Chapter 10

Staying Alive

CONTEXT AREA

- How do plants and animals stay alive?
- Why can't desert animals live in a rainforest?
- Could rainforest trees grow in a desert?
- All living things are suited, or adapted, to living how and where they live.
- Their adaptations help them to stay alive.
- Sometimes a newcomer will upset the balance.
- Cats are better hunters and faster breeders than many native Australian animals.
- Sparrows are better competitors for food and nesting sites than many native birds.
- Does this mean that Australian animals are doomed?

PRESCRIBED FOCUS AREAS

4.3 identifies areas of everyday life that have been affected by scientific developments

4.5 describes areas of current scientific research

DOMAINS

KNOWLEDGE AND UNDERSTANDING

4.10 identifies factors affecting the survival of organisms in an ecosystem
a describes some adaptations of living things to factors in their environment

SKILLS

4.13 clarifies the purpose of an investigation and, with guidance, produces a plan to investigate the problem

4.14 follows a sequence of instructions to undertake a first-hand investigation

4.17 evaluates the relevance of data and information

4.20 uses an identified strategy to solve problems

VALUES AND ATTITUDES

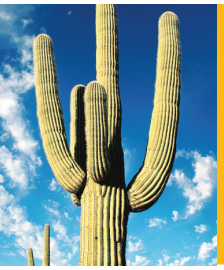
4.25 recognises the relevance and importance of lifelong learning and acknowledges the continued impact of science in many aspects of everyday life

4.26 recognises the role of science in providing information about issues being considered and in increasing an understanding of the world around them

4.27 acknowledges their responsibility to conserve, protect and maintain the environment for the future

CONCEPTS

Responding to danger	Stimulus and response
	Response words
Investigating responses	Plant responses
	Penguin behaviour
	Size of rabbits
	Lizards in burrows
Adaptations	Significance and examples
Living in the dark	Adaptations to a life in the dark
Designing animals	Design animals for particular roles
	Feral cat buster



10.1 Responding to danger

An animal living in the wild has to be very careful. It has to eat but not be eaten, hunt but not be hunted, hide but not be found. It has to find shelter, and raise its young. It has to defend its territory, so that other animals do not come and eat its food or take its shelter. Above all, it has to respond to danger.

Responses

To help them survive, animals must act on the changes around them. If a mouse finds some fresh seeds, it will eat them. If the same mouse sees an owl about to swoop on it, the mouse will run and seek shelter. These actions help the mouse to survive. Each action is a response. A response is something a plant or animal does which helps it to survive.

Plants respond more slowly than animals. The tendrils of a grape vine will grow around a post. This helps support the plant. Flowers will grow in response to longer days. In some plants, the leaves follow the Sun or the flowers close at night.

A grape vine has tendrils that wrap around other things for support

Stimuli

A change which causes a plant or animal to respond is called a stimulus (plural = stimuli). For the mouse, a stimulus was smelling the food or seeing an owl swooping towards it.

Animals detect a stimulus through their senses. Their senses of sight, hearing, touch, smell and taste ensure their survival. Animal senses may be more acute than ours. Some animals have senses that we don't have. A platypus can detect tiny electrical signals produced by the muscles of swimming animals such as yabbies and shrimps. A rattlesnake can detect the heat given off by a mouse. Bats use high-frequency sound so they can fly in the dark. Many animals that feed at night have long whiskers to help them feel their way around. People think that pigeons use magnetism to find their way back to their roost. Bees use a feature of sunlight called polarisation to find flowers with nectar in them.

These senses enable animals to detect stimuli, so they can respond to the stimuli and survive.

Response words

Plants and many invertebrate animals respond automatically to changes around them. Each of these automatic responses is given a name. The name is made of two parts. The beginning of the response word is the stimulus, or what is being responded to.

- response to light—the first part of the word is photo–
- response to gravity—the first part of the word is geo–
- response to hot or cold—the first part of the word is thermo–
- response to sunlight—the first part of the word is helio–
- response to water—the first part of the word is hydro–
- response to chemicals—the first part of the word is chemo–
- response to touch—the first part of the word is thigmo–

These beginnings are also used in lots of other words, such as photograph, thermometer and hydroelectric.

