Discovering cells

Lesson 1

When you have completed this lesson you will be able to:

- Identify cells
- Use a microscope to look at some plant and animal cells

Living things are made of **cells**. Just as bricks and planks of wood are the building blocks for houses, cells are the building blocks of living things. Cells, although they are very small, have all the characteristics of life.

All living things share the characteristics of life: growth, movement, feeding, respiration, feeling, excretion and reproduction.

The first drawing of cells

In 1665, the scientist Robert Hooke used one of the first microscopes to magnify a thin piece of tree bark. He saw that it was made up of hundreds of little boxes, which he called *cells*. He drew the very first pictures of cells from what he saw through his microscope.

We now know that all living organisms are made up of one or more cells.

Activity 1

What do plant cells look like under a microscope?

You are going to prepare a piece of the onion to be the specimen you look at under the microscope. Notice how the onion is made of layers. You are going to look at cells from the outside of one of these layers.

You will need:

a microscope, two microscope slides, two coverslips, tweezers, large pins, sharp knife, two droppers, iodine solution, piece of onion.

- Take a layer of the onion off. With a sharp knife, cut two squares of onion about one centimetre square.
- Take two clean microscope slides. Use a dropper to put a drop of water in the centre of one of the slides. Use another dropper to put a drop of iodine solution in the centre of the other slide.
- Take a pair of tweezers. Starting at one corner of one square of onion, use the tweezers to lift up the thin skin that covers the outside of the onion layer and peel off as much as you can. Gently put the skin into the drop of water on one slide, so that the skin unrolls and stays flat. Cover it with a coverslip.
- Do the same with the other square of onion and put this square into the iodine solution on the other slide. Cover with a coverslip.
- Use the low-power lens to look at the piece in water under the microscope. Describe what you see.
- Look at the piece in iodine. Is it different to the piece in water? What has the iodine done?
- Make a large drawing of an onion cell as you see it under the microscope.
- Draw a group of four to six cells to show how they are arranged.

Activity 2

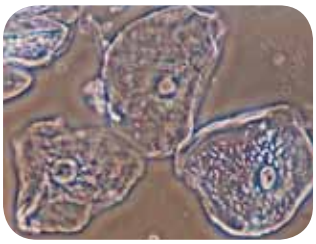
What do animal cells look like under a microscope?

You are going to prepare some cells from the inside of your cheek to be the specimen you look at under the microscope.

You will need:
microscope, microscope slide, coverslip, dropper, tweezers, methylene blue, clean wooden toothpick.

- Wash your hands. Take a clean toothpick and gently scrape along the inside of your cheek.
- Rub the toothpick gently on the centre of the microscope slide. This will leave a smear of cells.
- Add one drop of methylene blue to the smear.
- Cover the smear with a coverslip.
- Put the slide on the microscope and look carefully at your cells. The cells are very thin and hard to see.
- Draw a picture of what you see.

You could not see the cells of the onion or your cheek just with your eyes. You need a microscope to magnify them, because the cells are very, very small – they are **microscopic**.


Human cheek cells seen through the microscope


Onion skin cells seen through the microscope

The smallest living things (or organisms) are made of just one cell – they are **unicellular** organisms. Unicellular organisms that can only be seen with a microscope are called micro-organisms. Human beings are **multi-cellular** organisms: our bodies are a collection of millions of millions of cells doing many different tasks.

Fascinating fact

In 1676, Anton van Leeuwenhoek was the first person to see microscopic organisms. He used a light microscope that magnified objects 300 times. He put a drop of rainwater on a slide; inside that drop, he saw hundreds of micro-organisms that had never been seen before. Imagine the excitement his discoveries created!


Micro-organisms in rain water

What you have learnt

All living things are built from ____. A human body is ____ – it is built from billions of cells. The smallest living things are just one cell – they are called ____ organisms. Cells are ____; they are so small they can only be seen using a microscope.

Key words

cells microscopic
multi-cellular unicellular

Check your progress

1. What are cells?
2. What characteristics does a cell have?
3. What is the difference between a unicellular and a multi-cellular organism?

Comparing plant and animal cells

Lesson 2

When you have completed this lesson you will be able to:

- Identify some of the features of plant and animal cells
- Describe similarities and differences between plant and animal cells

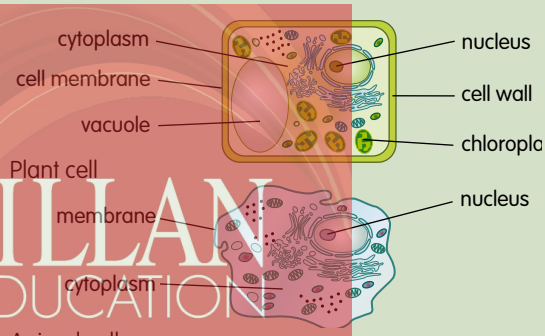
Plants and animals are built from cells. Plant and animal cells are the same in many ways but there are important differences. These differences come from the different ways plants and animals obtain their food and support their bodies.

