STUDENT WORKBOOK

YEAR 5 BIOLOGICAL SCIENCES

INTRODUCING ADAPTATIONS

Government of Western Australia
Department of Education

THE UNIVERSITY OF WESTERN AUSTRALIA

spice
science teachers enrichment program

Cover image: Echidna © The University of Western Australia

STUDENT SHEET 1

FINDING THE FACTS

1. After you've read the story, *Bara Boodie, the burrowing bettong* organise all the real life facts about burrowing bettongs you can find in it. (Hint: Stories' illustrations may add details that don't appear in the text.)

   In the space below, present facts as a table, a mind map, a diagram or any other way.

   These categories may help you organise the information: physical features; habitat in the past and in the story; location and type of home Bara lived in; food; sounds burrowing bettongs make; behaviours and reasons for these; predators; and, other information in the story.

STUDENT SHEET 1: FINDING THE FACTS

2. Do you think any or all of the facts you've listed are correct? Why do you think this?

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3. Explain how some of these features and behaviours help burrowing bettongs live in their environment.

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4. Research burrowing bettongs (boodies) on the Internet or in your library. Tick each of the facts you found in the story that are correct.

5. Add any other facts about burrowing bettongs you discovered in your research.

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STUDENT SHEET 2

EMPEROR PENGUIN

(APTENODYTES FORSTERI)

There are 17 species of penguins, and all are found in the Southern Hemisphere.

Emperor penguins live around the Antarctic continent, and are one of the top predators in the Antarctic food chain. They hunt in the Southern Ocean, diving after prey such as squid, fish, and krill.

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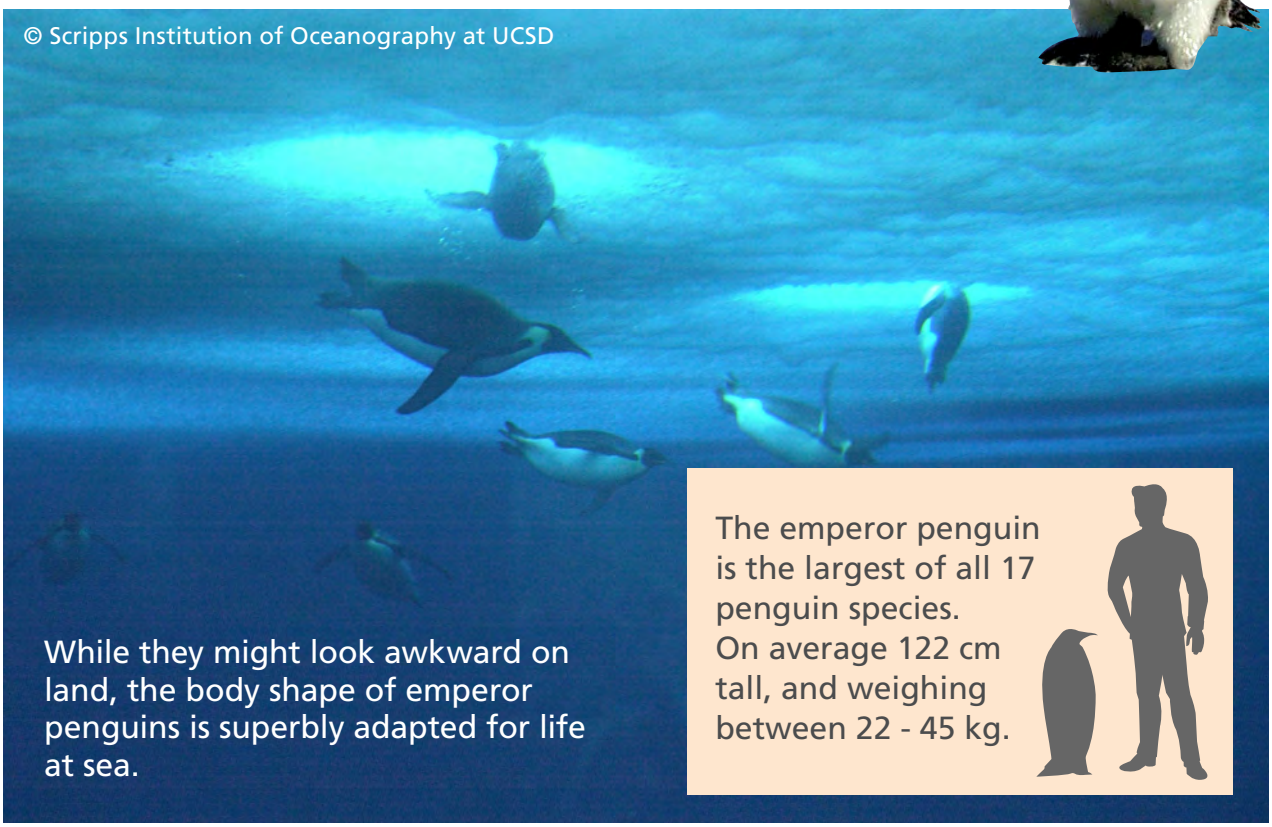
SURVIVING ANTARCTIC EXTREMES

