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QCE | BIOLOGY UNITS 1&2

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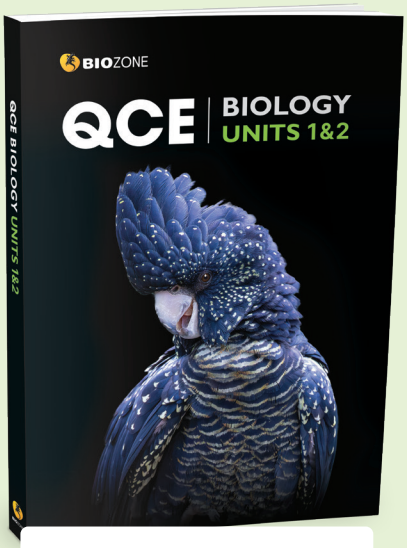

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QCE | BIOLOGY UNITS 1&2

This new edition of QCE BIOLOGY, Units 1&2 has been written to meet the requirements of the 2025 Queensland (QCE) Biology syllabus.

BIOZONE's high-quality infographics and inquiry-driven pedagogical approach inspires students to be curious about the scientific world. Our full colour, unique, interactive worktext approach encourages direct engagement with the content, allowing students to record their answers within the context of the stimulus material and form a "**record of work**" for quick and easy revision.

A simple tab system identifies where Science as a Human Endeavour, Science Understandings, and Science Inquiry are integrated into an activity. Syllabus and related unit objectives are also identified within the tab system.

Assessment tasks conclude each chapter and each unit and topic of study, making it easy to assess student understanding of the content.

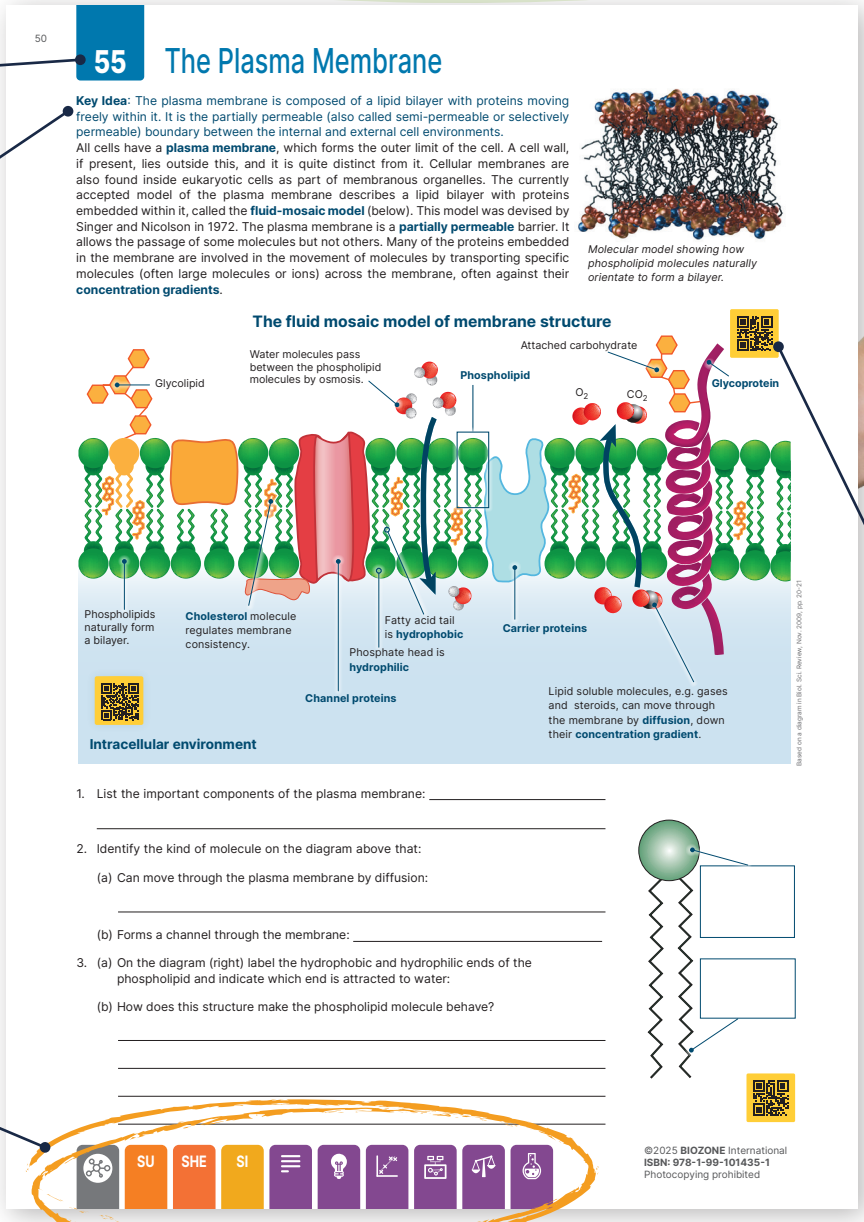
Activity number
Activities are numbered to make navigation through the book easier.

Key Idea
Each activity has a key idea. It helps you to understand where the activity's emphasis lies.

Content organisation
Logically organised content makes it easier for you to access and engage with the information.

Comprehensive, engaging diagrams
Engaging, high quality diagrams provide a visual focus whilst delivering important information in an accessible format.

Tab system
Tab codes identify where the syllabus objectives material has been incorporated into an activity. They also indicate online support via BIOZONE's weblinks.



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55 The Plasma Membrane

Key Idea: The plasma membrane is composed of a lipid bilayer with proteins moving freely within it. It is the partially permeable (also called semi-permeable or selectively permeable) boundary between the internal and external cell environments.

All cells have a **plasma membrane**, which forms the outer limit of the cell. A cell wall, if present, lies outside this, and it is quite distinct from it. Cellular membranes are also found inside eukaryotic cells as part of membranous organelles. The currently accepted model of the plasma membrane describes a lipid bilayer with proteins embedded within it, called the **fluid-mosaic model** (below). This model was devised by Singer and Nicolson in 1972. The plasma membrane is a **partially permeable** barrier. It allows the passage of some molecules but not others. Many of the proteins embedded in the membrane are involved in the movement of molecules by transporting specific molecules (often large molecules or ions) across the membrane, often against their **concentration gradients**.

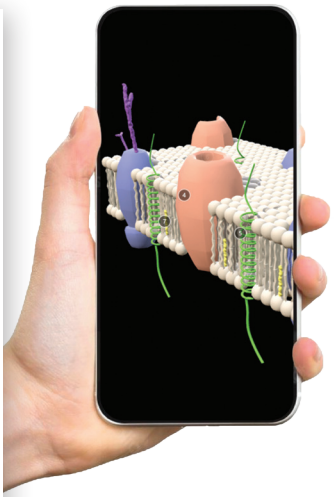
Molecular model showing how phospholipid molecules naturally orientate to form a bilayer.

