

Teachers' Resource Kit

# Atoms, Dinosaurs & DNA

VERONIKA MEDUNA & REBECCA PRIESTLEY

From Joseph Banks to Ernest Rutherford and Beatrice Tinsley to Ingrid Visser, *Atoms, Dinosaurs & DNA* profiles 68 of New Zealand's most remarkable scientists. Among them are some of the earliest explorers and collectors, the first professional scientists, twentieth-century pioneers in emerging scientific disciplines and some of today's leading scientists who are continuing to make discoveries about our world and working to shape our future.

Whether they measure the universe or the atom, work with whales or microbes, explore some of the world's most inhospitable places or persevere against all odds to discover the last survivors of a species considered extinct, each of the scientists profiled in this book is driven by a passion for their discipline and a desire to better understand the world around us. By presenting the life and work of each scientist in chronological sequence, this book also charts the history of science in New Zealand over the past two centuries. *Atoms, Dinosaurs & DNA* is based on a major science exhibition, curated by the authors and held at the National Library of New Zealand in 2006.

**VERONIKA MEDUNA & REBECCA PRIESTLEY**

**Veronika Meduna** is a science journalist best known for her broadcasts on Radio New Zealand National. **Rebecca Priestley** is a science historian and writer, and editor of *The Awa Book of New Zealand Science*.



## Atoms, dinosaurs & DNA

68 GREAT NEW ZEALAND SCIENTISTS



Veronika Meduna & Rebecca Priestley



L-R: Veronika Meduna, Rebecca Priestley, *Porphyrio mantelli*

Including classroom activities for students aged 8-13 in English, Science, Social Studies, Art, and Careers:

- Report for Migrants
- Huia
- Unique NZ Plants
- Atomic Power
- Alpine Fault Line
- Space Timeline
- Fossils
- Fighting Crime with Science
- Predators and Sanctuaries
- Naming and Classifying the Orca
- Plant Discovery



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# Overview

- Title words and cover images: Why do you think they were chosen? What are the New Zealand links to atoms, dinosaurs and DNA?
- Mindmap as many branches of science as you can.
- Find out why scientists' job titles often end in 'ologist'.
- Match these scientists with things they study:
  - entomologist                      bones
  - cosmologist                        bugs
  - palaeontologist                    birds
  - ornithologist                        big bang
- How many significant New Zealand scientists can you name? List their names and important New Zealand discoveries.
- What do scientists contribute to our society?
- Choose one scientist in the book to research (several are included below with questions and activities about them and their areas of study). Create a poster that shows the highlights in the scientist's working life, their great achievements or contributions.

## Preface and Introduction (pp.6-9)

- What criteria did the authors use to select scientists?
- Why is New Zealand science internationally significant?
- What is the Nobel Prize? (p.7) Find out who it is named after, why it is awarded and in what areas.
- What is 'mātauranga'?
- Define a 'gentleman naturalist'. (pp.7, 32)
- Why was Linnaeus important in the history of science?
- When did New Zealand have its first university and national museum? (pp.7, 8)
- What factors helped science to grow in New Zealand during the nineteenth century? (p.8)
- Why do you think science was dominated by men at first? Why has this changed for women now? Does the book reflect this?
- Why was DSIR so important in developing science in New Zealand? (p.8)
- Do scientists always have to be highly trained academics? (p.9)
- What is a CRI? Why is AgResearch the largest? (p.9)

Science Activity: New Zealand Science History  
Create a timeline showing the development of science in New Zealand.

Plot main events, people and organisations from 1860 to 2003. (pp.8–9)

## Ernst Dieffenbach (pp.12-13)

- Find out what an ethnologist studies. (Use the Glossary on page 133.)
- What job did Dieffenbach do for the New Zealand Company? (p.12)
- What did he discover?
- Read the quote on page 13. Find out what ‘barbarous’ means.

- What was Dieffenbach worried would happen to the Māori? Did these things happen?

