Human and Social Biology for CSEC™

NEW EDITION

SAMPLE CHAPTER

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Boost

HODDER EDUCATION

Human and Social Biology for CSEC™

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Contents

Section A

Living organisms and the environment

Learning outcomes

At the end of Section A, you will:

- understand the processes that govern the interactions of organisms in the environment, and the processes by which life is perpetuated
- understand the nature of the interdependence of the processes, structures and functions of the major systems within an organism in the maintenance of health.

Cells are the building blocks of life – your own body cells have many structures and functions in common with the cells of a whistling-cracking frog or a breadfruit! You will discover the secrets of cells, which can only be revealed with the help of a **microscope**. You will compare the cells of plants with those of animals, and you will also explore the structure of tiny organisms called microbes, which are very important to life on Earth, yet which can cause many deadly diseases.

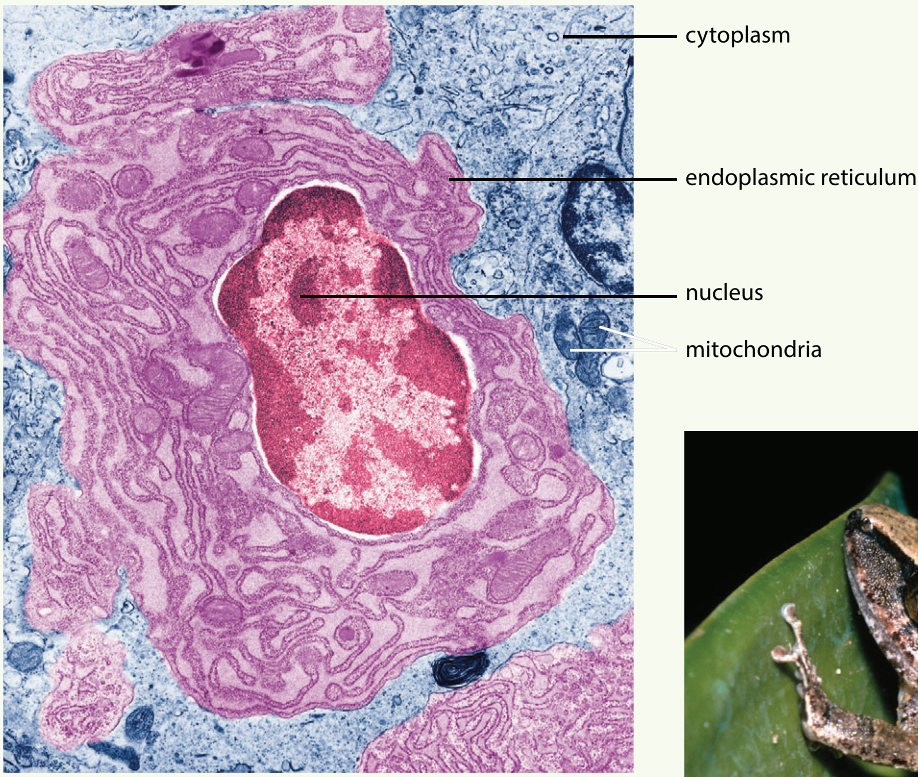


Figure Intro 1.1 The innermost workings of a cell are only visible when they are magnified many thousands of times, yet we have discovered a great deal about how our whole body works from studying the internal secrets of the cell.

Figure Intro 1.2 The cells of this whistling-cracking frog have a great deal in common with those of every other living creature, yet its place in the feeding relationships of the animals of the Caribbean is unique.

Living organisms are linked by their similarities at a cellular level, but they are interconnected at other levels as well. There are feeding relationships between all the different groups of living organisms, starting with plants, which have the ability to make their own food by photosynthesis. Almost all other types of living organisms depend on plants, and the plants rely on the actions of microbes to return nutrients to the soil. You will explore some of these feeding relationships and how they work. You can work out the energy flow right through a food chain until it reaches yourself!

Revision tip

Start early:

* ***Early in the school year***
* ***Early in the day – especially at weekends***

Chapter 1 The structure and function of cells

When you have completed this chapter, you will be able to:

- state the functions of cell structures including the cell membrane, cell wall, nucleus, mitochondria, vacuoles, ribosomes, chloroplasts and endoplasmic reticulum
- explain the processes of diffusion, osmosis and active transport, and why they are so important in living systems
- describe the characteristics of living organisms
- draw and label diagrams to show the structure of unspecialised animal and plant cells
- identify selected specialised cells in the human body and explain how they are adapted to their function

The planet we live on teems with a wide variety of living organisms including animals, plants and microbes. To understand these organisms, both as individuals and as part of an integrated **environment**, we need to consider the most basic facts of life. All living organisms are made up of units called cells. Some organisms, such as Amoeba, consist of single cells. Others, such as ourselves, are made up of many millions of cells all working together. Organisms that contain more than one cell are called multicellular, which means 'many cells'.

What the examiners say

- Candidates often demonstrate a basic understanding of cells, but are not as competent in explaining their relationship to other topics such as diseases or respiration.
- Candidates are sometimes unable to differentiate between fundamental concepts such as breathing and respiration, or discuss differences between living and non-living things.
- There are repeated misconceptions regarding the functions of cells. For example, one misconception is that one of the functions of red blood cells is to transport nutrients around the body, while white blood cells aid in coagulation.

DID YOU KNOW?

Human beings contain an enormous number of cells. Estimates range from 10 million million cells to 100 million million cells – no wonder no one has been able to count them accurately!

The biologist's toolkit: Asking questions

Scientists ask a lot of questions! This is how we find out more about the living world around us.

There are many different types of questions. Some of them are answered by science. A scientific question is one we answer by collecting and thinking about **data**. Data is information. It may be numbers from measurements, or words or drawings describing observations.

Most science investigations start with a question. Here are some examples of questions that science can answer:

- Which flowers do copper-rumped hummingbirds like best?
- Which Caribbean island uses the most fossil fuels?
- Does being **obese** increase your risk of heart disease?

However, science cannot answer all questions, for example:

- What is my favourite food?
- Will I get into the school cricket team?

When you plan an investigation, choose the question you are going to answer carefully. Make sure it can be answered by science.

Copper-rumped hummingbird

The characteristics of living organisms

All living organisms have specific characteristics, which they display regardless of whether they have one cell or millions. In some cases, particularly in the larger multicellular animals like humans, it is easy to show that all these processes are taking place. In others, such as microscopic organisms and plants, we have to rely on technology to show us what is happening.

The seven life processes, described in Table 1.1, are common to most living organisms.

Table 1.1 Life processes

Life process	Illustration	Description
Movement	 All these flowers have turned to face the Sun.	The process by which all organisms get nearer to things they need or away from problems. Animals move using muscles; plants move more slowly using growth (Figure 1.2).
Respiration	 Respiration supplies energy to the cells of all organisms including this hummingbird.	The process by which living organisms get the energy from their food.