The fluid mosaic model of membrane structure

Glycolipid
Water molecules pass between the phospholipid molecules by osmosis.
Phospholipid
Attached carbohydrate
Glycoprotein
O_2
CO_2
Phospholipids naturally form a bilayer.
Cholesterol molecule regulates membrane consistency.
Fatty acid tail is **hydrophobic**
Phosphate head is **hydrophilic**
Channel proteins
Carrier proteins
Lipid soluble molecules, e.g. gases and steroids, can move through the membrane by **diffusion**, down their **concentration gradient**.
Intracellular environment

1. List the important components of the plasma membrane: _____
2. Identify the kind of molecule on the diagram above that:
   (a) Can move through the plasma membrane by diffusion: _____
   (b) Forms a channel through the membrane: _____
3. (a) On the diagram (right) label the hydrophobic and hydrophilic ends of the phospholipid and indicate which end is attracted to water:
   (b) How does this structure make the phospholipid molecule behave? _____

SU SHE SI



QR Codes
Scan the QR code to directly interact with 3D models (above).

Write-on answers
Input your answers directly onto the page. This becomes a record of work and helps you revise for tests and exams.

Direct questioning
A direct questioning style helps you to easily identify what is being asked.

See inside back cover for details about **Resource Hub**

See our website for more details and local pricing
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Chapter 3 Unit 1: Topic 1

Cellular Differentiation and Specialisation

Key Terms

- adult stem cell
- bioartificial tissue
- bioethics
- cell
- cell specialisation
- circulatory system
- connective tissue
- differentiation (cellular)
- digestive system
- embryonic stem cell
- epithelial tissue
- ethics
- excretory system
- hierarchical organisation
- gas exchange
- mitosis
- multipotent
- muscle tissue
- nervous tissue
- nutrition
- organ
- pluripotent
- potency
- respiratory system
- self renewal
- specialised cell
- stem cell
- system (body)
- tissue
- totipotent
- unipotent
- waste (removal)
- zygote

Key Concepts

- Stem cells have the capacity to differentiate into different cell types.
- Multicellular organisms have a hierarchical structure from cells to organ systems.
- Organ systems interact with one another for maximum efficiency.

Types and properties of stem cells

			Activity Number
☐	1	Describe the properties of stem cells, including self-renewal and potency. Describe the properties and features of different types of stem cell.	43
☐	2	Explain the process of cell differentiation and the role of stem cells in producing specialised cells that make up tissues and organs in multicellular organisms.	44
☐	3	Explain the process of mitosis in an animal cell with reference to the stages of interphase, prophase, metaphase, anaphase, telophase and cytokinesis.	45
☐	4	**SHE:** Explain the potential of pluripotent stem cells to develop into specialised cells that can be utilised for the restoration or substitution of failing organs and tissues. Discuss how advancements in technology can be used to produce pluripotent stem cells.	43, 46
☐	5	**SI:** Explore the safety, ethics, and efficacy of stem cell technologies. Discuss the use of adult and embryonic stem cells (ASC and ESC) in medical technology. Analyse data and evaluate alternative perspectives on the use of stem cell research.	46-47

Multicellular organisms have a hierarchical structure

☐	6	Using examples, describe the hierarchical structure of multicellular organisms, including reference to organelles, cells, tissues, organs, and organ systems.	48
☐	7	Explain how a hierarchical organisation builds structural complexity and contributes to the functional efficiency of the organism as a whole. Include reference to emergent properties. Discuss the presence of specialised cells, with varying organelle composition, adapted to allow each body system to function optimally.	48, 50-52
☐	8	Explore aspects of hierarchical organisation through a dissection of a mammalian organ such as a heart or kidney. Explain how the arrangement and interaction of tissues produce the organ's structure and contribute to its function.	49
☐	9	Recognise that organ systems cooperate and interact to deliver essential functions such as exchanging respiratory gases, circulating materials, obtaining nutrients, and removing waste products.	50-52
☐	10	**SHE:** Identify how scientists simplify complex biological systems into manageable components for study, noting that new properties emerge at each level of the biological hierarchy.	48
☐	11	**SHE:** Explain the importance of using animals in research as crucial for advancing scientific knowledge about multicellular organisms. Discuss the use of bioartifical tissue in the context of ethical treatment of animals as sentient beings, adhering to the three strategies of replacement, reduction, and refinement.	53
☐	12	**SI:** Use photographs to compare epithelial, connective, muscle, and nervous tissues of the human body. Use photographs to view tissues from the respiratory, circulatory, excretory, digestive, and plant systems.	49

25 The Cell is the Unit of Life

Key Idea: All living organisms are composed of cells. Cells are broadly classified as prokaryotic or eukaryotic.

The cell theory is a fundamental idea of biology. This idea, that all living things are composed of cells, developed over many years and is strongly linked to the invention and refinement of the microscope in the 1600s.

The cell theory

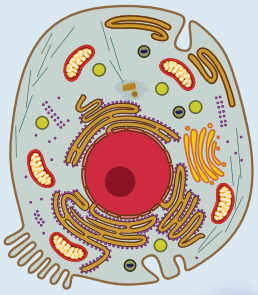
The idea that cells are fundamental units of life is part of the cell theory. The basic principles of the theory are:

- All living things are composed of cells and cell products.
- New cells are formed only by the division of pre-existing cells.
- The cell contains inherited information (genes) that are used as instructions for growth, functioning, and development.
- The cell is the functioning unit of life; all chemical reactions of life take place within cells.

All cells show the functions of life

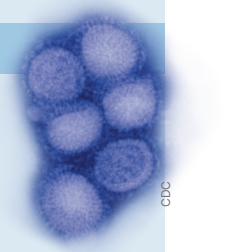
Cells use food (e.g. glucose) to maintain a stable internal environment, grow, reproduce, and produce wastes. The sum total of all the chemical reactions that sustain life is called metabolism.

- **Movement**
- **Respiration**
- **Sensitivity**
- **Growth**
- **Reproduction**
- **Excretion**
- **Nutrition**



Viruses are non-cellular

- Non-cellular.
- Typical size range: 20-300 nm.
- Contain no **cytoplasm** or organelles.
- No chromosome, just RNA or DNA strands.
- Enclosed in a protein coat.
- Depend on cells for metabolism and reproduction (replication).



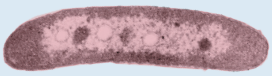
CDC

Influenzavirus

Living things

Cells

Prokaryotic (bacterial) cells



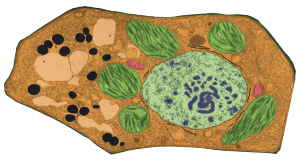
- Autotrophic or heterotrophic
- Single celled
- Lack a membrane-bound **nucleus** and membrane-bound **organelles**
- Cells 0.5-10 µm
- DNA a single, circular chromosome. There may be small accessory chromosomes called plasmids.
- **Cell walls** containing peptidoglycan.

