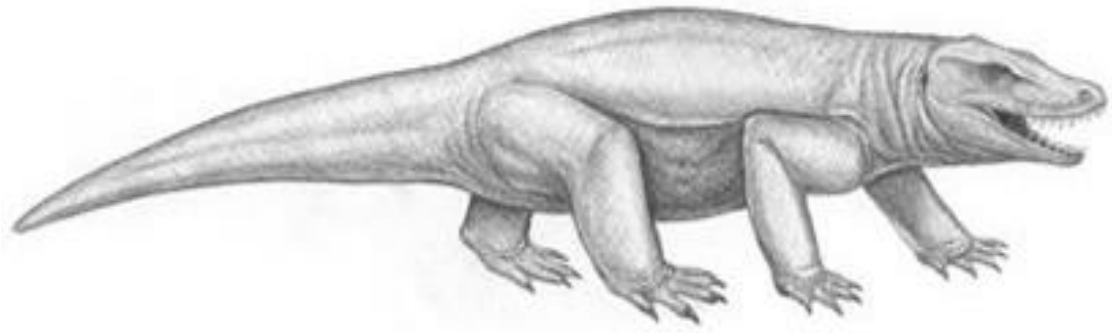
Fascinating Fossils

Educator-led Program
Stage 5



AUSTRALIAN MUSEUM

Teacher Notes

Briefing
On arrival at the Museum the students will be met and briefed about the Museum. Please ensure all students and accompanying adults attend this short this briefing.

Bag Storage
Museum staff will securely store the students' bags.

Exhibitions
Outside of any educator-led sessions students and teachers may explore the Museum's exhibitions. Some special exhibitions incur an extra charge. We suggest that you divide the students into small groups to move through the exhibitions to prevent overcrowding of the displays.

Lunch
We recommend that students bring their recess and lunch and eat it in Hyde Park. Re-entry to the Museum is free. Alternative locations will be provided in wet weather.

Photography
Students are welcome to bring mobile devices to record their excursion. There may be some photography restrictions for special exhibitions.

Free Wi-fi at the Museum
The Museum offers free Wi-fi for onsite visitors. It is available in 30 minute sessions. Students and teachers can log on for more than one session.

Photocopying
Please photocopy the following materials for students and accompanying adults:

- Student Activity Sheets: pages 6–10
- Australian Museum Guide Map: page 11

Student Mobile Devices
Students can complete their activities using their mobile device.

Pre-visit student activities
To make the most of your visit to the exhibition we recommend that you prepare your students by completing the suggested pre-visit activities.

Post-visit student activities
After your visit your students will be full of enthusiasm and ideas. We recommend some post-visit activities to harness their interest.

Front cover illustration
Megalania reconstruction.
Anne Musser, Australian Museum.

Fascinating Fossils

Fascinating Fossils is a program for Stage 5 Science students. The program is designed for a session with a Museum educator and comprises two hands-on activities.

Activity A: 'Reconstructing Animals from their Fossil Remains'
Students conduct hands-on investigations that follow the steps used by palaeontologists in fossil interpretation to reconstruct extinct Australian animals from their fossil vertebrae.

Activity B: '*Diprotodon*'
Students handle and closely examine cast and real specimens to determine relationships between two modern-day marsupials and the *Diprotodon*, an extinct Australian megafauna marsupial.

Syllabus Links

The student activities are relevant to the following New South Wales Board of Studies Science Years 7-10 Syllabus outcomes:

Knowledge and Understanding
Outcome:

- SC5-15LW: Explains how biological understanding has advanced through scientific discoveries, technological developments and the needs of society

Content:

- LW4: The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence

Skills – Working Scientifically
Outcomes:

- SC5-6WS: Undertakes first-hand investigations to collect valid and reliable data and information, individually and collaboratively
- SC5-7WS: Processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions
- SC5-8WS: Applies scientific understanding and critical thinking skills to suggest possible solutions to identified problems
- SC5-9WS: Presents science ideas and evidence for a particular purpose and to a specific audience, using appropriate scientific language, conventions and representations

Further Information

- http://australianmuseum.net.au/surviving-australia-exhibition-guide
- http://australianmuseum.net.au/event/surviving-australia
- http://australianmuseum.net.au/blogpost/lifelong-learning/diprotodon-resources
- http://australianmuseum.net.au/fossils

Pre-visit Activities

To make the most of your visit to the exhibition we recommend that you prepare your students before their excursion with some of the following suggested activities.