Sensitivity (irritability)		Eyes, ears and whiskers help this mouse detect its surroundings.	Living organisms are all sensitive to changes in their surroundings, in different ways.
Nutrition		Humans eat many different types of food.	All living organisms need food to provide the energy used by their cells. Plants make their own food by photosynthesis, while animals eat other organisms.
Excretion		Many animals excrete through their kidneys.	The process of removing the poisonous waste products produced by the cells.
Reproduction		Offspring often look similar to their parents.	The process of producing offspring is vital to the long-term survival of any type of living organism.
Growth		Growth is a permanent increase in size.	When organisms grow, they increase in both size and mass, using chemicals from their food to build new material and new cells.

Looking at cells

Everything we know about the structure of cells has depended on the development of the microscope. We have been able to look at cells for more than 300 years, and as microscopes have improved, so has our knowledge and understanding of cell structure. Light microscopes let us magnify up to 1500 times. They are relatively cheap and widely used. **Electron microscopes** are big and very expensive, but they let us magnify things up to 1 million times or more, so they show us extra things inside our cells.

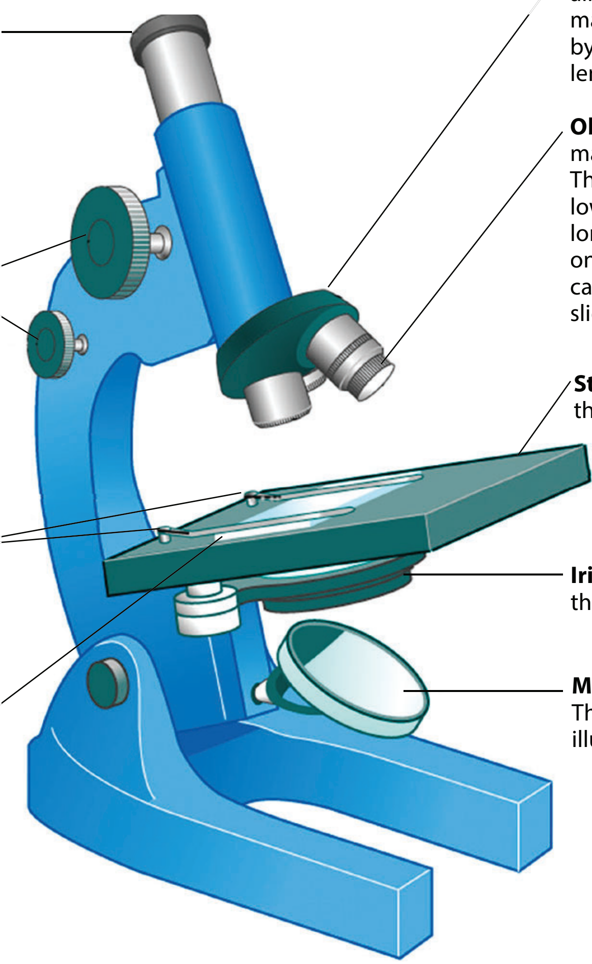


Figure 1.1 A compound light microscope has two sets of lenses that are used to magnify a specimen. These microscopes are widely used to look at cells.

There are some basic similarities between most animal and plant cells. For example, almost all cells have a **nucleus**, a **cell membrane**, **mitochondria**, **ribosomes**, **endoplasmic reticulum** and **cytoplasm**.

There are other features that are often seen in plant cells, particularly in the green parts of plants. This has led scientists to develop a **model** of the basic structure of an unspecialised animal cell and an unspecialised green plant cell. Although not many cells are this simple, the idea of unspecialised animal and plant cells gives us a very useful base point with which to compare other, more specialised cells.

DID YOU KNOW?

The biggest single cell is an unfertilised ostrich egg – it is around 180 mm long, 140 mm wide and weighs about 1.5 kg!

Structures and functions in unspecialised animal cells

Structures suspended within a cell membrane are called **organelles**. These organelles contain **enzymes** and chemicals to carry out specialised jobs within the cell. You will learn more about enzymes later in this book.

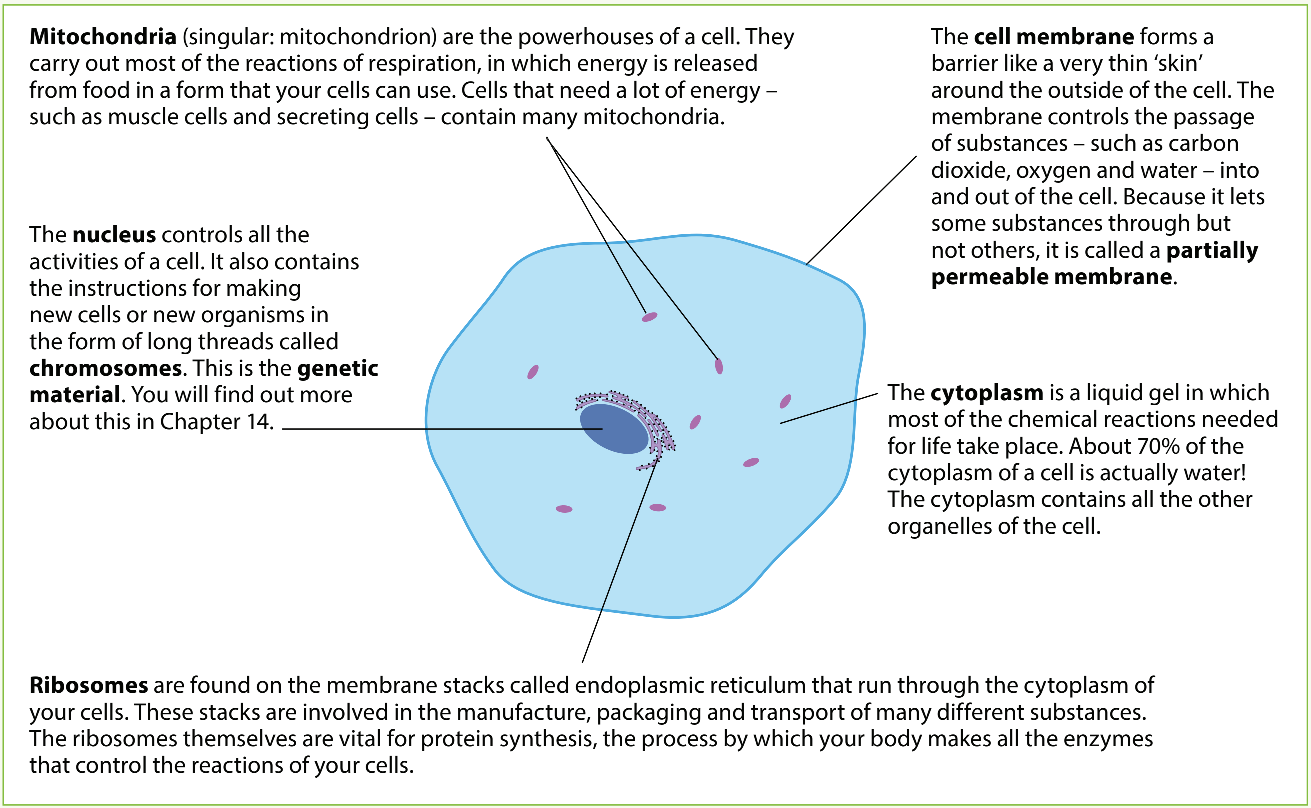


Figure 1.2 A simple animal cell like this shows the features that are common to almost all living cells.