### Social Studies Activity: Report for Migrants

Find out about your locality’s plants, animals, mineral and other natural resources, then write a report about them for prospective migrants.

## Walter Buller (pp.26-27)

- What is an ornithologist?
- Why might Buller be regarded as our first famous scientist?
- Why is he a ‘self-made’ scientist? (p.26)
- What is his ‘iconic’ world-famous book? Look at it or see the extracts and paintings in a more recent book, *The Art of J.G. Keulemans: Paintings of the Birds of New Zealand*, in your local library.
- Why did some early scientists kill rare birds?

### Science/Social Studies Activity: Huia

- The huia had extreme specialisation: the male and female had completely different-shaped beaks. The male’s short strong beak was used to poke holes in trees to find insects. The female’s beak was long and curved for picking out insects from the holes and feeding them to the male. Find a picture of huia and draw the male and female beaks.
- The huia was wiped out by 1907. Find out how it became extinct and report back to the class.

## Leonard Cockayne (pp.34-35)

- Name six remarkable New Zealand native plants mentioned by Leonard Cockayne.
- Find a photo of a 'vegetable sheep' and some facts about this strange plant on the internet or in a book.
- Find out more about the Ōtari Open Air Native Plant Museum that

Leonard Cockayne established ([http://www.kennett.co.nz/otariwiltons\\_bush2/](http://www.kennett.co.nz/otariwiltons_bush2/)). Are there any similar plant-related parks or facilities in your area?

### Science Activity: Unique New Zealand Plants

Research facts and figures about other unique New Zealand plants and present them on a poster.

## Ernest Rutherford and Ernest Marsden (pp.44-45, 54-55)

- What are three of Rutherford's major discoveries?
- Read the quote on page 45. Find out what an 'alchemist' is.
- What role did Marsden have in Rutherford's research? (p.54)
- What was Marsden's attitude to nuclear weapons?

### Social Studies Activity: Atomic Power

Ernest Rutherford described the nucleus of an atom. Scientists later split the nucleus of uranium and it released massive amounts of energy. Nuclear bombs and power stations use this energy. Research and make a list of advantages and disadvantages associated with nuclear power. What is your opinion on the use of nuclear technology?

## Harold Wellman (pp.68-69)

- What was his great discovery?
- Why did he 'scorn' book learning? What advantage did this give him? (p.68)

### Science/Social

### Studies/English Activity: Alpine Fault Line

New Zealand sits on top of the collision boundary between the Pacific Plate and the Australian Plate. The boundary runs

almost diagonally across the whole country. The whole country is being stretched as the plates move in opposite directions: Auckland is moving away from Christchurch at a rate of 1 metre every 20 years!

The Alpine Fault in the South Island is one of the longest natural straight lines on the planet — visible from space.

- Photocopy or draw a map of the North and South islands. Find out where the Alpine Fault runs and draw it in. Repeat Wellman's 'eureka' moment

by cutting along the fault and sliding the pieces to join Nelson and Otago.

- The length of time between earthquakes on the fault has varied from fewer than 100 years to more than 280 years. A major quake occurs when there is movement along a fault line. Write a story about such a quake and its effect on large cities.

## Bill Pickering (pp.72-73)

- Which NASA missions was Pickering involved in?
- What was the 'space race'?
- Why are the Van Allen belts so important?

### Science Activity: Space Timeline

Research the history of space exploration to find these events, then place them on a timeline.

A. Neil Armstrong is the first human to walk on the moon.

B. US space shuttle Challenger explodes after lift-off.

C. Galileo uses a telescope to prove the Earth goes around the Sun.

D. Russia sends the first satellite, Sputnik, into space.

E. Mariner 2 does a fly-by of planet Venus.

F. The Cassini space probe reaches Saturn after 7 years.

G. The Chinese invent the first rockets, powered by gunpowder.

## Joan Wiffen (p.82-83)

- How do we know there were dinosaurs in New Zealand?
- Why do you think ‘perseverance and passion’ are vital qualities for a scientist?
- What is a fossil?
- Name some of the different sorts of fossils that Joan Wiffen has found.