- Introduce concepts related to:
    - what a fossil is
    - extinction and that, over time, many Australian animals have become extinct
    - what a vertebrate is
    - the five types of vertebrates – fish, amphibians, birds, reptiles and mammals
    - organisms are classified using physical features, and those with similar features tend to be more closely related.
- Provide a context for the excursion to the Museum including the reasons for visiting the Museum, the tasks to be completed and the expected outcomes.

On-site Activities

The Fascinating Fossils activity is led by a Museum educator in the Australian Museum's **Science Studio** – a discrete room for booked education groups. Students work in small groups to complete one or two hands-on investigations in one hour.

Activity A: Fascinating Fossils – *'Reconstructing animals from their fossil remains'*
Students explore the processes used by scientists to reconstruct and interpret animals from their fossil remains, while immersed in a stimulating specimen-rich environment. Students compare the vertebrae of modern reptiles and mammals. They then identify two extinct reptiles and a mammal from fossil vertebrae and ultimately determine the approximate body sizes of two extinct Australian animals using comparisons with close living relatives.

Activity B: Fascinating Fossils – *'Diprotodon'*
Students handle and closely examine fossil casts from an extinct megafauna marsupial, *Diprotodon,* to investigate some body structures and their associated functions. They then compare *Diprotodon* skull and foot structures with two modern-day marsupials – the Tasmanian devil and the common wombat. Using their observations, students are asked to determine which modern-day marsupial is more closely related to the extinct Diprotodon.

Organisational tips

- A Museum educator will guide students to the *Science Studio* and introduce the session utilising life-size casts and models of extinct megafauna, including Australia's largest megafauna and the world's largest ever marsupial the *Diprotodon*.
- Students will then be divided into small groups, and each group will be allocated an Activity Box containing a set of specimens and information cards.
- The activities offered provide flexibility to meet the needs of the groups. Students may complete one or both activities depending on student numbers and abilities.
- The Museum educator will facilitate the investigations. Teachers should assist students where appropriate and ensure they remain on task.
- After the session, teachers can guide students to the *Surviving Australia* exhibition on Level 2 to view a life-sized *Diprotodon* reconstruction and real fossils from *Diprotodon* as well as a variety of other extinct Australian megafauna. (Note: these displays are found at the end of the *Surviving Australia* exhibition that is closest to the *Dinosaurs* exhibition.)

Post-visit Activities

After your visit to the Australian Museum we recommend the following post-visit activities.

- Students share the results of their on-site activities in a class discussion
- Students conduct further research in an area of interest from their visit, either individually or in small groups, and present their findings as a report, poster or class presentation. The Australian Museum website can be utilised to search for relevant information on evolution and Australian megafauna.

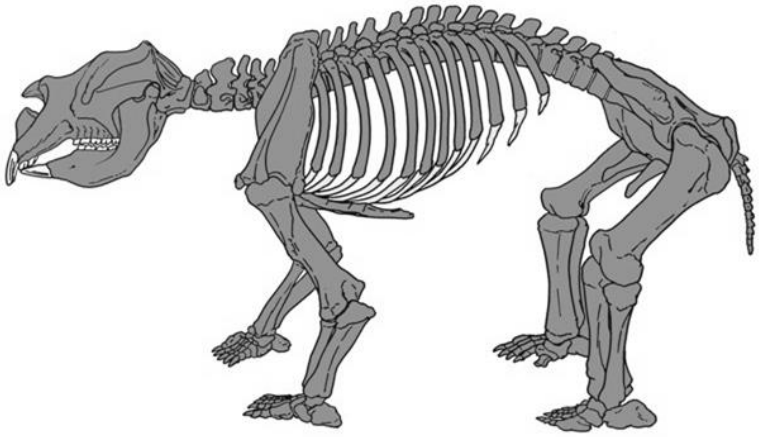


Illustration: Diprotodon skeleton.
Anne Musser, Australian Museum.

