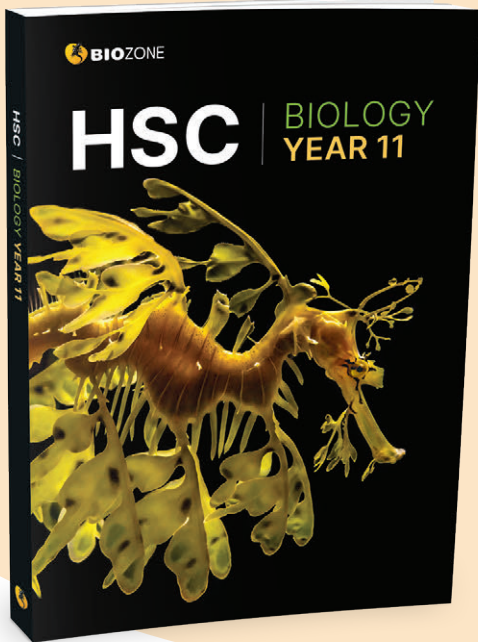


HSC

BIOLOGY YEAR 11



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HSC Biology: YEAR 11

Available in **PRINT + DIGITAL** formats.

This edition of **HSC Biology: Year 11**, has been written to meet the Biology Year 11 syllabus (2025) requirements for New South Wales.

The unique design of **HSC Biology: Year 11** allows students to keep written answers and annotations organised and in one place. A key feature of the worktext is that it allows students to evaluate, return to, and improve their written responses, precisely where the stimulus material is located, creating a powerful learning and revision tool. The organisation of the chapters and coding system allow easy navigation through the course, and the activities, investigations, and assessment tasks have been specifically **designed to meet HSC Biology: Year 11 requirements**.

Further learning support is available in the linked digital **Resource Hub**, containing a wide-range of useful videos, weblinks, and digital interactives. Many pages have direct QR code links to 3D models which allow direct interaction with graphics.

ISBN: 978-1-99-101484-9
Edition: 2nd
No. Pages: 382

Activity number

Activities are numbered to make navigation through the book easier.

Key idea

A key idea provides a primary focus for the activity. It helps students to understand where the activity's emphasis lies.

Content organisation

Logically organised content makes it easier for students to access and engage with the information.

Critical thinking questions

A direct questioning style helps students easily interpret the question. A wide range of tasks, including free response, data analysis and presentation, and the interpretation and evaluation of evidence, scaffold student learning to build confidence and competence.

Write-on answers

Students write their answers directly onto the page. This becomes their record of work and helps students revise for tests and exams.

148

83 Diffusion and Cell Size

Key Idea: Diffusion is less efficient in cells with a small surface area relative to their volume than in cells with a large surface area relative to their volume. Small objects, e.g. cells, have a large surface area relative to their volume and **diffusion** can efficiently move materials in and out. The larger an object, the smaller its **surface area to volume ratio** and so diffusion becomes less effective in transporting materials to the inside. The effectiveness of diffusion is therefore the controlling factor determining how big an individual cell can become. In large, **multicellular** organisms, specialised systems deliver materials to the many cells that make up the tissues of the body.

Single-celled organisms
 Single-celled organisms (e.g. Amoeba), are small and have a large surface area relative to the cell's volume. The cell's requirements can be met by the diffusion or active transport of materials into and out of the cell. For each square micrometre of membrane, only so much of a particular substance can cross per second.

Multicellular organisms
 Multicellular organisms (e.g. plants and animals) generally have a small surface area compared to their volume. They require specialised body systems to transport the materials they need to and from the cells and **tissues** in their body.

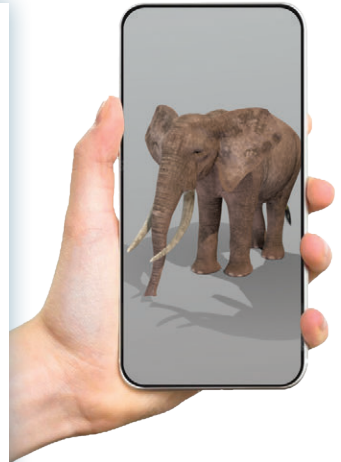
The plasma membrane, which surrounds every cell, regulates movements of substances into and out of the cell. For each square micrometre of membrane, only so much of a particular substance can cross per second.

The diagram below shows four hypothetical cells of different sizes. They range from a small 2 cm cube to a 5 cm cube. This exercise investigates the effect of cell size on the efficiency of diffusion.

1. Calculate the volume, surface area and the ratio of surface area to volume for each of the four cubes above (the first has been done for you). When completing the table below, show your calculations.

Cube size	Surface area	Volume	Surface area to volume ratio
2 cm cube	$2 \times 2 \times 6 = 24 \text{ cm}^2$ (2 cm x 2 cm x 6 sides)	$2 \times 2 \times 2 = 8 \text{ cm}^3$ (height x width x depth)	24 to 8 = 3:1
3 cm cube			
4 cm cube			
5 cm cube			

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QR Codes

Scan the QR code to directly interact with 3D models.

Comprehensive diagrams

Provide an engaging, highly visual delivery of the important information.

Activity coding system

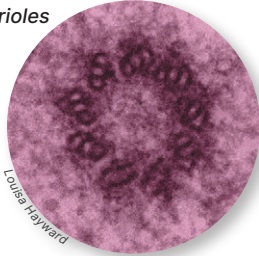
Tabs indicate online support via BIOZONE's Resource Hub and identify the key components of the working scientifically outcomes.

Key Idea: The main components of a cell are water and compounds of carbon, hydrogen, nitrogen, and oxygen.

Water is the main component of cells and organisms, providing an aqueous environment in which metabolic reactions can occur. Apart from water, most other substances in cells are compounds of carbon, hydrogen, oxygen, and nitrogen.

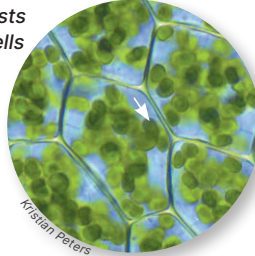
Carbon can combine with many other elements to form a large number of carbon-based (or organic) molecules. The organic molecules that make up living things can be grouped into four broad classes: carbohydrates, lipids, proteins, and nucleic acids. In addition, a small number of inorganic ions are also components of larger molecules.

Centrioles



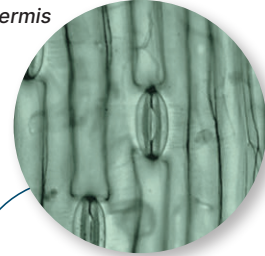
Louisa Hayward

Chloroplasts in plant cells



Kristian Peters

Plant epidermis

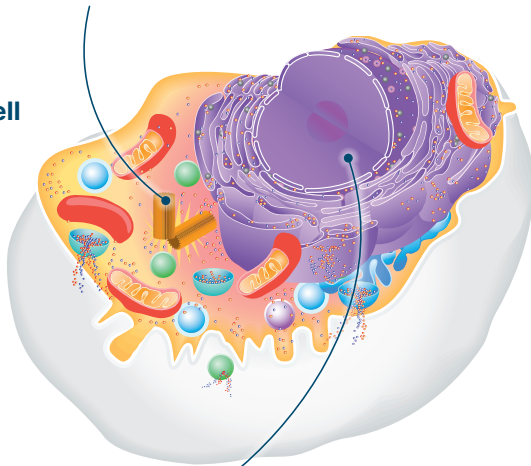


Proteins have an enormous number of structural and functional roles in plants and animals, e.g. as enzymes, structural materials (such as collagen), in transport, and movement (e.g. cytoskeleton and **centrioles**).

