Surviving

7.1 The human body is divided into systems

Teacher notes (pages 116–117)

Introducing the chapter

This chapter builds on existing knowledge of cell structure and function to examine how the cells in multicellular organisms specialise for particular functions, to provide all the needs of the organisms including nutrition and excretion. The digestive, respiratory, circulatory and excretory systems are explored.

Teaching tips: Human anatomy

So much of the content in this chapter provides excellent opportunities for hands-on activities. Dissections are invaluable experiences for students to see what ‘real’ body systems look like. There are also plenty of human anatomy models available for schools to purchase. Many science or health and physical education departments will already have a range of these models. The use of models also helps students to visualise the structure and function of organs and systems in the body, and models are more appropriate for the more squeamish students who may not wish to participate in dissections.

Differentiation

For less able students:

Labelled diagrams and models will help students recall the names of key components of systems.

For more able students:

Building working models of organs and/or systems can be an excellent challenge for some students.

Additional activity: Class discussion

These questions, used as a class discussion, are a really good opportunity to establish prior knowledge and any misconceptions. These are some common misconceptions:

• ‘The brain is not essential for all human behaviours.’ (The brain is essential for all human behaviours.)

• ‘Lungs are hollow like balloons.’ (Lungs are made up of cells.)

• ‘The urinary bladder is part of the digestive system.’ (The urinary bladder is part of the excretory system.)

• ‘Most of the food we eat goes in the mouth and disappears or goes out the anus.’ (Most of the food we eat gets broken down and absorbed by the body.)

• ‘Daughters inherit their characteristics from their mothers and sons from their fathers.’ (Sons and daughters inherit their characteristics from both their mother and their father.)

• ‘A foetus doesn’t look anything like a human until it is born.’

• ‘We are not animals or we are unlike any other animal.’ (Humans are animals and are mammals.)

• ‘Plants aren’t male or female.’ (Plants can be male or female or both.)

Additional activity: Timeline of scientific discovery

Ask students to prepare a timeline showing early to modern scientific discoveries relating to the human body. What discoveries have been made in the last 50 years? What do they think were the most important ones and why?

Additional activity: Body snatchers

Students could research some interesting facts. Here are some examples:

• Prior to 1832, some criminals were sentenced to dissection after committing a crime; however, these bodies did not provide enough subjects for medical students.

• Stealing a corpse was only a misdemeanour and, therefore, only punishable with a fine and imprisonment.

• Body snatchers were careful not to steal anything such as jewellery or clothes, as this would result in a felony charge.

Going further

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

**Science videos**  
This website has a number of great videos explaining human body systems and organs.

7.2 The digestive system is made up of organs

Teacher notes (pages 118–119)

Introducing the topic

This section focuses on the human digestive system and its role in providing nutrients to cells of a multicellular organism. Digestion involves both the mechanical (chewing of food) and chemical (saliva and other enzymes) breakdown of food. Mechanical digestion is called mastication and is the start of the digestive process. Chemical digestion starts alongside mastication with enzymes in the saliva. Both the mechanical and chemical breakdown of food continue at various stages throughout digestion.

Teaching tips: Anatomical models

The use of anatomical models will assist visual and kinaesthetic learners. Students can also make their own models, or draw their own annotated posters. Examining the skulls of different animals to compare tooth structure and diet can also be engaging. There are many video clips of the digestive system and its organs in action available on the Internet.

Additional activity: M&M challenge

Students could investigate the dissolving time of an M&M using different methods of consumption.

**1** Instruct each student to place one M&M in their mouth. They should not move or chew the M&M. Ask students to record the time it takes for the M&Ms to dissolve.

**2** Instruct each student to place a new M&M in their mouth and to use their tongue to move it around, but no chewing. Ask students to record the time it takes for the M&M to dissolve.

**3** Instruct each student to place another M&M in their mouth and to swirl it around with their tongue and to chew. Ask students to record the time it takes for the M&M to dissolve. Students can compare the time taken for the M&M to dissolve with each method.

Which was most effective? Why?

Additional activity: Outline systems

Students could use large pieces of butcher’s paper and work in pairs. One student lies down on the paper and the other traces around them. The students then fill in the outline – drawing in all parts of the digestive system. This can also be done as a modelling activity where students turn the two-dimensional drawings into three-dimensional shapes using papier-mâché.

Additional activity: Creative writing

Ask students to prepare a one-page story written from the perspective of a piece of food that travels through the digestive system. This can be a creative way of remembering the different parts of the digestive system and what they do.