Fascinating Fossils

Stage 5 - Student Activities

Activity A: Reconstructing Animals from their Fossil Remains

Aim

To apply the processes palaeontologists use to reconstruct animals from their fossilised remains.

Photo: vertebra, Australian Museum

Instructions

Please handle all the specimens gently!
They include a variety of vertebrae from both extinct and modern-day animals.

1. Identifying fossils using comparisons with modern animals

➢ **What do we already know about modern animals?**

	How does each vertebra join to the next one? (Circle the appropriate option for each.)		
human vertebrae	flat surfaces	OR	a ball and socket
snake vertebrae	flat surfaces	OR	a ball and socket
kangaroo vertebra	flat surfaces	OR	a ball and socket

Conclusion

Mammals have vertebrae that have _____ where they join.

Reptiles have vertebrae that have _____ where they join.

➢ **Now, let's look closely at the fossils: Reptile or mammal?**

Fossil **A** is from a _____ because it has _____

_____

Fossil **B** is from a _____ because it has _____

_____

Fossil **C** is from a _____ because it has _____

_____

➢ **Further research: Narrow down the options!**

Look at the **Information Card** showing vertebrae illustrations to determine the type of animal that Fossil A and Fossil B has each come from.

Fossil **A** is from a _____ Fossil **B** is from a _____

Look around the room. What animal do you think Fossil **C** is from? _____

2. Using a fossil to estimate the size of an animal

➢ How can we estimate body size using ratios?

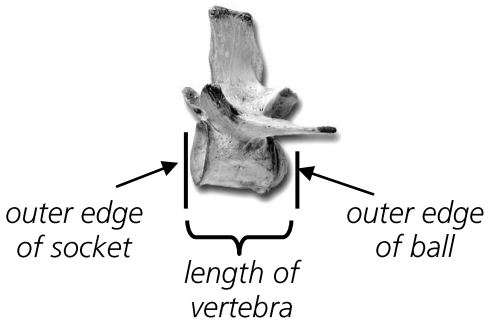
Scientists have worked out that it is possible to estimate the size of an animal from a single vertebra, using a simple ratio. For example:

Snake Ratio (vertebra length : body length) = **1 : 200**

This means that for every one unit of vertebra length, the estimated full length of a snake's body is 200 times greater.

➢ Let's estimate length using a fossil snake vertebra!

Measure: Use the diagram as a guide to accurately measure the length of Fossil **A.** Record your result in the table below.
Calculate: Apply the snake ratio (1 : 200) to calculate the estimated length of the fossil snake.
(NB: Length of snake = length of vertebra x 200)



	Length of vertebra (cm)		**Length of snake** (cm)
Snake Ratio	1	:	200
Fossil A			

3. Estimating more than one body dimension

Being able to estimate the length of different body segments allows scientists to construct a clearer picture of what an animal may have looked like!

➢ Let's look at a large lizard this time!

First we need to work out a body ratio using a modern-day animal.

a) **Measure:** Measure the X-ray of a modern-day goanna to complete the first row in the table below.

b) **Calculate**: Use your 3 goanna measurements to work out a ratio for large lizards. Enter this in the second row of the table below (shaded area).

(**Hint**: Divide each goanna measurement by the 'length of 1 vertebra' above. Round off results to the nearest whole number to make your calculations easier.)