The biologist's toolkit: Calculating magnification

When you look at a **specimen** using a magnifying lens or a microscope you need to record the **magnification**. In other words, you must show how much bigger they are when seen through your lenses than they are in real life.

When you use a light microscope you can calculate the magnification of your specimen easily.

Multiply the magnification of your **eyepiece lens** (see Figure 1.1) by the magnification of the **objective lens** (see Figure 1.1).

Example:

If your eyepiece lens is **×4** and your objective lens is **×10**: your total magnification = 4 × 10 = **40×**

Always give the magnification at which you looked at a specimen when you label drawings made using a microscope, for example: **human cells as viewed at 40×**

Activity 1.1

Using the light microscope to look at animal cells

You will need:

- a microscope
- a lamp
- prepared microscope slides of human cheek cells/epidermal cells

Method

1. Set up your microscope with the lowest power lens (the smallest lens) in place.
2. Clip the prepared slide into place on the stage using the slide clips. Position the specimen over the hole in the stage.
3. If your microscope has a built-in lamp, switch it on. If it has a mirror, adjust the angle of the mirror until the specimen is illuminated.
4. Now look through the eyepiece lens and adjust the iris diaphragm until the light is bright but does not dazzle you. The illuminated area you can see is called the field of view.
5. Looking at your microscope from the side (not through the eyepiece lens), and using the coarse focusing knob, slowly move the objective lens down so it is as close as possible to the slide without touching it.
6. Now look through the eyepiece lens again. Turn the coarse focusing knob very gently in the opposite direction to move the objective lens away from the slide. Do this while you are looking through the eyepiece lens, and the specimen will gradually appear in focus. Once you can see the specimen clearly, use the fine focusing knob to get the focus as sharp as you can.
7. You may find that if you now shut the iris diaphragm down further, so that the hole for the light to pass through gets smaller, you will see the specimen better (the contrast is greater).
8. To use the higher magnifications, rotate the nosepiece so that the next lens clicks into place. Do not adjust the focusing knobs at this point as the specimen should still be in focus and, with the coarse focusing knob in particular, it is very easy to break the slide. If you do need to adjust the focus, use the fine focusing knob only with higher magnifications. Take great care to not touch the slide with the lens. You may want to adjust the iris diaphragm as well.
9. Human cheek cells and simple epithelial cells are very similar to the diagram of an unspecialised animal cell on page 10. Draw some of the cells you see and label them as fully as you can. Remember you will not see ribosomes or mitochondria under normal light microscopes.

Remember

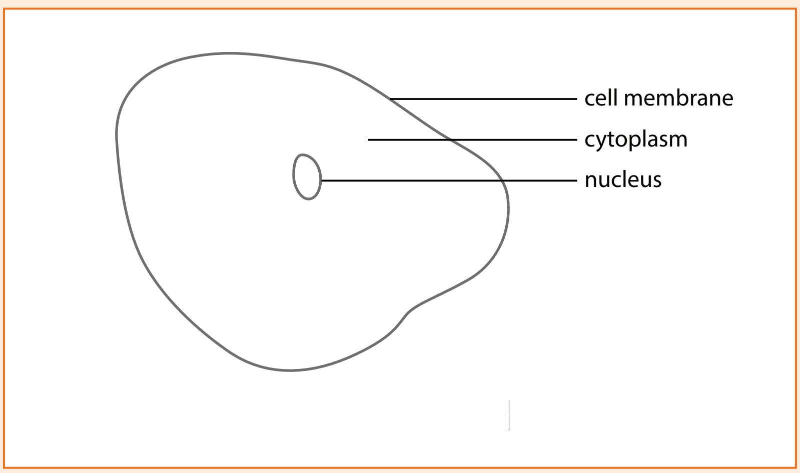
Microscopes are expensive and delicate pieces of equipment, so always take care of them and handle them safely. You will not be able to see mitochondria and ribosomes with a light microscope.

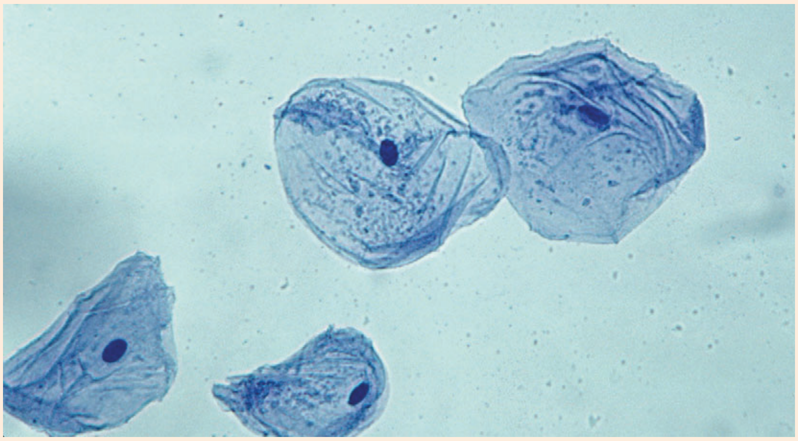
The biologist's toolkit: Observations – biological drawings

A biologist must be very observant. We have lots of ways of making and recording our observations. One way is to draw biological specimens such as whole organisms, parts of organisms such as bones, flowers or feathers, and the inside of organisms or parts of organisms seen through a magnifying lens or a microscope.

Biological drawings are different from **diagrams**. A diagram represents a complicated structure and helps you understand it. A biological drawing is an accurate picture of what you actually observe. There are a few simple rules to follow when you make a biological drawing:

- Give your drawing a clear title to say what it is and how magnified it is, for example: drawn life size (x1) or drawn 400× magnification.
- Use plain, unlined paper if possible.
- Use a pencil – no colouring in.
- Put your drawing in the middle of the page so that there is room for labels
- Label your diagram. Label lines must be drawn with a ruler so they are straight and the label lines should not cross each other.
- Give a scale line to show how much bigger the drawing is than life size.





A micrograph of a human cheek cell

Why do cells have organelles?