Additional activity: Form and function

Looking at form and function inside the mouth Ask students to consider how their mouths and all the parts inside their mouths are designed (the form). Now ask students to consider the functions of the various parts. In pairs, students can create a list of the major parts of the mouth (teeth, tongue etc.) and explain, for each, why their form is important for their function. For example, some teeth are sharp for tearing, others have an uneven surface for chewing food into pieces; they are hard because they have to chew tough and stringy food.

Going further

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

**Digestive system (Male view)**  
This interactive resource provides lots of specific information about the human digestive system.

7.3 The digestive system varies between animals

Teacher notes (pages 120–121)

Introducing the topic

This section focuses on the digestive systems of different animals with a particular focus on herbivores. Students are often surprised to hear that cows have four compartments to their stomachs, unlike our own single stomach. Each of the four compartments has an important job to do.

Teaching tips: Animals can have different digestive systems

Cows are not the only animals that have different digestive systems. It can be good to discuss the different and unique systems with students. Not only is it interesting and engaging, but it allows students to compare the form (design) with the function (job). Birds and camels are good examples of unique digestive systems. Camels have a three-tiered system (similar to cows’ four-tiered system) and birds have a beak, crop and gizzard that are used for different parts of digestion.

Differentiation

For less able students:

Labelled diagrams of the cow’s digestive system will help students recall the names of key components of the system.

For more able students:

When cows first grab a clump of grass, it begins to break down in their mouths using the enzymes present in the cows’ saliva. More able students could research further into saliva and enzymes and the important role they play in digestion.

Additional activity: Comparing teeth

Ask students to research a number of different animals that have different diets. What conclusions can they draw about their teeth? Why do some animals (such as the cow) have fewer teeth than others? Why does the cows’ diet of grass ensure that they need strong molars? What kinds of animals have sharp teeth and why do they have them?

Additional activity: Summary glossary

Students can write their own definitions of the bold key words as they appear throughout the text. Encourage them to write their own definitions rather than just copying an existing definition. Paraphrasing definitions is a good skill and demonstrates real understanding of the terms.

Going further

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

**Ruminant digestion**  
This animation details the digestive system of ruminants.

7.4 Things sometimes go wrong with the digestive system

Teacher notes (pages 122–­123)

Introducing the topic

This section considers some common issues with the digestive system, including stomach ulcers, gallstones, gluten intolerance and constipation. The digestive system is just like a production line in a factory. Each organ relies on the previous section working effectively. Unfortunately, this does not always occur, leading to problems in the digestion system.

Teaching tips: Checking knowledge

Many students are likely to have come from primary school with some concept of the digestive system and issues in the digestive system. An informal pre-test would be ideal to determine those students who may need extra help, or those who already have a good understanding and require extension work. General discussion about each main heading in the sections, as well as discussion about the images presented throughout, will assist you to determine prior knowledge in an informal way. These discussions are also likely to provide students with an idea of where the chapter is going. There are some great images and videos of the inside of the digestive system available online. Encourage students to find these images and videos for a close-up look.

Differentiation

For less able students:

Providing the component names for students to match to diagrams and models can provide students with a greater level of success rather than relying on students to memorise the names as well as where they go.

For more able students:

This chapter offers ample opportunity for self-directed research tasks, where students can choose an organ or systems to investigate in terms of diseases, treatments and current research.

Additional activity: Unhealthy diets

Ask students to research the problems associated with an unhealthy diet. An unhealthy diet can affect nearly all the body systems, including the digestive system. Ask them to trace around a human body and annotate the butcher’s paper with the types of issues that can occur. This task could also be used for assessment purposes.

Going further

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

**Healthdirect Australia: Digestive system**  
This website provides further information about the digestive system, as well as outlining common problems.

7.5 The respiratory system exchanges gases

Teacher notes (pages 124–125)

Introducing the topic

This section investigates the respiratory system. This system helps the body absorb oxygen and expel carbon dioxide, when oxygen and carbon dioxide molecules are passively exchanged through diffusion between the gaseous environment and the blood; this occurs in the alveoli. A common misconception made by students is that respiration is the same as breathing. Begin by defining breathing and respiration. Breathing is a mechanical process of taking oxygen into the lungs and exhaling carbon dioxide. Respiration is a chemical process where oxygen is used by the body.