In the Antarctic, emperor penguins live in some of the harshest conditions on the planet. Coping with extreme cold and living mainly in water means emperor penguins have many special features to help them survive. These features are known as adaptations.

Staying warm underwater

Emperor penguins dive underwater for food, where temperatures can be as low as -1.9°C. Staying warm is essential, so they have a thick layer of fat under their skins. This keeps cold out and their body heat in.

Emperor penguins also have four layers of feathers that help them stay warm. The outer layer of feathers is waterproofed with special oil which stops icy cold water coming into contact with their skin.



© Scripps Institution of Oceanography at UCSD

While they might look awkward on land, the body shape of emperor penguins is superbly adapted for life at sea.

The emperor penguin is the largest of all 17 penguin species. On average 122 cm tall, and weighing between 22 - 45 kg.

STUDENT SHEET 2: EMPEROR PENGUIN

The toughest winter on Earth

© Australian Antarctic Division

During the bitingly cold Antarctic winter most penguin species migrate to warmer areas, but emperor penguins are famous for spending winter on the Antarctic sea ice.

Emperor penguins breed on sea ice, the frozen seawater surrounding the Antarctic continent. However, that doesn't mean breeding colonies are close to the sea, some have to trek 50 - 120 kilometres to reach it.

At the start of winter female emperor penguins lay a single egg. Males are left to incubate (keep warm) the eggs while females return to the ocean to feed. Males delicately balance the eggs on their feet beneath a pouch of skin, known as the brood pouch, where it stays warm. If they drop their eggs onto the ice it's a disaster, as the eggs quickly freeze, killing developing chicks inside.

Emperor penguins huddling during a severe storm.
© Australian Antarctic Division

Males have to withstand the extreme Antarctic winter: temperatures below -40°C, wind speeds up to 200 kilometres per hour, and up to 20 hours of darkness per day.

During extreme weather conditions male emperor penguins huddle together to stay warm and save energy. Temperatures at the centre of these huddles can be as high as 24°C. Huddles are never still: the penguins constantly shuffle around so even those on the outside get to benefit from conditions in the centre.

When females finally return at the end of winter males won't have eaten for up to 115 days and can lose up to 20 kg in body weight. During the next month both males and females forage and feed their chicks.

These are just some of many adaptations emperor penguins have to allow them to live in one of the coldest and harshest environments on Earth.

© Michael Van Woert, NOAA NESDIS, ORA

STUDENT SHEET 3

KEEPING WARM UNDERWATER

PART 1

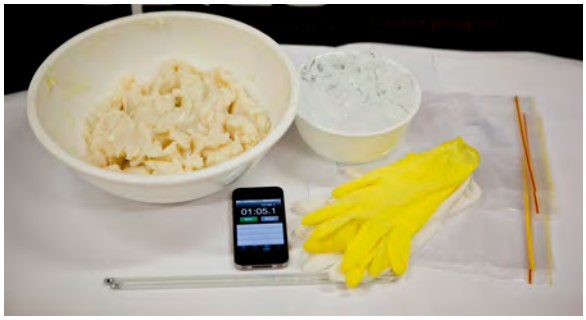
Emperor penguins find and catch their food in waters around Antarctica where the temperature is a freezing -1.9˚C. To stop their internal organs from freezing they have a thick layer of fat beneath the surface of their skin. Fat acts as an insulator; this means it prevents heat from escaping, so the body heat of emperor penguins isn't lost to the frigid water.

