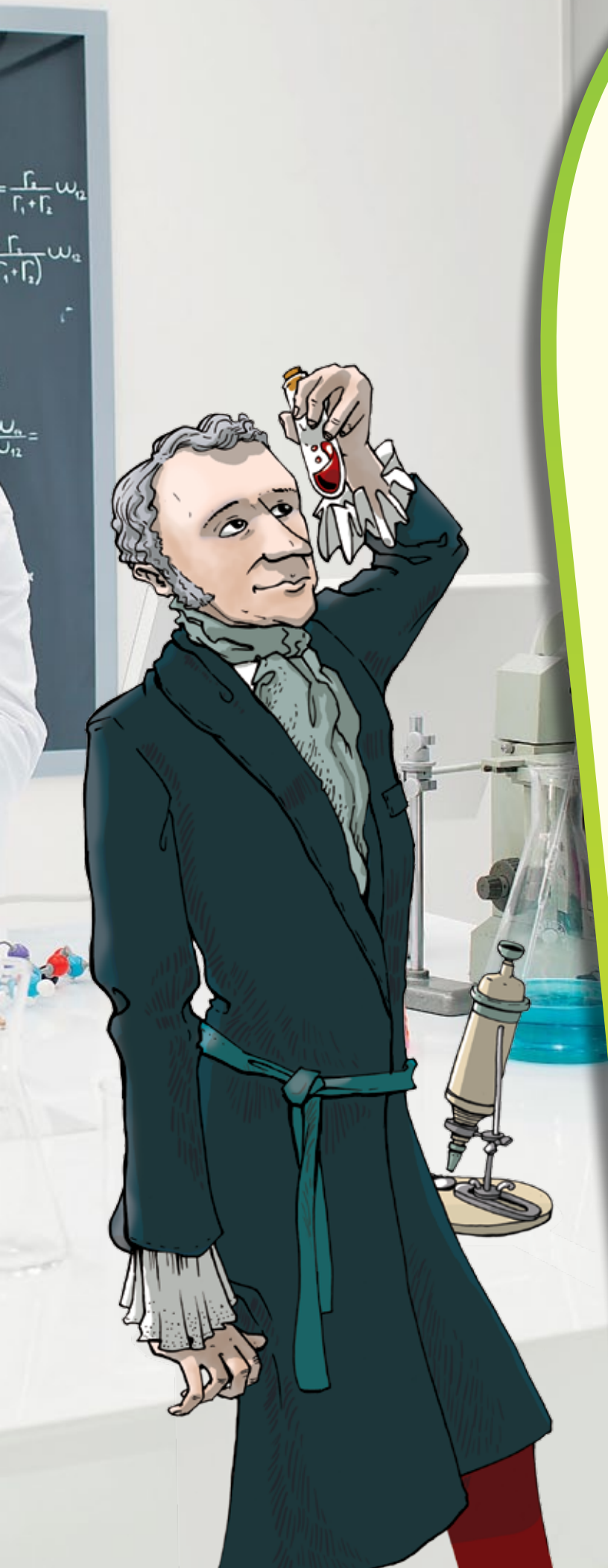


The importance of... scientific curiosity

Much of our scientific knowledge is due to the observational skills of people who, moved by the desire to know more, have devised new methods to interpret and understand the world around us.

Final task

At the end of the unit you will be able to use your own powers of observation to analyze the vital functions of a living thing.



A clever mind

Robert Hooke was born in 1635, in a small town in England. His father had no money to send Hooke to school, so he decided to teach his son to read, write and do some maths himself. Surprised, he soon saw that his son had a brilliant mind.

When he was 13, Robert's father died and he decided to go to London to find work.

At just 18, a great scientist of the time, Robert Boyle, gave him a job helping in his laboratory. Thanks to his ingenious mind, Hooke devised all sorts of things: a pump to compress gases, clocks, thermometers, and even microscopes which allowed him to observe in detail parts of plants and animals that were not visible to the naked eye.