Eukaryotic cells

• Cells 30-150 µm • Membrane-bound nucleus and membrane-bound organelles • Linear chromosomes

Plant cells

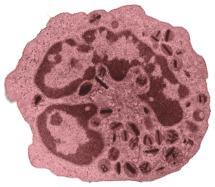
- Exist as part of multicellular organism with specialisation of cells into many types.
- Autotrophic (make their own food): photosynthetic cells with **chloroplasts**.
- Cell walls of cellulose.



Generalised plant cell

Animal cells

- Exist as part of multicellular organism with specialisation of cells into many types.
- Lack cell walls.
- Heterotrophic (rely on other organisms for food).



White blood cell

Protist cells

- Mainly single-celled or exist as cell colonies.
- Some are autotrophic and carry out photosynthesis.
- Some are heterotrophic.

Amoeba cell

Fungal cells

- Rarely exist as discrete cells, except for some unicellular forms (e.g. yeasts)
- Plant-like, but lack chlorophyll.
- Rigid cell walls containing chitin.
- Heterotrophic.

Yeast cell

1. What are the characteristic features of a prokaryotic cell? _____

2. What are the characteristic features of a eukaryotic cell? _____

3. Why are viruses considered to be non-cellular (non-living)? _____

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31 Identifying Structures in a Plant Cell

Key Idea: The position and appearance of the organelles in an electron micrograph can be used to identify them.

1. Study the diagrams on the other pages in this chapter to familiarise yourself with the structures found in eukaryotic cells. Identify the 11 structures in the cell below using the following word list: *cytoplasm, smooth endoplasmic reticulum, mitochondrion, starch granule, chromosome, nucleus, vacuole, plasma membrane, cell wall, chloroplast, nuclear membrane*

(a)

(b)

(c)

(d)

(e)

(f)

(g)

(h)

(i)

(j)

(k)

2. State how many cells, or parts of cells, are visible in the electron micrograph above: _____

3. Describe the features that identify this cell as a plant cell: _____

_____

_____

4. (a) Explain where cytoplasm is found in the cell: _____

_____

(b) Describe what cytoplasm is made up of: _____

_____

5. Describe two structures, pictured in the cell above, that are associated with storage:

(a) _____

_____

(b) _____

_____

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36 Preparing a Slide

Key Idea: Correctly preparing and mounting a specimen on a slide is important if structures are to be seen clearly under a microscope. A wet mount is suitable for most slides.

Specimens are usually prepared in some way before viewing in order to highlight features and reveal details. A wet mount is a temporary preparation in which a specimen and a drop of fluid are trapped under a thin coverslip. Wet mounts are used to view thin tissue sections, live microscopic organisms, and suspensions such as blood. A wet mount improves a sample's appearance and enhances visible detail. Sections must be made very thin for two main reasons. A thick section stops light shining through making it appear dark when viewed. It also ends up with too many layers of cells, making it difficult to see any detail.

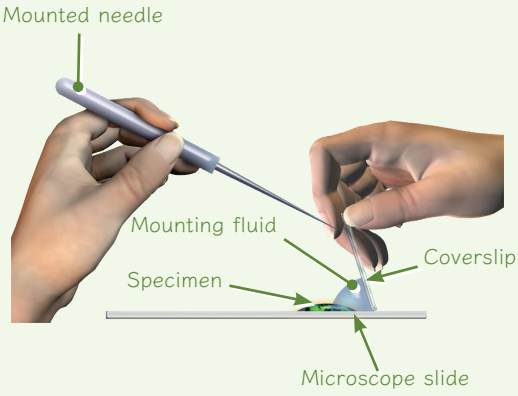
Investigation 2.1 Preparing an onion slide

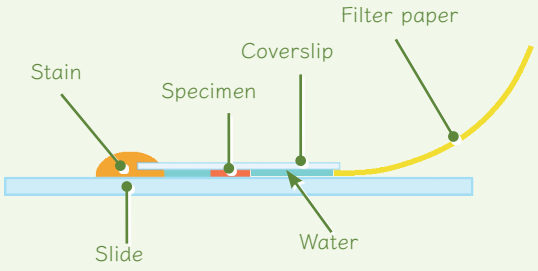
See appendix for equipment list.

Caution is required when using scalpels or razors. Iodine stains skin and clothes, and irritates the eyes. You should wear protective eyewear.

1. Onions make good subjects for preparing a simple wet mount. Cut a square segment from a thick leaf of the bulb using a razor or scalpel.
2. Bend the segment towards the upper epidermis until the lower epidermis and inner leaf tissue (the parenchyma) snaps so that just the upper epidermis is left attached.
3. Carefully peel off the parenchyma from one side of the snapped leaf and then the other, leaving a peel of just the upper epidermis.
4. Place peel in the centre of a clean glass microscope slide and cover it with a drop of water.
5. Carefully lower a coverslip over the peel. A mounted needle can be used for better precision. This avoids including air in the mount.
6. Use a small piece of tissue or filter paper to remove any excess water.
7. Place the slide on the microscope tray. Locate the specimen or region of interest at the lowest magnification. Focus using the lowest magnification first (remembering to move the lens away from the slide) before switching to the higher magnifications.
8. After viewing the slide under various magnifications, remove the slide and place it on the bench.
9. At the edge of the coverslip place a small drop of iodine stain.
10. On the opposite side of the coverslip use a piece of tissue or filter paper to draw the water out from under the coverslip. The iodine will be drawn under the coverslip.
11. Replace the slide on the microscope and view the stained onion peel.
12. Your teacher will have prepared slides of epithelial, connective, muscle, or nervous tissue available. View these under low and high power and note down any differences you see in the cells.

These photos KP





1. Why must sections viewed under a microscope be very thin? _____

_____

2. Why do you think the specimen is covered with a coverslip? _____

_____

3. Why would no chloroplasts be visible in an onion epidermis cell slide? _____

_____

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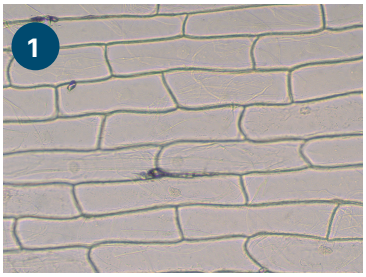
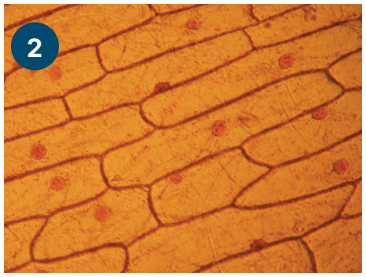
Stains and their uses

- Staining material for viewing under a microscope can make it easier to distinguish particular cell structures.
- **Stains** and dyes can be used to highlight specific components or structures. Stains contain chemicals that interact with molecules in the cell. Some stains bind to a particular molecule making it easier to see where those molecules are. Others cause a change in a target molecule, which changes their colour, making them more visible.
- Most stains are non-viable, and are used on dead specimens, but harmless viable stains can be applied to living material.