The end of the response word usually tells us whether a plant or animal is responding. If an invertebrate animal is responding, the end of the word is –taxis. If a plant is responding, the end of the word is –tropism.

To name a particular response, you just join together the beginning and the end of the response name. The motion of a moth flying toward a bright light is called phototaxis. Photo refers to the light, and taxis is used because the moth is an animal. A plant turning its leaves towards the Sun is called phototropism.

Thigmotaxis is important in spiders that make webs.

CHECKPOINT:

COPY AND COMPLETE

To help them _____, animals must ___ on the changes around them. Each action is a _____. A response is something a _____ or _____ does which helps it to _____. The change which causes a plant or animal to _____ is called a _____. Animals detect a stimulus through their _____. Some animals have _____ that we don't have. These senses enable animals to _____ _____, so they can _____ to the stimuli and _____.

QUESTIONS

1 Match each word below with its meaning. Copy the word and the correct meaning into your note book.

sense	*the message that a plant or animal receives*
response	*something a plant or animal does that helps it to survive*
stimulus	*used by an animal to detect a change*

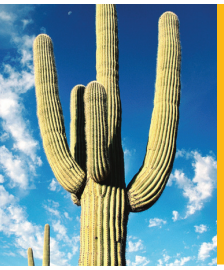
2 Copy and complete the table below.

Response word	***Responding to***
hydro	*water*
photo	
chemo	
helio	
thermo	
thigmo	
geo	

3 What is the difference between taxis and tropism?

4 Write the response word for each of the responses described below. There may be more than one answer for some of them.

a a plant growing upwards
b tree roots growing towards water
c a worm crawling away from the bright light
d leaves turning to face a sunny window
e a butterfly attracted to a flower
f tree roots growing away from the sunlight
g the roots of a seedling always grow down
h a beetle turning over after being put on its back
i a Venus flytrap plant snapping shut on a fly
j the leaves on a plant curl up on a hot day
k the leaves of a plant closing at night
l worms wriggle when you touch them
m bees finding their way back to their hive by using the sun
n a bivalve closing tightly when you touch it
o a moss capsule opening when it rains



10.2 Investigating responses

We can do experiments to confirm the responses of some plants and animals. Animals like slaters (also called woodlice) are small and common. They do not carry diseases and cannot bite you. They are found under stones and bits of wood. They eat rotting plants and wood. Plants like broad beans are ideal because they grow fast indoors. When you have finished with them you can plant them in a garden and eat the bean pods when they grow.

Simulations

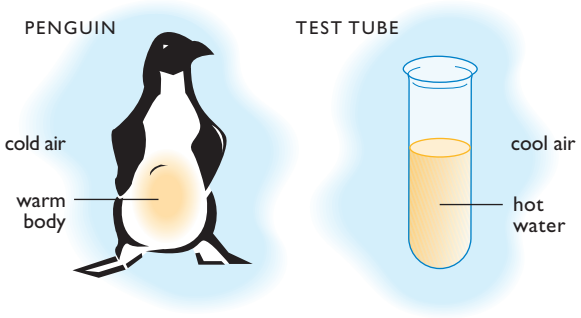
There are some animals that we cannot do experiments on. This might be because they will bite us like lions and tigers, or because they are too big to handle like elephants, or because they are too far away, like penguins. In these cases we have to simulate, or copy, the aspect of the animals we wish to study.

An interesting group of birds is the penguins. They are flightless birds, many of which live on the ice and snow of Antarctica. There are no land

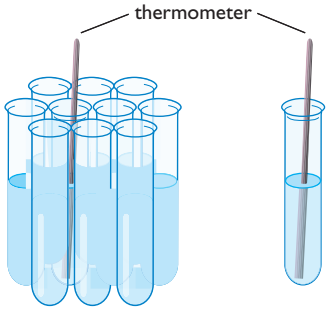
EXPERIMENT

AIM: To investigate why penguins stand in huddles

Why do penguins stand in huddles? One hypothesis (guess) is that penguins stand in huddles to keep warm. We can test this hypothesis with an experiment. We will simulate penguins by using test tubes filled with warm water.



