

Living things: Cells

The cell is the smallest unit capable of living an independent existence. Most cells contain a nucleus which controls the way they work; the only cells in the human body with no nuclei are the red blood cells. Cells are the building units of living things and most of them are tiny. Animal and plant cells have similar internal structures and composition, but plant cells, because of their cellulose walls, have a more rigid structure. Animal cells lack chloroplasts, which are the structures which plants use for photosynthesis.

Essential features of each cell are: the membrane, which encloses the cell and restricts the flow of substances in and out; and cytoplasm, a watery jelly containing structures which carry out protein synthesis, as well as DNA which forms the hereditary material.

Plants and animals grow because they add material to themselves. Some students may have difficulty understanding this; they may imagine that plants and animals grow because they swell, rather like a balloon. This is true, in part, of plants: individual cells fill with water and swell to produce the rapid elongation of shoots and roots. But most growth is by cell division – the splitting of cells to increase the number (but not the volume) of cells. The subsequent swelling of the new cells leads to permanent growth. Some of these new cells will become specialised structures.

Cells are grouped together to form a tissue. There are several kinds of tissue, each consisting of cells of a particular kind bound together. Some common forms of tissue in animals are muscle tissue, nervous tissue, epithelial tissue (which lines the inside of the stomach and other body organs), connective tissue (which holds parts together) and reproductive tissue, which produces the sperm and eggs.



Lesson 1: Discovering cells

Lesson preparation

Objectives

- 🔍 identify cells
- 🔍 use a microscope to look at some plant and animal cells

Science skills

using a microscope to look at cells

Equipment

Warm up: a thin slice of cork or prepared slides, a microscope

Activity 1 a microscope, two microscope slides, two coverslips, tweezers, large pins, a sharp knife, two droppers, iodine solution, a piece of onion

Activity 2 a microscope, a microscope slide, a coverslip, a dropper, tweezers, methylene blue, a clean wooden toothpick

Key words

cells: the basic units from which living things are built

microscopic: something so small it can only be seen with a microscope

multi-cellular: describes a living thing built from many cells; animals are multi-cellular

unicellular: describes a living thing that consists of a single cell

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Background information

The cell is the smallest unit capable of living an independent existence. Cells are the building units of living things. Most of them are tiny. Animal and plant cells have similar internal structures and composition, but plant cells, because of their rigid cellulose walls, have a more rigid structure.

Lesson plan

Warm up

Tell the students about Robert Hooke:

Robert Hooke was born in 1635. He was a great scientist – an astronomer, a physicist and a biologist. His book called Micrografia contains his observations and his drawings.

Looking at a thin sheet of cork, he saw tiny boxes. They reminded him of the little rooms in a monastery, so he called them 'cells'. Nearly two hundred years later, Matthias Schleiden first suggested that all plants are made from cells.

The students could copy Robert Hooke's activity, but you will need to slice cork extremely thinly. For this you will need an extremely sharp blade – for teacher use only – or obtain pre-prepared slides.

Ask the students what they know about cells and their importance.

How many different body cells can you name? What do these different cells look like? What is their function?

How do cells work together? For example, the cells in our muscles and bones?



Activity 1 p11

Students look at piece of onion under the microscope to observe plant cells.

Activity 2 p12

Students look at some cells from the inside of their cheek to see what animal cells look like under the microscope.

Extension

This lesson invites students to find out more about the different sorts of animal cells. They could begin their investigation on the Internet with a number of science websites, especially those that show them the variety of unicellular life.

Concluding the lesson p13

What you have learnt answers

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

Check your progress answers

- 1 the building blocks of living things
- 2 all the characteristics of life: growth, movement, feeding, respiration, feeling, excretion and reproduction
- 3 Unicellular organisms have just one cell; multi-cellular ones have many cells.

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After the lesson

Workbook p4–5

Answers

- 1 **a** microscopic **b** cell **c** unicellular **d** multi-cellular
- 2 **a** human cheek cell **b** micro-organism **c** onion skin cells
- 3 **a** tube **b** eyepiece **c** focusing knob **d** objective lens **e** limb **f** stage **g** base **h** mirror
- 4 **a** with both hands
b coarse focusing knob to wind the objective lens up; fine to focus the image as sharply as possible

Lesson 2: Comparing plant and animal cells

Lesson preparation

Objectives

- 🔍 identify some of the features of plant and animal cells
- 🔍 describe similarities and differences between plant and animal cells



Lesson 2: Comparing plant and animal cells

Science skills

identifying characteristics

Equipment

Extension: research facilities

Key words

cell membrane: the thin layer that encloses a cell

cellulose: the substance in the cell walls of plants that gives them strength

chloroplasts: small green discs in plant cells; chloroplasts contain chlorophyll, the green substance that plants use to trap the energy of sunlight

cytoplasm: the liquid that fills most of the space inside a living cell

nucleus: the part of a living cell that controls its life processes

vacuole: a liquid-filled space in a cell

Background information

All cells have a membrane, which encloses and restricts the flow of substances in and out, and a jellylike material called cytoplasm within it. The cells of plants, bacteria and fungi possess a rigid cell wall that protects the cell and maintains its shape. Most cells contain a nucleus; the only cells in the human body with no nuclei are the red blood cells. Plant cells have rigid cellulose walls and chloroplasts – the photosynthesising structures; animal cells do not.