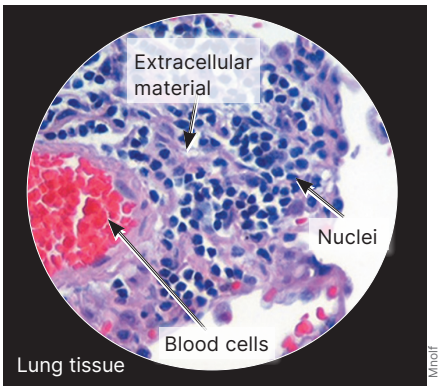
Some commonly used stains		
Stain	Final colour	Used for
Iodine solution	Blue-black	Starch
Crystal violet	Purple	Gram staining
Aniline sulfate	Yellow	Lignin
Methylene blue	Blue	Nuclei
Hematoxylin and eosin (H&E)	H=dark blue/ violet E=red/pink	H=Nuclei E=Proteins





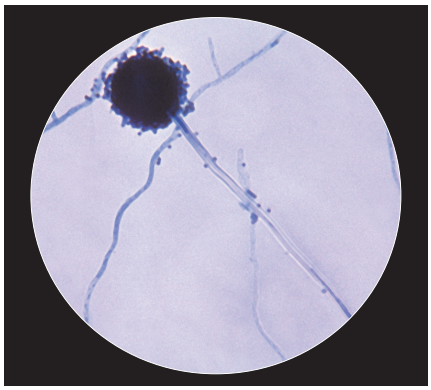
Photos: Eli

The light micrographs 1 and 2 (above) show how the use of a stain can enhance certain structures. The left image (1) is unstained and only the **cell wall** is easily visible. Adding iodine (2) makes the cell wall and nuclei stand out.



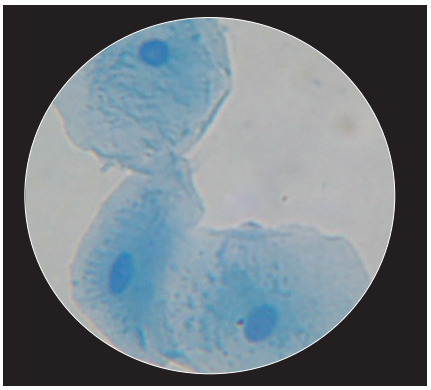
PloS

H&E stain is one of the most common stains for animal tissues. Nuclei stain dark blue, whereas proteins, extracellular material, and red blood cells stain pink or red.



Mnolf

Viable stains do not immediately harm living cells. Trypan blue is a vital stain that stains dead cells blue but is excluded by live cells. It is also used to study fungal hyphae.



CDC: Dr Lucille K. Georg

Methylene blue is a common temporary stain for animal cells, such as these cheek cells. It stains DNA and so makes the nuclei more visible.

4. Why is it necessary to focus on the lowest magnification first, before switching to higher magnifications?

5. Describe the difference the iodine stain made when viewing the onion cells under the microscope compared to when they were viewed without the stain:

6. What is the main purpose of using a stain? _____

7. What is the difference between a viable and non-viable stain? _____

8. Identify a stain that would be appropriate for distinguishing each of the following:

   (a) Live vs dead cells: _____ (c) Lignin in a plant root section: _____

   (b) Red blood cells in a tissue preparation: _____ (d) Nuclei in cheek cells: _____

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50 Respiratory and Circulatory Systems

Key Idea: The circulatory and gas exchange systems interact to provide the tissues with oxygen and remove carbon dioxide.

Circulatory system

Function

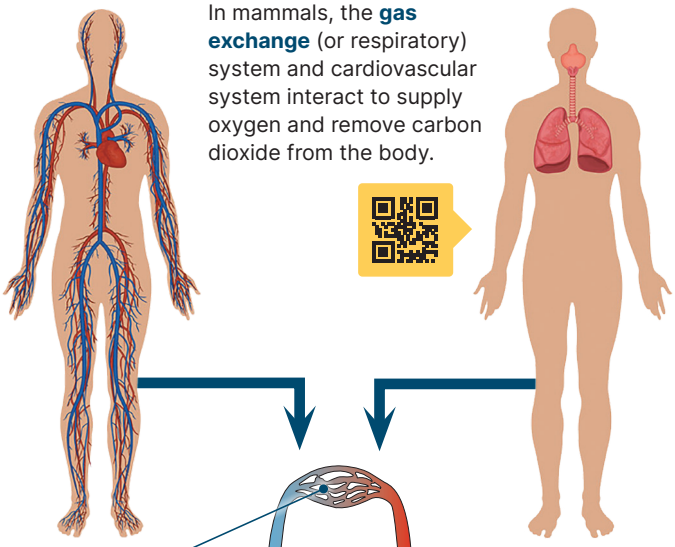
Delivers oxygen (O_2) and nutrients to all **cells** and **tissues**. Removes carbon dioxide (CO_2) and other waste products of metabolism. CO_2 is transported to the lungs.

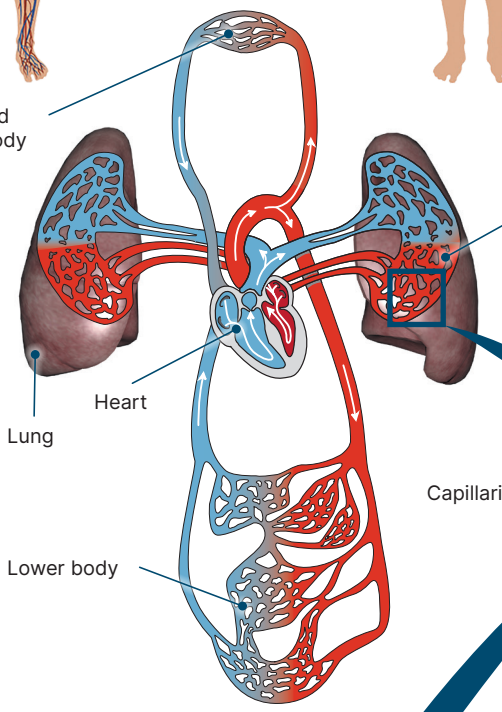
Components

- Heart
- Blood vessels:
  - Arteries
  - Veins
  - Capillaries
- Blood

Interaction between systems

In mammals, the **gas exchange** (or respiratory) system and cardiovascular system interact to supply oxygen and remove carbon dioxide from the body.





Oxygen (O_2) from inhaled air moves from the lungs into the circulatory system and is transported within red blood cells to the heart. The heart pumps the blood to the body where O_2 is released and carbon dioxide (CO_2) is picked up. The blood returns to the heart and is pumped to the lungs where CO_2 is released into the lungs to be breathed out.