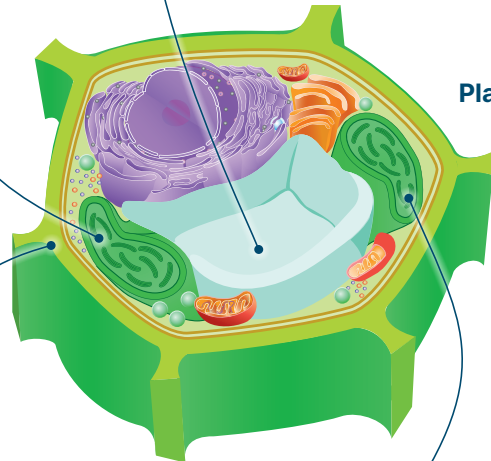
Inorganic ions: Dissolved ions participate in metabolic reactions and are components of larger organic molecules, e.g. Mg^{2+} is a component of the green chlorophyll pigment in the **chloroplasts** of green plants.

Water is a major component of cells: many substances dissolve in it and metabolic reactions occur in it. In plant cells, fluid pressure against the cell wall provides turgor, which supports the cell.

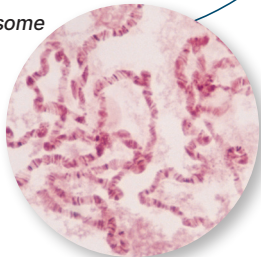
Animal cell



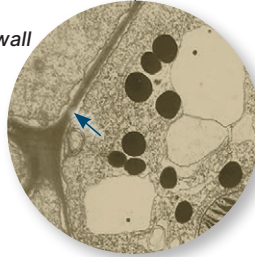
Plant cell



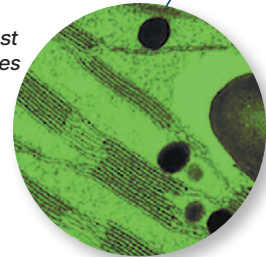
Chromosome



Plant cell wall



Chloroplast membranes



Nucleic acids (DNA and RNA) encode information for the construction and functioning of an organism. ATP, a nucleotide derivative, is the energy carrier of the cell.

Carbohydrates form the structural components of cells, e.g. cellulose **cell walls** (arrowed). They are important in energy storage and they are involved in cellular recognition.

Lipids provide a concentrated source of energy. Phospholipids are a major component of cellular membranes, including the membranes of organelles such as chloroplasts and mitochondria.

1. Given the components of cells above, predict some substances they need to remain functioning and the importance of those substance:



16 Prokaryotic Cells

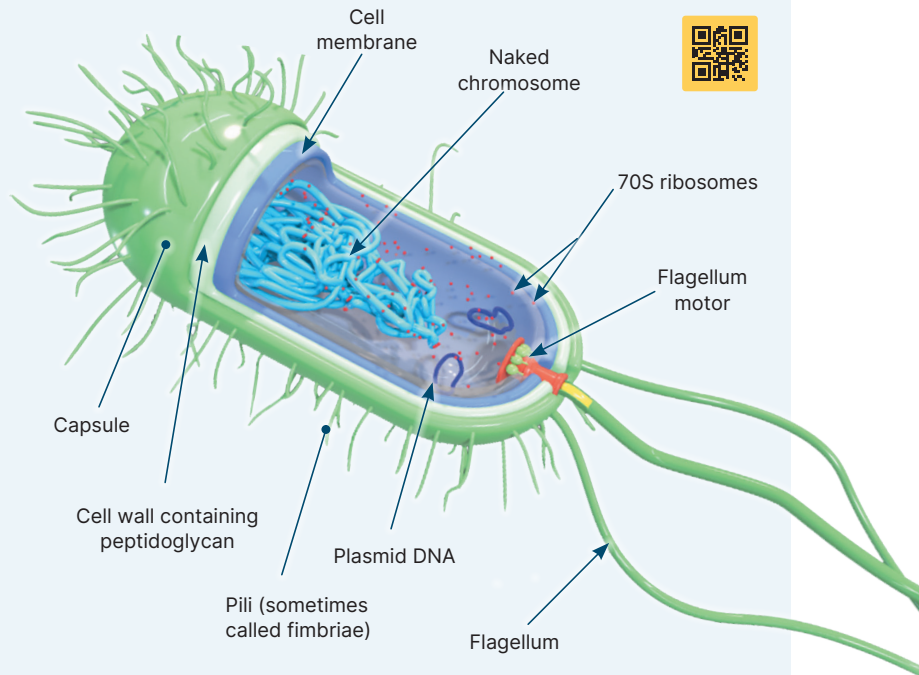
Key Idea: Prokaryotes are unicellular and have a relatively simple internal structure.

Prokaryotes include the groups Bacteria and Archaea. They are much smaller and simpler than the cells of eukaryotes

and lack a distinct **nucleus** and membrane-bound cellular **organelles**. Despite their simplicity compared to eukaryotes, prokaryotes are extremely diverse and can be found living in some of the most extreme environments on Earth.

Prokaryotic cells

- ▶ **Prokaryotic cells** are small (~0.5-10 μm) single cells. They lack any membrane-bound organelles.
- ▶ They are relatively unstructured with little cellular organisation. Their DNA, **ribosomes**, and enzymes are free floating within the cell's **cytoplasm**. The ribosomes (70S) are smaller than eukaryotic ribosomes.
- ▶ They have a single, circular chromosome of naked DNA (not associated with protein). They commonly have small, circular accessory chromosomes called plasmids.
- ▶ Some bacteria are photosynthetic. They have enzymes and light capturing membranes like those in eukaryotic **chloroplasts**.
- ▶ Prokaryotes have **cell walls**, but they are different in composition from the cell walls of eukaryotes.
- ▶ Examples of bacterial cells include the gut bacterium *Escherichia coli* and the cyanobacterium *Anabaena*.

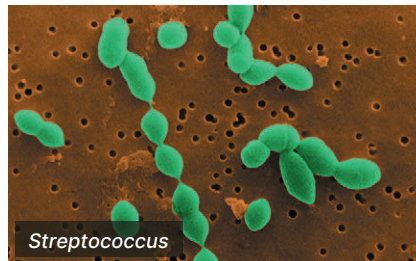


Prokaryote cell shapes

In terms of their appearance, there are only a few basic shapes found (shown below). The way in which members group together after division is often helpful in identifying certain species.



Bacilli: Rod-shaped bacteria that divide only across their short axis. Most occur as single rods, although pairs and chains are also found.