Teaching tips: Demonstration

A sheep’s pluck can be obtained from a local butcher and the lungs can be inflated for students to observe how lungs work. The lungs can be inflated using a piece of rubber hose. The advantage of this demonstration is that students can also see other organs and their rough location. Before inflating the lungs, ask students to guess what the lungs would feel like. Ask them to come up with a hypothesis based on what they know about the function of lungs. A good answer will be that they expect the lungs to feel light, soft and spongy because of the air sacs inside. Students may also say that they will feel ‘stretchy’ as they are able to inflate and increase in size. Once students have made their hypotheses, they can each put on a disposable glove and take turns to feel the lungs with their hands. This is important as it will assist them to link the form and function of the lungs. When inflating the lungs with the rubber tubing, blow slowly and grip the tubing at the entry site to avoid air escaping. If one lung is not inflating, try the other. Butchers can often slice the lung when removing a pluck so check this first. Afterwards, the lung can be cut in half to show students the inner tissue.

Teaching tips: Dissections

Prior to reading about dissections, ask students what they understand dissection to mean. For example, if you were to ask them to dissect an organ, what would that involve? After covering the material in the book, students could reflect on their initial understandings and how similar or different the reality is.

Differentiation

For less able students:

Video could be used to show the oxygenation of blood cells. Flash cards will help students recall the different parts of the respiratory system. Labelling a diagram of the respiratory system will assist students to memorise the parts.

For more able students:

Building working models of the respiratory system can be an excellent challenge for some students. Students could be given some balloons, tape, plastic bottles, thick elastic and cardboard for this activity.

Additional activity: Differences in respiratory systems

Students could compare the anatomy and physiology of other animals’ respiratory systems. Some suggestions include horses, elephants, birds, reptiles, amphibians, fish, insects and molluscs. Students can also choose to focus on one particular comparison, for example, the respiratory system of fish compared to that of humans. Students will find this interesting as it will also answer the question of why humans can’t breathe underwater. Responses will include the fact that both humans and fish have hearts and circulatory systems, fish use gills to get oxygen from their surroundings (water) and the rate at which oxygen can be used by the body of a fish compared to the body of a human (which is why humans can’t breathe underwater).

Additional activity: A fish out of water

What happens to fish when they are out of water? Ask students to undertake further research into what happens when fish are removed from water. Why can’t fish filter oxygen from a waterless environment? Are there any types of fish that can?

Going further

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

**The Respiratory system**  
This is a short video showing respiratory function.

7.6 Things sometimes go wrong in the respiratory system

Teacher notes (pages 126–127)

Introducing the topic

This section looks at common problems with the respiratory system including asthma, emphysema and pneumonia. The respiratory system is responsible for supplying the oxygen we need for energy. When things go wrong, our body struggles to survive. Small irritations make us cough. Asthma causes the airways to become smaller. Emphysema prevents the oxygen from entering our blood. Pneumonia is an infection that fills our lungs with fluid.

Differentiation

For less able students:

Less able students could prepare a KWL chart about issues in the respiratory system. Many students begin this topic with existing knowledge, for example a family member may have asthma. They also find the topic interesting and so may have some great ‘Wonderings’ for their chart. A KWL chart is made up of three parts: 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.

For more able students:

Building models to demonstrate the effect of some of the illnesses and diseases covered in the chapter can also be engaging, getting students to focus on the cause and effect on systems when things go wrong.

Additional activity: Respiratory problems

Students could research some common respiratory problems and what causes them. Asthma is a leading cause of childhood illness. What is it? Why is it so common? Pneumonia is another example of a respiratory illness that could be researched.

Assessment

Students create a scientific poster that shows the affect of cigarette smoke on the lungs. A good scientific poster uses images and limited text to convey information. On the back should be a list of references. Students display their posters around the room and guests or other students tour the room looking at the posters while students explain and present their posters. This assessment provides both written assessment as well as verbal. This can also provide a good peer-assessment opportunity, with students and guests completing a feedback sheet or simply voting for the best poster and presenter.

Going further

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

**Quit: Health risks of smoking**  
This website details the major health risks associated with smoking.

7.7 The circulatory system carries substances around the body

Teacher notes (pages 128–129)

Introducing the topic

This topic looks at the structure and function of the heart and blood vessels and their roles in the circulatory system. The circulatory system encompasses both the lymphatic system and the cardiovascular system. The lymphatic system is part of the immune system, and distributes lymph, which is a fluid that picks up bacteria and returns it to the lymph nodes to be destroyed. The cardiovascular system consists of the heart, blood and blood vessels. It also involves pulmonary circulation, which is a ‘loop’ through the lungs where blood is oxygenated, and systematic circulation, which is a ‘loop’ through the body to provide oxygenated blood to the body. An average adult has approximately 4.7–5.7 litres of blood.