Let's speak

- 1 Look at the picture. Are the microscopes designed by Hooke the same as our modern microscopes?
- 2 Robert Hooke built microscopes which he used to study animal and plant parts that are not visible to the naked eye.
 - a) What other instrument can be used to observe small living things?
 - b) What instrument is used to see objects which are far away? And what is used to look at objects as far away as the stars?
- 3 Which of the following characteristics do animals and plants have in common?
 - a) They feed on other living beings.
 - b) They are living things and perform vital functions such as nutrition, sensitivity and reproduction.
 - c) They move to obtain their food.

The characteristics of living things

Clearly, a cat and a geranium are living things. The geranium is a plant that grows and flourishes, it needs water and light; The cat is an animal which runs and purrs when you stroke it, and it also needs food.

But the flame in the fireplace in the picture also moves and yet it is not a living being.

What do living things have in common? What makes them different from non-living things?

Vital functions

All living things are alike in performing some specific functions, called **vital functions**. These functions include **nutrition**, **sensitivity** and **reproduction**.



► Nutrition

The role of **nutrition** is to transform food into simple substances called **nutrients**, and energy.

Some living things, like plants, make their own food using light. Others, like animals, eat other living things.



Oak leaves capture sunlight.



Deer eat plants.

► Sensitivity

Sensitivity is the **perception of changes** that occur both in the environment and inside the body, and the ability to react to them.

For example, plants grow towards the sunlight, and animals are frightened when they perceive a threat.



The palm tree finds the light it needs.



The cat cowers when it sees the dog.

► Reproduction

Reproduction allows living things to produce **offspring** like themselves.

So, the fertilization of one flower's original seeds germinate and develop into new plants. And baby animals are new organisms that resemble their parents.



This plant reproduces through its flower.



This turtle hatches from an egg.

The size of living things

An oak tree, a cat or a turtle are living things that we can see with the naked eye, they are **macroscopic beings**.

There are other living things that are so small that we cannot observe them even with a magnifying glass. To look at these living things we need an instrument called a microscope. Therefore, these living things are called **microscopic beings** or **micro-organisms**. Despite their small size, these beings also perform the vital functions.



Some living beings are so small that we cannot see them under a magnifying glass.



A microscope allows us to observe a dust mite in detail.



Micro-organisms in a drop of water viewed under a microscope.

Did you know...

The first scientist who observed microscopic beings was Antony van Leeuwenhoek in the seventeenth century.

Young Leeuwenhoek was very curious. So much, that he learned to carve lenses and through them discovered a microscopic world.

Although he was forced to leave school to get a job, thanks to his curiosity he still ended up being a good scientist.

- ▶ All living things perform the **vital functions** of **nutrition**, **sensitivity** and **reproduction**.
- ▶ Living things that can be seen by the naked eye are called **macroscopic beings**. Those which cannot be seen by the naked eye are called **microscopic beings** or **micro-organisms**. We use an instrument called a microscope to observe these beings.

Activities

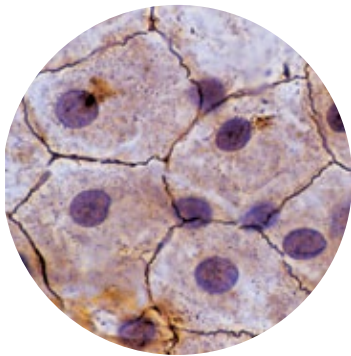
- 1 Explains the vital functions of living things. Give examples.
- 2 In your notebook, write which vital function each sentence relates to and why.
 - A sunflower grows towards the sun.
 - A fox chases a rabbit to eat it.
 - A hen lays an egg.
 - A bean germinates.
- 3 Do you think it would be possible to know about all living things if the microscope had not been invented? Why?