Aim

Using vegetable shortening investigate how a thick layer of fat helps emperor penguins stay warm when they dive underwater for food.

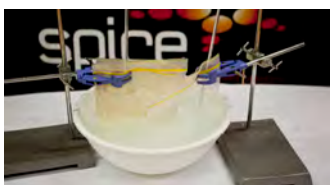
What you will need

- 4 plastic or zip-lock bags
- masking tape
- vegetable shortening (softened)
- basin/bucket of cold water
- ice cubes
- 2 thermometers
- stopwatch/timer
- gloves



What to do

1. Predict which will stay warmest in icy water: a plastic bag insulated with vegetable shortening or an empty plastic bag? Write your answer in your workbook or investigation planner.
2. Fill a plastic bag with vegetable shortening.
3. Place a second plastic bag inside this bag. Spread the shortening evenly. Place a thermometer inside the inner bag.
4. Place another two plastic bags inside one another, with no shortening. Place a thermometer inside the inner bag.
5. Fill basin with cold water. Place a thermometer in the basin.
6. Add ice until the temperature reaches 10°C.
7. Record water temperature and remove thermometer.
8. Secure each pair of bags with masking tape or using zip-lock feature. It's important water doesn't enter bags.
9. Place both plastic bags into the icy water basin.
10. Record temperatures inside the bags after two minutes, and again after four minutes.
11. Record your observations in your workbook or investigation planner.



STUDENT SHEET 4

KEEPING WARM UNDERWATER

PART 2

Aim

Use vegetable shortening to discover how insulation protects your own skin from icy water.

What you will need

- 2 plastic or zip-lock bags (extra bags may be required)
- masking tape
- vegetable shortening (softened)
- basin/bucket cold water
- ice cubes
- disposable gloves, 1 pair per student
- stopwatch
- thermometer

What to do

1. Predict which hand will stay warmest in icy water: the one insulated with vegetable shortening or the one inside a glove with no shortening? Write your answer in your workbook or investigation planner.
2. Put on your disposable gloves.
3. Fill basin with cold water. Place a thermometer in the basin.
4. Add ice until the temperature reaches 10°C.
5. Record temperature of water.
6. Fill a plastic bag with vegetable shortening.

7. Place one hand inside the bag containing vegetable shortening. Spread the shortening evenly around your hand. Seal the bag around your hand to prevent water entering.

8. Place your other hand inside the empty glove. Seal the bag around your hand to prevent water entering.
9. Place both hands into the basin of icy water.

10. Observe how long it takes before your hands begin to feel cold. Remove your hand immediately.
11. Record your observations in your workbook or investigation planner.

Note: Do not put your hands in cold water for longer than one minute.

STUDENT SHEET 5

STAYING WARM ON ICE

Emperor penguins breed during the Antarctic winter when temperatures are a numbing -40°C, and ferocious winds and blizzards are common. Male emperor penguins, left on the ice to incubate eggs, protect themselves from cold by huddling together in large groups.

Huddling together prevents emperor penguins from losing body heat to their surroundings. Additionally, temperatures at the centre of an emperor penguin huddle can reach an astonishing 24°C. It's clearly worth huddling to stay warm.

Aim

Use test tubes and hot water to investigate how emperor penguins' social huddling helps to reduce heat loss to the icy Antarctic environment.

What you need

- 8 test tubes or small glass jars
- rubber bands
- 2 thermometers
- 2 stands or similar
- 2 clamps or similar
- stopwatch/timer
- source of hot water

What to do

1. Predict which test tubes or jars will stay the warmest: the tube at the centre of the group, or a single test tube? Write your answer in your workbook or investigation planner.
2. Fasten seven test tubes or jars together using rubber bands.
3. Attach group of test tubes to stand using clamp.
4. Attach single test tube alone to stand using clamp.
5. Fill all test tubes with hot water. Take care when handling hot water.
6. Place thermometer in the centre of your test tube group.
7. Place a second thermometer in single test tube.
8. Record temperature from each thermometer at the start, and then every two minutes for 10 minutes.
9. Record your observations in your workbook or investigation planner.

STUDENT SHEET 6

INVESTIGATION PLANNER

1. What are you going to investigate?

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2. What do you think will happen? Explain why.

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3. Which variables are you going to:

- change?.....
- measure?.....
- keep the same?.....