Heat a large beaker of water. When the water temperature reaches about 60°C, turn off the Bunsen burner or heat source. Pour this water into test tubes. Place one test tube on its own, and stand the other test tubes in a group. Tie them together with a rubber band, or stand them in a beaker.



Test tubes represent a huddle of penguins

You will need two thermometers. Record the temperature of the solo test tube, and the middle test tube in the group, every minute. Write your results into a table like that drawn below. Graph your results.

Explain your results in words and then write a conclusion about penguins based on your results.

TIME	TEMPERATURE OF SOLO TEST TUBE	TEMPERATURE IN HUDDLE OF TEST TUBES
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

predators there to kill them. Some penguins stand in tight huddles of many thousand birds. The penguins have warm bodies. The air temperature is below freezing, and there is often a strong, biting wind.

In these experiments we will simulate the behaviour of penguins to explain their responses.

EXPERIMENT

AIM: To investigate why animals in cold climates grow larger

People have noticed that the rabbits living in the cold mountain regions grow larger than rabbits which live in hot areas. Is this an adaptation to their climate which helps them to survive?

Like the penguins, we can simulate this with hot water. We will use a large beaker to simulate a large rabbit, and a small beaker to simulate a small rabbit. You will need two thermometers to record the temperature of the hot water as it cools.

Before you start:

- What is your hypothesis?
- How will you design your experiment? Write down a method and draw a diagram.
- Prepare a results table. Label the columns.
- Check with your teacher before starting the experiment.

During the experiment, measure the temperatures and write your results in the table. After the experiment:

- Graph your results.
- Explain your results in words.
- Write a conclusion about rabbits based on your results.

EXPERIMENT

AIM: To design and conduct an experiment to show that plants respond to gravity or light

There are many experiments you can do to show responses in plants and animals. Design an experiment with a control to show that plants respond to gravity or to light. Write the aim and method in your note book, and check with your teacher before starting the experiment. The photograph might give you some hints.

If you want to test plant responses, use bean plants. Depending on your climate, they can germinate in two days and grow 6 cm a day. Wash your hands after handling seeds, because they might have been sprayed with a fungicide to kill any fungus which might grow on the seeds. The fungicide could wipe off your fingers onto your food.

Testing plant responses

Your teacher will tell you which experiments you can do. Write the experiment into your note book, starting with your aim and method, and leave space for your results if you are testing plants.

EXPERIMENT

AIM: To investigate why desert animals live in burrows

Why do desert animals live in burrows? In this exercise the bulb of a thermometer represents the body of a small lizard. The lizard has been out in the sun. Will the lizard become cooler if it crawls into a burrow?

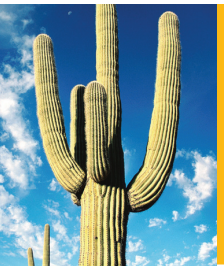
Select a sunny garden or grassed area in your school. Use a pen to push a 5 cm deep hole into the ground. Use one thermometer to record the temperature on the surface, and another to record the temperature 5 cm below the surface. Do not move the thermometers while you are doing the experiment. Enter your results into a table and then graph them.

Do this in an experiment like the others on this page. Think about these before you start:

- What is your hypothesis?
- How will you design your experiment? Write a method and draw a diagram.
- Prepare a results table. Label the columns.
- Check with your teacher before starting the experiment.

During the experiment, measure the temperatures and write your results into a table. After the experiment:

- Graph your results.
- Explain your results in words.
- Write a conclusion about lizards based on your results. Is it true that living in a burrow is cooler than living on the surface of the ground? How much cooler is it?



10.3 Adaptations

Plants and animals are suited to the area where they live. This gives them the best chance of survival. We say that they are adapted to live in these areas. The features which help them survive are called adaptations. Plants and animals are born with their adaptations.