Extra activities

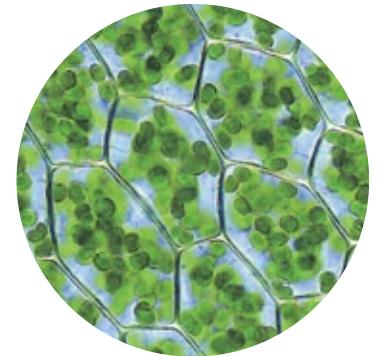
- 4 Search on the Internet for pictures of different creatures that are doing different things. Print the pictures out and classify them according to the vital role they are performing.
- 5 Choose a living thing and, on one piece of paper, draw a comic with six panels showing its vital functions.

2 The cell

As you know a cat and a geranium are both living things. However, they look very different. But when you look at a small sample of them both under a microscope, do they have anything in common?



Cat cells



Geranium cells

This is what you can see when you look at a sample of a cat and a geranium through the microscope. In both cases there are small units called **cells**.

What is a cell?

A cell is the smallest unit of life. It is a living thing because it performs the three vital functions: **nutrition, sensitivity and reproduction**.

All living things are made of cells. But, how are plant and animal cells the same and how are they different?

Animal and plant cells

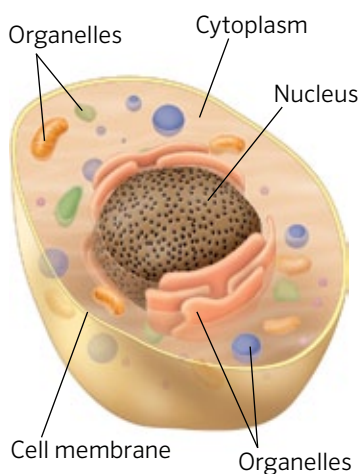
Animal and plant cells are very similar. Both have **cell membranes, cytoplasm, organelles** and a **nucleus**.

- The **cell membrane** is the outer shell of the cell and is involved in the function of sensitivity.
- **Cytoplasm** is inside the cell. It is a viscous liquid which the organelles float in.
- The **organelles** perform various cell functions, such as manufacturing chemicals and energy.
- The **nucleus** contains the material necessary to reproduce the cell and to direct the activities of the cell. In both animal and plant cells, the nucleus is separated from the cytoplasm by a **membrane**.

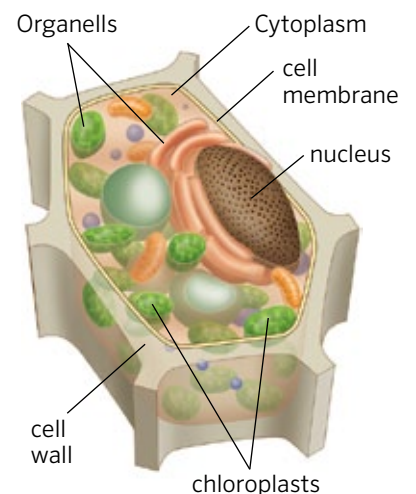
Plant cells also contain **chloroplasts** and a **cell wall**.

- **Chloroplasts** are green organelles that capture light and produce nutrients.
- The **cell wall** is a rigid structure that surrounds the cell membrane and protects the cell.

Animal cell



Vegetable cell

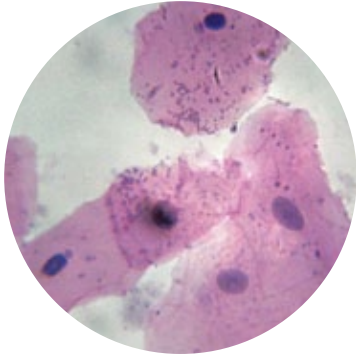


Science workshop

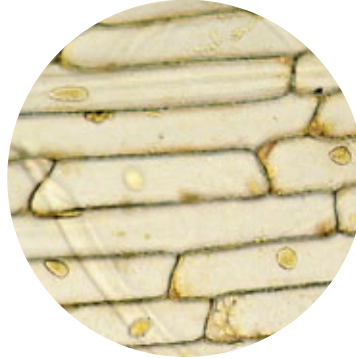
Recognize the parts of a cell under a microscope

You are going to observe two samples under the microscope: the cells from inside a person's mouth and the skin of an onion.