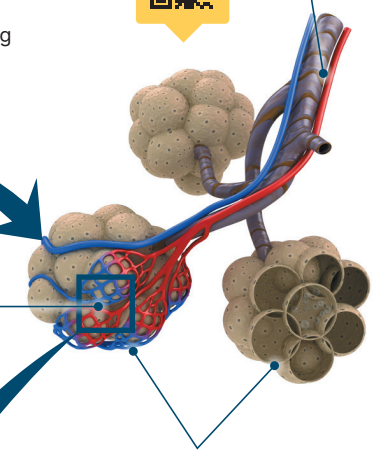
Gas exchange system

Function

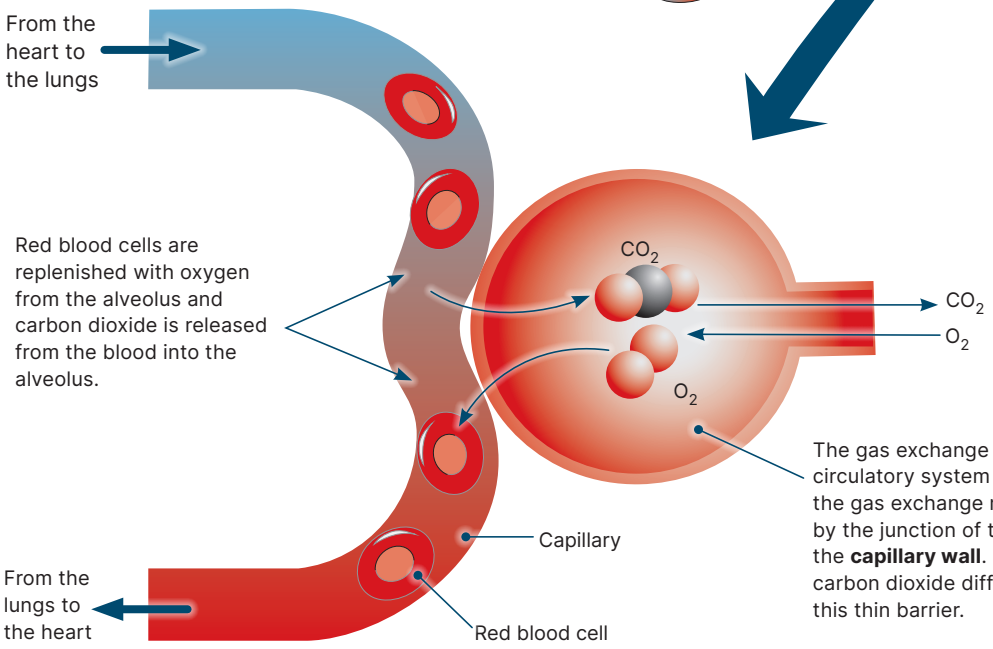
Provides surface for gas exchange. Moves fresh air into and stale air out of the body.

Components

- Airways:
  - Pharynx
  - Larynx
  - Trachea
- Lungs:
  - Bronchi
  - Bronchioles
  - Alveoli
- Diaphragm



The airways of the lungs end at the alveoli, the microscopic air sacs that enable gas exchange.



Red blood cells are replenished with oxygen from the alveolus and carbon dioxide is released from the blood into the alveolus.

The carbon dioxide released from the blood exits the body during exhalation. Inhalation brings in fresh air, containing oxygen.

The gas exchange system and the circulatory system come together at the gas exchange membrane formed by the junction of the **alveolus** and the **capillary wall**. Oxygen and carbon dioxide diffuse easily across this thin barrier.

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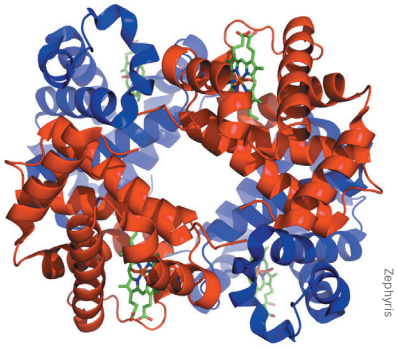
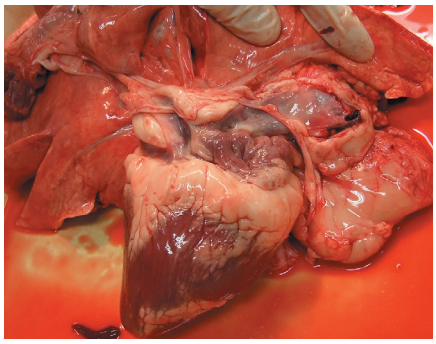
The response to exercise shows the close link between the circulatory and gas exchange systems. During exercise, breathing rate increases to provide more oxygen, which is carried by the blood to supply respiration (ATP generation) in working muscles. Heart rate increases to increase the rate at which oxygen is delivered to the tissues and carbon dioxide is returned to the lungs.



Zephyris

Oxygen is transported in red blood cells by the protein haemoglobin (above). In the capillaries of the lungs (high oxygen), haemoglobin binds oxygen tightly. In the tissues, higher carbon dioxide levels cause haemoglobin to release its oxygen. CO_2 is carried in the blood as bicarbonate ($CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3^-$). In the lungs, this dissociates back into CO_2 and water.



As with all **organ** systems, the circulatory and gas exchange systems are interdependent. Organs in the circulatory system (e.g. the heart) need oxygen to keep working and this is supplied by the lungs. If the heart were to stop beating it and all other organs would quickly run out of oxygen. Similarly, if breathing were to stop, all organs would quickly run out of oxygen.

1. (a) What happens to the rate of blood flow during exercise? _____

   (b) What happens to the breathing rate during exercise? _____

   (c) How do the circulatory and gas exchange systems interact to accommodate the extra oxygen requirements of an exercising person?

   _____

   _____

   _____

2. Lung diseases affect rates of gas exchange in the lung. Suggest how this would affect the body:

   _____

   _____

   _____

   _____

3. (a) At which point in the body do the respiratory and circulatory systems directly interact?

   _____

   _____

   (b) Explain what is happening at this point: _____

   _____

   _____

   _____

4. In your own words, describe how the circulatory system and respiratory system work together to provide the body with oxygen and remove carbon dioxide:

   _____

   _____

   _____

   _____

   _____

   _____

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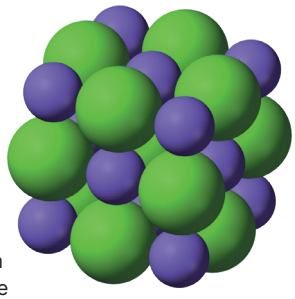
166 Salt Tolerance in Plants

Key Idea: Different species have differing tolerances to abiotic factors. Levels outside an organism's tolerance limits can reduce its chances of survival. Salt tolerance in plant species can be measured experimentally.

Tolerance limit is the ability to live within a certain range of abiotic factors (such as temperature or rainfall). For plants, salt tolerance is important because soil salinity affects plant growth and productivity. Above certain soil salinities, plants will not germinate or grow. In many regions of Australia, soil salinity is increasing (salinisation) lowering productivity. Human activities, such as removal of natural vegetation and poor irrigation management, contribute to salinisation.



