Cells

6.1 All living things are made up of cells

Teacher notes (pages 96–97)

Introducing the chapter

Students will now know how to use a microscope and what different microscopes are used for. This section looks at the ‘building blocks of life’ – cells. The next unit will build on this when students explore groups of cells – tissues, and then groups of tissues (organs). Students may have heard of cells before, but not know that they have different cells in their bodies that do different jobs and look different (i.e. a nerve cell looks very different from a muscle cell).

Teaching tips: Form and function

You may wish to revisit form and function at this point. Why do cells with different jobs look different? How does their form make their function easier to understand?

Teaching tips: Cell size

This section looks at the unit that is used when measuring cells. Cells are very small, so small that they are measured in a unit called a micrometre. A micrometre is 1000 times smaller than a millimetre. Students have difficulties comprehending the minute size of cells and, especially, the organelles inside the cell. It may be helpful to explain this in terms of the human body and the organs inside it.

Teaching tips: Cell function

Discuss the functions a living organism undertakes to stay alive and be successful: movement, respiration, response to stimuli, growth, reproduction, excretion of wastes and nutrition. The jobs of a cell are similar to those of a living organism as cells are the building blocks of living things.

Differentiation

For less able students:

Students could benefit from a visual and interactive website that allows them to develop a basic understanding of the parts of the cell. A website like this is available in the ‘Going further’ section below.

For more able students:

Students could prepare a ‘size line’ of different components of the human body. The smallest parts will be listed or drawn on the far left, then further right as the components grow in size.

Additional activity: Flash cards

This section has a number of new terms for students to remember or learn for the first time. Ask students to create flash cards in pairs. On one side of the card is the term and on the other, the definition. Students create cards using the bold key words in this page and then test each other. Flash cards can then be made for the key words in the rest of the chapter. Ask students to identify these themselves.

Additional activity: Establishing prior knowledge

These questions, used as a class discussion, are a really good opportunity to establish prior knowledge and any misconceptions. Common misconceptions (and key concepts) include the following:

• ‘Cells are within the human body, but do not make up the body.’ (Cells make up the human body.)

• ‘Cells are in the human body, but not in anything else.’ (Cells are the building blocks of all life.)

• ‘Cells can be seen with the naked eye.’ (Cells can only be seen with microscopes, and even then not all organelles can be identified.)

• ‘Cells are simple structures.’ (Cells are complex structures, with organelles working together.)

• ‘If an organism is bigger, it has bigger cells.’ (Size of the organism doesn’t necessarily influence the size of the cell.)

• ‘New cells just appear.’ (New cells are created from existing cells.)

• ‘Cells can’t move.’ (Some cells have structures such as cilia or flagella to propel them.)

Additional activity: Robert Hooke

Ask students to consider Robert Hooke’s situation and reflect on how important it can be to support and encourage scientists. Students can then write an encouraging letter to a present-day scientist, perhaps one working on renewable power or a treatment for Parkinson’s disease or cancer. The best letters could be posted by the school.

Going further

A useful weblink is available on your obook/assess. To access it, click the weblink tile on the Dashboard for this unit.

**Cells alive: Eukaryotic organelle cell model**  
This Cells Alive website provides interactive models of both plant and animal cells.

6.2 Microscopes are used to study cells

Teacher notes (pages 98–99)

Introducing the topic

Microscopes work by magnifying the size of the object placed under them. There is more than one type of microscope. The one that students will use most frequently is the compound light microscope (2D images). This is the most common type of microscope found in school settings. They may also have access to a stereomicroscope (3D surface images).

Teaching tips: Understanding microscope functions

It is important that students learn how to use a microscope proficiently. This will also ensure that they are able to use glass slides without damaging or breaking them, a common problem in schools. As an introductory activity, ask students to set up the microscopes and then have free time to explore various prepared slides. The most interesting ones for students include insect legs and heads, blood cells, muscle tissue and hair samples.

Common mistakes when using microscopes include having them facing the wrong way – with the arm facing away from the student, and not starting on the lowest magnification. Students should also be introduced to the levels of magnification on the microscope and shown that for some specimens, specific magnifications are best. Students will require hands-on practice to improve their ability to focus the microscope, mostly by drawing the stage up slowly so as not to break the glass slide.

Teaching tips: Demonstrating correct usage

It would be beneficial to demonstrate the correct use of a microscope, and read through the tips with the class. It may also be useful to get students to identify the different parts of the microscope, such as the eyepiece, stage, focus knobs, etc. Students could work towards achieving a ‘microscope license’, which they can receive by demonstrating the correct use of a microscope and knowing the parts of a microscope.