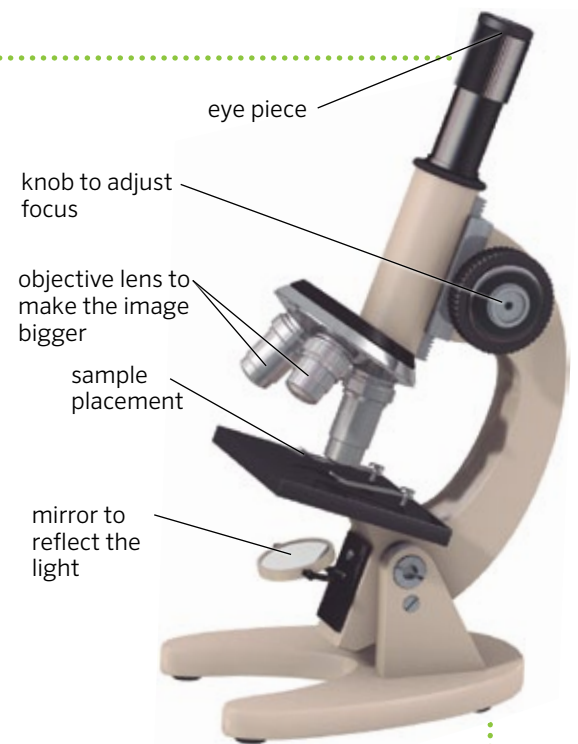
When you look at these samples you should be able to identify the different parts of the cells.



Animal cells from inside a mouth



Vegetable cells from an onion skin



- 1 Draw both cells in your notebook. Which parts can you recognize? What is similar and what is different in these two cells.

- ▶ All living things are made of **cells**.
- ▶ The cell is the smallest unit of life. Cells perform three vital functions: **nutrition**, **sensitivity** and **reproduction**.
- ▶ Cells consist of a **cell membrane**, **cytoplasm**, **nucleus** and **organelles**. Plant cells also have **chloroplasts** and a **cell wall**.

Activities

- 2 What vital functions does a cell perform? Which parts are involved in reproduction?
- 3 What are plant cells organelles called?
- 4 Why is it necessary to use a microscope to see a cell?
- 5 Design a scheme to organize what you have learned about cells. You can add photographs and drawings.

- 6 Which of these two cell is a plant cell? Explain why. Copy the animal cell in your notebook and label the parts that you recognize.

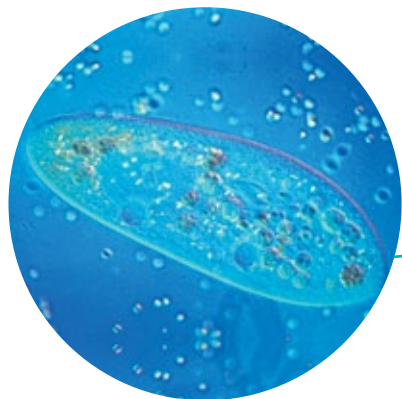


3 Unicellular and multicellular beings

A wide variety of living things lives around us. Some, like the paramecium in the photo below, are very simple and consist of a single cell. Others, such as a child or a tree, are more complex and are composed of many cells.

Unicellular organisms

Living things that are composed of a single cell are called **unicellular organisms**. Their single cell performs all the functions needed to live.



The paramecium is a unicellular organism which lives in water.



Daniel is a multicellular organism

Multicellular organisms

Living things that are composed of two or more cells, like Daniel, are called **multicellular organisms**. In these living things all the cells are coordinated so that the organism can perform the vital functions.