### Science Activity: Fossils

Draw an illustrated flowchart to show how a fossil is made:

1. The animal dies.
2. It’s covered in mud or sand.
3. Soft parts rot; hard parts don’t.
4. Water that contains minerals seeps into the bones.
5. These minerals fill spaces in the bones or replace the bones as they decay.
6. After more than 10,000 years, the bones have turned to stone.

## Maurice Wilkins and John Buckleton (pp.78-79, 114-115)

- What does a biophysicist study? (p.78)
- Wilkins’ work contributed to nuclear bombs. What do his later actions suggest he felt about this? (pp.78-9)  
Find out how many people were killed when nuclear bombs were dropped in Japan.
- Find simple diagrams showing the structure of a DNA molecule and draw a double helix shape yourself.
- Why does John Buckleton’s work depend on what Wilkins and his colleagues found out?

- Find out what ‘forensic’ means. (p.114)
- How can DNA be used to solve mysteries and crimes?

### English Activity: Fighting Crime with Science

Write a detective story where just ‘one DNA molecule’ enables crime-fighters to catch a burglar.

## Don Merton (pp.96-97)

- How did he save the black robin when there were only five left in the world? Read more about 'Old Blue' and other black robins in the book *A Bird in the Hand*.
- Read Merton's quote on page 97. Do you agree that our national identity is found in native animals?
- Why is Richard Henry famous? (p.97) Read more about Richard Henry in *A Bird in the Hand*.

Science/Art/Social Studies

Activity: Predators and Sanctuaries

- Endangered birds can be kept safe from predators on islands and in reserves. What other animals must first be removed from these places? Draw one of these deadly bird predators.
- Find out about the native bird sanctuary nearest you (on an island or mainland reserve), identify it on a map and write a short history of it.

## Ingrid Visser (pp.122-123)

- How has Ingrid Visser become so familiar with orca?
  - How does she fund her study of orca?
- Science Activity: Naming and Classifying the Orca
- Visit Visser's website at [www.orcaresearch.org/name.htm](http://www.orcaresearch.org/name.htm) to hear the sound of an orca and read about orca names. List some of the different names for orca from around the world.
  - One common name for orca is 'killer whales'. Research orca more (<http://animals.nationalgeographic.com.au/animals/mammals/killer-whale.html> or [www.seaworld.org/infobooks/KillerWhale/dietkw.html](http://www.seaworld.org/infobooks/KillerWhale/dietkw.html) have useful information) and

say how you think orca came to be called killer whales.

- In science, animals and plants are categorised and named to show where they fit in the natural world and how they are related to each other. The orca is a kind of dolphin. Dolphins are in the class Mammalia. Dolphins and whales belong to the order Cetacea. Cetaceans are divided into two suborders: baleen whales and toothed whales. Dolphins are classified as toothed whales. Toothed whales are further divided into families, including the ocean dolphins, Delphinidae. The Delphinidae family includes orca, which have the genus name *Orcinus*

and species name orca. Complete this family tree for the orca:

- class —
- order —

- suborder —
- family —
- genus —
- species —

## Meto Leach and Stephen Tauwhare (pp.124–125, 128–129)

- What does a ‘natural products chemist’ do?
- List traditional or new uses for these New Zealand native plants: koromiko, kawakawa, pikopiko, miro berries, harakeke, awheto.
- Read Meto’s quote on page 125. In what ways do you think the traditional Māori world view differs from the scientific view?

### English Activity: Plant Discovery

Imagine you have discovered that a particular native plant can be very useful to humans. Write a story about this discovery — what the plant is, how you learned about its special properties and what happened next.

## Bonus Activity for Early Finishers – Careers

Choose one of the disciplines in the book. Find out what the job involves, how to train for it, etc.