Cocci: usually round, but sometimes oval or elongated. When they divide, the cells stay attached to each other and may remain as pairs or clusters.



Spirilla and vibrio: Bacteria with one or more twists. Spirilla bacteria have a helical (corkscrew) shape. Bacteria that look like curved rods (comma shaped) are called vibrios.

1. Identify three distinguishing features of prokaryotes: _____

2. Cyanobacterial cells (shown top) are photosynthetic. Describe features that enable them to capture and store energy:



Investigating Photosynthetic Rate

Key Idea: Measuring the production of oxygen provides a simple way to measure the rate of photosynthesis.

The rate of **photosynthesis** can be investigated by tracking the substances involved in photosynthesis. These include

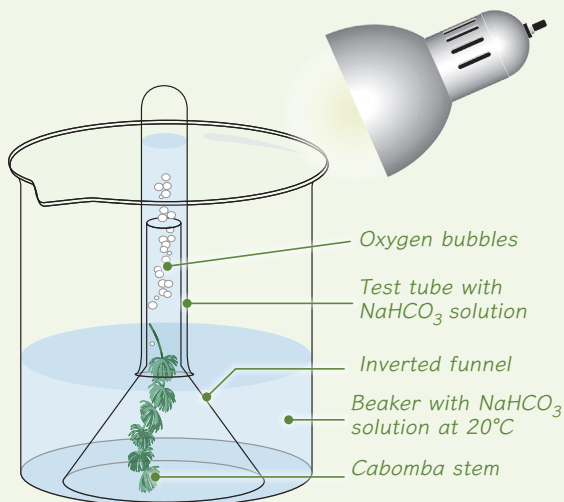
measuring the uptake of carbon dioxide, the production of oxygen, or the change in biomass over time. Measuring the rate of oxygen production provides a good approximation of the photosynthetic rate and is relatively easy to carry out.



Investigation 7.1 Investigating light intensity and photosynthetic rate

See appendix for equipment list.

1. Weigh 0.8-1.0 grams of *Cabomba aquatica** stem on a balance. Cut the stem underwater and invert to ensure a free flow of oxygen bubbles.
2. Place into a beaker filled (at approximately 20°C) with a solution containing 0.2 mol/L sodium hydrogen carbonate (to supply carbon dioxide).
3. Invert a funnel over the *Cabomba* and then invert a test tube filled with the sodium hydrogen carbonate solution on top to collect any gas produced.
4. Place the beaker at distances 20, 25, 30, 35, 40, 45, and 50 cm from a 60W or similar white light source. Measure the light intensity with a lux meter at each interval.
5. Leave the *Cabomba* stem to acclimatise to the new light level for 5 minutes before recording data. Count the bubbles for a period of three minutes at each distance and record.
6. Alternatively the volume of gas captured in the test tube can be measured and recorded.



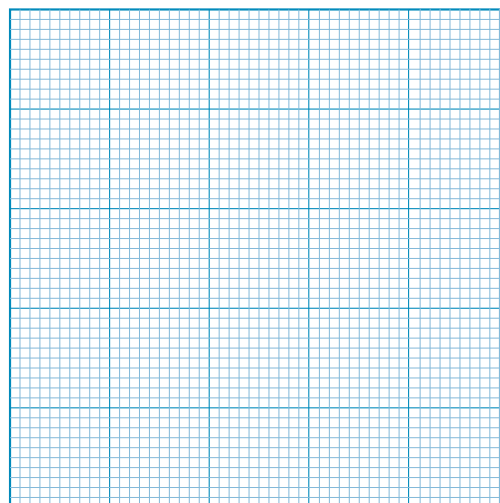
Distance (cm)	Light intensity (lx)	Bubbles counted in three minutes	Bubbles per minute	Volume (mL)
50 cm				
45 cm				
40 cm				
35 cm				
30 cm				
25 cm				
20 cm				

* *Elodea* or common pond weed can also be used if *Cabomba* is not available.

1. Use the data to draw a graph of the bubble produced per minute vs light intensity:
2. Why is measuring light intensity directly in lux better than inferring light intensity from the measured distance?

3. The sample of gas collected during the experiment was tested with a glowing splint. The splint reignited when placed in the gas. What does this confirm about the gas produced?

4. Why is measuring gas collected rather than bubbles produced a more accurate way of recording data?



The Digestive System

Key Idea: The digestive tract is specialised to maximise the digestion of food, absorption of nutrients, and elimination of undigested material.

The human **digestive system** (gut) is a tubular tract, which is regionally specialised into a complex series of organs and glands. These work in sequence to maximise the efficiency with which food is processed. Collectively, the organs

of the digestive tract carry out the physical and chemical breakdown (**digestion**) of food, **absorption** of nutrients, and elimination of undigested material. The gut is a hollow, open-ended, muscular tube, and the food within it is essentially outside the body, having contact only with the cells lining the tract. Several accessory organs and glands lie external to the digestive tract. These secrete enzyme-rich fluids to the food to aid digestion.

Salivary glands produce lubricating secretions with α -amylase, which begins starch digestion

Oesophagus

Gall bladder

Pancreas

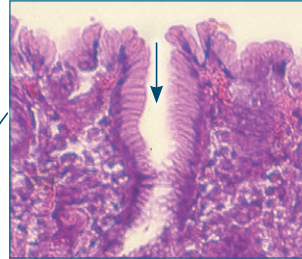
Liver

Stomach

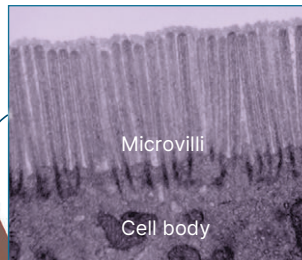
Large intestine

Small intestine

Gastric gland

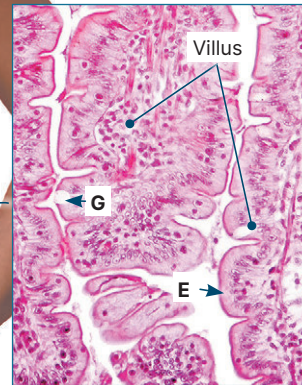


In the **stomach**, gastric glands contain parietal cells, which produce hydrochloric acid, and chief cells, which produce a protein-digesting enzyme. Scattered endocrine cells secrete a hormone to regulate gastric activity.



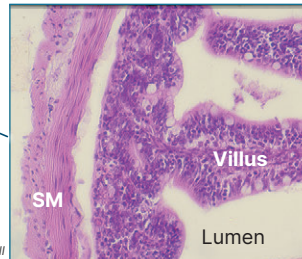
Louisa Howard, Katherine Connolly Dartmouth College

Cells lining the walls on the **small intestine** (the intestinal epithelium) have microscopic extensions of the plasma membrane called microvilli. These form a brush border that increases the surface area for absorption of food molecules. Under lower power microscopy, it appears as a fuzzy edge.



Nephron

In the small intestine, the intestinal epithelial cells (E) and mucus-producing goblet cells (G) make up the epithelium lining the gut wall. The wall is folded into finger like projections called villi (*sing.* villus). These further increase the surface area of the intestine.