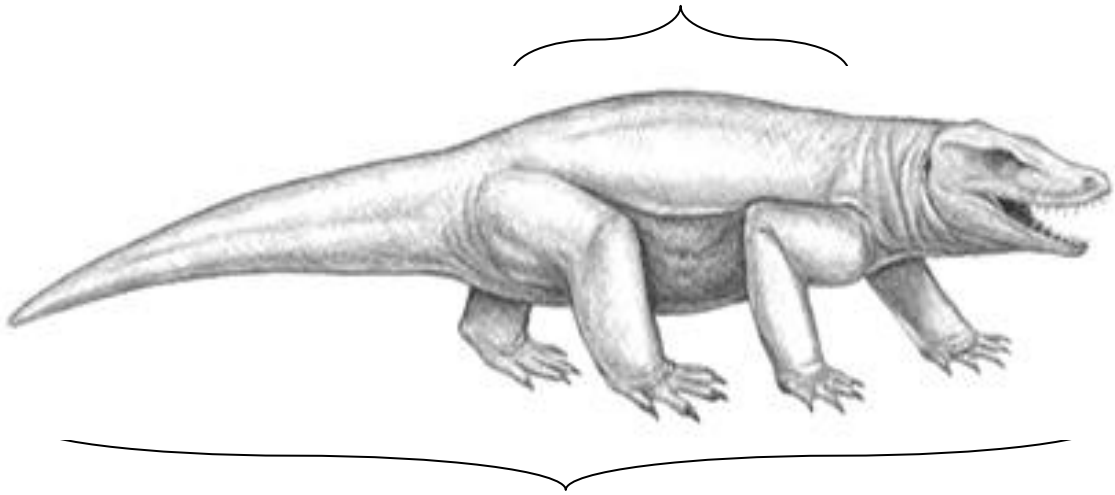
	Length of 1 vertebra (cm) (main body area)	**Distance between front and back legs** (cm) (measure along the backbone)	**Total length of animal** (cm) (from nose to tail tip)
Modern Goanna X-ray			
Large lizard ratio	1 :	:	

➢ **Now let's apply our ratio to a fossil vertebra!**

Fossil **B** is from an extinct Giant Goanna called *Megalania*.
Measure the length of Fossil **B** and complete the table below to calculate the dimensions of *Megalania*.
(Hint: Multiply Fossil **B** 'length of 1 vertebra' measurement by the large lizard ratio.)

	Length of 1 vertebra (cm)	**Distance between front and back legs** (cm)	**Total length of animal** (cm)
Fossil B (*Megalania*)			

Results Distance between front and back legs = _____ centimetres



Discussion

Tick any of the following statements that would make your investigations on body dimensions more accurate. We suggest you discuss the answers to these in class so you can explain why you agreed or disagreed with each statement.

a) Use more than one vertebra from the animal and average the results.
b) Use bones from other parts of the animal's body.
c) One person measures many times and averages their results.
d) Many people measure once and average their results.
e) For each animal, use vertebrae from both males and females.
f) For each animal, use vertebrae from both juveniles and adults.
g) Create a ratio by measuring a mixture of vertebrae from different groups of animals.
h) Measure actual specimens of goanna vertebrae instead of using an X-ray.
i) Use the large lizard ratio to calculate the size of a large snake.
j) Use an X-ray of a goanna lying in a straight rather than curved position.
k) Use more precise measuring equipment.

Fascinating Fossils

Stage 5 - Student Activities

Activity B: Diprotodon

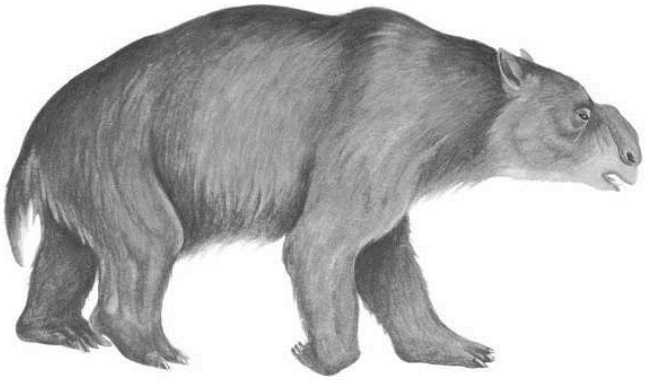


Illustration: Diprotodon.
Anne Musser, Australian Museum.