Activity 1

Look at these drawings of typical animal and plant cells.

What things are the same? What things do plant cells have that animal cells don't have? Copy and complete the table.

Characteristic	Plant cell	Animal cell
nucleus	✓	✓
cytoplasm		
cell membrane		
cell wall		
chloroplast		
large vacuole		



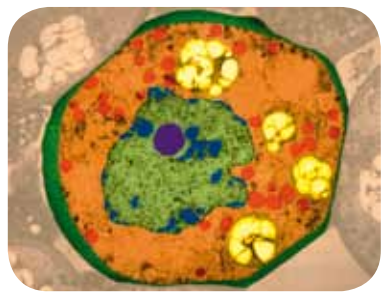
Plant and animal cells

Plant and animal cells both have the following:

Nucleus

The **nucleus** is the cell's control centre. It controls the way the cell works. The only human cells that don't have a nucleus are red blood cells.

Cytoplasm



Cytoplasm is mainly water but it is where a cell's chemical reactions happen. You can't see much in the cytoplasm if you use a light microscope but through a powerful electron microscope we can see it has lots of tiny structures that perform different tasks, such as releasing energy and making new materials.

Cell membrane

The **cell membrane** is the cell's surface. It holds the cell together like a thin bag. There are 'gateways' in the cell membrane that let different substances in and out of the cell.

Plant cells

Plant cells also have the following:

Cellulose

Plant cells have a strong cell wall made from **cellulose**. Plants do not have skeletons. The cell walls help to support the plant and give it strength.

Chloroplasts

Chloroplasts contain the substances, including chlorophyll that the plant uses to trap the energy of sunlight and make its own food.

A large vacuole

The large vacuole is a space inside the cell filled with a watery solution. This stores chemicals that the plant needs. It is pressurised (like a blown-up football) and this helps to keep the plant rigid.

Cotton fibres are made from cellulose.

Fascinating fact

The tiny *chloroplasts* in plants make the whole world green! If you could look at the Earth from outer space, you'd see that most of the land is green. The green colour comes from *chlorophyll* in the chloroplasts of plant cells.

What you have learnt

Plant and animal cells have a ____, which controls how the cell works. The cell is filled with ____, which is mainly water. The cell is surrounded by a ____, which holds the cell together and lets different substances in and out. Plant cells have a strong cell wall made from ____. Plant cells also have green ____ that help the plant trap the energy of sunlight and a large ____ that contains chemicals.

Key words

cell membrane
cellulose
chloroplasts
cytoplasm
nucleus
vacuole

Check your progress

1. What is the job of the nucleus in a cell?
2. Which part of the cell has 'gateways' to let materials in and out?
3. Do animal cells have chloroplasts?
4. What is a vacuole?

Building tissues

Lesson 3

When you have completed this lesson you will be able to:

- Understand how cells reproduce
- Know that there are different types of cells
- Know that tissues are made up of cells and that organs are made up of tissues

You started life as a single cell, formed when a **sperm** cell from your father joined with an egg cell from your mother to make your mother pregnant. But how have you grown since? How has that single cell turned into your body?

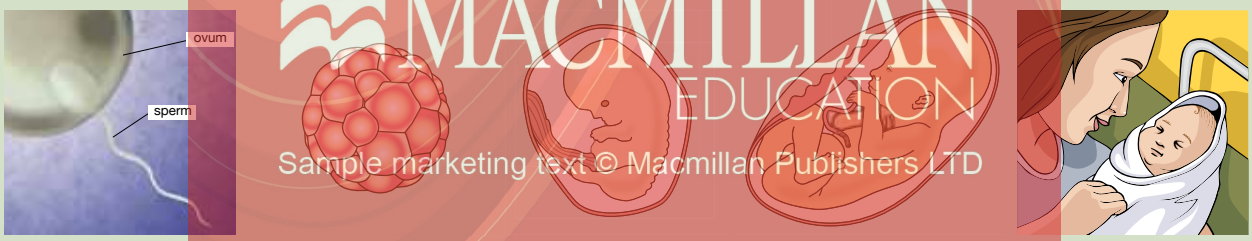
Cells do not get bigger as the body grows. They **divide** to create more cells. The single cell that you started as divided over and over again to produce all the different cells that make up your body today. Your body is built from more than ten million million cells

Activity 1

You are going to look at how a human baby is formed.

Work in a group. Look at the growth sequence in the diagram and answer the questions.