All the processes of life take place within a single cell. Imagine 100 different reactions going on in a laboratory test tube – chemical chaos and probably a few explosions would result! However, this is the level of chemical activity going on in a cell at any one time. Cell chemistry works because each reaction is controlled by an enzyme, a protein designed to control the rate of each specific reaction. Each enzyme makes sure that the reaction it controls takes place without becoming mixed up with any other reactions.

The enzymes involved in different chemical processes are usually found in different parts of a cell. For example, many of the enzymes:

- controlling the reactions of respiration are found in the mitochondria
- controlling the reactions of photosynthesis are found in the chloroplasts
- involved in protein synthesis are found on the surface of the ribosomes.

These cell compartments or organelles help to keep your cell chemistry well under control.

Structures and functions of unspecialised plant cells

Plants are very different from animals – they do not move their whole body about and they make their own food by photosynthesis. So, while plant cells have all the features of a typical animal cell – nucleus, cell membrane, cytoplasm, mitochondria, endoplasmic reticulum and ribosomes – they also have unique structures that they need for their own, very different way of life.

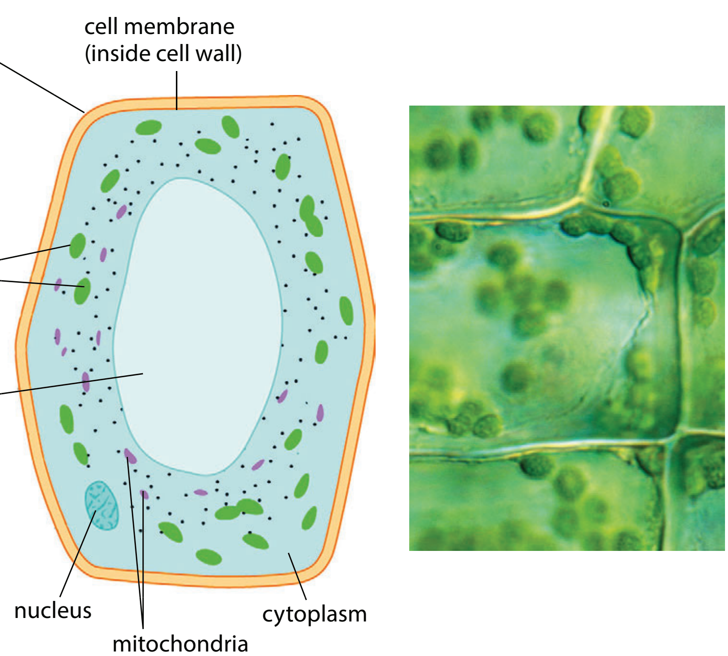


Figure 1.3 A photosynthetic plant cell has many features in common with an animal cell, but it has others that are unique to plants.

Activity 1.2

Making a slide of plant cells

The prepared slides you looked at in Activity 1.1 showed animal cells that were dead and stained to make them easier to see. In this activity, you are going to look at one of a number of different types of plant cells – onion, rhubarb or pondweed.

You will need:

- a microscope
- microscope slides
- cover slips
- forceps
- a mounted needle
- a pipette
- a lamp
- a piece of onion, rhubarb or pondweed, for example, Elodea (Canadian pondweed)

Remember
Microscopes are expensive and delicate pieces of equipment so always take care of them and handle them safely.

Method

Onion cells do not contain any chlorophyll, so they are not coloured. You can look at them as they are, or stain them using iodine, which reacts with the starch in the cells and turns blue-black.

1 Take your piece of onion and remove a small piece of the thin skin (inner epidermis) on the inside of the fleshy part using your forceps. It is very thin and quite tricky to handle.

2 Place the epidermis onto a microscope slide and very gently add either a drop of water or a drop of iodine from a pipette.

3 Using the mounted needle (or a sharp pencil), very gently lower the cover slip over the specimen. Take great care not to trap any air bubbles – these will show up as black rings under the microscope.

4 Remove any excess liquid from the slide using tissues and place it under the microscope. Starting with the low-power lens, follow the procedure for looking at cells described in Activity 1.1 on page 6. Use the higher power lenses to look at the cells in as much detail as possible.

5 Make a labelled drawing of several of the cells you can see.

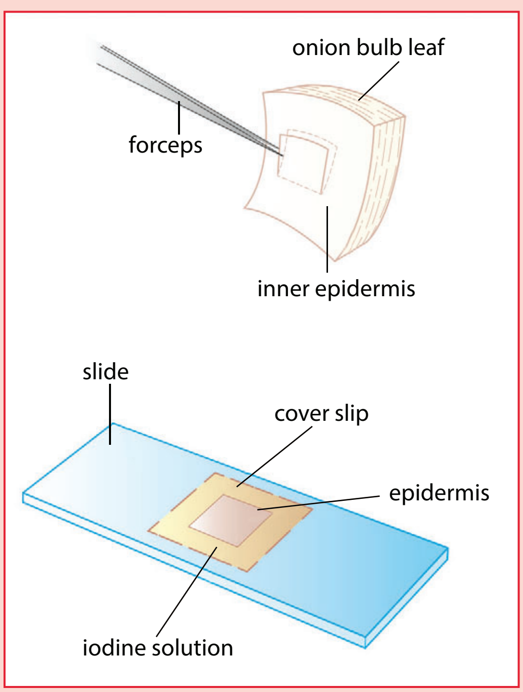


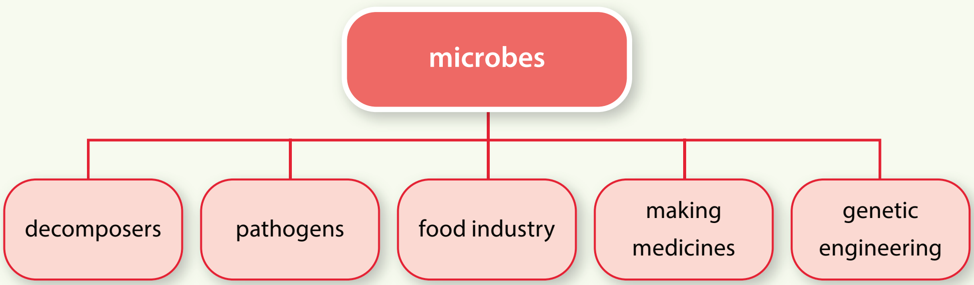
Figure 1.4 Making a slide on onion epidermis

Checkpoint questions

1. State the seven life processes that are common to all living organisms.
2. a Describe the cytoplasm of a cell.
   b State two of the main jobs of the cytoplasm of a cell
3. a What are enzymes?
   b Explain why they are so important in a cell
4. State what an organelle is and justify its importance in a cell.
5. Make a table to compare the similarities and differences in structure between unspecialised animal cells and unspecialised plant cells.