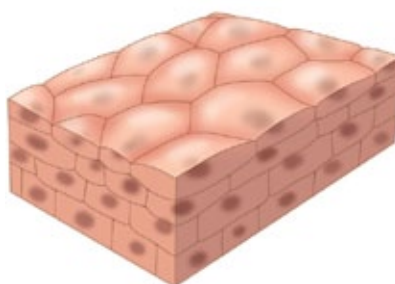
Looking at cells from different parts of Daniel's body under the microscope, we can see that they do not all look the same. They are different because they are **specialized** and perform different functions. The cells of the same type are grouped together to form a **tissue**.

Muscle cells



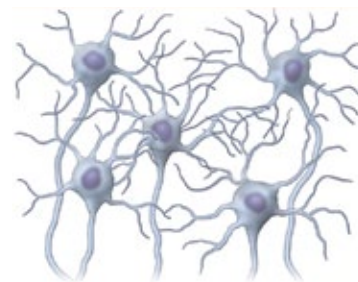
Muscle cells are elongated. These cells, and tissues that they form, shrink and stretch. This allows muscles to **move**.

Epithelial cells



Epithelial cells are usually flat. These flat cells line certain areas of the body such as the skin. They **insulate** the body and **protect** it.

Nerve cells



Nerve cells are star-shaped with long extensions or 'arms'. These cells establish connections and then **transmit information** to all parts of the body.

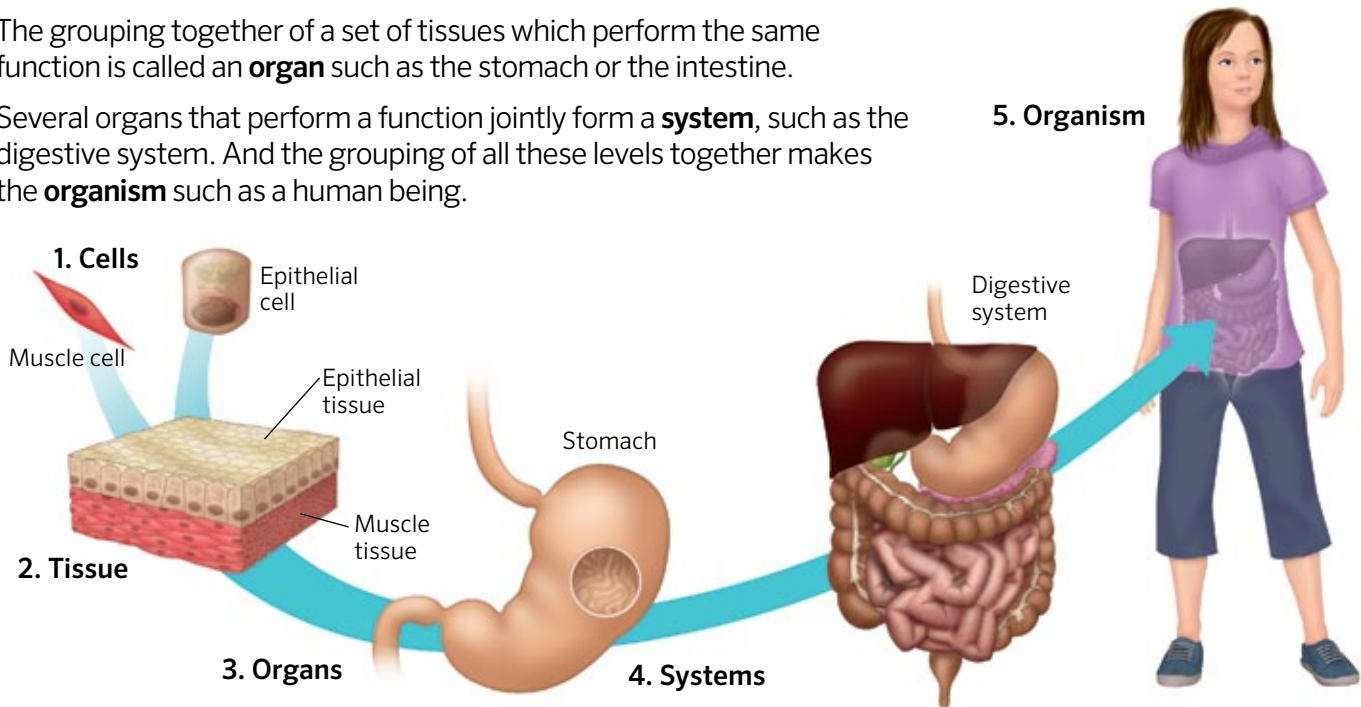
Levels of organisation in multicellular organisms