Sodium chloride

Sodium chloride (NaCl) is an important contributor to soil salinisation. Increased soil salt concentrations have several negative effects on plants:

- High salt increases osmotic stress and decreases the ability of a plant to take up water.
- Large uptakes of Na^+ and Cl^- have a negative effect on growth by impairing metabolic processes and decreasing photosynthetic efficiency.

Plants can cope with NaCl to varying degrees. Some excrete excess salt onto their leaves (e.g. mangroves and salt grass) and other compartmentalise the salts (often in vacuoles).

The aim

Determine how temperature and salt levels influence the growth of salt grass (*Distichlis spicata*).

Salt grass (Distichlis spicata)

Matt Lavin CC 2.0

Salt grass (*Distichlis spicata*) is a native American plant found in a number of habitats including coastlines, desert scrub and marshes. It is very salt tolerant and capable of growing in very salty soils. Excess salt is excreted from its tissues onto the leaf surfaces.

The method

- Salt grass seeds were germinated in quartz sand and transplanted into their solutions of salt water when the fourth leaf appeared.
- The salt water concentrations were prepared by diluting sea water to obtain the following concentrations: 306, 612, 1834, and 2448 ppm.
- A nutrient enrichment solution was added to each sea water solution after dilution. The pH was adjusted to 5.7-6.0.
- Samples were prepared in duplicate.
- A control was grown in nutrient solution only.
- The plants were raised in greenhouses at either 12.7°C or 21.1°C.
- Material was harvested (as two cuttings) dried and weighed. The data are presented in the table below.

The results

Table 1: Effect of salt water concentration and temperature on salt grass growth

Concentration of sea water (ppm)	Weight of dry matter Average of 2 cultures (first cutting) (g)		Weight of dry matter Average of 2 cultures (second cutting) (g)		Total weight of dry matter (first cutting + second cutting) (g)	
	12.7°C	21.1°C	12.7°C	21.1°C	12.7°C	21.1°C
0 ppm + complete nutrient solution	47.0	21.2	49.0	25.3	*96.0*	*46.5*
306 ppm + dilute nutrient solution	14.4	8.3	21.2	12.5		
612 ppm + dilute nutrient solution	14.3	7.7	20.0	11.1		
1834 ppm + dilute nutrient solution	12.7	7.7	13.1	9.5		
2448 ppm + dilute nutrient solution	11.3	3.4	10.5	3.6		

Data: Ahi and Powers (1938) Salt tolerance of plants at various temperatures. Plant Physiol. 13 : 767-789.

1. Complete the table above by calculating the total weight of dry matter for each temperature and salt concentration. The first one has been done for you:

2. (a) Plot the total weight of dry matter at each temperature as a line graph on the grid (following page):

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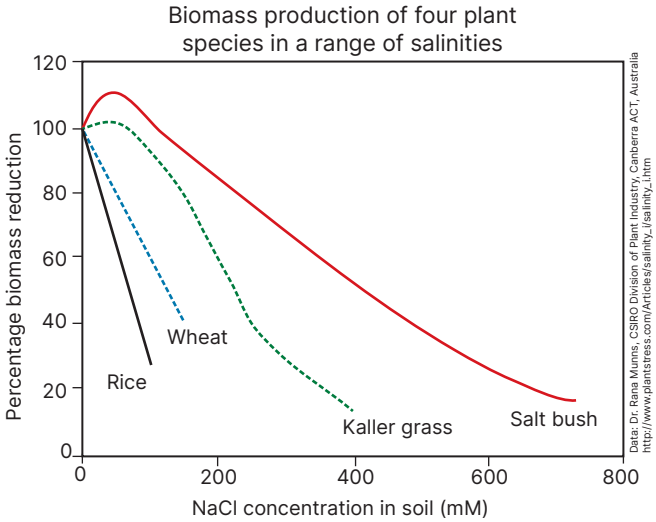
(b) Describe how salt water concentration and temperature affect salt grass growth: _____

3. How does salt grass remove excess salts and suggest how might this help it to survive in saline conditions?

4. Wheat and rice are important food crops. The graph on the right shows their salt tolerance compared to two salt adapted species. Based on the data for salt grass, and assuming that salinisation will continue to be a problem, how might increasing soil salinity affect productivity of these important food crops in Australia?



5. How could the development of salt tolerant plants (e.g. through genetic modification) benefit Australian farmers?

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201 Containing the Spread of Disease

Key Idea: Preventing the entry and spread of pathogens is important in protecting a country's population and industries from infectious diseases.

Many factors can influence the **spread** of **disease**, including the social climate, diet, general health, and access to medical care. Human intervention and modification of behaviour, including **vaccination**, can reduce the **transmission** rate of some diseases and inhibit their spread. Global air travel and international trade in commodities has increased the risk that diseases of humans, livestock, and crops will be spread between countries. Australia is fortunate in that its geographical isolation has helped to prevent the spread of disease from other parts of the world.

Quarantine
Transmission of disease can be reduced by adopting 'safe' behaviours, such as isolation of people already infected, or establishing **quarantine** procedures for people who have been exposed to infection. The quarantine lasts until hosts are no longer infectious.

Contact tracing
If viral infected patients are able to recall the people and places they had been in contact with in the previous period when they were contagious then contact tracers can test and/or quarantine them. This has the potential to stop further spread.

Disinfecting
Disinfectants and sterilisation techniques, e.g. autoclaving (above), destroy pathogenic microbes before they have the opportunity to infect. The use of these techniques in medicine has significantly reduced post operative infections and associated deaths.

Lockdown and social distancing
During the Covid-19 **pandemic** in early 2020, many countries implemented 'lockdown' procedures where businesses and schools were closed, and small groups remained isolated in 'bubbles' at home. Public gatherings were very limited and people outside their bubbles needed to adhere to social distancing to avoid spread.

Hygiene
Appropriate personal hygiene practices reduce the risk of infection and transmission. Soap may not destroy the pathogens but washing will dilute and remove them from the skin. Masks can also prevent the spread of airborne viruses and were mandatory in many businesses and work places during the Covid-19 pandemic.

CDC

Vaccination
Vaccination schedules form part of public health programmes. Vaccination and **vaccine** development is one of the most effective ways of preventing transmission of contagious diseases. If most of the population is **immunised**, herd immunity limits outbreaks to sporadic cases and prevents **epidemics**.