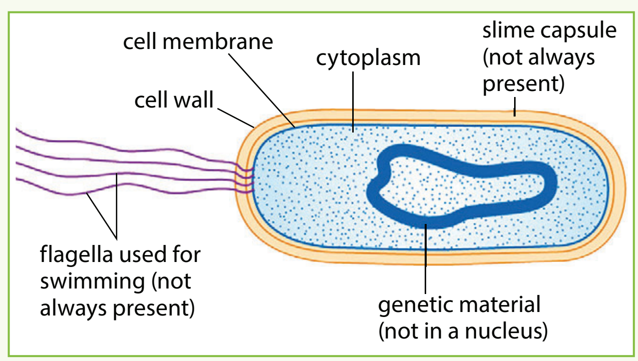
The structure of microbes

Animals and plants are not the only types of living organisms. Microbes (also called microorganisms) are tiny living organisms that are usually so small that we need to use a microscope to see them. Many of these microbes are very important, as shown in the diagram below.



Examples of microbes are bacteria, viruses, fungi, yeasts and moulds.

Bacteria are single-celled organisms (Figure 1.5). They are much smaller than the smallest animal and plant cells. A bacterial cell has many similarities to animal and plant cells. It is made up of cytoplasm surrounded by a membrane and a **cell wall**. Inside the bacterial cell is the genetic material, but this is not contained in a nucleus. A bacterial cell wall differs from a plant cell wall because it is not made of **cellulose**. Some bacteria have other features, like flagella to help them move, or protective slime capsules. Bacteria also come in a variety of different shapes and sizes. Some are rod-shaped, some are round, some are comma-shaped and some are spirals. While some bacteria cause disease, many are harmless and many are actively useful to people.



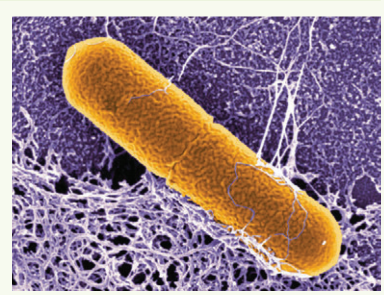
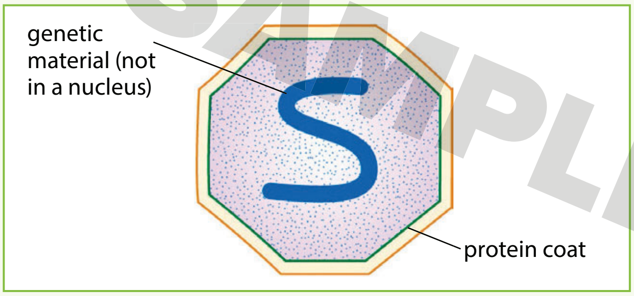


Figure 1.5 Bacteria come in many different shapes and sizes but they all have the same basic structure.

Viruses are even smaller than bacteria. They usually have regular geometric shapes, and they are made up of a protein coat surrounding genetic material that contains relatively few **genes**. They do not carry out any of the functions of normal living organisms except reproduction, and they can only reproduce by taking over another living cell. Most naturally occurring viruses cause disease.



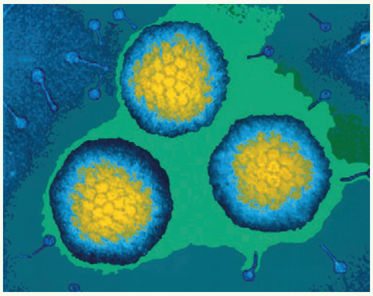


Figure 1.6 Viruses are very small with a very simple structure. There is some argument about whether or not they are living organisms.

Fungi are living organisms that obtain their food from other dead or living organisms. Some of the microorganisms that are most useful to people are moulds and yeasts, which are both types of fungi. Both moulds and yeasts are extremely important as decomposers, breaking down animal and plant material, and returning nutrients to the environment (see Chapter 4).

Yeasts are single-celled organisms. Each yeast cell has a nucleus, cytoplasm and a membrane surrounded by a cell wall. The main way in which yeasts reproduce is by asexual budding – splitting to form new yeast cells.

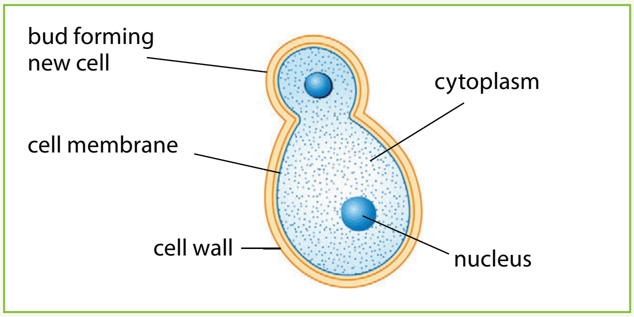


Figure 1.7 Yeast cells are microscopic organisms that have been useful to us for centuries.

Moulds are different. They are made up of tiny, thread-like structures called hyphae (Figure 1.8). The **hyphae** are not made up of individual cells – they are tubes that consist of a cell wall containing cytoplasm and lots of nuclei. Moulds, like yeasts, generally reproduce asexually, but they do it by producing fruiting bodies that contain spores. The mycelium of many fungi grow underground or through wood – and the fruiting bodies of these fungi are large. They appear as the toadstools, mushrooms and bracket fungi that we see around us.

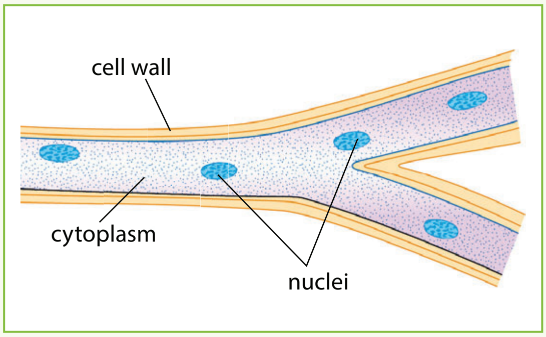


Figure 1.8 a) The mycelium of a fungus, made of hyphae b) The fruiting body of a fungus spreads the spores to make new fungi c) A diagram of fungal hyphae.

Checkpoint questions

6 **Make a table to compare the structure of the basic units of bacteria, viruses and fungi.**

7 **Identify features that are similar in all of the cells you have looked at – animals, plants and microbes.**

Cell specialisation in humans

When an egg and a sperm combine to form an embryo, a single cell is formed. In multicellular organisms, like humans, this cell divides many times. As the embryo develops, the cells **differentiate** – they become **specialised**, which means they are adapted to carry out particular functions (jobs) in your body. For example, some cells differentiate to become red blood cells and carry oxygen, some become muscle cells, and others become **neurons** (nerve cells). This differentiation takes place as some of the genes (genetic material) in the nucleus of the cells are switched on and others are switched off. Scientists are still not quite sure what causes these changes to take place, but it seems to be at least partly due to the position of the cells in the embryo itself.