4. How will you make it a fair test?

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5. What equipment will you need?

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STUDENT SHEET 6: INVESTIGATION PLANNER

6. What happened? Describe your observations. Use a table to record your results.

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7. Present your results as a column graph.

8. What do your results tell you?

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9. Were your results different from your prediction? Explain.

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10. What problems did you experience in doing this investigation?

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STUDENT SHEET 7

COOL PENGUINS

KEEPING WARM UNDERWATER part 1

1. Over the four minute time period, predict which plastic bag will show the lowest temperature: the bag containing vegetable shortening, or the bag without?

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2. What does vegetable shortening represent in this activity?

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3. In the table below enter temperatures collected from both plastic bags, during the activity.

Table 1: temperatures in insulated plastic bag and empty plastic bag over a four minute time period.

TIME (MINUTES)	GLOVE 1 (INSULATION) TEMPERATURE (°C)	GLOVE 2 (NO INSULATION) TEMPERATURE (°C)
2		
4		

4. Was your prediction about which temperature was lowest correct?

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KEEPING WARM UNDERWATER part 2

5. Did you notice a difference in temperature when you submerged both hands in cold water? Describe any differences you noticed.

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6. What advantage would a thick layer of fat provide the emperor penguin in the Antarctic environment?

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STUDENT SHEET 7: COOL PENGUINS

STAYING WARM ON ICE

1. Predict which test tube, filled with hot water, will cool down fastest: the test tube in the centre of the group, or the single test tube.

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2. In the table below enter temperatures collected from both the group of test tubes and single test tube.

Table 2: temperature of grouped test tubes and single test tube.

TIME (MINUTES)	SINGLE TEST TUBE TEMPERATURE (°C)	GROUPED TEST TUBES TEMPERATURE (°C)
0		
2		
4		
6		
8		
10		
total change in temperature		

3. Calculate, using subtraction, the total change in temperature from 0 minutes to 10 minutes for both single test tube and grouped test tubes.

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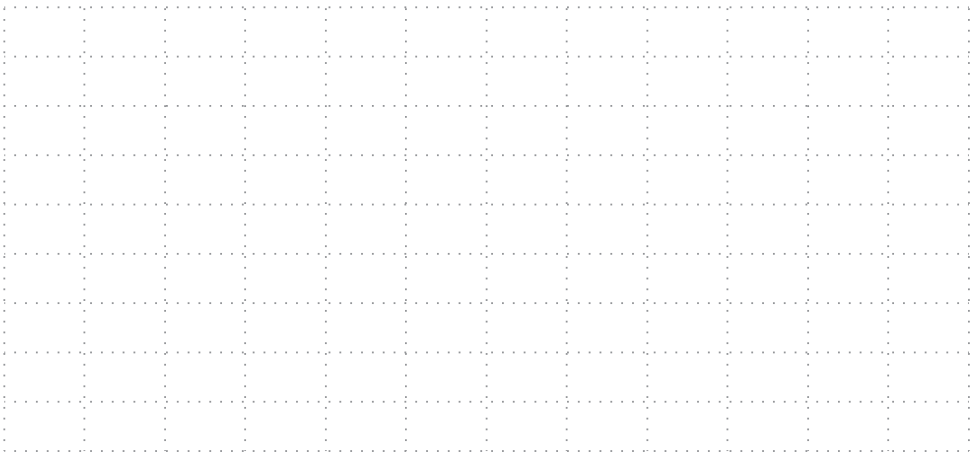
4. Present results from the table in a column graph using the grid below. Display both the single test tube and grouped test tube results in your graph.

Graph title:.....



Temperature (°C)

Time (minutes)

STUDENT SHEET 7: COOL PENGUINS

5. Was your prediction about which test tube would cool down quickest correct?

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6. How does huddling together help emperor penguins stay warm?

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7. Fill in the missing words.

Huddling behaviour and insulating fat are both .....of the emperor penguin that help it ..... in the Antarctic.

8. Write down any other information you might know or research about emperor penguins and their adaptations for life in Antarctica.

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STUDENT SHEET 8

MY ANIMAL ADAPTATIONS

Investigate an animal from the card game *Find my food* in more detail.

1. Choose an animal from the card set. .....

2. Draw your animal in the space provided below. Label any adaptations of your chosen animal.

3. Write a short paragraph about your animal based on what you have learned from the game *Find my food* or by researching your animal on the Internet.

