

Teacher Notes

Themes

- Animals
- Environmental factors

Key learning outcomes

- Learn about tardigrades and why they are so good at surviving.
- Extend students' vocabulary and use of scientific terminology.
- Learn about technologies that allow scientists to discover the world around us.

Key curriculum areas

- **Science:** Science Understanding (Biological sciences); Science Inquiry (Planning and conducting)
- **English:** Language; Literacy
- **Mathematics:** Measurement
- **HASS:** Questioning and researching

Publication details

Tardigrades: Nature's Toughest Survivors

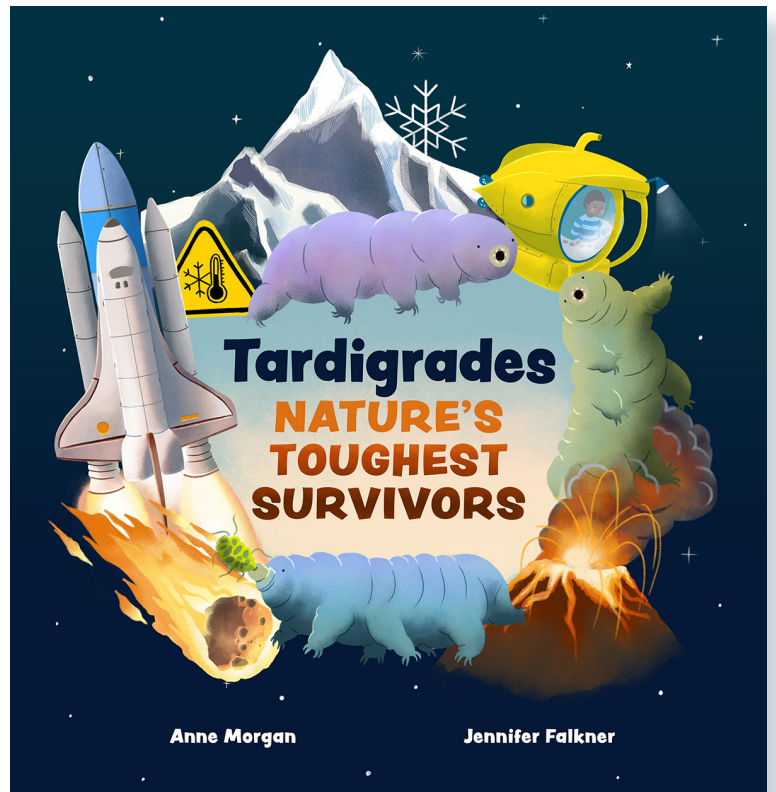
ISBN: 9781486316052

These teacher notes are licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 Licence (CC BY-NC-SA). They may be reproduced free of charge but may not be offered for commercial sale.

Teacher notes prepared by Jillian Brooks.

CSIRO Publishing
Private Bag 10
Clayton South, VIC 3169, Australia

Website: www.publish.csiro.au
Tel: 1300 788 000 (local call in Australia)
Email: publishing.sales@csiro.au



Tardigrades

Nature's Toughest Survivors

Anne Morgan and Jennifer Falkner

About the book

Tardigrades are one of the toughest creatures in nature! These tiny little animals, nicknamed 'moss piglets' or 'water bears', have incredible survival superpowers.

They've been found in astonishing places, from the top of a mountain to the bottom of an ocean. They've even survived a trip into space!

Tardigrades: Nature's Toughest Survivors showcases these astounding little creatures and their remarkable ability to survive.

Recommended for

Readers aged 6 to 9 (Years 1 to 4)



PUBLISHING

Teacher Notes

About the author/illustrator

Dr Anne Therese Morgan began her working life as a teacher and is now a full-time writer. Her picture book *The Way of the Weedy Seadragon* (CSIRO Publishing, 2021) was a CBCA Notable Book and shortlisted in the Wilderness Society's Environment Award for Children's Literature.

Jennifer Falkner is an illustrator based in Perth, Australia. Jennifer's work is inspired by her passion for nature, the antics of her two boys and her time spent working in South-East Asia.

Pre-reading questions or activities

We are going to read a book about some amazing animals that live all around us.

What are some animals you think are amazing and why?

Have students Think, Pair and Share their ideas and write these as a brainstorm on the board.