Ell

The entire gastrointestinal tract is supported by underlying **connective tissue**. Two layers of smooth muscle (SM), one running lengthwise and one running around the gut, encircle the tube, contracting in waves to move food through the gut. This process is called peristalsis.



- (a) How are villi formed? _____

(b) What is the purpose of microvilli? _____

- What is the purpose of the smooth muscle surrounding the intestine? _____



153 The Evolution of Platypus

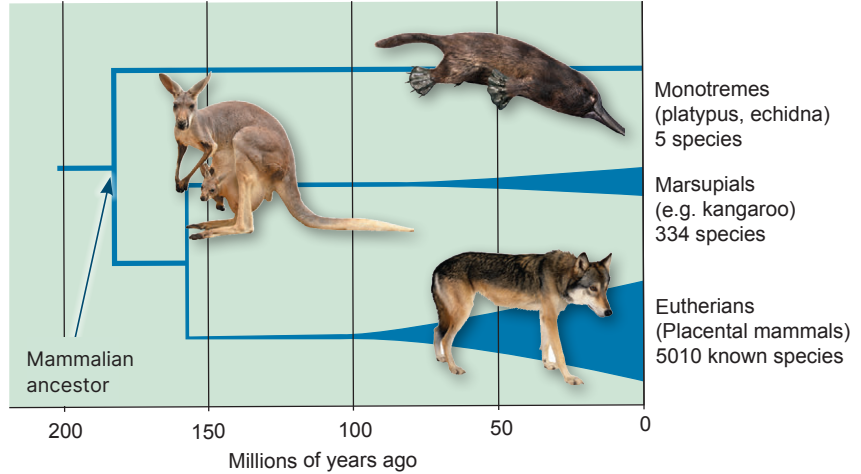
Key Idea: The ancestry of the platypus can be dated back to the Cretaceous period.

The platypus is one of only five monotreme species (the other four being echidnas). It is the last surviving member of the family Ornithorhynchidae. The fossil record contains many closely related species, and shows the Ornithorhynchidae

inhabited parts of the ancient supercontinent Gondwana, including the southern part of South America. The oldest platypus-like fossils found in Australia date to about 123 million years ago. The oldest modern platypus fossils date to about 100,000 years ago. Modern platypus have no teeth, unlike their fossil ancestors.

Monotreme ancestry

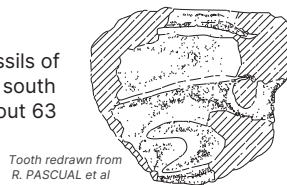
- ▶ Monotremes have a number of features that show their mammal-like reptile ancestry. They lay eggs, have a lower body temperature than other mammalian groups, have a reptile-like shoulder girdle, and possess a cloaca (common chamber into which the digestive, urinary, and reproductive tracts open). Monotremes split from the rest of the mammalian lineage during the Jurassic period, between 201 and 145 million years ago.
- ▶ Exactly when platypus diverged from echidna is still debated; with molecular studies suggesting between 17 and 80 million years ago, but the fossil record suggests a much earlier split.



Platypus evolution

Teinolophus trusleri. Dated to about 123 million years ago, *Teinolophus trusleri* represents the most primitive fossil found. Fossil is a partial jaw bone, including teeth.

Monotrematum sudamericanum. Fossils of teeth (right) found in south Argentina date to about 63 million years ago.

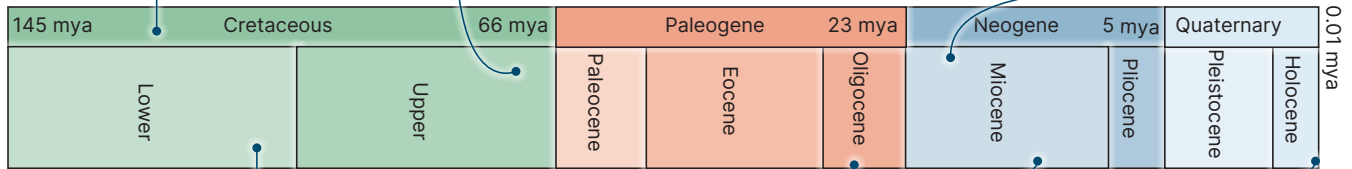


Tooth redrawn from R. PASCUAL et al



Skye M CC 4.0

Obdurodon dicksoni. Found in northern Australia, it is the most complete fossil skull found. Dated to between 10 and 15 million years ago.



Ghedoghedo CC 3.0



Steropodon galmani. A platypus-like animal that lived about 110 million years ago. Fossil is a partial jaw bone found in New South Wales.

Obdurodon insignis. Dated to 25 million years ago, fossil teeth were found in South Australia.

Obdurodon tharalkooschild. A molar tooth found in 2013 was dated to between 5 and 15 million years ago. This platypus species may have been over a metre long.

Ornithorhynchus anatinus. Modern platypus

1. List three features that monotremes share with reptiles that other mammals no longer do: _____

2. Where have fossils of platypus and platypus-like animals been found? What does this say about its range over time?

3. Identify the anatomical trend the various fossils of ancient platypus fossils show over 130 million years:



Key Idea: Thermoregulation is related to energy balance and animals have behavioural responses to reduce energy consumption when energy sources are scarce.

Animals have many different behavioural responses to help them regulate their body temperature. These may be very simple, such as moving out of the sun into the shade, or they may be more complex, such as hibernation over winter or periods of torpor. **Endotherms** expend large amounts

of energy to maintain a high constant body temperature and high metabolic rate. Periods of reduced activity and low body temperature, such as occur during hibernation, conserve large amounts of energy and enable survival through periods when food is scarce. Such energy savings are particularly important for many small endotherms, because they lose heat very quickly and their per gram metabolic costs are much higher than for larger animals.



Bernard DUPONT CC 2.0

Regulating body temperature can be as simple as moving in or out of the shade. During the hottest parts of the day, both endotherms and **ectotherms** seek shade.



Both endotherms and ectotherms huddle together in cold conditions to conserve body heat. Snakes group together in crevasses during times of brumation.



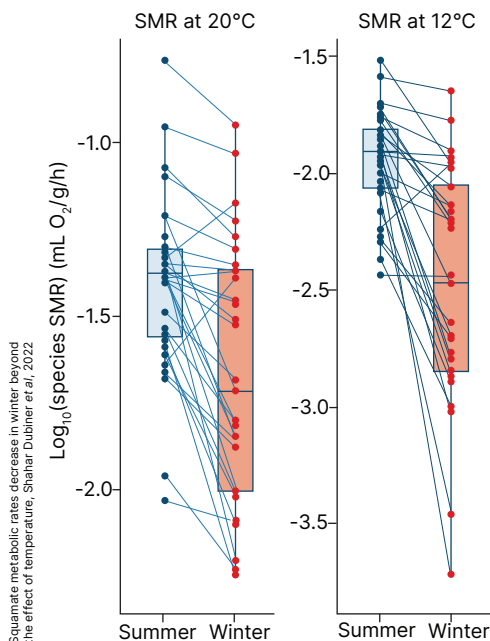
Panting and sweating help to reduce body temperature. Kangaroos cover their forelimbs in saliva which evaporates and cools blood vessels close to the surface of the skin.