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STUDENT SHEET 9

ADAPTATIONS MATCH-UP

WHO LIVES HERE?

Your task is to match an animal or plant with its environment, its adaptations, and the function of each adaptation.

Cut out each environment image.

Paste each environment image on a sheet of A4 paper. One environment per sheet.

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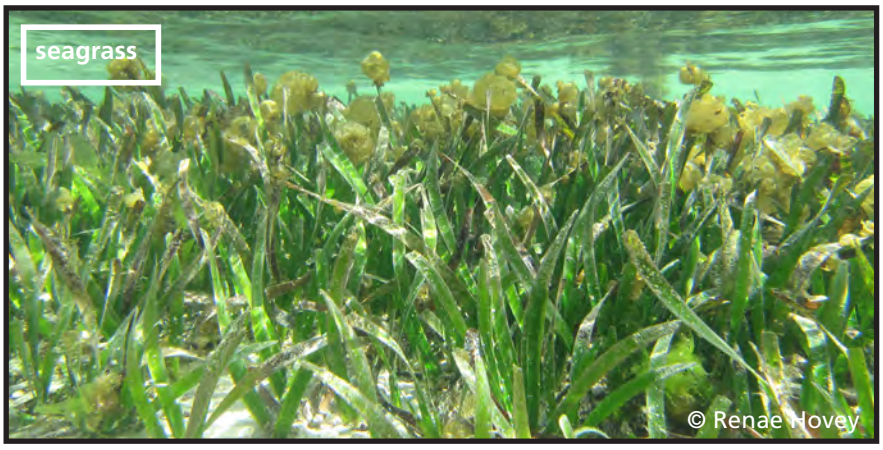
STUDENT SHEET 9: ADAPTATIONS MATCH-UP

SPECIES IN THE SPOTLIGHT

Your task is to match an animal or plant with its environment, its adaptations, and the function of each adaptation.

Cut out each animal or plant image.

Paste each animal or plant image under the correct environment image you pasted on your sheet of A4 paper.

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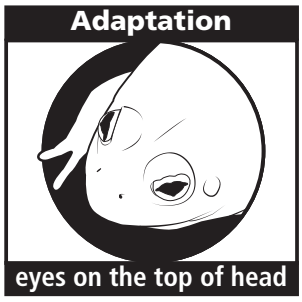
STUDENT SHEET 9: ADAPTATIONS MATCH-UP

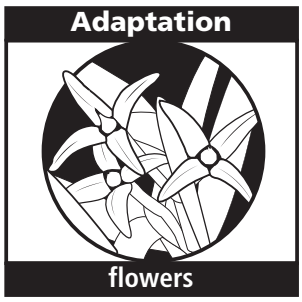
WHICH GOES WITH WHICH?

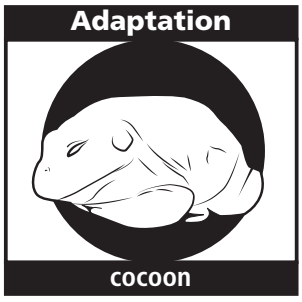
Your task is to match an animal or plant with its environment, its adaptations, and the function of each adaptation.

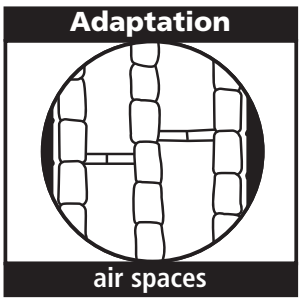
Cut out the adaptation images below.

Paste each adaptation image in rows next to the correct animal or plant image you pasted on your A4 sheet.









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STUDENT SHEET 9: ADAPTATIONS MATCH-UP

WHAT IS EACH ADAPTATION FOR?

Your task is to match an animal or plant with its environment, its adaptations, and the function of each adaptation.

The labels below describe the function (action or purpose) of each adaptation. For instance, the function of a kangaroo's pouch is to carry young.

Cut out each function label.

Paste each function in a column under its correct plant or animal adaptation on A4 sheet.