The saguaro cactus is a desert plant. It has a tough skin that stops it from losing water, and its thorns protect it from being eaten by animals.

An owl is a bird which hunts at night. An owl would not survive long if it could not see in the dark, did not have sharp claws for holding small animals, and did not shelter from its enemies during the daytime. These features which help in the survival of the owl are called adaptations.

A common brushtail possum

A possum is a nocturnal animal. This means that it comes out at night. A possum has many adaptations. Its eyes, ears and whiskers help it find its way around at night. Its tail and claws help it climb through trees. Its thick fur retains body heat and its colour helps it hide. Its long snout, pointed teeth and keen sense of smell help it obtain nectar from flowers.

Many animals are camouflaged. This means that their shape or colour or habits disguise them and make them harder to see. Camouflage helps animals stay alive.

Plants also have many adaptations. Many rain forest plants have shiny, waxy leaves with a 'drip tip' on the end to drain the rainwater quickly. The rainforest soil is usually shallow, so the bigger trees have buttressed roots to help prevent them from being blown over in a strong wind. Desert plants need to lose as little water as possible in the hot days, but gain as much water as possible when it rains. Some desert plants have small, rolled-up leaves, which do not get as hot as large, flat leaves. Other desert plants have spiky leaves or leaves covered with small hairs. These adaptations prevent the leaves from getting too hot and from losing too much water.

The shape of teeth is an adaptation seen in mammals. Carnivores are meat-eating animals. They have sharp pointed teeth to hold meat and help rip it apart. Their side teeth are jagged and cut meat like a pair of scissors. Carnivores usually swallow meat without chewing it. Herbivores are plant-eating animals. They have flat teeth for grinding grass and leaves. Leaves are tougher than meat, and are harder to digest. A diet of plants needs a lot more chewing than a diet of meat.

Dog skull, showing sharp, pointed teeth

Sheep skull, showing flat teeth

CHECKPOINT:

COPY AND COMPLETE

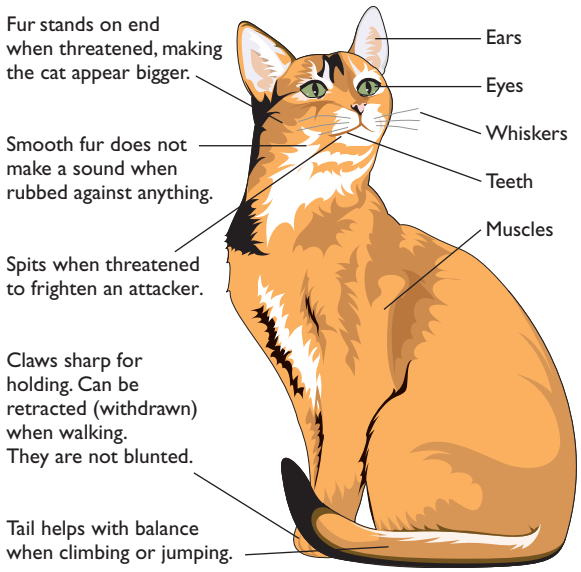
Plants and animals are _____ to the area where they ____. This gives them the best _____ of _____. We say that they are _____ to live in these areas. The _____ which help them _____ are called _____.
A _____ has many adaptations. Its _____, _____ and _____ help it find its way around at night.
Many animals are _____. This means that their _____ or _____ or _____ _____ them and make them _____ to ___. Camouflage helps animals ____ _____.
Plants also show many _____. Many rainforest plants have _____, ____ leaves. Some desert plants have _____, _____-__ leaves.

QUESTIONS

1 What are the meanings of: adaptation, camouflage, nocturnal?

2 What is the difference between an adaptation and a response? How do they affect the survival of living things?

3 Wild cats are carnivores. Some adaptations of a cat are shown in the picture. Copy the drawing, and explain each adaptation on the right side of the drawing, using the headings provided.



Adaptations of a cat

4 Trace or copy the illustration of the brushtail possum on the opposite page. List the adaptations of a possum and the reasons for these, as you did for question 3. Some adaptations have been mentioned in the text.