At the page with the rocket in outer space, stop reading and get the students to draw what they think this animal is going to look like.

Once students have created their drawings, ask them to walk around and have a look at each other's drawings. Invite some students to talk about their drawing with the group.

Discussion questions

Science

1. What is an animal? *An animal breathes oxygen, can move, grows and has sensory organs (humans have eyes, ears, nose, mouth).*

Are humans animals? *Yes.*

Name as many animals as you can.

2. Why do we need a microscope to see a tardigrade? *Because human eyes cannot see something so small. A microscope is like a really powerful set of glasses.*
3. What is a scientist? *Someone who asks questions about the world and then tries to answer those questions.*

Teacher Notes

Mathematics

1. A tardigrade is about 1 millimetre (mm) or smaller in length. Can you find something in your classroom that is also 1 mm? *1 mm is about the thickness of your fingernail.*

HASS

1. Why might a tardigrade go into suspended animation? *Because the environment is currently unsuitable to survive.*

Activities

Science

Mould experiment

Mould is another living organism that is very small and hard to see. It is not an animal like the tardigrade; it is a type of fungus. Unlike tardigrades, you can see mould when there are lots of them in one place. In this activity, you will make mould. This experiment can also be used to show the importance of hand washing before eating.

Safety: Mould is not safe to eat, so once the bread is in the bags, please ensure that the bags are zipped up and not opened again. To dispose of the bread, place the unopened bags containing the bread into the general waste bin.

Things you will need:

- Bread (enough for each group/student to have two slices)
- Clear resealable bags (enough for each slice of bread)
- Access to soap and water and paper towels
- Permanent marker
- Paper
- Pencil or crayon

What to do:

1. On each bag write your name in permanent marker.
2. On one bag write 'unwashed hands' and on the other bag write 'washed hands'.

Teacher Notes

3. Get one slice of bread and put a handprint into the middle of the bread.
4. Place this slice of bread into the bag labelled 'unwashed hands'.
5. Wash hands thoroughly with soap and dry well.
6. Get a second slice of bread and put a handprint in the middle of the bread.
7. Place this slice of bread into the bag labelled 'washed hands'.
8. Allow mould to grow on the bread. This will take a couple of days.
9. Once you observe white and blue colours on the bread, mould has grown.
10. If a digital microscope is available, use it to look at the mould on the bread. Do not open the bags.
11. Draw a picture of what you see with the microscope.

As a class, discuss how there are many living things that we cannot see in the world. You can also discuss the difference between the 'unwashed hands' bag and the 'washed hands' bag.

Microscope simulation

To be able to see the tardigrades in real life, scientists have to use a microscope. The following link will take you to a website that simulates using a microscope in a laboratory:

<https://www.ncbionetwork.org/iet/microscope/>

Students can pretend that they are a scientist. The website goes through how a microscope works, and students get to use a virtual microscope to look at sample slides (of plant, animal and bacteria cells). There are also quizzes to test their knowledge of microscopes.

English

Vocabulary

In this book you will come across many new words; some of these words are in the glossary. On the board create a table that looks like this:

Word	Definition	Picture (if possible)
Organism	An animal, plant or other life form	

Teacher Notes

Ask the students to raise their hand if there is a word they do not understand while you read this book. Each time a student raises their hand, stop reading and discuss the meaning of the word and add it to the table. Use the glossary for any bold words in the story, and demonstrate how students can use the glossary to help them search for definitions. If a word is not in the glossary, explain where students can look to find the definition (e.g. a dictionary, or online search).

Younger students may want to know about many words. This may mean that it will take a long time to get through the book. Consider breaking up the reading with other activities, such as drawing what they think this creature will be, or reading a couple of pages each day.

Text to text connection

Once students have read *Tardigrades: Nature's Toughest Survivors*, discuss if there are any other books they have read that remind them of this book.

Some examples are:

- *Sleeping Beauty* – Tardigrades can sleep for a long time in suspended animation to survive. In the book *Sleeping Beauty*, a princess falls asleep for a hundred years.
- *The Very Hungry Caterpillar* – In the book *The Very Hungry Caterpillar*, the caterpillar creates a cocoon to help it grow into a butterfly. Tardigrades have skin called a cuticle that they shed to help them grow.