Function:	Function:	Function:	Function:
to blend in with the environment.	to help me swim.	to anchor me to the sea floor.	to reduce drag when swimming.
Function:	**Function:**	**Function:**	**Function:**
to stop me drying out.	to keep me warm.	to help my leaves bend with the waves.	to keep water out.
Function:	**Function:**	**Function:**	**Function:**
to help me dig burrows.	to act as a rudder.	to help me keep an eye out for food.	to move gas around.
Function:	**Function:**	**Function:**	**Function:**
to help me swim.	to help me sense prey underwater.	to help me to reproduce.	to help me crush prey.

STUDENT SHEET 9: ADAPTATIONS MATCH-UP

environment

animal

adaptations
and functions

STUDENT SHEET 9: ADAPTATIONS MATCH-UP

environment

animal

adaptations
and functions

STUDENT SHEET 9: ADAPTATIONS MATCH-UP

environment

animal

adaptations
and functions

STUDENT SHEET 10

MY ADAPTATIONS

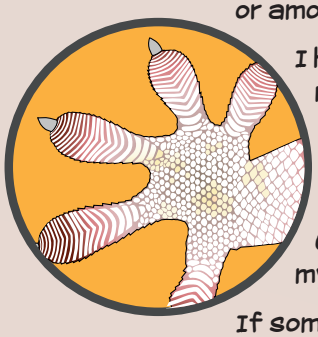
Velvet gecko

I'm a reptile.

I rely on heat from the environment to warm my body.

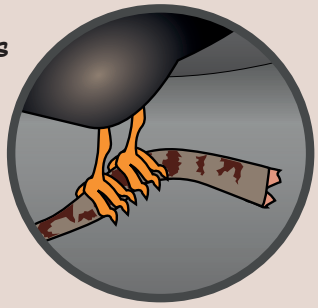
I'm nocturnal and hunt insects at night.

I live in most places around Australia, except inland deserts. I prefer living in trees or amongst rocks, where there are lots of places to hide.



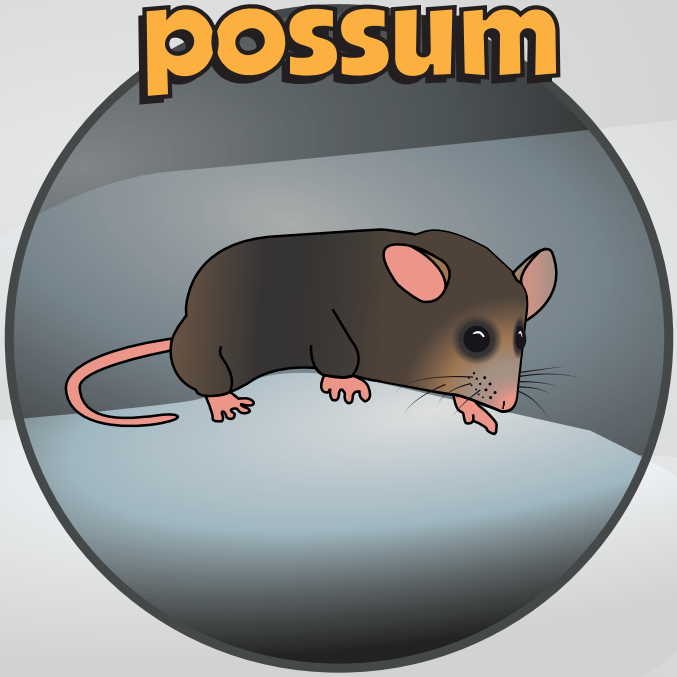
I have suction cups on my toes, which means I can stick to most surfaces. I can run along panes of glass, and even, upside down on ceilings.

I have patterned skin that matches my surroundings. It helps me sneak up on my prey and also to hide from my predators.



If someone does attack I have another trick. I drop my tail, leave it behind, and make my getaway before I end up as someone else's dinner. Afterwards, I can grow my tail again.

Mountain pygmy possum



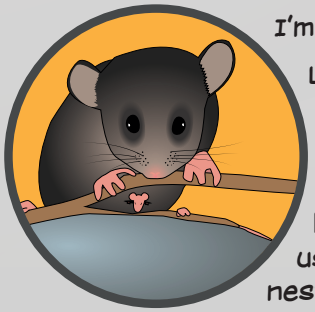
I'm a marsupial, and I'm critically endangered.

I live in the Alps of eastern Australia.

I'm tiny, weighing only 45 grams.