Lesson plan

Warm up

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What do you remember from the last lesson about cells? Why are they called the building blocks of life? Why are they called cells? What do they resemble?

Are cells all the same? How are they different? Name some of the cells in the human body.

Plant and animal cells are different. Why might that be?

What can plants do that animals can't? What do we mean by photosynthesis? What is the chemical that is so important for photosynthesis? I'll give you a clue – it's green in colour.

Because they lack this vital chlorophyll, animals are unable to photosynthesise like plants and cannot make their own food. But there are other differences between plant and animal cells.

Activity 1 p14

Answers

Plant cell: nucleus, cytoplasm, cell membrane, cell wall, chloroplast, large vacuole

Animal cell: nucleus, cytoplasm, cell membrane

Extension

Using illustrations from books and from the Internet, ask students to draw a generalised plant and a generalised animal cell. Different groups could tackle each kind of cell; and then the two could be compared to see which structures are in each cell and which are missing.



Concluding the lesson p15

What you have learnt answers

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

Check your progress answers

- 1 It controls the way the cell works.
- 2 cell membrane
- 3 no
- 4 space inside a cell filled with a watery solution

After the lesson

Workbook p6

Answers

- 1 Animal; **a** cell membrane **b** nucleus **c** cytoplasm
- 2 Plant; **a** cytoplasm **b** nucleus **c** cell membrane **d** cell wall **e** cell vacuole **f** chloroplast
- 3 large vacuole; cell wall; chloroplast
- 4 **a** cytoplasm **b** nucleus **c** chloroplast **d** cell membrane

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Lesson 3: Building tissues

Lesson preparation

Objectives

- 🕒 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

Science skills

understanding cell reproduction

Equipment

Warm up: sheets of wallpaper

Activity 2 a chess board and a bag of rice

Extension: long strips of paper, cardboard boxes



Key words

differentiate: to become different

divide: splitting into parts; a cell reproduces by dividing

epithelial: the skin or outer tissue of a body or an organ

foetus: a baby developing in the womb

pregnant: expecting a baby. Pregnancy is the time during which a baby develops in the uterus

sperm: male sex cells

tissue: body components made from cells of one type, muscle tissue for example

Background information

In biology, any kind of cellular fabric that occurs in an organism's body is called a tissue. There are several kinds of tissue, each consisting of cells of a particular kind bound together – by cell walls in plants, or by a kind of matrix in animals. So, for example, nerve and muscle are different kinds of tissues in animals.

An organ is part of the living body, such as the liver or the brain, with a separate function or set of functions. Some of the common forms of tissue are muscle tissue, nervous tissue, epithelial tissue (which lines the inside of the stomach and other body organs), connective tissue (which holds parts together) and reproductive tissue, which produces the sperm and eggs.

Lesson plan

Warm up

How many different organs are there inside you? Ask a partner to lie on a sheet of wallpaper and draw round them. Now draw in as many body organs as you can in the right places.

Have you finished? How many different organs can you find? Some are in pairs, like kidneys and lungs. Some are single structures.

Tell me what each organ does. What is the function of the brain? What does the heart do? What is special about the lungs?

Do the organs all look alike? No, they are made up from different tissues and tissue is the word we use to describe the material that makes up organs. Tissues are different because they contain different kinds of cell.

Activity 1 p16

Answers

1 40 weeks

2 It divides again and again.

3 no

4 Example answer: muscles, nerves, blood.

Activity 2 p17

Cells divide to replace cells that are worn out or damaged. New cells are made by other cells dividing into two, growing to full size and dividing again and so on. This is how all living things grow and repair themselves. In our bodies, more than 2 million blood cells are made every second to replace old ones dying at that rate. Students use a chess board to work out how cells divide and multiply and how many stages are needed to produce all the cells in the human body.



Activity 3 p17

Answers

1 d 2 b 3 c 4 a

Extension

Review what the students have learnt about the different kinds of cells. What are the most amazing facts they have discovered about themselves and their bodies? Perhaps you could produce a wall of amazing facts about cells. For example, nerve cells can be extremely long and can conduct nerve impulses at 160 m/s. Cardiac muscle goes on beating throughout our lives without ever faltering. There are 5 billion red blood cells per litre of blood. They lead a hard life as they are forced at high pressure through arteries, veins and capillaries. White blood cells are fierce defenders against invading bacteria, while some of them make the protein that forms a scab over damage to our bodies.

Different cells are different shapes. We are going to make a television game to identify different cells. Here's how to do it. First you need a long strip of paper on which you draw all the different cell types you can think of. You can have some duplicates. You need a box to thread the strip of paper through. Make two slots in the box and slip the paper through the first one and back through the second, so that when you pull on the paper it slides across the front as if across a television.

Now you're ready to play the game. Ask a friend to watch the cells sliding across in front of them and to name the type of cell before it's gone and see how many they can as you slide the paper through slowly and then as you slide it through faster.

Concluding the lesson p18

What you have learnt answers

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

Check your progress answers

- 1 divide means to split to create more cells; differentiate means to develop in different ways
- 2 a group of cells that work together to do the same job
- 3 muscle; nervous; epithelial; connective

After the lesson

Workbook p7–8

Answers

- 1 Students complete the diagram and the table to show how cells divide and how many cells are produced in each generation.
- 2 a false b true c false d true

- 3 a epithelial b divide c differentiate
- 4 a nerve cell b muscle cells
c epithelial cells d red blood cells