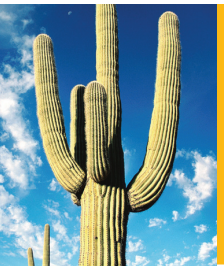
5 Explain why these features are adaptations of a bilby.

- nocturnal
- very concentrated urine
- large ears
- lives in a burrow

The bilby's large ears help cool its body

6 The photograph shows a grey butcherbird. It eats grubs, worms and insects, which it hunts from low branches or on the ground. List three adaptations of this bird.

The grey butcherbird stores extra food on the branches of trees



10.4 Living in the dark

An adaptation helps a plant or animal survive better in its environment. Plants cannot live in the dark because they need light to make their food. Many animals live in the dark, and they have special changes to their bodies to help them survive.

Living on land

Some animals live all their life in a dark cave. These animals might look like other animals, but often do not have eyes or colour. Their senses of hearing and feeling are more developed than those of similar animals which depend on their eyes.

Bats are nocturnal animals. Nocturnal means that they are active at night. They cannot see very well, and navigate (find their way around) using an echolocation system. Echolocation relies on sound and echoes for navigation. Bats make noises and listen for the echoes that have bounced off objects. The ears of some bats are shaped to hear the faint sounds coming back to them, and determine the direction and distance of the objects in the area.

The bat is adapted to catch insects at night

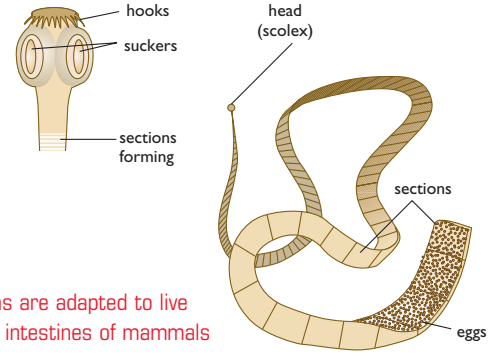
Grasshoppers and crickets communicate by sound. On most nights, crickets can be heard chirping from lawns and gardens. The males of these insects sing to attract females to them. Moths rely on smell. The males of some moths can smell a female up to three kilometres away, and fly toward her. Using his sense of smell, the moth can find his mate.

Moths use their sense of smell to navigate

Living inside intestines

Not having any eyes is just one adaptation of the tapeworm. It is perfectly adapted to its life in the intestines of another animal. As well as no eyes, it has no mouth, no limbs, no muscles, no intestines, and no lungs.

The tapeworm has no need for internal organs or limbs or eyes. It lives surrounded by digested food, and has no need to move anywhere else. Its world is dark, so it does not need eyes. It uses a special digestive process to get oxygen from its food. The tapeworm has special adaptations to stop it from being swept away by the food as it moves past, and to spread its eggs to lots of other animals.



Tapeworms are adapted to live inside the intestines of mammals

Living deep in the ocean

There is no light or plant life at the bottom of the ocean. Everything that lives there has to feed on the food which floats down from the ocean above, or on other animals which live there. These marine animals are adapted to the total darkness, extremely cold temperatures and very high pressures in the deep oceans.

An angler fish has its own light above its head. It uses the light to attract animals to it, which it then eats. Only animals with eyes are attracted to the light.

Fish such as the gulper eel cannot see the fish they eat. They swim around with their huge mouth open, and scoop in fish and other animals in the darkness. A gulper eel's mouth can hold a fish larger than the eel.

In the 1980s, fishermen noted unusually large numbers of fish in a region south of Tasmania. In this region there are seamounts (underwater mountains) which rise over 1000 m from the bottom of the ocean. Each seamount is home to previously unknown types of animals. These animals are collected only by trawling (dragging a net over the ocean bottom). Most of them are damaged when they are pulled onto the fishing boats.

A Angler fish are adapted to living in the deep, dark parts of oceans **B** The gulper eel lives in the deep ocean; its huge jaws open wide so it can swallow large creatures **C** Some sea spiders have part of their intestines inside their legs!