Additional activity: Microscope magnification

Total magnification is the multiplication of the objective lens magnification and eyepiece lens magnification. Some students struggle with the concept of having two lenses in the microscope and, therefore, forget to use the two magnifications. This is something that could be practised as a class, using various combinations. Students could also quiz each other as they are using the microscopes.

Additional activity: Compare and contrast

A good way to introduce the use of microscopes is to compare them with a magnifying glass. In pairs, students will consider a number of items and substances under a magnifying glass and then study them using a microscope. Substances could include human hair, a small insect, a scrap of newspaper, a fingerprint, sand, salt and string or cotton. On completion, ask students to consider the positives and negatives of using a microscope compared with using a magnifying glass (some things are able to be seen in adequate detail using a magnifying glass, which also requires a lot less time to set up).

Additional activity: See, Know, Wonder

A good way to begin to analyse microscope images is with a See, Know, Wonder activity. See, Know, Wonder activities always involve a visual cue like a photo or video. Choose two or three different images obtained from different microscopes, perhaps one image from a scanning electron microscope (SEM), one from a simple light microscope and one from a transmission electron microscope. Display one image at a time. Students draw a three-column table and start by working individually, listing three things that they can see in the image. For example, a SEM image of an insect might show small hairs, eyes, wings. They then complete the column for Know – what do they know when they look at the image? For example, ‘I know that this is a flying insect’. The final column is Wonder – what does the image make them wonder? For example, ‘Where can you find this insect?’ Students then pair up and, in a different coloured pen, add any See, Know, Wonder points that their partner had that were different from their own. This comparison can be repeated in different pairs or even among the whole class. See, Know, Wonder activities help students to develop observational skills as well as questioning and working with others.

Assessment

A good formative assessment option is to ask students to compare the various types of microscope in a table:

• How do they differ?

• How are they similar?

• What kind of images do they produce?

• When were they invented?

Going further

A useful weblink is available on your obook/assess. To access it, click the weblink tile on the Dashboard for this unit.

**ABC Catalyst**  
This episode of ABC’s *Catalyst* investigates one of the most powerful microscopes in the world.

6.3 Plant and animal cells have organelles

Teacher notes (pages 100–103)

Introducing the topic

This topic looks at the complex components of cells and how these facilitate a range of bodily functions, such as producing glucose for energy and proteins for tissue growth and oxygenation of the blood. Understanding how these small components affect the larger organism gives students a deeper appreciation for the importance of healthy cell function.

Teaching tips: Organelles

A good way to remember the various jobs that each organelle carries out is to draw a comparison between organelles and another real-life context. For example, ask students to imagine that the cell is a factory. Now give each organelle a job in the factory. For example, the cell membrane can be the security guard who lets people in or keeps them out. The nucleus can be the boss who tells everyone what to do.

Differentiation

For less able students:

Students could be given a worksheet of a blank cell and asked to label the different parts and organelles from memory. Students should be given 10 minutes to memorise the cell parts as much as possible before commencing.

For more able students:

Students could perform the same activity as above, labelling as many parts and organelles from the cell as possible, but also write a brief description of what each one does.

Additional activity: Organelle ‘job advertisement’

Ask students to write a small job advertisement for each of the organelles. The advertisement needs to detail what their duties will be and what their work conditions will be like (including ‘who’ they may be expected to work with). This may also be used as a cross-curriculum opportunity with English or Humanities.

Additional activity: Scientific diagrams

When looking at cell structure it may be useful to revisit the broader task of drawing scientific diagrams. Like most documentation in science (e.g. experiment reports) it is important to keep them neat, clear and simple. Set up a Bunsen burner with a tripod and a beaker on top (or a similar familiar science scene). Ask students to draw a labelled scientific diagram of the scene. Remind them to keep the diagram simple – clear, two-dimensional with no shading or elaboration. Labels can be inserted using a ruled line and printed text. Students then swap with the person next to them and offer constructive criticism. A second (final) drawing can be submitted.

Additional activity: KWL of cells and organelles

Most students will be more familiar with some parts of cells than others, for example, the nucleus and the cell membrane more than the mitochondrion and ribosomes. For each organelle, students could construct a KWL chart (Know – what they already know; W – what they want to know; and, at the end of the section, L – new information they have learnt). This strategy then also becomes a summary activity and helps reflection on the effectiveness of teaching and student learning.

Expose the students to as many examples of organelles as possible. Looking through a microscope at different types of cells always fascinates students.