In multicellular organisms, cells are grouped to form different **levels of organisation**. The end result is an **organism**.

The first level of organisation are the **cells**. A set of one type of cells which perform the same function, will group together to form **tissue**. An example is the muscle tissue, which allows us to perform movements.

The grouping together of a set of tissues which perform the same function is called an **organ** such as the stomach or the intestine.

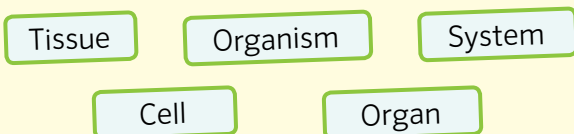
Several organs that perform a function jointly form a **system**, such as the digestive system. And the grouping of all these levels together makes the **organism** such as a human being.



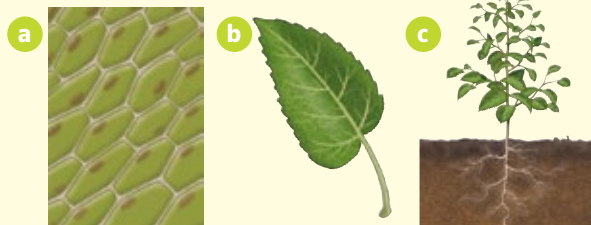
- ▶ Living organisms can be **unicellular** or **multicellular**.
- ▶ The **cells** of multicellular living organisms, which perform the same functions, group together and form **tissues**, these tissues group together to form **organs**, which in turn group together to form **systems**. All these levels of organization result in an **organism**.

Activities

- 1 Draw two examples of animal tissue and describe what function the cells perform.
- 2 Arrange the following levels of organization, from the simplest to the most complex. Then define them in your own words.



- 3 What do the following images represent? What level of organization does each belong to?



- 4 Make a scheme with drawings of the levels of organization of a different multicellular living thing from the girl on this page.

How the body works

To function, the robot needs energy, pieces that hold it together, sensors that provide information, and electronic circuits ... People are **multicellular** living things. To perform the vital functions we need organ systems that work in a coordinated manner.

Human beings and nutrition

So that we can perform the function of nutrition various systems in our bodies need to work together.

- The **digestive system** converts food into simpler substances that the body can use.

The stomach and intestines are organs of the digestive system.