I don't climb trees often like other possums, instead I spend most of my time on the ground. I live in boulder fields in the mountains, hiding between rocks.

I eat insects, and especially love to snack on moths. I also eat fruit and seeds.



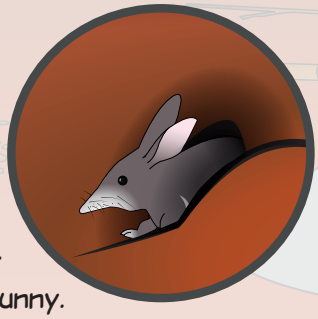
I'm nocturnal, sleeping during the day and eating at night.

Like most marsupials I've a pouch for raising young. My pouch is a safe place for my young to eat, sleep and grow up.

When my young are old enough to leave the pouch I build them a nest. I use my long grasping tail to line the nest with leaves and grasses.

In winter when it's very cold I build a cosy den and go to sleep (hibernate). My deep sleep helps me save energy and survive the winter.

Bilby

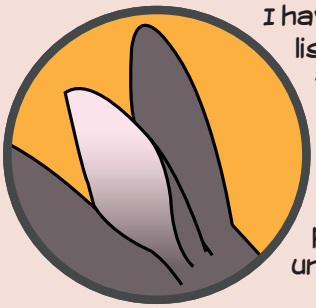


I'm a type of marsupial called a bandicoot, and I'm endangered.

My large ears mean I'm sometimes called Australia's Easter Bunny.

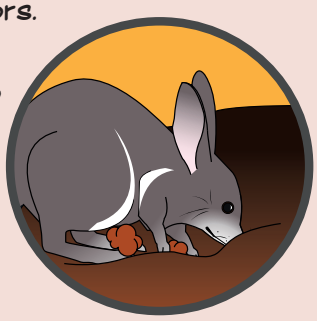
I live in central Australia where it's hot, dry and there's not much water. I'm not fussy about what I eat: insects, plants, roots and fungi are all on the menu.

I don't have great eyesight.



I have huge ears which give me super sensitive hearing so I can listen for insects underground. My super hearing is also handy to help me avoid being eaten by predators.

I'm an expert digger. With my strong legs and sharp claws I build burrows to live in. Burrows keep me safe from predators and help me stay cool underground when it's hot.



Forest red-tailed black cockatoo

I'm a splendid bird with flashy feathers. You might recognise me from the bright red plumes in my tail and my loud raucous caws.

I lay my eggs in the hollows of trees.

I live in the southwest corner of Western Australia, favouring forests and woodlands.

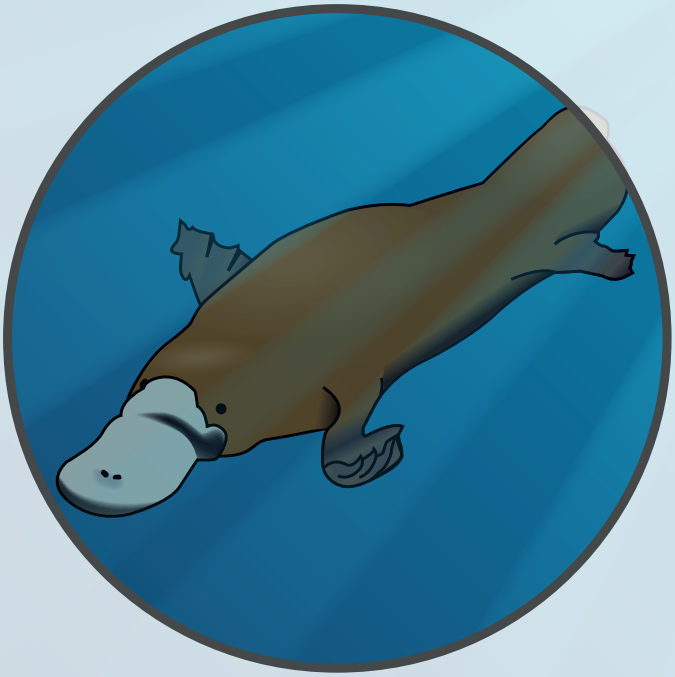
I eat nuts and seeds from native trees. I feed in the day and return to my favourite trees to roost at night.

My powerful, sharp beak helps me collect food. I use it to break open tough outer skins of nuts and seeds. It's also a good weapon if I'm threatened.