Students could construct a table that summarises the key features of structure and function of different organelles. At the end of the chapter, the class can then discuss the relationship between the structure of organelles and their function or job.

Going further

A useful weblink is available on your obook/assess. To access it, click the weblink tile on the Dashboard for this unit.

**Organelles: Internal components of a cell**  
This video summarises the major organelles and their functions.

6.4 All organisms have cells that specialise

Teacher notes (pages 104–105)

Introducing the topic

This topic looks at the differences found in various cells. This includes animal, plant and bacterial cells as well as prokaryotes and eukaryotes more generally. Students will also gain an appreciation of the different structure and function of a plant cell and how this affects the way in which it produces energy.

Teaching tips: Using similes

Students may not know what a simile is, so an explanation may be necessary. Similes are an excellent way of remembering information, as well as explaining concepts. This can be particularly useful for recalling complex cell functions and structures. Students may like to use them as a way of remembering information for tests or assessment tasks.

Additional activity: Labelling a cell

Page 104 shows a cross-section of an animal cell and a plant cell. You may wish to draw these cells on the board. Keep the diagrams unlabelled and ask students what is the simplest way to tell the difference between a plant and an animal cell (the presence of a cell wall, which is only found in plant cells). Learning the parts and functions of cells can seem daunting to students; a fun way to do this is described below.

Additional activity: Mind map

A mind map can be an effective and visual way for students with low literacy skills to engage with the concepts in this section. A mind map featuring the different parts and types of cells (bacteria, plant, animal and unicellular) could be completed by students with key linking terms (along the lines of the mind map), ensuring that the major concepts have been understood.

Additional activity: Three-dimensional model

A practical (and fun) assessment option for this unit is for students to create a three-dimensional cell model at home or school using everyday items. Students can use food (pasta, confectionery, etc.), fabric or any other materials that can be used to represent the parts of a cell. Students must carefully select objects that look like the organelles inside cells. Students can present their cell models at school or with a corresponding short report that outlines the function of each organelle.

Additional activity: Music memory

Ask students to create a song that will help them remember the parts of the cell and what they do. Students can choose a song they like and write the verses in tune with that song. Using songs to memorise things can often help students recall information at a later time. Students can work in pairs and often find this activity to be a fun and creative way to learn cell parts. Students who struggle with this task may prefer to write a simple rhyming poem instead.

Additional activity: Venn diagram

Students could construct a Venn diagram or table to identify the similarities and differences between the different types of cells. They should be able to identify that animals are the only cell type without cell walls, and Fungi, Protista and Monera can be considered similar to plants.

Going further

A useful weblink is available on your obook/assess. To access it, click the weblink tile on the Dashboard for this unit.

**ABC Splash**  
This ABC website shows prokaryote and eukaryote cells under a microscope.

6.5 Bacteria are single-celled organisms

Teacher notes (pages 106–107)

Introducing the topic

This section covers the microbes that exist in our bodies. Many are beneficial, keeping us healthy (e.g. the bacteria that live in our digestive system). These microbes are called natural flora. There are some microbes that cause disease. These microorganisms are called pathogens.

Teaching tips: Not all microbes are dangerous

It is important for students to understand that some microbes are fine and quite healthy. If we destroy all microorganisms, our immune system doesn’t have the opportunity to build up immunity to common microbes and diseases, which will ultimately result in more illnesses. The stronger the immune system, the less likely we are to become ill.

Teaching tips: HIV/AIDS

Teaching and learning about HIV/AIDS will require sensitivity. Most young people will have heard of HIV/AIDS but may not be able to distinguish between the two. They may also have misconceptions about the transmission of the disease.

HIV/AIDS is a pandemic (a global disease). HIV/AIDS is extremely widespread; since it was first identified, more than 60 million people have been infected by HIV. AIDS is the advanced state of HIV infection – they are not the same thing. HIV is so prevalent in South Africa that there is a puppet on the South African version of Sesame Street that has HIV. This is part of an awareness-raising campaign in South Africa where about one in nine people has the virus.

Additional activity: Mind map

As a class, identify some common microbes and discuss the effects of these. A mind map could be created to demonstrate students’ current knowledge. This could be added to as students develop their knowledge.

Additional Activity: The Ebola virus

The Ebola virus was first reported in 1976. Ebola became famous because of its high fatality rate. In fact, it has the highest known fatality rate of any pathogenic virus. Nearly 90% of people who contract the Ebola virus die as a result. Ebola is spread through skin-to-skin contact. It is a gruesome disease and, in some cases, patients bleed internally and externally before dying. Ask students to investigate the Ebola virus. Encourage them to write a short report on Ebola using what they now know about microbes that cause disease. Students should use the following key words: pathogen, infectious disease, symptoms and microbes.