1. (a) Identify three ways in which the environment can be made less suitable for establishment and transmission of diseases:

_____

_____

_____

(b) How is disease transmission reduced in medical care situations? _____

_____

(c) Why is sanitation important in preventing the spread of disease? _____

_____

_____

2. Why is reducing the prevalence of disease preferable to trying to contain an outbreak?

_____

_____

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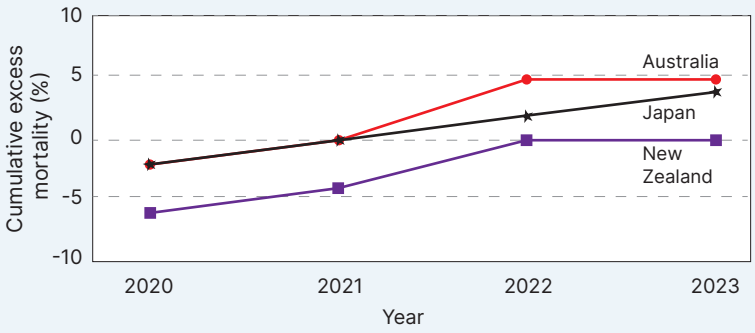
Covid 19 and excessive mortality rates

- The first confirmed case of COVID-19 in Australia was reported on January 25, 2020. By March 12, there were 140 confirmed cases in the country. A series of public health and social measures were put in place to slow the spread of the virus.
- A number of health measures including vaccinations and anti-viral medicines have been used to reduce serious illness or death in Covid-19 infected patients. However, data shows mortality (death) rates are above what would typically be expected within the Australian population.
- The graph (right) shows the percentage difference between the cumulative number of deaths since 1 January 2020 and the cumulative expected number of deaths based on previous years (2015–2019).

Cumulative excessive mortality (%) since the beginning of the Covid-19 pandemic for three countries

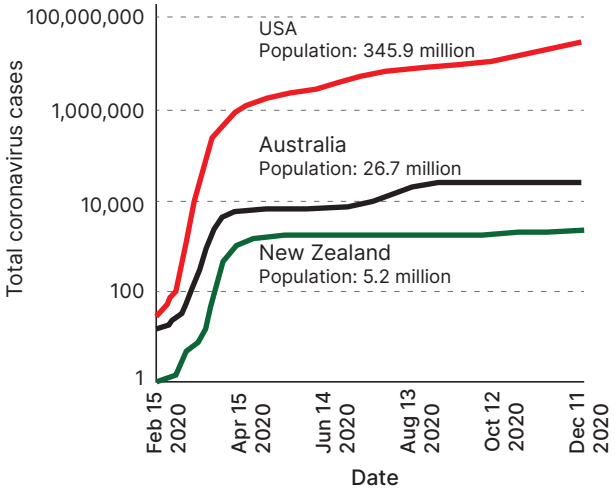


Data source: Australian Institute of Health and Welfare
https://www.aihw.gov.au/reports/australias-health/covid-19

Covid 19: Different countries, different outcomes

- During the early stages of the pandemic, some countries were very successful in slowing or containing the spread of the virus. Graphically, this was shown by a flattening of the infection curve.
- In some countries the virus spread widely and quickly. This is illustrated by a steep, exponential increase on a graph.
- The way governments, health departments, and populations responded to the disease was important in the pattern of Covid-19 spread.
- The graph (right) shows the number of confirmed cases for three countries: Australia, New Zealand, and the US in the first year of the pandemic.
- Although these countries have very different populations and recorded their first Covid-19 infection at different times, the data can be used to see how well each country contained the spread of disease.

Comparison of Covid-19 cases by country (Feb 15 2020 - Dec 11 2020)



Data source: Worldometer https://www.worldometers.info/coronavirus/

3. Study the graph showing cumulative excess mortality rates during the Covid-19 pandemic.

   (a) What trend does the data show? _____

   _____

   (b) Compare Australia's excessive mortality rates against those of Japan and New Zealand:

   _____

   _____

   (c) How could the data be used to study the effect of Covid-19 on death rates? _____

   _____

   _____

   _____

4. Study the graph showing the number of Covid-19 cases in the USA, Australia, and New Zealand.

   (a) All three countries showed exponential increase in Covid-19 cases during one period. When was this?

   _____

   (b) Which country was most successful at controlling Covid-19 spread? Explain your answer: _____

   _____

   _____

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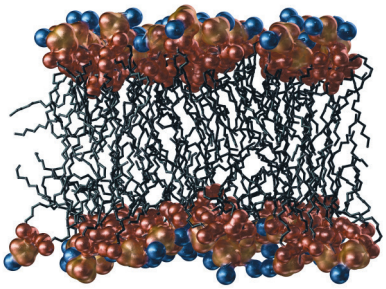
55 The Plasma Membrane

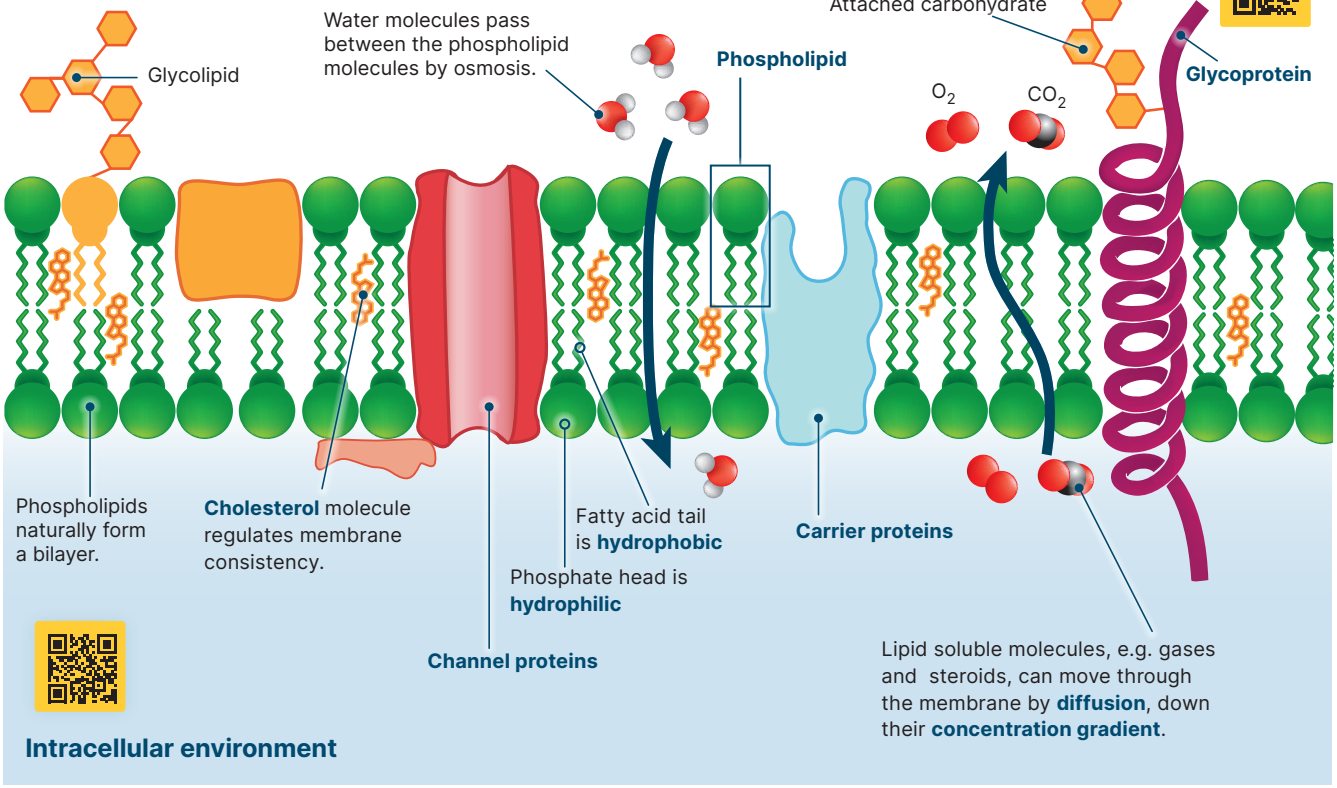
Key Idea: The plasma membrane is composed of a lipid bilayer with proteins moving freely within it. It is the partially permeable (also called semi-permeable or selectively permeable) boundary between the internal and external cell environments.