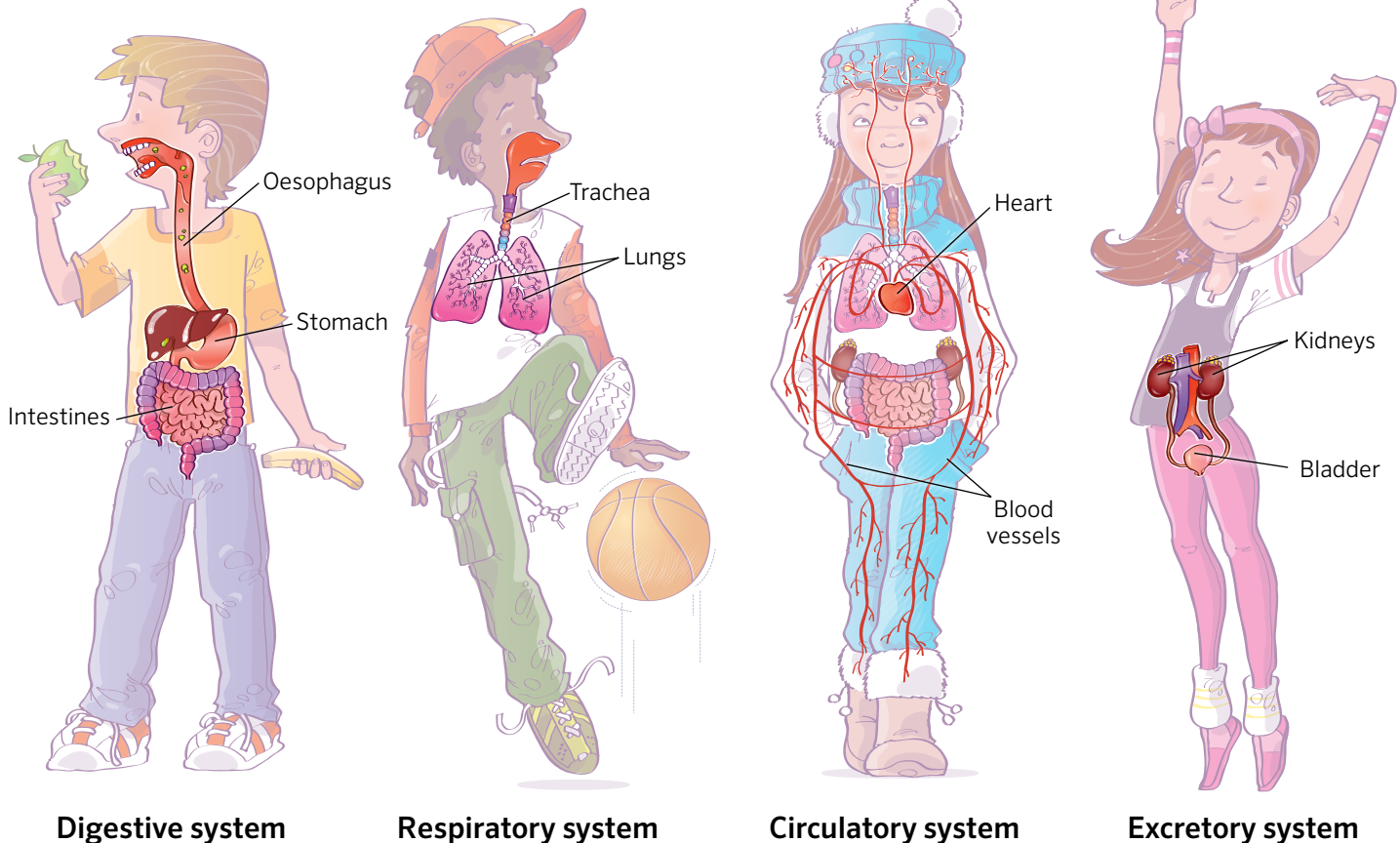
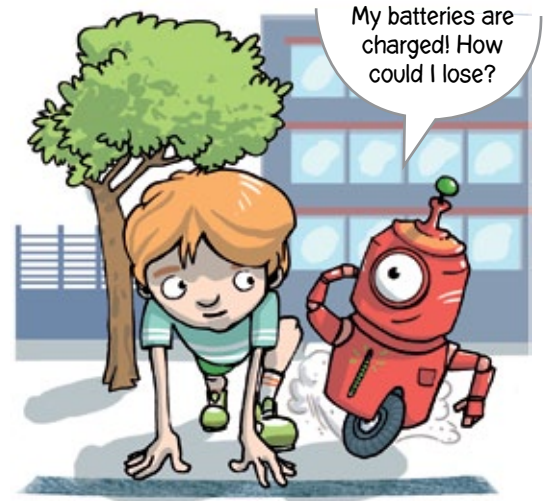
- The **respiratory system** takes the oxygen we need from the air and expels carbon dioxide.

The lungs and trachea are organs of the respiratory system.

- The **circulatory system** carries blood with oxygen and nutrients in it to each and every one of the body's cells and collects waste substances and carbon dioxide.