Teaching tips: Different learning styles

Many videos and animations on the circulatory system can be found on the Internet. The use of anatomical models will assist visual and kinaesthetic learners. Students can also make their own models, or draw their own annotated posters.

Differentiation

For less able students:

Provide students with labels for diagrams, rather than relying on students remembering the names of the parts as well as where they go.

For more able students:

Students could be challenged to make a working model of the human heart.

Additional activity: Build a model

Students can build a labelled model of the human heart or the three different blood vessels using plasticine or other materials. Encourage students to provide brief descriptions of the functions of each of the structures of the tissues.

Additional activity: Make a simple stethoscope

**Materials**

• A balloon

• A piece of tubing

• 2 small funnels (or tops of 2 plastic bottles)

• Scissors

• Rubber band (optional)

**Method**

**1** Take the piece of tubing and fit a funnel to each end.

**2** Stretch the balloon by blowing it up and then letting the air out.

**3** Cut off the top one-third of the balloon with scissors.

**4** Stretch the top one-third of the balloon tightly over the open end of one of the funnels. If necessary, use a rubber band to hold it in place.

**5** Sit somewhere quiet and place the end of the funnel with the balloon over it against your chest, over your heart. The other funnel should be placed next to your ear.

Students should hear two types of beats often referred to as ‘lub-dub’. The ‘lub’ occurs when the atrioventricular valves shut to prevent blood moving from the ventricles back into the atria. The ‘dub’ occurs when the semilunar valves shut after blood inside the ventricles is forced through them.

Going further

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

**The virtual heart: Cardiac anatomy**  
This interactive comparison of the hearts of different animals could be used for students who do not wish to participate in the heart dissection.

7.8 Things sometimes go wrong in the circulatory system

Teacher notes (pages 130–131)

Introducing the chapter

Blood vessels carry oxygen and nutrients around the body. When something goes wrong, the body is unable to make the energy it needs to survive. Valves in the heart can leak (valve disease), the vessels can narrow (atherosclerosis) and the cells in the heart can die in a heart attack. Healthy eating and regular exercise all help to keep your heart healthy.

Teaching tips: Questions

Encourage students to ask questions, in general, and big questions, specifically, throughout this chapter. If they propose simple questions, ask them to rethink and transform them into big questions. This chapter provides an excellent opportunity for class discussions about the questions posed by your students. An ongoing activity throughout the topic could be the discussion of a student-proposed question at the start of each lesson. In the first lesson, each student could write down a question to be collected and drawn at random at the start of each subsequent class. After a short class discussion, if the solution has not been found, the student who posed the question could be asked to research it and present the answer at the next class.

Differentiation

For less able students:

Ask students to come up with a way of remembering that arteries move blood towards the heart and veins move it away.

For more able students:

Students could complete the same activity as above, but as an extension draw a diagram that uses colour to show oxygenated and deoxygenated blood moving throughout the circulatory system.

Additional activity: Healthy-living campaign

Students could use information in this chapter as well as further research to create a healthy-living campaign at school. Split students into groups and they could choose a way to be involved, including the creation of a podcast or student radio station, a presentation at an assembly, the creation of posters and so on. This task could also be used as an assessment tool.

Going further

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

**BBC Bitesize: Heart disease**  
This website considers what happens when arteries become blocked due to genetic or lifestyle factors.

7.9 The excretory system removes waste

Teacher notes (pages 132–133)

Introducing the topic

Wastes are removed from the human body by the excretory system. When thinking about excretion and wastes, many students may only think of urine and faeces and do not consider things such as sweating. The organs of the excretory system are the kidneys, liver, lungs and skin.

Teaching tips: How does the excretory system work?

Many videos and animations on the excretory system can be found online. The excretory system helps maintain homeostasis within the organism. It is responsible for the removal of any metabolic waste products as well as any excess liquids and gases.

Teaching tips: Homeostasis

It can be good to discuss homeostasis with students at this stage. Homeostasis is the ability of an organism to maintain a relatively stable internal environment. The excretory system helps maintain homeostasis. It is responsible for the removal of any metabolic waste products that may become toxic, as well as any excess liquids and gases.