How the human body develops



a Fertilisation
A sperm joins with an egg cell.

b Division
The cell **divides** again and again and the embryo grows.

c Differentiation
Cells grow in particular ways to do different tasks; for example muscle cells, nerve cells or blood cells.

d Growth
The **foetus** develops and grows.

e Birth
About forty weeks after fertilisation, the new baby is born.

1. How long does it take for a fertilised human egg cell to develop into a fully formed baby?
2. How does the cell transform into a human body? Does it get bigger, like a balloon blowing up or does it change in some other way?
3. Are all the cells in the human body identical?
4. List some tasks that different cells must do.

You will need:
a chess board and a bag of rice.

Activity 2

Divide and multiply

How many stages of cell division were needed to produce all the cells in your body?

- Place one rice grain on the first square. This grain stands for one cell.
- Place two grains on the second square, to show the two cells produced by the first division.
- Both cells divide and four cells are produced. Place four grains on the third square.
- Imagine these four cells divide to produce eight; eight divide to produce sixteen and so on. Carry on putting the right number of grains of rice on each square.
- Can you work out how many cells (grains of rice) you will have by the forty-third square?

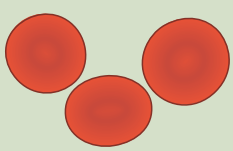
You will run out of rice well before you reach the forty-third square! Dividing in this way, just forty-three stages of cell division can turn one cell into 10 million million cells – the number of cells in the human body.

Cell types

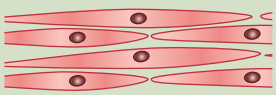
About twelve hours after fertilisation, the egg cell starts to divide. The cells continue to divide about every twelve hours: two cells become four, four become eight and so on, until a ball of cells forms. After about five days, the cells start to **differentiate** or develop in different ways. Some cells become muscle cells, others become blood cells, nerve cells or any of the many types of cell in the human body.

Activity 3

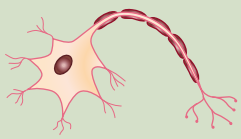
These pictures show some of the different cells in the human body. Match each cell to its description.



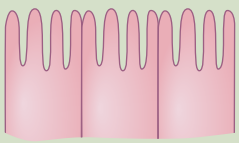
a Blood cells



b muscle cells



c nerve cells

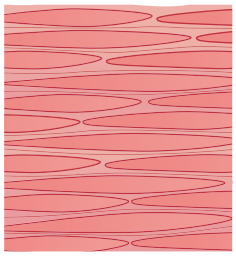


d Intestine wall cells (**epithelial** cells)

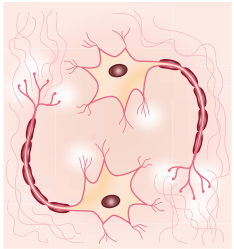
1. These cells make chemicals that digest food.
2. These cells contain fibres that shorten to make the cells change length.
3. These cells are long thin threads that can carry electrical signals.
4. These cells are packed with a special substance, called 'haemoglobin', that joins to oxygen.

Cell teams

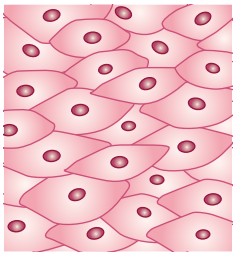
You can't win a football match on your own. You need to be part of a team. Working as a group is often more efficient than working by yourself. Cells work in this way in your body. A group of cells of the same kind is called a **tissue**. The cells of a tissue are the same size and shape and work together to do the same job. Here are some different types of tissue in the human body.



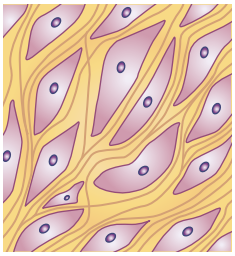
Muscle tissue (moves body parts)



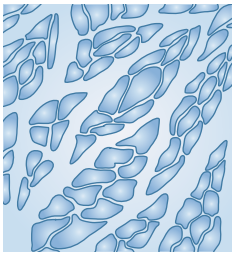
Nervous tissue (sends signals between body parts)



Epithelial tissue (lines surfaces such as the inside of the stomach)



Connective tissue (holds body parts together)



Reproductive tissue (produces sperm and eggs)

What you have learnt

A woman becomes ____ when a ____ fertilises her egg. The fertilised egg grows as its cells ___ to make more and more cells. As the number of cells gets bigger and bigger, the cells ____ to become blood cells, muscles cells and other cell types and a ____ is formed. A ____ is a group of cells of one type that work together to do a job. Muscle tissue produces movement; ____ tissue lines surfaces in the body.

Key words

differentiate
epithelial
pregnant
tissue
divide
foetus
sperm

Check your progress

1. As a new living thing grows its cells *divide* and *differentiate*. What do these words mean?
2. What is a body tissue?
3. What kinds of tissues:
   - produce movement?
   - send signals around the body?
   - line surfaces in the body?
   - hold body parts together?