As a class read *The Very Hungry Caterpillar*, then create a Venn diagram showing the similarities and differences of *The Very Hungry Caterpillar* and *Tardigrades*.

HASS

Animals that shed their skin research activity

Use books from the library or the internet to research other animals that shed their skin, and why. An example of another animal that sheds its skin is a snake. Why do snakes shed their skin?

Here is a link that you can use to start your research journey:

<https://wildlifeinformer.com/animals-that-shed-their-skin/>

Use the worksheet on the next page to help you record your research.

Teacher Notes

Animals that shed their skin

Name: _____

Animal	Why does it shed its skin?	How does it shed its skin?	When does it shed its skin?

Teacher Notes

Word search

Name: _____

Tardigrades

N	O	I	E	C	T	S	I	T	N	E	I	C	S
L	X	R	E	A	L	B	A	C	T	E	R	I	A
I	Y	N	G	L	N	O	C	U	T	I	C	L	E
E	G	Y	E	C	O	L	O	N	Y	D	M	I	O
S	E	C	S	U	B	M	E	R	S	I	B	L	E
P	N	S	P	E	C	I	E	S	F	U	N	G	I
D	E	C	A	D	E	S	O	I	Y	C	Y	S	T
I	U	P	M	U	E	X	T	R	E	M	E	C	T
E	P	O	C	S	O	R	C	I	M	C	N	S	I
I	V	A	C	C	I	N	E	S	T	Y	L	E	T
L	A	M	I	N	A	G	I	C	E	A	G	L	A
S	N	O	I	T	A	C	I	F	I	N	G	A	M
E	A	H	A	B	I	T	A	T	B	N	E	P	V
S	M	S	I	N	A	G	R	O	O	R	C	I	M

HABITAT
VACCINES
FUNGI
EXTREME
SUBMERSIBLE
DECADE
MICROSCOPE
COLONY
CELLS
MICROORGANISMS
MAGNIFICATION
STYLET
CUTICLE
ANIMAL
ALGAE
SPECIES
SCIENTIST
BACTERIA
OXYGEN
CYST

Teacher Notes

Australian Curriculum Links (Version 9.0)

Year level	Learning area: Science	Other learning areas
Year 1	<p>Science Understanding: Biological sciences</p> <ul style="list-style-type: none"> Identify the basic needs of plants and animals, including air, water, food or shelter, and describe how the places they live meet those needs (AC9S1U01) <p>Science Inquiry: Planning and conducting</p> <ul style="list-style-type: none"> Suggest and follow safe procedures to investigate questions and test predictions (AC9S1I02) 	<p>English: Language</p> <ul style="list-style-type: none"> Recognise the vocabulary of learning area topics (AC9E1LA09) <p>English: Literacy</p> <ul style="list-style-type: none"> Use comprehension strategies such as visualising, predicting, connecting, summarising and questioning when listening, viewing and reading to build literal and inferred meaning by drawing on vocabulary and growing knowledge of context and text structures (AC9E1LY05) <p>Mathematics: Measurement</p> <ul style="list-style-type: none"> Compare directly and indirectly and order objects and events using attributes of length, mass, capacity and duration, communicating reasoning (AC9M1M01) <p>HASS: Questioning and researching</p> <ul style="list-style-type: none"> Collect, sort and record information and data from observations and from provided sources, including unscaled timelines and labelled maps or models (AC9HS1S02)
Year 2	<p>Science Inquiry: Planning and conducting</p> <ul style="list-style-type: none"> Suggest and follow safe procedures to investigate questions and test predictions (AC9S2I02) Make and record observations, including informal measurements, using digital tools as appropriate (AC9S2I03) 	<p>English: Language</p> <ul style="list-style-type: none"> Experiment with and begin to make conscious choices of vocabulary to suit the topic (AC9E2LA09) <p>English: Literacy</p> <ul style="list-style-type: none"> Use comprehension strategies such as visualising, predicting, connecting, summarising, monitoring and questioning to build literal and inferred meaning (AC9E2LY05) <p>Mathematics: Measurement</p> <ul style="list-style-type: none"> Measure and compare objects based on length, capacity and mass using appropriate uniform informal units and smaller units for accuracy when necessary (AC9M2M01) <p>HASS: Questioning and researching</p> <ul style="list-style-type: none"> Collect, sort and record information and data from observations and from provided sources, including unscaled timelines and labelled maps or models (AC9HS2S02)
Year 3	<p>Science Understanding: Biological sciences</p> <ul style="list-style-type: none"> Compare characteristics of living and non-living things and examine the differences between the life cycles of plants and animals (AC9S3U01) <p>Science Inquiry: Planning and conducting</p> <ul style="list-style-type: none"> Use provided scaffolds to plan and conduct investigations to answer questions or test predictions, including identifying the elements of fair tests, and considering the safe use of materials and equipment (AC9S3I02) Follow procedures to make and record observations, including making formal measurements using familiar scaled instruments and using digital tools as appropriate (AC9S3I03) 	<p>English: Language</p> <ul style="list-style-type: none"> Extend topic-specific and technical vocabulary and know that words can have different meanings in different contexts (AC9E3LA10) <p>Mathematics: Measurement</p> <ul style="list-style-type: none"> Measure and compare objects using familiar metric units of length, mass and capacity, and instruments with labelled markings (AC9M3M02) <p>HASS: Questioning and researching</p> <ul style="list-style-type: none"> Locate, collect and record information and data from a range of sources, including annotated timelines and maps (AC9HS3S02)