Differentiation

For less able students:

Provide students with labels for diagrams, rather than relying on students remembering the names of the parts as well as where they go.

For more able students:

Students can investigate different forms of urea/ammonia excretion in fish and birds and compare it to excretion in mammals.

Additional activity: Brainstorm wastes and waste removal

Students may feel uncomfortable talking about the excretory system, so it is essential to discuss its importance. An example would be to ask students to imagine what would happen if the rubbish and wastes accumulated in their homes. This may be a good brainstorming activity to demonstrate the importance of the excretory system.

Additional activity: Water consumption

Ask students to respond to the following statement: ‘Drinking water is very important to the health of your body’. Students should respond to the statement using what they have learnt about the excretory system. They must use the following words in their response: dilute, excrete, ammonia and kidney. An extension of this activity could be to research what other body systems and organs also benefit from drinking water (e.g. the brain).

Additional activity: Kidneys as filters

**Materials**

• Cheesecloth/fine mesh fabric

• Water

• Food colouring

• Fine sand

• Tall, narrow glass jar

**Method**

**1** Mix sand and some water to form a thin loose mixture and add some food colouring.

**2** Half-fill the jar with clean water and drape the cheesecloth over the jar.

**3** Pour the sand and water mixture over the cheesecloth and watch the water in the jar change colour (the sand won’t flow into the water).

**4** Pull the cheesecloth up and pour the water out of the jar (this is like urinating).

**5** Pour clean water to the top of the cheesecloth. The sand and water mixture will gradually lose its colour after several changes (this represents the kidneys cleaning out toxins but retaining blood cells).

As an extension, students could calculate how much food colouring must be added to maintain the colour. This can be used to demonstrate how the body must maintain a salt balance

Going further

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

**Kidney Health Australia: What do your kidneys do?**  
This website including YouTube links explains how the kidneys function.

7.10 Plants have tissues and organs

Teacher notes (pages 134–135)

Introducing the topic

This section focuses on plants as multicellular organisms. In particular, it looks at the plant body systems required to obtain water, for photosynthesis and for transportation of water and sugars around the plant. Students explore each system separately, but should be encouraged to see how all the systems work together to ensure that all cells in the plant obtain the nutrients they require and have their wastes removed.

Teaching tips: Plant growth

Simple flowering plants, such as tomatoes or peas, are easily grown in the classroom. If grown in an ant farm or between two plates of glass, the root system of the plants can also be observed. Seeds could be planted a week apart, staring a week or two before students are introduced to the topic, so students can see plant development at different stages. This visual demonstration of plant growth and development can help visual learners understand the different plant body systems.

Teaching tips: Transpiration stream and capillary action

The transpiration stream can be a tricky concept for students to understand. They tend to believe that gravity should prevent water from rising to the tops of trees. Capillary action is the ability of substances, including water, to rise up a tube against the force of gravity. A number of different processes help push and pull water up the plant:

• Osmosis of water from the soil into the roots pushes the existing water in the xylem upwards.

• Water cohesion is the attraction force between water molecules that helps the water form a continuous column inside the xylem; without it, the transpiration stream would fail.

• Water adhesion is the attraction force between water molecules and the inside surface of the xylem tissue. Adhesion is what forms the meniscus. The narrower the tube, the higher the water molecules can climb and the steeper the curve of the meniscus.

• Transpiration of water through the stomata in the leaves helps ‘pull’ water up the plant.

Differentiation

For less able students:

Allow students to handle a three-dimensional model of a plant cell and use sticky notes or stickers to label the key features of the model.

For more able students:

Students could build a model to demonstrate the structure and function of xylem and phloem in plants.

Additional activity: Vascular tissue and transpiration

The vascular tissue of plants can be easily seen as the ‘strings’ in celery stalks. Take a single celery stalk with the leaves still attached and slice halfway up the length of the stalk. Place one side of the stalk in a beaker containing water and blue food dye and the other half in a beaker containing water and red food dye. A combination of osmosis and transpiration will draw the coloured water up the stalks and colour the leaves. A cross-section through the stalk will highlight the vascular tissue.

Additional activity: Summarising plant body systems

Using a simple diagram, students can create an annotated poster or model showing the main plant body systems (roots, shoots, leaves and vascular tissue) and indicate the inputs and outputs of each system

Going further

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

**Photosynthesis**  
This is an interactive tutorial on photosynthesis and leaf structure and function.