The heart is an organ of the circulatory system.

- The **excretory system** cleans the blood of waste products. The kidneys are organs of the excretory system.



Digestive system

Respiratory system

Circulatory system

Excretory system

Human beings and sensitivity

Sensitivity enables us to collect information of what is surrounding us and to react. The following organs and systems are involved in sensitivity:

- The **sense organs** such as the eyes, ears and skin, capture information from the outside.
- The **nervous system** gathers the information from the sense organs and prepares orders.
- The **musculoskeletal system** receives the orders from the nervous system and responds with movement.

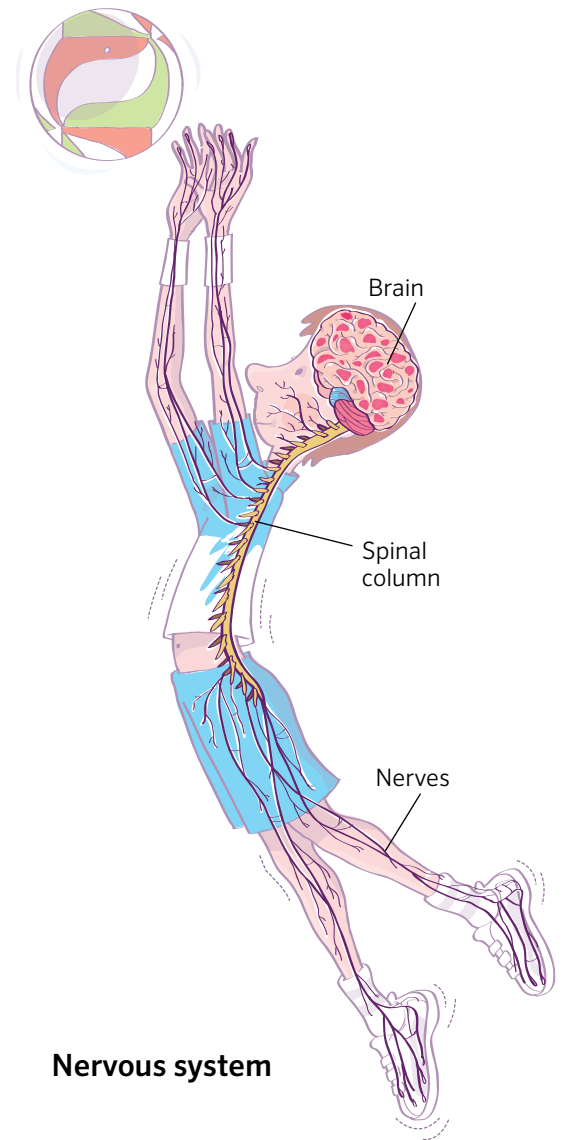
Human beings and reproduction

Humans are **viviparous**, this means that we are born from our mother's womb.

Reproduction involves the **reproductive system**. The reproductive systems of men and women are different. Men have male reproductive systems and women have female reproductive systems.

Our bodies' health

The organ systems of our body can become sick. To prevent this it is advisable to follow a **healthy lifestyle**, such as eating a balanced diet, doing physical exercise, having good hygiene, good posture and engaging with our family and friends.



Nervous system

- ▶ People are **multicellular** living things.
- ▶ For multicellular living things to perform the three **vital functions** they need to involve different **organs** and **organ systems**.

Activities

- 1 Copy the two columns in your notebook and match them using arrows.
 - Musculoskeletal system
 - Digestive system
 - Reproductive system
 - Circulatory system
 - Sense organs

Nutrition •

Sensitivity •

Reproduction •
- 2 What do you think would happen to our organism if our excretory system did not work properly?

Extra activities

- 3 Currently smoking is prohibited in public places such as shops, cafes and schools.
 - a) Why do you think this ban exists?
 - b) What system of our organism is mainly affected by the consumption of tobacco?
 - c) How would you explain to a smoker that smoking harms you and the people around you.