Teacher Notes

Year level	Learning area: Science	Other learning areas
Year 4	<p>Science Inquiry: Planning and conducting</p> <ul style="list-style-type: none">Use provided scaffolds to plan and conduct investigations to answer questions or test predictions, including identifying the elements of fair tests, and considering the safe use of materials and equipment (AC9S4I02)Follow procedures to make and record observations, including making formal measurements using familiar scaled instruments and using digital tools as appropriate (AC9S4I03)	<p>English: Language</p> <ul style="list-style-type: none">Expand vocabulary by exploring a range of synonyms and antonyms, and using words encountered in a range of sources (AC9E4LA11) <p>English: Literacy</p> <ul style="list-style-type: none">Use comprehension strategies such as visualising, predicting, connecting, summarising, monitoring and questioning to build literal and inferred meaning, to expand topic knowledge and ideas, and evaluate texts (AC9E4LY05) <p>Mathematics: Measurement</p> <ul style="list-style-type: none">Interpret unmarked and partial units when measuring and comparing attributes of length, mass, capacity, duration and temperature, using scaled and digital instruments and appropriate units (AC9M4M01) <p>HASS: Questioning and researching</p> <ul style="list-style-type: none">Locate, collect and record information and data from a range of sources, including annotated timelines and maps (AC9HS4S02)

Related books from CSIRO Publishing

For younger readers:

- *Dung Beetle on a Roll* (<https://www.publish.csiro.au/book/8184>)
- *Wonderful Wasps* (<https://www.publish.csiro.au/book/8057>)

For older readers:

- *Nema and the Xenos: A Story of Soil Cycles* (<https://www.publish.csiro.au/book/7908>)
- *Sensational Australian Animals* (<https://www.publish.csiro.au/book/8094>)
- *The Great Australian Science Book* (<https://www.publish.csiro.au/book/8083>)

Double Helix magazine

Packed with fun, exciting and quality articles, Double Helix magazine is created to inspire young readers. It covers a range of topics across science, technology, engineering and maths.

Learn more on our Teachers page: <https://doublehelixshop.csiro.au/en/Teachers>. Subscriptions can be purchased via the Double Helix website: <https://doublehelixshop.csiro.au/Subscribe>

Double Helix blog

Looking for interesting science, technology, engineering and maths ideas? For our latest news, hands-on activities, quizzes and brainteasers, visit the Double Helix blog: <https://blog.doublehelix.csiro.au>

There is plenty of free content that can be used at school or home to support learning.

Teacher Notes

Double Helix Extra

Sign up to receive a fortnightly Double Helix email newsletter, including a quiz, brainteaser, news and a hands-on activity: <https://doublehelixshop.csiro.au/eNewsletter>

Other CSIRO resources

CSIRO has developed and delivered a broad range of high-quality STEM education programs and initiatives for nearly 40 years. Our programs aim to inspire the pursuit of further STEM education among students and the community, to equip the emerging workforce with tomorrow's skill sets, and to strengthen collaboration between industry and classrooms across Australia. For more information visit: <https://www.csiro.au/en/Education>