When it's breeding time males sing and dance and display their colourful feathers to impress us girls.

I build nests to raise my chicks, in high up hollows of tall trees, where they'll be safe from predators.

Platypus



I'm a monotreme; a mammal that lays eggs.

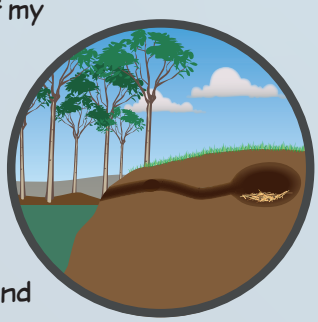
I'm an extraordinary creature, with the beak of a bird and the body of a mammal.

I live in eastern Australia in rivers and streams.

I'm semi-aquatic and a superstar at hunting underwater where I search for worms, insects and shrimp.

I'm mainly nocturnal, preferring to get out of bed in the evenings, but sometimes you can see me during the day.

When I'm not sleeping I spend most of my time in the water. I'm an excellent swimmer. I have webbed feet that propel me along, and a thick flat tail that helps me steer.



I build burrows along waterway edges to sleep during the day. I build a deeper, longer burrow when I'm raising my young. I line my burrow with leaves and reeds I carry with my tail. Burrows keep my young and me safe from predators.

Goliath stick insect

I'm a stick insect.

I'm quite colourful: green, with spots of gold, red and purple.

I'm found in most parts of Australia.

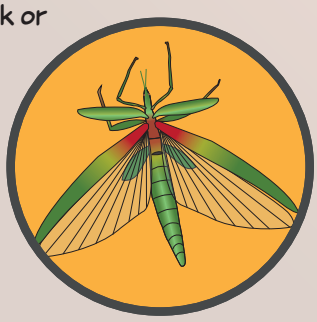
I'm one of the largest stick insects in Australia, growing over 20 centimetres long.

I prefer to live in forests where I spend my time in trees. I'm an herbivore, eating only plants.

I'm a master of camouflage. I look just like part of a plant. This means I can hide from predators, like birds, that love to eat me.

I'm nocturnal. During the day I pose like a stick or leaf, and come out to feed at night.

If a predator does catch up with me I use trickery to scare it off. I puff up my wings and flash my red undersides to make myself appear big and dangerous. I also make a whirring noise with my wings.



STUDENT SHEET 11

TYPES OF ADAPTATIONS

Name .....

My structural adaptations are:

My behavioural adaptations are:

My structural adaptations help me survive by:

My behavioural adaptations help me survive by:

Draw your animal.

My environment has shaped my adaptations because it has:

.....

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STUDENT SHEET 12

SHOW WHAT YOU KNOW

Here's a chance to show your knowledge and creativity!

Your challenge is to introduce an Australian animal by writing your own folk story, combining fact and fiction, about how an animal came to have particular adaptations, how it uses them, and how they help the animal survive in its environment.

Your story can include illustrations, photos, diagrams, maps … whatever you dream up. Present your story in any form you wish: written text, digital or multimedia.

Read these steps for an overview of what to do. Then begin!

1. Identify your animal and research information about it.

Choose an Australian animal to write about.

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Research facts about your animal and list your findings under the headings below, or choose your own headings.

Adaptations and their functions

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Environment

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Where the animal lives (its home)

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Food and how animals find it

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Sounds your animal makes

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Behaviours and reasons for these

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Predators

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Other information

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2. Decide what scientific facts to include.

Choose which of your animal's adaptations to write about. Think about how your animal came to develop the adaptation you've chosen (fiction), and its function (correct facts). Also decide which other correct facts about your animal you'd like to include in your story, such as its environment.

3. Plan your story's form (narrative) and contents (fact and fiction).

Re-read *Bara Boodie, the burrowing bettong* and plan your story outline, how your plot will develop, the imaginary events you need to tell the story, and how you'll include facts about your animal. It may be helpful to plan your content on a separate piece of paper under these headings:

- Introduction
- Sequence of events
- Conclusion

4. Write your story.

Once you've planned its content, draft your story. As you write you'll probably think of additional information and changes that work better. Go ahead and change your plan. Think of it as a flexible guide to be built on, expanded and reworked when you feel you've come up with better idea.

Edit your story, check your facts, and prepare your final version.