Brumation

Brumation is the reptile equivalent of mammalian hibernation, although with a few differences. Hibernation is a prolonged (usually seasonal) state of reduced activity and reduced metabolic activity during which body temperature drops. Brumation is similar except that the reptile may still be active at times, such as for basking and for finding water. Instead of energy being stored primarily as fat, it is also stored as glycogen.

The graph below shows the drop in the specific metabolic rates in 32 different reptile species during brumation at 20°C and 12°C. At 20°C there was an average drop of 46.6%, and at 12°C there was an average drop of 69.6%.

Changes in reptile specific metabolic rates

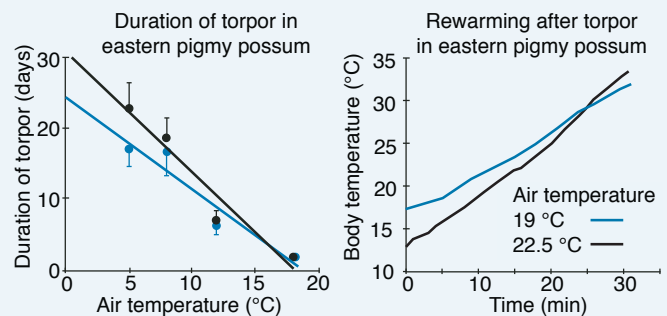


Torpor

Some animals reduce their metabolic activity on a daily (or rather nightly) basis during their sleep. This is called torpor. The eastern pygmy possum is found throughout the eastern coast and south of Australia. It weighs up to 43 grams. During winter it carries out daily torpor. The period of the torpor depends on the air temperature. The possum may remain in a torpid state for up to 35 days at a time during winter hibernation and its body temperature may fall as low as 1°C.



Phil Spark CC 2.0



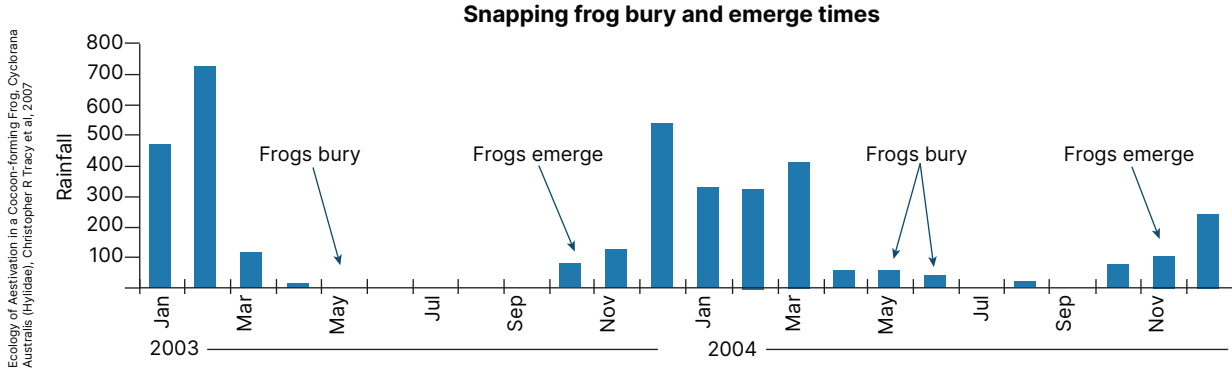
- Two longest bouts of torpor at each temp.
- Undisturbed bouts of torpor

Source: Australian Journal of Zoology, 1993



Aestivation

Aestivation is a form of hibernation or torpor that occurs during the warmer months of the year rather than the cooler months. In endotherms, it is physiologically difficult to distinguish from torpor (except that it occurs in the warmer months). It occurs in many mammals including echidnas, dunnarts (a mouse-sized marsupial), possums, and bats. Many mammals that aestivate enter daily torpor for most months of the year and are constantly active only during the most favourable months (be they the hottest or coolest months depending on the environment). Aestivation is often a response to a lack of food in dry environments. It reduces the need to expend energy keeping cool and can reduce the amount of water lost due to evaporation (by between 20-40% in dunnarts). Aestivation also occurs in some birds although it is much rarer. In Australia, snapping frogs, *Ranoidea australis*, create chambers around 10 cm below the ground during the dry seasons where they form a cocoon from hardened shed skin to conserve water until the rains come again.



1. What is the difference between hibernation, torpor, and aestivation? _____

2. (a) What are the survival advantages of hibernation? _____

- (b) How is brumation different to hibernation? _____

- (c) What happens to the metabolic rates of reptiles during brumation? _____

3. (a) How does air temperature affect the length of bouts of torpor in the eastern pygmy possum? _____

- (b) Why does torpor enhance survival of small endotherms in cold conditions? _____

4. (a) What is often the trigger for aestivation? _____

- (b) How does aestivation help animals survive dry conditions? _____

Analysing DNA Sequences

Key Idea: The similarity and differences of genes can be used to determine the relatedness of mammals.

The **DNA** (genetic material) of mammals is very similar. They all share the same kinds of **genes** (e.g. protein-coding sequences that code for hair production, muscle fibres, milk production, bone, etc). However, there is clearly some

difference in these genes because different groups of mammals look different to other groups. By comparing the DNA sequences in genes we can determine how closely related the groups are and, within limits, how long ago they diverged from each other. Consider the examples of mammals below:



1. Human



2. Sooty mangabey



3. Alpaca



4. Rhesus macaque



5. Flying lemur



6. Bactrian camel



7. Chimpanzee

1. We can compare the similarity of DNA base sequences for the mammalian gene FLNA which helps build the cell's cytoskeleton. The aligned sequences for a section between bases 7800 and 7900 of the FLNA gene are shown below.

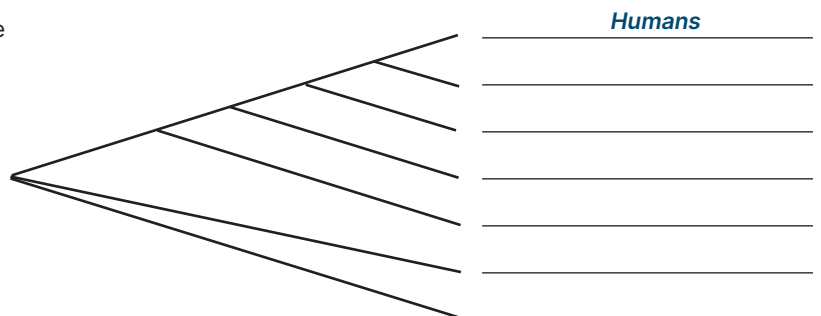
Human: C A T G G G G C C C C G G G T C C T G G G C C T G C T G A C G C C A G
 Sooty mangabey: C A T G G G G C T C C G G G T C C T G G G C C T A C T G A C G C C G C
 Alpaca: C A T G G G G C C C C A G G C C C A G G C C C C T C C G A T G C C A G
 Rhesus macaque: C A T G G G G C T C C G G G T C C T G G G C C T G C T G A C G C C G C
 Flying lemur: C A T G G G A C C C C A G G C C C A G G T C T T G C T G A C G C C A G
 Bactrian camel: C A T G G G G C C C C A G G C C C A G G T C C C T C C G A T G C C A G
 Chimpanzee: C A T G G G G C C C C G G G T C C T G G G C C T G C T G A C G C C A G

(a) For convenience we will compare the DNA sequences above to the human sequence. By counting the differences between any one sequence and the human sequence we can estimate the percentage similarity. For example, there are 4 base differences between humans and Sooty mangabey (shown in red above) out of 34 bases shown. To calculate: $34 - 4 = 30$. $30 \div 34 \times 100 = 88\%$ similarity.