Additional activity: Research

Students can research a disease caused by bacteria. These include tuberculosis, pneumonia, Legionnaires’ disease, cholera or another of their own choosing.

Assessment

Research the spread of HIV/AIDS in Africa. Why is it so widespread? What practices are being employed in order to slow down the spread of HIV/AIDS? What education programs are being put in place? An example of an initiative to increase awareness of HIV/AIDS and its transmission is the introduction of an HIV-positive puppet to the South African version of Sesame Street (see above).

Going further

A useful weblink is available on your obook/assess. To access it, click the weblink tile on the Dashboard for this unit.

**How viruses work**  
This website explains how viruses work.

6.6 Eukaryotic cells undergo mitosis

Teacher notes (pages 108–109)

Introducing the topic

Cells do not live forever. There are lots of different cells in the human body with different jobs, and each of these cells lives for a different period of time. A red blood cell, for example, lives an average of 120 days. When a cell dies, it has to be replaced and so new blood cells are made. The cells in our bodies do this by a process called mitosis. This section also investigates cancer, a disease caused when cells do not self-destruct or over-multiply.

Teaching tips: Discussing cancer

Cancer may be an emotional subject for some students. It may be beneficial to preface this section with an acknowledgement that at some point in life, many people are affected by cancer, either by having it themselves or knowing someone who does. It can be explained that it is therefore useful to have a scientific understanding of what cancer is.

Teaching tips: Types of cancer

Students may be curious about the different types of cancer. It may be beneficial to discuss the types of cancer with a focus on cancers that are common in young men and women. An example of this is cervical cancer; young women are now able access a cervical cancer vaccination. Young men should also be aware of testicular cancer and the signs and symptoms. Schools may wish to separate boys and girls for a health ‘workshop’; this could also be done as a research task.

Differentiation

For less able students:

Students could create a mind map that helps them to link the key words in this section, including DNA, cells, mitosis, nucleus, parent cell and daughter cell.

For more able students:

Students may be interested in comparing mitosis with meiosis. This will need to be done using further research, as meiosis is not covered in this chapter.

Additional activity: Melanoma

Research a common form of cancer such as melanoma. Why is it so widespread in Australia? What practices are being employed in order to prevent it? What education programs are being put in place? What treatments are available? What treatments are in development?

Going further

A useful weblink is available on your obook/assess. To access it, click the weblink tile on the Dashboard for this unit.

**Cells alive: Animal cell mitosis**  
The animation on this Cells Alive website shows mitosis within in animal cell.

6.7 Fungal cells can save lives

Teacher notes (pages 110–111)

Introducing the topic

This section discusses key discoveries regarding fungal cells – the famous discovery of penicillin in 1928 by Alexander Fleming and its production in the 1940s by Howard Florey and Ernst Chain. Students may not realise how important these discoveries are; without them it would be easy to die from many trivial things.

Teaching tips: Video

There are many excellent documentaries about the discovery of penicillin. Using videos may make the information in this section more accessible for students.

Differentiation

For less able students:

Students could create a scientific poster detailing the history of the discovery of penicillin featuring information and pictures.

For more able students:

Students may be interested in researching other key medical and chemical breakthroughs. An example of this is the smallpox vaccine. The smallpox vaccine was the first successful vaccine to ever be developed.

Additional activity: Cartoon

Ask students to use the information on pages 110 and 111 to prepare a minimum eight-box cartoon strip that shows the timeline of the key stages in the discovery and production of penicillin. Students could either draw this by hand or use a computer program such as Comic Life.

Additional activity: Quiz

At the end of this topic, students could work in groups to develop 10 questions and their answers for a quiz on cells. These questions can be collated and used in a class trivia competition. This can be used as formative assessment and the appropriate revision planned. Kahoot! is an example of a free online quiz maker that allows students (and teachers) to make fun and interactive quizzes. The quizzes are multiple choice and can include images. Students then log in to the quiz using a unique ID and the timed quiz is projected on to the screen with students racing each other to win the quiz. Students can use computers or their mobile phones to play.

Going further

A useful weblink is available on your obook/assess. To access it, click the weblink tile on the Dashboard for this unit.

**Maker of the miracle mould**  
This article about penicillin is originally from CSIRO’s *The Helix* magazine.