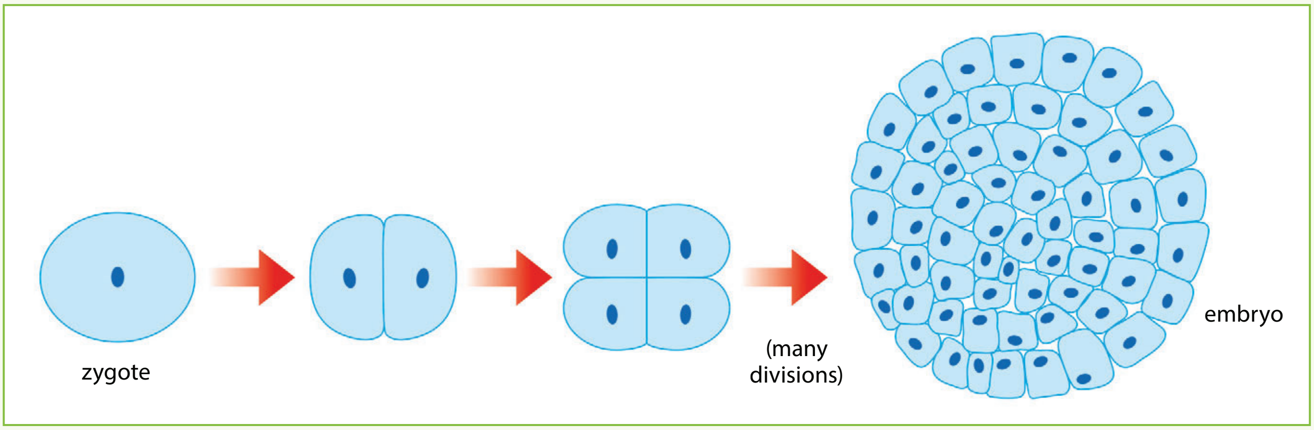


Figure 1.9 Animals and plants grow by cell division.

Specialised cells with similar functions are often grouped together to form a tissue, for example, in humans, **connective tissue** such as **tendons** and **cartilage** joins parts of the body together, while **nervous tissue** carries information around the body and **muscle tissue** contracts to move the body around.

In many living organisms, including people, there are more levels of organisation. Several different tissues work together to form an organ such as the heart, the kidneys or the lungs, and each organ carries out a particular function in your body. For example, the heart pumps blood around your body, your kidneys remove waste products and your lungs take in oxygen and remove waste **carbon dioxide**.

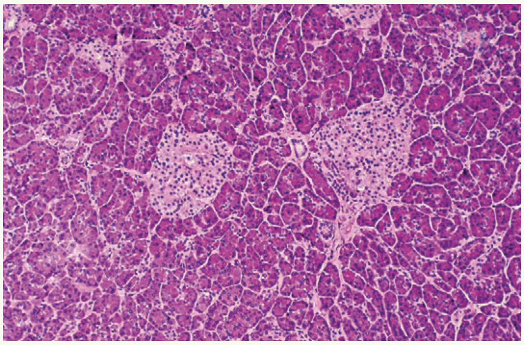


Figure 1.10 The pancreas controls your blood sugar and produces digestive enzymes to break down your food. Inside the organ, using a microscope, you can see two very different tissues made up of different types of cells that carry out these different jobs.

In turn, different organs work together in organ systems to carry out major functions in the body such as transporting the blood all around your body or reproduction. Examples include the cardiovascular system (the heart, lungs and blood vessels) and the digestive system (Figure 1.12).

These different levels or organisation are very important in large, multicellular organisms. Groups of cells or tissues working together to carry out particular functions in the body mean different parts of the animal or plant work together so the organism can carry out all of the functions of life efficiently. You will learn more about many of these organs and organ systems in the rest of your Human & Social Biology course.

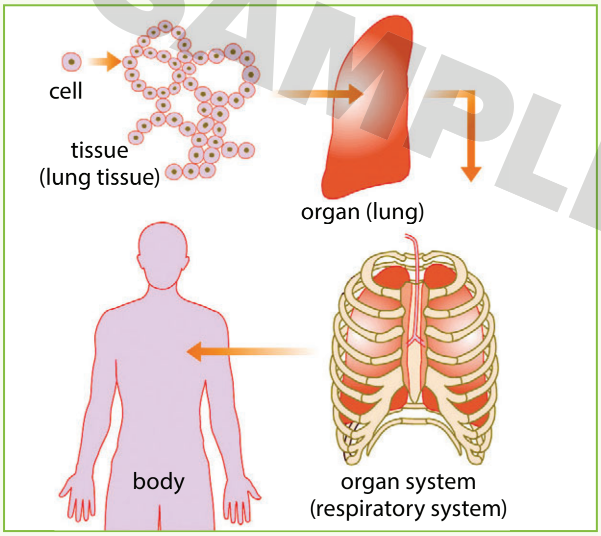


Figure 1.11 Large living organisms have many levels of organisation. As a result, each part of the body is perfectly adapted to carry out its functions.

Specialised cells

When cells become specialised, their structure is modified or adapted to suit the specialised job that the cell is doing. For example:

- cells that use a lot of energy have many mitochondria
- cells that are important for **diffusion** have a large surface area
- cells that produce lots of proteins have many ribosomes and mitochondria.

By looking carefully at specialised cells, you will see how their structure is adapted to their function. Here are some examples of the specialised cells you will find in the human body.

Epithelial cells

Epithelial cells play many very important roles in the human body. They are usually arranged in thin sheets of epithelial tissue (which are often only one cell thick), and they cover internal and external surfaces. So, your skin is made up of epithelial cells, and your gut, your respiratory system, your reproductive system and many other organ systems of your body are all lined with epithelial cells.

Table 1.2 The functions of epithelial cells

Type of epithelial cell	Function
Squamous epithelium (flattened cells	Found in the lungs and gut walls, where diffusion is very important.
Cuboidal epithelium	Found in glands, and aids in secretion and **absorption** of chemicals.
Ciliated columnar epithelium	Found in the respiratory and reproductive systems, with small, hair-like cilia that beat rhythmically to move substances through a tube. They move mucus and microbes away from the lungs, and help the ovum move towards the uterus.

Reproductive cells – eggs and sperm

If you are female, your ovaries contain ova or egg cells. These female sex cells have only half the number of chromosomes in their nucleus compared to the number of chromosomes found in normal body cells (see Section C). They have a protective outer coat to make sure only one sperm gets through to fertilise the egg, and a store of food in the cytoplasm for the developing embryo. A small number of relatively large egg cells are released by the ovaries over a woman's reproductive life.