Diprotodon was a giant Australian animal and the largest marsupial that ever lived! Like many marsupials, *Diprotodon* protected its young inside a pouch.

Diprotodons lived in Australia during the last two million years and were extinct by about 30,000 years ago. Although they no longer wander through our woodlands and grasslands, their fossils have been found in many parts of Australia.

Let's look at some *Diprotodon* fossils and find out more.

Aim

To find out which modern-day Australian animal is most closely related to the extinct *Diprotodon* by comparing the skeletons of a *Diprotodon*, a wombat and a Tasmanian Devil.

Method

1. Look at the photos of *Diprotodon* and the large life-sized replica of a *Diprotodon* skull.
2. Unpack the *Diprotodon* fossils from the box and look at them carefully.
3. Use the specimens and the Photo inventory card to label the skeleton below to show where each fossil is found.

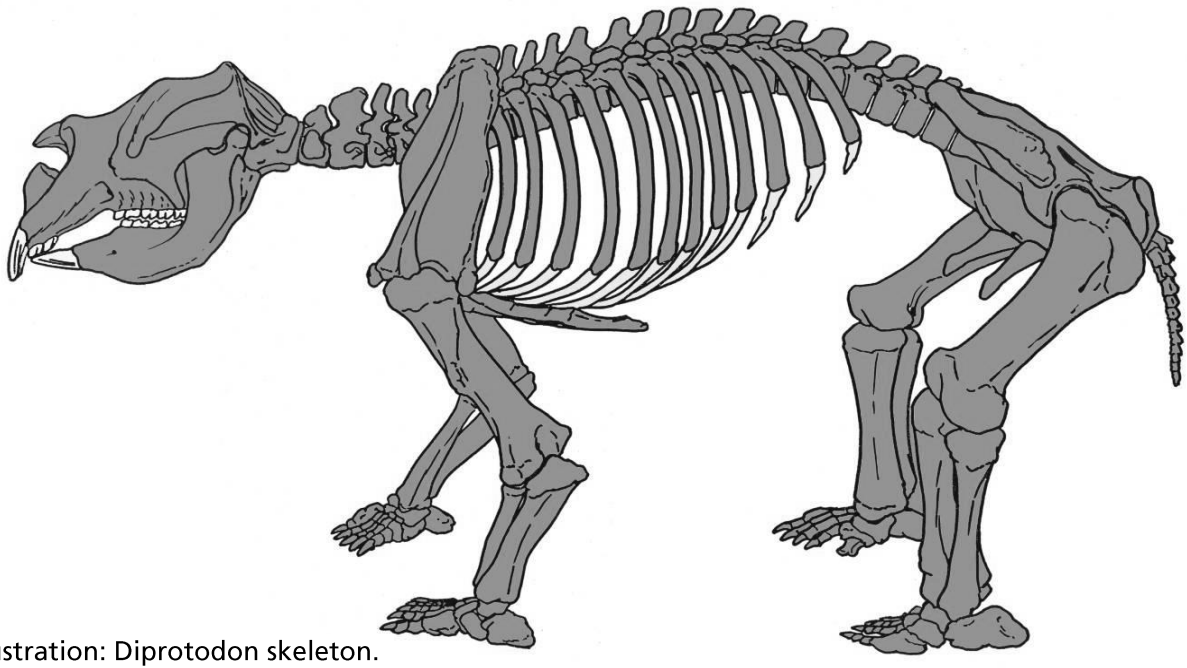


Illustration: Diprotodon skeleton.

4. Write a description of each fossil and then draw a line to match it with its function.

Fossil	Description
rib	
back foot	
tooth	
vertebra	
pouch bones	

Function
used for chewing plants
supports the weight of the pouch
holds the weight of the animal
protects the spinal cord, helps support the body
helps protect the heart and lungs

5. Read information Card A and Card B and also examine the skulls of the modern-day wombat and Tasmanian Devil.
6. Use the skulls, specimens and cards to compare the wombat, Tasmanian Devil and *Diprotodon* then complete the table below.