CHECKPOINT:

COPY AND COMPLETE

An adaptation helps a _____ or _____ survive better in its _____. Many animals live in the _____, and they have special _____ to their bodies to help them _____.
Bats are _____ animals. This means that they are _____ at _____. They _____ using an _____ system. Bats make _____, and listen for the _____. The _____ of some bats are _____ to hear the _____ _____ coming back to them.
Not having any _____ is just one _____ of the tapeworm. It is perfectly adapted to its life in the _____ of another _____. As well as no _____, it has no _____, no _____, no _____, no _____, and no _____.
An angler fish has its own _____ above its _____. It uses the light to _____ _____ to it, which it then eats.

QUESTIONS

1 What is the meaning of these words: nocturnal, navigate, sonar, echo, echolocation?

2 Prepare a listing of some animals that live in the dark, and describe an adaptation to help each one live in the dark.

3 Look at the photograph of an angler fish. Explain the adaptations of this fish.

4 A tapeworm has many unusual adaptations. Explain the reason for the following adaptations:
- hooks around its 'head'
- suckers
- thin, tape-like body
- sections of its body which drop off easily
- produces millions of eggs

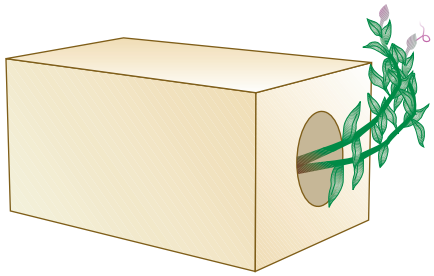
5 List the adaptations needed for an animal living in the deep ocean, where it is dark, extremely cold and still, and the water pressure is very high.

Review and Research

Review questions

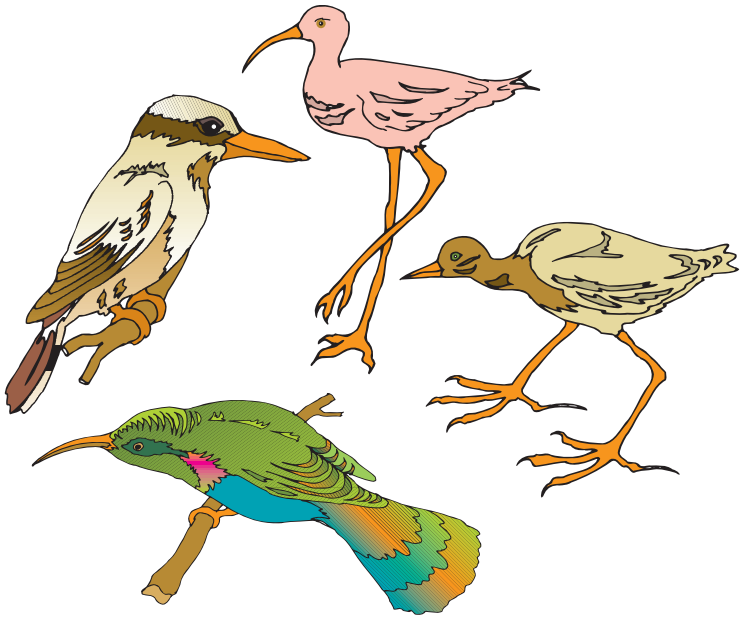
1 What is the meaning of these words: stimulus, response, adaptation, camouflage?

2 A student grew some bean seeds in a cardboard box. The small bean plants grew out of a hole in the side of the box. Why did the plant grow out of the hole? What is this response called?

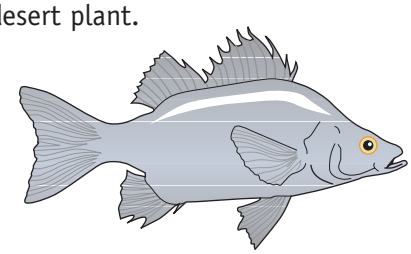


3 Name these types of responses:
- **a** a snail withdrawing its tentacles when they are touched
- **b** a sunflower following the Sun across the sky
- **c** leaves of a plant closing at night and on a cloudy day
- **d** a mimosa plant closing its leaves when you touch it
- **e** a bee flying to a brightly coloured flower.