Calculate the percentage similarity of human DNA to the other five mammals in the list:

- (i) Chimpanzee: _____ (iv) Alpaca: _____
- (ii) Rhesus macaque: _____ (v) Bactrian camel: _____
- (iii) Flying lemur: _____

(b) We can use the similarities to determine relatedness. Add the mammal names to the appropriate spaces, right:



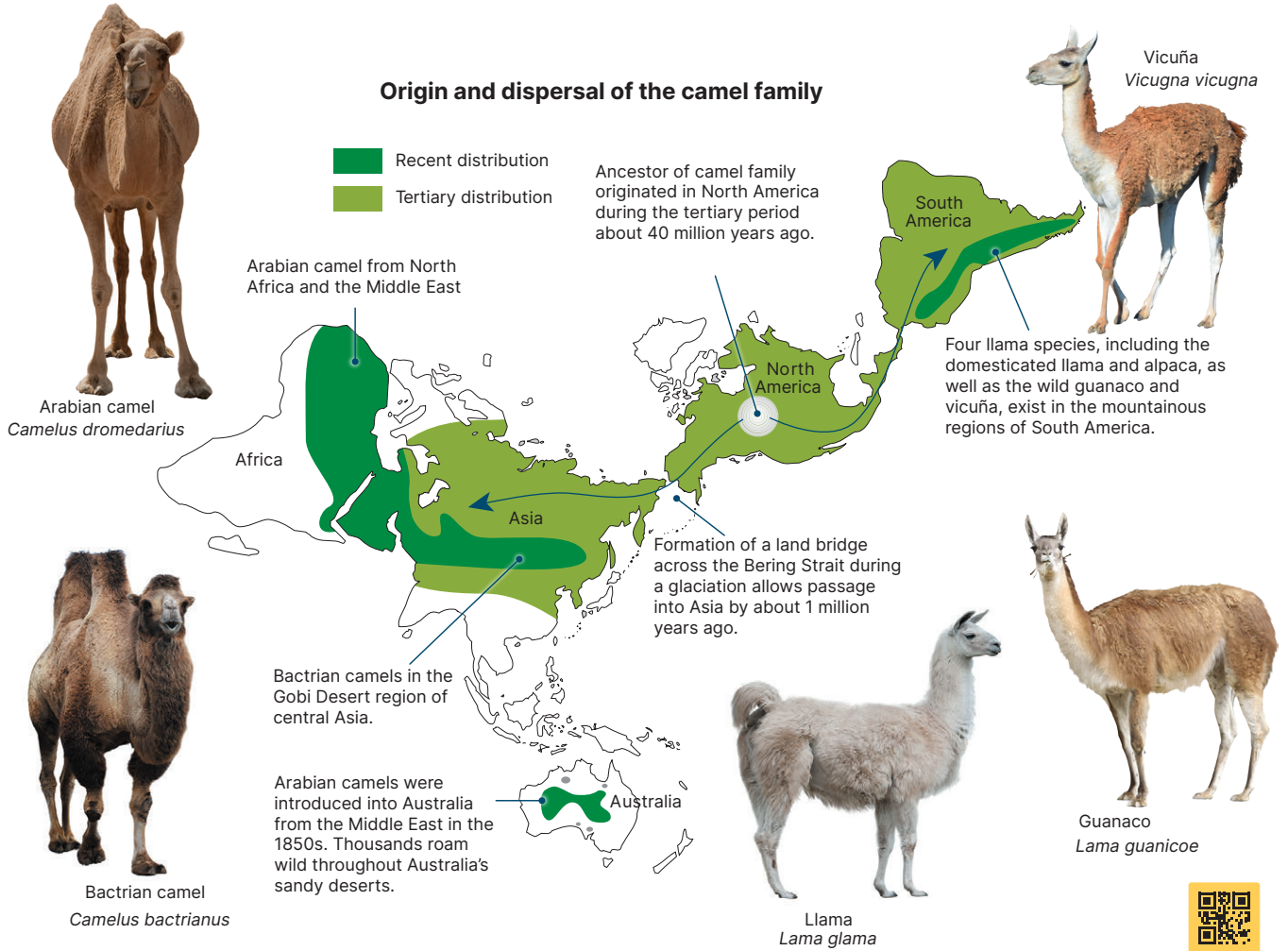
Humans



Key Idea: The current fragmented distribution of the camel family can be explained by natural phenomena such as migration, plate tectonics, and changes in sea level.

The camel family, Camelidae, consists of six modern-day species on three continents: Asia, Africa and South America. Geophysical phenomena such as plate tectonics and glacial cycles have determined their present, fragmented distribution. Three principles about the dispersal and distribution of land animals are:

- ▶ When very closely related animals were present at the same time in widely separated parts of the world, it is highly probable that there was no barrier to their movement in between the localities in the past.
- ▶ The most effective barrier to movement of land animals (especially mammals) was a sea between continents.
- ▶ The scattered distribution of living species can be explained by migration out of their original range or extinction in regions between the current populations.



1. Arabian camels are found wild in the Australian outback.
 - (a) How did they get there? _____
 - (b) Why were they absent during prehistoric times? _____
2. The camel family originated in North America. Suggest why there are no members of the family in North America now: _____
3. Suggest how early camels managed to get to Asia from North America: _____
4. (a) Describe the present distribution of the camel family: _____
- (b) Explain why it is scattered (discontinuous): _____