All cells have a **plasma membrane**, which forms the outer limit of the cell. A cell wall, if present, lies outside this, and it is quite distinct from it. Cellular membranes are also found inside eukaryotic cells as part of membranous organelles. The currently accepted model of the plasma membrane describes a lipid bilayer with proteins embedded within it, called the **fluid-mosaic model** (below). This model was devised by Singer and Nicolson in 1972. The plasma membrane is a **partially permeable** barrier. It allows the passage of some molecules but not others. Many of the proteins embedded in the membrane are involved in the movement of molecules by transporting specific molecules (often large molecules or ions) across the membrane, often against their **concentration gradients**.



Molecular model showing how phospholipid molecules naturally orientate to form a bilayer.

The fluid mosaic model of membrane structure



Based on a diagram in Biol. Sci. Review, Nov. 2009, pp. 20–21

1. List the important components of the plasma membrane: _____

   _____

2. Identify the kind of molecule on the diagram above that:

   (a) Can move through the plasma membrane by diffusion:

   _____

   (b) Forms a channel through the membrane: _____

3. (a) On the diagram (right) label the hydrophobic and hydrophilic ends of the phospholipid and indicate which end is attracted to water:

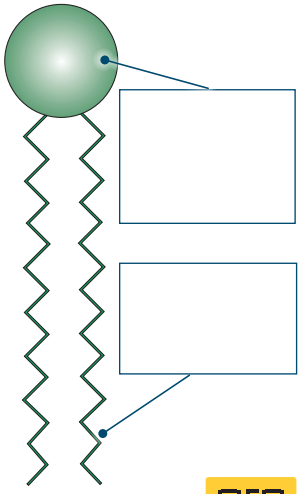
   (b) How does this structure make the phospholipid molecule behave?

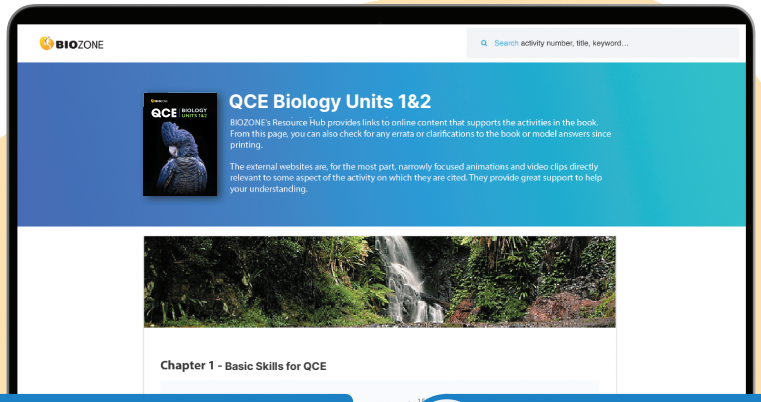
   _____

   _____

   _____

   _____





Resource Hub

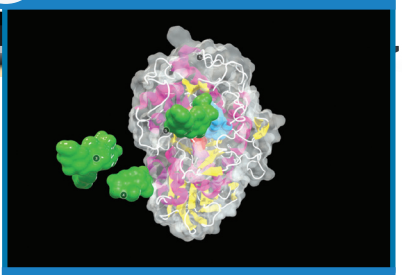
The **Resource Hub** provides print book users with **FREE access** to curated material and resources which support the content of the worktext.

There is much to explore!

Curated Online Third-party Resources

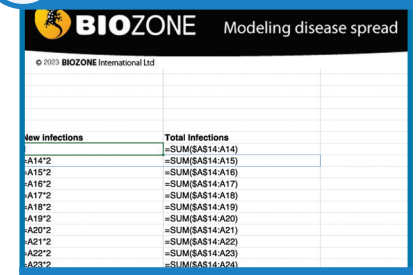
Activities are supported with videos, animations, and weblinks.

BIOZONE's 3D Models



Interactive 3D models provide a fun way to engage students.

Spreadsheets



Spreadsheets support data exploration and analysis in some activities

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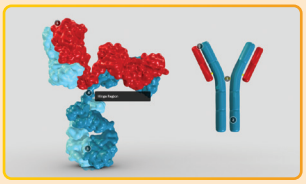
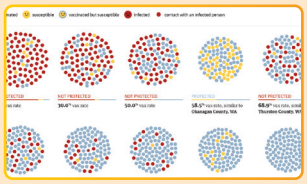
3D Models

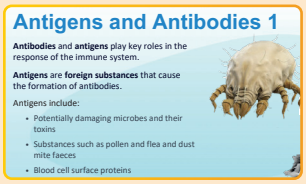


Weblinks



Curated Videos

Presentation Slides



This new edition of **QCE Biology Units 1&2** has been written to meet the requirements of the 2025 Queensland (QCE) Biology syllabus. BIOZONE's high-quality infographics and inquiry-driven pedagogical approach inspires students to be curious about the scientific world. Our full colour, unique, interactive worktext approach encourages direct engagement with the content, allowing students to record their answers within the context of the stimulus material and form a "**record of work**" for quick and easy revision.

What's new in QCE Biology Units 1&2?

BIOZONE's second edition of **QCE Biology Units 1&2** has been written to meet the changes made to the Biology senior syllabus (**2025** version). It also includes pedagogical enhancements. Notable changes include:

- Rearrangement of content as prescribed in the 2025 syllabus document.
- Addition and/or removal of content as prescribed in the 2025 syllabus document.
- Inclusion of hands-on practical investigations.
- Equipment list for the practical investigations.
- Updated coding for easy identification of key syllabus components.
- Glossary of key terms to build scientific literacy.
- Updated Classroom Guide.
- Updated model answer files.

Interactive Learning Made Easy:

QCE Biology is available in print and digital formats. The content has the same flow and order in both formats and is perfect for schools wanting to use dual media for delivery. Access to curated materials through BIOZONE's Resource Hub supports content delivery.

QCE11-2-SP (IH 0924)

QCE11-2-SP24

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