4 Describe the adaptations of the birds drawn below.

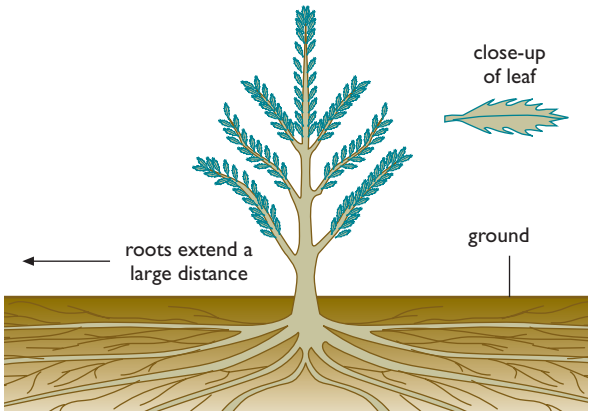


5 The drawings below are of two fictitious (make-believe) animals, called a swamp fish and a spiky desert plant.



A swamp fish

The swamp fish lives in murky water, especially in the small spaces around fallen logs and branches. There is less oxygen in swamp water than in ordinary water. The swamp fish has small fins that bend without breaking. Its scales are slippery and its skin is tough.



A spiky desert plant

The spiky desert plant has a very broad root system, and the plant stores water in its trunk and branches. The trunk is covered with sharp spikes. Even the leaves have spikes along their sides. The plant makes a poison which stops other plants from growing near it.

List five adaptations of the swamp fish and spiky desert plant. List them neatly. Use only the information given in the drawing and description.

6 Many trees have roots which grow towards water pipes, and break the pipes. What is this response called? How does it help the tree to survive? Do bean plants have this response? Or do only trees have this response? Design an experiment to show whether the roots of bean plants grow towards water.

7 The picture shows a tropical fish. Explain how its colouring helps it stay alive.

A tropical fish

8 The leaves of some plants close up at night. Describe an experiment that you could do to show that this is a response to light, and not a response to time.

9 The photograph shows a black swan. List the adaptations that help this bird to survive in its environment.

A black swan

Thinking questions

1 Some animals do some things by instinct, and other animals learn by doing. Look up the meaning of instinct, and list three animal actions which are instinct and three actions which are learned. Are instincts an adaptation? Are learned actions an adaptation?

2 Home gardeners who grow plants from bulbs often put the bulbs in the refrigerator before planting them into the garden. The bulbs grow better if they are cooled before planting. Why is this? What is the stimulus and the response?

Extension experiments

AIM: To simulate the adaptations found in animals

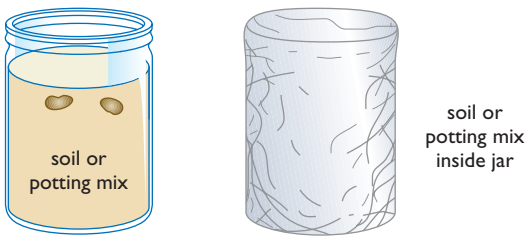
There are many experiments you could do to simulate the adaptations found in animals. Here are two ideas, and some hints for testing them.

1 Why do some animals have thick fur? Heat two beakers of water, and wrap one in paper towel and leave one uncovered. Which cools more quickly? Is paper towel a good simulation of fur? How could you improve the experiment?

2 Many desert animals have big ears. Why is this? Does it have something to do with heating and cooling? How can you simulate big ears and small ears? Are long thin and short thick test tubes suitable? What about plastic bags? Check with your teacher before you start.

3 In Activity 10.2 you might have experimented with the geotropism of bean seeds. What about the roots—are they geotropic and phototropic?

Fill two similar jars with soil or potting mix, and plant the same number of bean seeds in each. Wrap aluminium foil around the outside and bottom of one jar, to block out all the light reaching the soil. Grow the seedlings side by side.