Physical Factors in a Desert

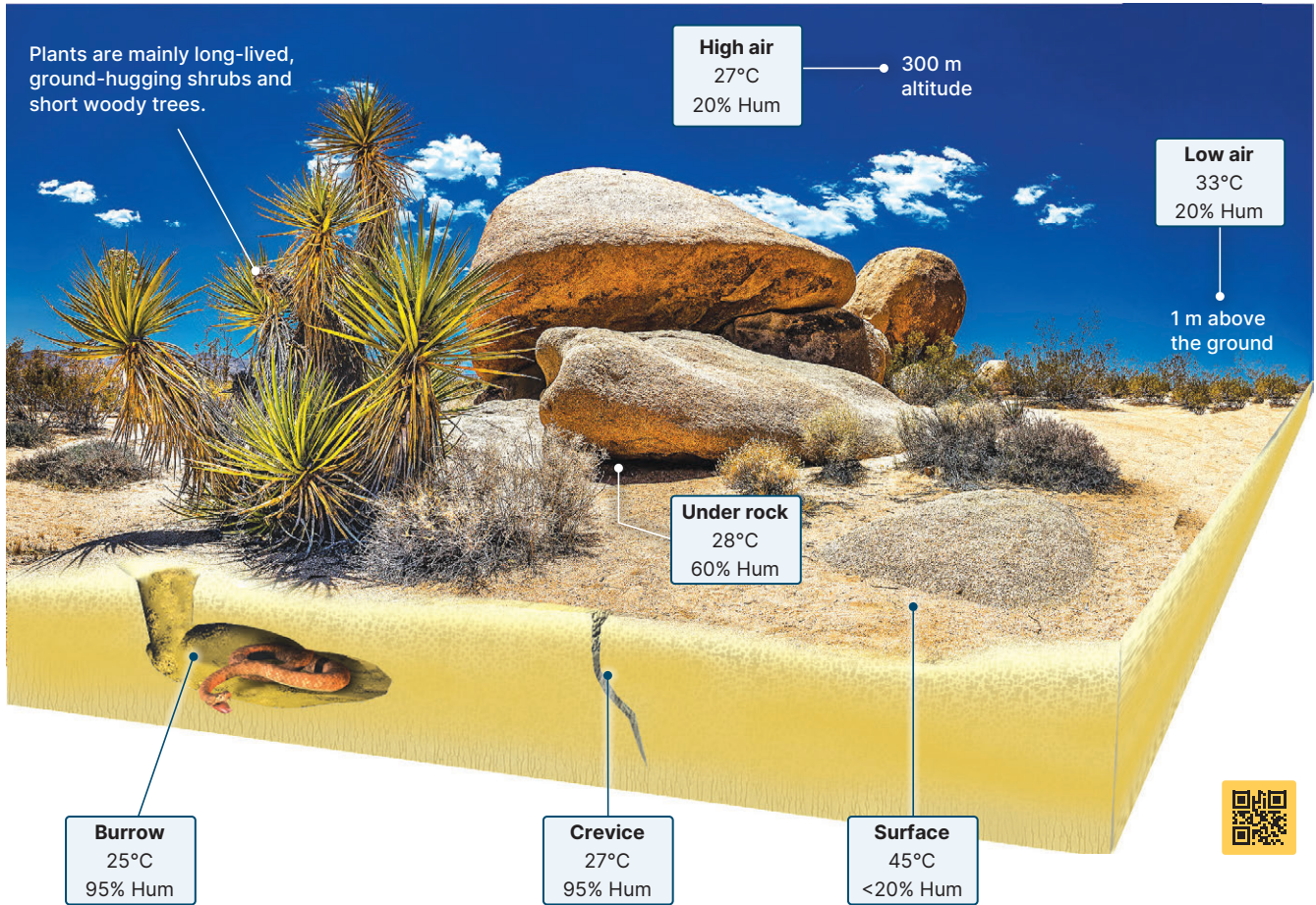
Key Idea: Gradients in the physical environment influence the range of physical conditions and may create microhabitats. Gradients in **abiotic factors** are found in all environments. They create microhabitats and microclimates (see definitions

below) within a larger area and influence patterns of species **distribution**. Organisms can exploit the microclimates produced by physical gradients and so occupy apparently inhospitable environments, e.g. frogs living in deserts.

A desert environment

Deserts experience extremes in temperature and humidity but they are not uniform with respect to these factors. The diagram below gives hypothetical values for temperature and humidity for typical microclimates in a desert environment at midday.

Microclimate: The climate of a very small or restricted area.
Microhabitat: A habitat of limited extent, which differs in its characteristics from the surrounding, more extensive, habitat.



1. (a) Study the diagram above and describe the general microhabitats where humidity is highest:

(b) How do these microhabitats enable land animals to survive the extreme high temperatures of midday:

2. Desert surfaces not only receive more solar radiation than humid regions, they lose much more heat at night, so night-time temperatures can be very low. How does this benefit both the plants and animals living there?

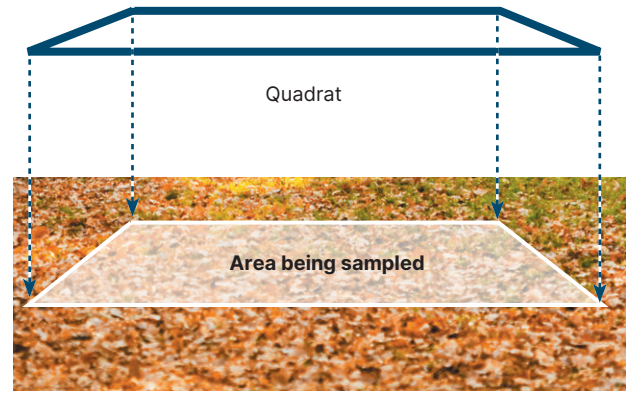
3. Suggest why there are relatively few large mammals in deserts: _____



201 Quadrat Sampling

Key Idea: Quadrat sampling involves a series of random placements of a frame of known size over an area of habitat to assess the abundance or diversity of organisms.

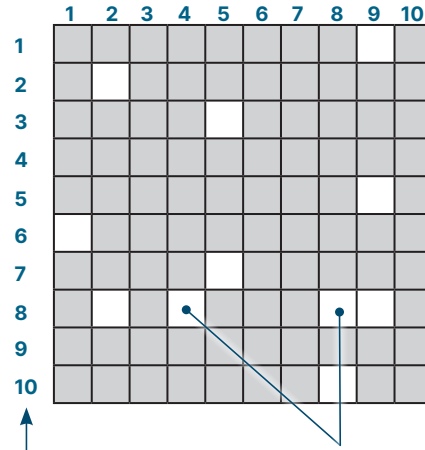
Quadrat sampling is a method by which organisms in a certain proportion (**sample**) of the **habitat** are counted directly. It is used when the organisms are too numerous to count in total. It can be used to estimate population **abundance** (number), **density**, frequency of occurrence, and **distribution**. Quadrats may be used without a **transect** when studying a relatively uniform habitat. In this case, the quadrat positions are chosen randomly using a random number table. The general procedure is to count all the individuals (or estimate their percentage cover) in a number of quadrats of known size and to use this information to work out the abundance or percentage cover value for the whole area.



$$\text{Estimated average density} = \frac{\text{Total number of individuals counted}}{\text{Number of quadrats} \times \text{area of each quadrat}}$$

Guidelines for quadrat use:

- The area of each quadrat must be known. Quadrats should be the same shape, but not necessarily square.
- Enough quadrat samples must be taken to provide results that are representative of the total population.
- The population of each quadrat must be known. Species must be distinguishable from each other, even if they have to be identified at a later date. It has to be decided beforehand what the count procedure will be and how organisms over the quadrat boundary will be counted.
- The size of the quadrat should be appropriate to the organisms and habitat, e.g. a large size quadrat for trees.
- The quadrats must be representative of the whole area. This is usually achieved by random sampling (right).