If you are male, once you have gone through **puberty**, your body produces millions of male sex cells called sperm. Like the egg cells, sperm have only half the chromosome number of normal body cells. Sperm cells are usually released a long way from the egg they are going to fertilise. They need to move through the female reproductive system to reach the egg. Then they need to be able to break into the egg. They have several adaptations to make all this possible. Sperm have a long tail that contains muscle-like proteins, which allows them to swim towards the egg. The middle section of a sperm is full of mitochondria, which provide the energy for the tail to work. They have a special sac called the acrosome, which stores digestive enzymes used to break down the outer layers of the egg. Finally, the sperm have a large nucleus containing the genetic information to be passed on to the offspring. Sperm cells are much smaller than egg cells, but they are produced in their millions every day.

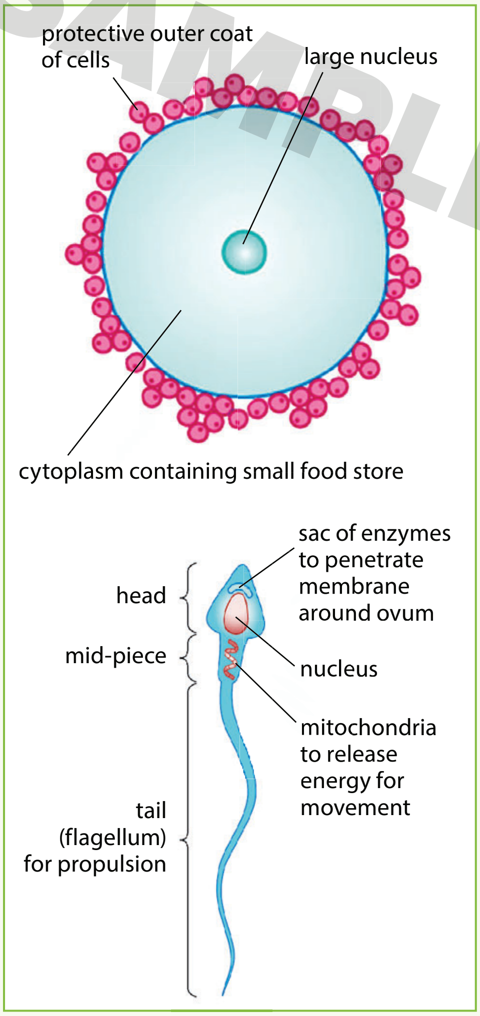


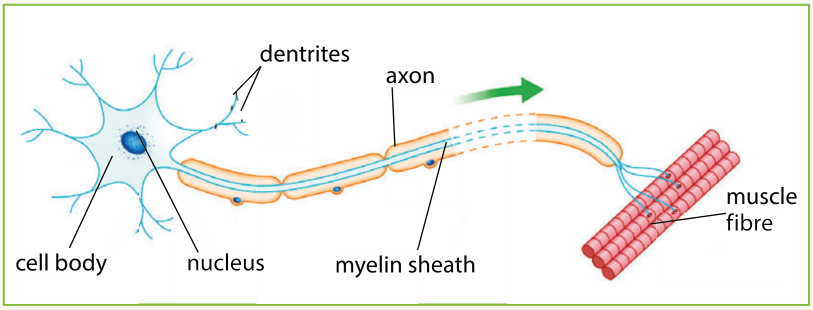
Figure 1.12 Egg and sperm cells show very clear adaptations to their specialised functions.

Nerve cells (neurons)

Nerve cells or neurons are part of the communication and control system of your body. Electrical nerve impulses pass along these nerve cells at great speed, carrying information from one part of your body to another. Nerve cells have a cell body that contains:

- the nucleus
- **dendrites** that communicate with neighbouring nerve cells
- nerve fibres (called **axons**) that carry the nerve impulse long distances.

Nerve fibres are often covered by a protective myelin sheath, which insulates the axon and allows the nerve impulses to travel faster.



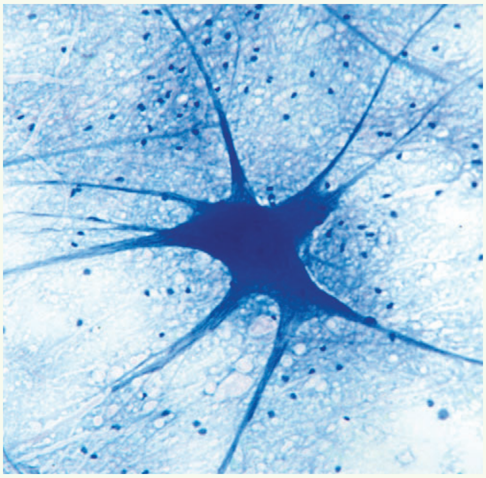
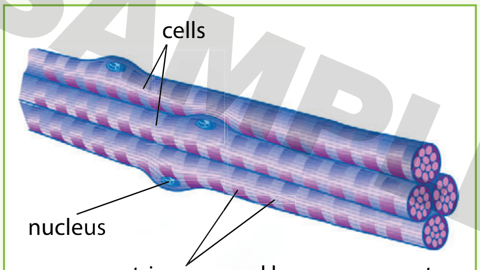


Figure 1.13 Nerve cells are very different from epidermal cells because they play a very different role in your body.

Muscle cells

Your muscles are responsible for movement in your body. They are made up of specialised muscle cells or muscle fibres. These are very long (elongated) cells that can contract and relax. When they are relaxed, they can be stretched, and when they contract, they shorten powerfully.

The muscle cells contain two proteins called **actin** and **myosin**, which enable the muscle cells to contract. The most common muscle in the body is striated or striped muscle, and these proteins are arranged so that the muscle cell looks striped. Muscle cells also contain lots of mitochondria, which provide the energy for them to contract. Muscle cells are always found in bundles and they all contract together. You will find out more about muscle tissue and its role in your body in Chapter 9.



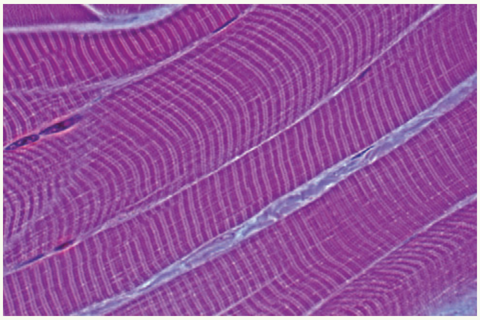


Figure 1.14 The arrangement of actin and myosin in your striated muscle cells makes them very distinctive, and allows them to contract and relax as they move the different parts of your body.

Connective tissue cells

There are lots of different types of connective tissue, from bone to the loose connective tissues that make up much of your skin and the adipose tissue where you store fat.

The main property of connective tissue cells is that the cells spread out in a matrix, made up of water and protein fibres produced by the connective tissue cells themselves. Some connective tissue cells make stretchy elastic fibres, and others make strong, inelastic fibres. The matrix may be very solid (for example, bone), stretchy (for example, **ligaments**) or liquid (for example, the liquid part of your blood). You will discover examples of different types of connective tissue as you work through this book.