Growing seedlings in light and darkness

When the plants are about 10 cm tall, remove the alfoil from the jar. Is there a difference in the growth of the roots? How can you explain it?

Word check

adaptations
behaviour
camouflaged
communicate
echo
larvae
nocturnal
response
seamount
simulate
sonar
stimulus

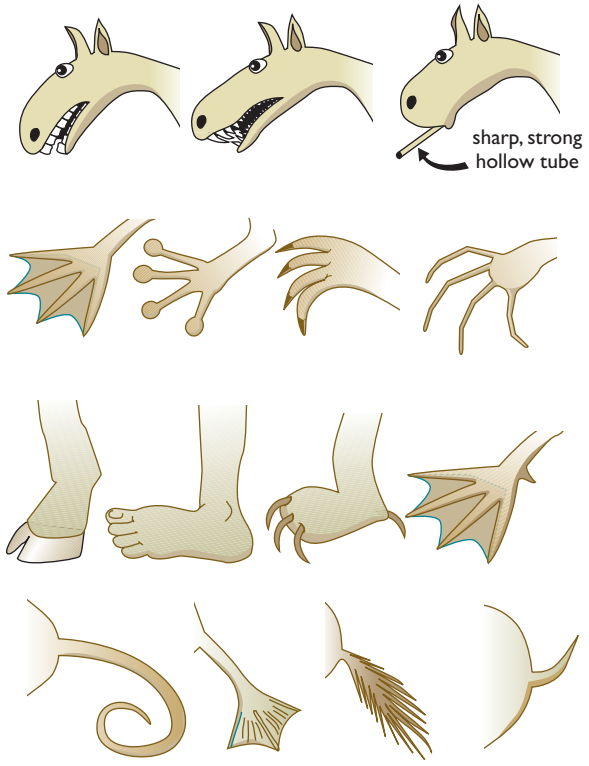
Concept map

Draw a concept map showing adaptations of living things.

Design an animal

This activity involves imaginary animals which you have to design to live on a newly discovered planet. The planet has large forests and areas of grasslands, but there are no animals. It is your job to design animals which could live on this planet.

You have some rules to follow: all the animals are the same size, and all have the same body. The only things you can change are the head, the front limbs, the back limbs and the tail.



Using the parts shown in the drawings, design animals to match each of the following descriptions:

1 grass-eater living on the open plains

2 hunter and killer of grass-eating animals

3 tree-living leaf-eater

4 living in the open sea eating fish-like animals

5 living in the shallow seas, eating water plants, but can run onto land to escape being eaten

6 living in trees, holding onto branches to eat the insides of flowers and fruit.

Feral cat buster

One of the greatest killers of Australian wildlife is the feral cat. Feral means living in the wild. Feral cats eat native animals to survive.

Design an imaginary animal which can hunt and kill the largest and hungriest feral cats. Your animal must be:

- less than one metre long
- able to live in forests and desert areas
- able to kill a feral cat quickly.

You can design your feral cat buster on scrap paper, then draw it properly on a blackboard, whiteboard, or sheet of cardboard. List the special adaptations around the drawing. Ask a teacher or a parent to judge them, with certificates for:

- the best-presented design
- the best-adapted feral cat buster
- the most imaginative cat buster.

Research questions

1 Native Australian animals and plants have many adaptations. Research one animal or plant and list its adaptations. Select one from the list below, or choose a plant or animal that you are familiar with.
- sundew
- bilby
- euro
- spinifex
- koala
- strangler fig
- epiphytes
- pelican
- antechinus
- ghost bat
- bettong
- archer fish
- kookaburra
- mountain ash
- blue-ringed octopus

2 Many plants and animals such as the cane toad, lantana and red fox, have been introduced to Australia. They have increased greatly in numbers and are now a major problem.

Select one of the following introduced plants or animals that has become a pest, and explain why it is a problem in Australia: blackberry bush, honey bee, Indian myna, privet bush, sparrow.