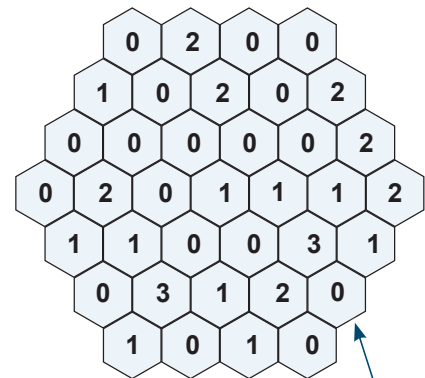


The area to be sampled is divided up into a grid pattern with indexed coordinates

Quadrats are applied to the predetermined grid on a random basis. This can be achieved by using a random number table.

Sampling a centipede population

A researcher by the name of Lloyd (1967) sampled centipedes in Wytham Woods, near Oxford in England. A total of 37 hexagon-shaped quadrats were used, each with a diameter of 30 cm (see diagram on right). These were arranged in a pattern so that they were all touching each other. Use the data in the diagram to answer the following questions.



Each quadrat was a hexagon with a diameter of 30 cm and an area of 0.08 square metres.

The number in each hexagon indicates how many centipedes were caught in that quadrat.



Centipede

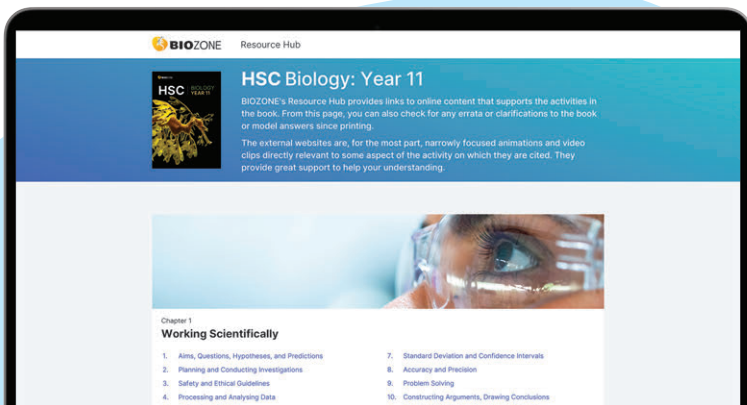
1. Determine the average number of centipedes captured per quadrat:

2. Calculate the estimated average density of centipedes per square metre (remember that each quadrat is 0.08 square metres in area):

3. Looking at the data for individual quadrats, describe in general terms the distribution of the centipedes in the sample area:

4. Describe one factor that might account for the distribution pattern.





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

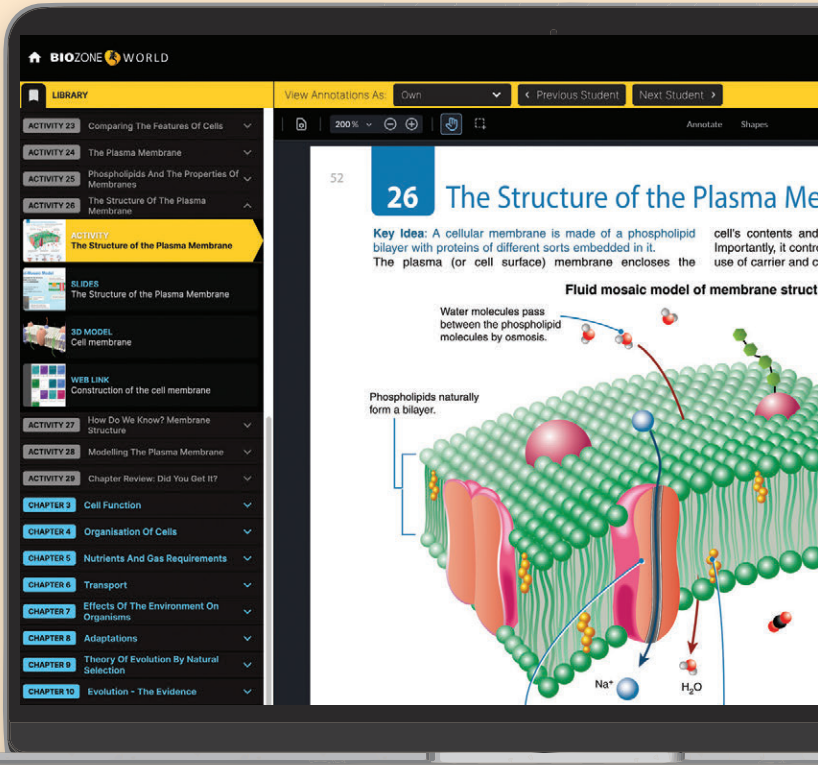
Interactive 3D models provide a fun way to engage students.

Interactives

Interactives promote concept retention and engagement.

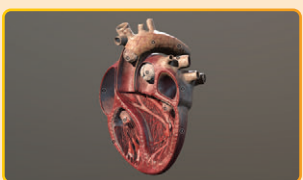
BIOZONE WORLD

This title can be purchased as a class set on **BIOZONE WORLD**. This platform revolutionises science education with an immersive learning experience. Explore the **HSC Biology: Year 11** worktext featuring 3D models, slides, weblinks, and videos. Engage with captivating visuals, interactive activities, and real-world case studies and examples, empowering you to unlock the wonders of science with your students. It not only provides seamless digital access to content and our OER support resources, it also allows teachers to set and grade student work. Ignite your students' passion for science with **BIOZONE WORLD**.

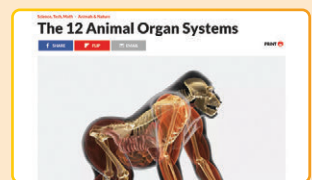


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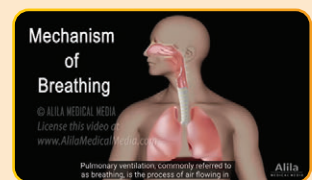
3D Models



Weblinks



Curated Videos



Presentation Slides



HSC | BIOLOGY YEAR 11

This edition of **HSC Biology: Year 11**, has been written to meet the Biology Year 11 syllabus (2025) requirements for New South Wales.

It is organised around the three Year 11 focus areas: cells as the basis of life, cells to systems, and evolution and ecosystems, and includes additional chapters to support the working scientifically outcomes and depth studies.

The interactive worktext format combines the best features of a workbook and textbook. This encourages students to interact directly with the content and record their answers within the context of the stimulus material to form a **'record of work'** for quick and easy revision. This can be revisited and self-corrected to ensure a deeper understanding of concepts. Practicals are integrated throughout the course, giving students the hands-on experience required to understand the concepts and think like a scientist.

Features and benefits:

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- **Model Answers** to all questions are included at the back of the worktext to support both independent learning and revision
- Dedicated chapter on **working scientifically**
- Support for **depth studies**
- Includes **practicals** and **equipment list**
- **Glossary** of key terms
- QR codes link directly to **interactive 3D models**
- **Assessments** conclude each **chapter** and each **focus area**

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