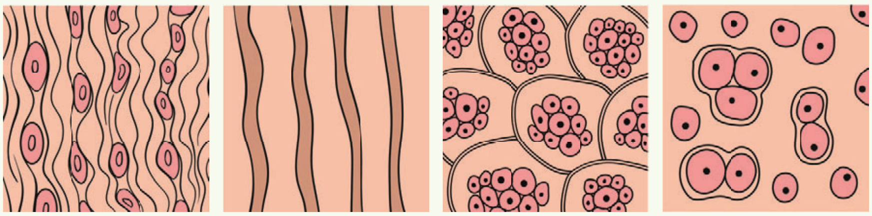


Figure 1.15 There are many types of connective tissue cells and they are all different. Learn some of the different types – and look out for widely spaced cells, a matrix and fibres.

All living cells carry out the characteristic functions of life. As a result, they all have some features in common. However, as you have seen, cells are specialised in many ways to carry out particular functions in your body. As you study more about the way the human body works in this book, you will discover more examples of specialised cells and their importance in the healthy functioning of your body.

DID YOU KNOW?

Some scientists work with unspecialised human embryonic stem cells to try and grow new adult tissues. They hope to use them to replace diseased tissues in people with serious illnesses. So far progress has been slow, partly because scientists are not sure how to make the undifferentiated cells become the specialised cells that the body needs, and partly because there are ethical issues about using cells from human embryos.

End-of-chapter summary

In this chapter, you have learnt that:

- all living organisms are based on units called cells
- there are seven life processes that are common to all living organisms: nutrition, respiration, excretion, growth, irritability(response to stimuli), movement and reproduction
- unspecialised animal cells all have the following structures and organelles: a cell membrane, cytoplasm, nucleus, mitochondria, ribosomes and endoplasmic reticulum; each of these parts has a characteristic structure and carries out clear functions in the working of the cell
- unspecialised plant cells all have the same basic structures and organelles as an animal cell; in addition, they have a cellulose cell wall and may have a permanent vacuole; in the green parts of a plant, all the cells contain chloroplasts, which in turn contain chlorophyll; each of these parts has a characteristic structure and carries out clear functions in the working of the cell
- microbes are very small organisms that can only be seen using a microscope; they include bacteria, viruses and fungi; each type of microbe has very distinctive cell structures
- in multicellular organisms like humans, the cells of the embryo differentiate to form specialised cells that carry out particular functions in the body
- cells specialised to carry out a particular function are grouped together to form a tissue, for example, muscle tissue and nervous tissue
- a group of different tissues that work together to carry out a particular function is called an organ, for example, the heart and the pancreas
- an organ system involves several different organs working together to carry out particular functions in your body, for example, the digestive system and the cardiovascular system
- there are many different specialised cells in the human body; they include epithelial cells, sperm cells, egg cells, nerve cells, muscle cells and connective tissue cells; a close look at their specialisations shows how they are adapted to their functions.

Possible SBAs using microscopes and knowledge of cells

→ How does the population of microscopic organisms in your local pond or stream vary over time?

→ How does the size of human cheek cells vary between different people?

→ Does the size of human cheek cells vary between students and adults?

→ How does the size and shape of the pollen produced by local plants vary depending on how the pollen is spread?

End-of-chapter questions

1 Which one of the following is not an organelle within a cell?

A Nucleus
B Chloroplast
C Mitochondrion
D Cytoplasm

2 Which one of the following is not one of the seven processes characteristic of living things?

A Movement
B Language
C Reproduction
D Respiration

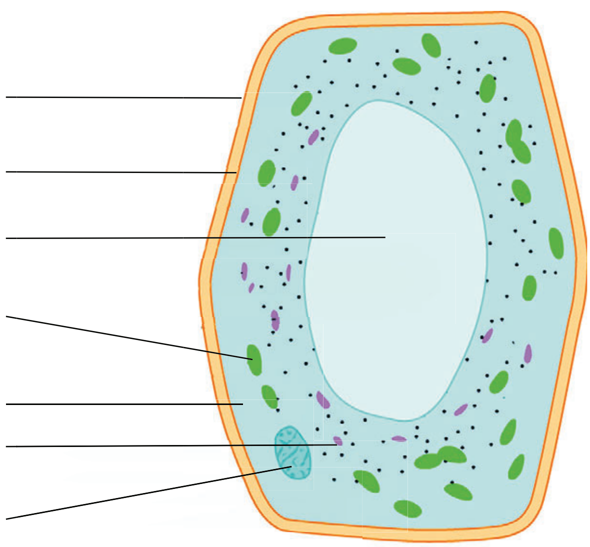
3 Which one of the following is an example of a tissue in humans?

A Heart
B Stomach
C Muscle
D Uterus

4 a Why have microscopes been so important in developing our understanding of cells? (2)

b Write a set of instructions that could be handed out with a microscope to make sure that students use it properly. (6)

5 This diagram shows an unspecialised plant cell from a blade of grass.

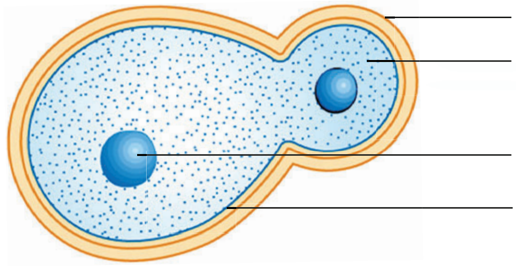


a Copy the diagram and use words from the list given below to help you label it. (7)

cell membrane	cell wall	chloroplast	cytoplasm	nucleus
mitochondrion	vacuole			

b Name **two** parts of this grass cell that you would not see in an animal cell. (2)

6 a Copy and label this diagram of a yeast cell. (5)



b How are yeast cells similar to plant cells? (2)

c How do yeast cells differ from plant cells? (2)

7 How is a sperm cell specialised for its role in reproduction? (4)

8 Read the following information about Chlamydomonas and then answer the questions below.

Chlamydomonas is a single-celled organism that lives in water. It has an eyespot that is sensitive to light and it can move itself about. It 'swims' towards the light using long flagella. It has a large chloroplast and uses the light to photosynthesise. It stores any excess food as starch. When it is mature and has been in plenty of light, it will reproduce by splitting in two.

a Chlamydomonas is a living organism. What features of Chlamydomonas show you that this is true? (4)

b For many years, scientists were not sure whether to classify Chlamydomonas as an animal or a plant. Now it is put in a separate group altogether!

i What features suggest that *Chlamydomonas* is an animal cell? (3)

ii What features suggest that *Chlamydomonas* is a plant cell? (3)

9 a Why do cells become specialised in the human body? (2)

b Choose **two** different types of cells and explain how they are adapted for the job they do in your body. (8)

c Describe the different levels of organisation in the human body from cells to the whole body. (4)

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SAMPLE CHAPTER

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ISBN 978-1-3983-7915-2
9 781398 379152