Results

	Tasmanian Devil	*Diprotodon*	Wombat
upper incisors (front teeth) – number and size in upper jaw			
lower incisors (front teeth) – number and size in lower jaw			
canines (just behind the incisors) – present or absent			
toes on back foot – number and size			
top of skull – flat or bumpy or has a raised crest			

Conclusion

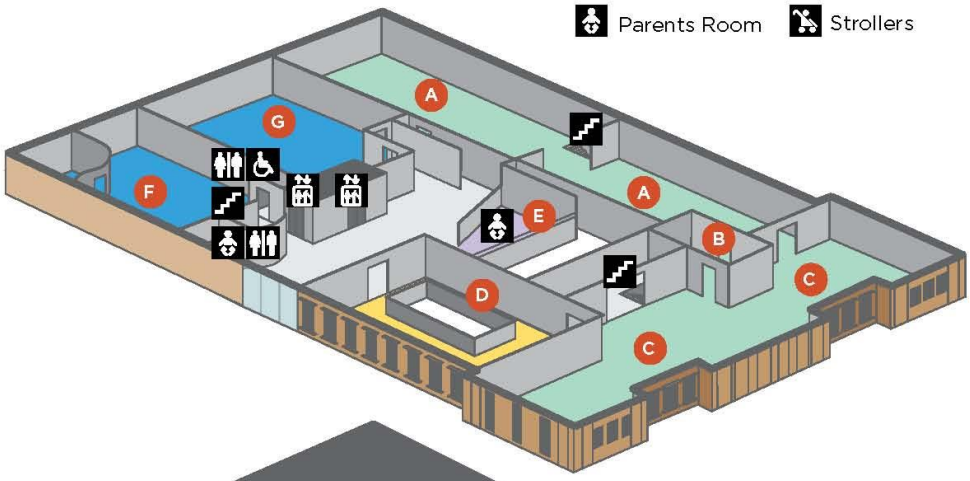
1. Using your results, which modern-day animal do you think is a close relative of the *Diprotodon?* Give reasons for your answer.

4 Rooftop Cafe

Visit our new Rooftop Cafe
Take the lift or stairs to Level 4
and enjoy food with a view.

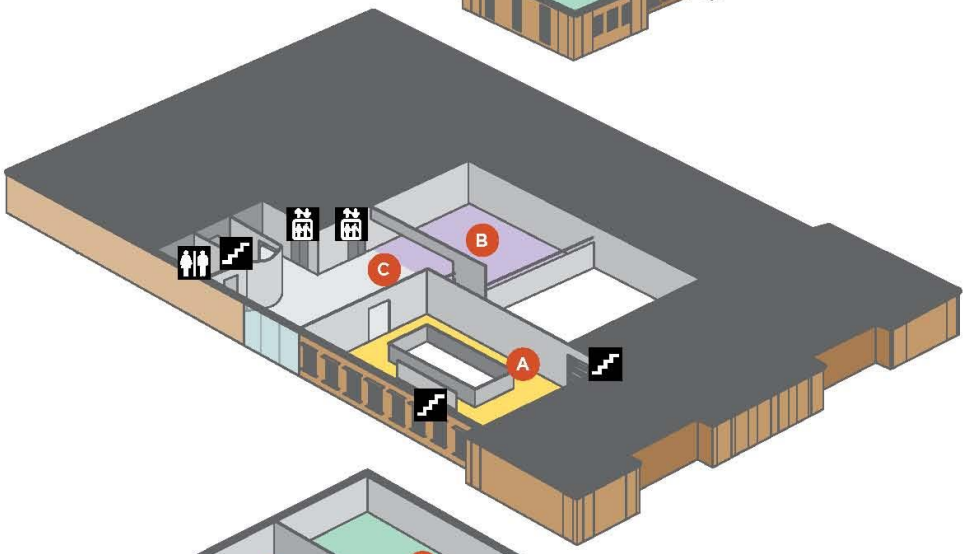
- Admissions
- Information
- Toilets
- Accessible
- Parents Room
- Theatre
- Stairs
- Lifts
- Lockers
- Strollers

2



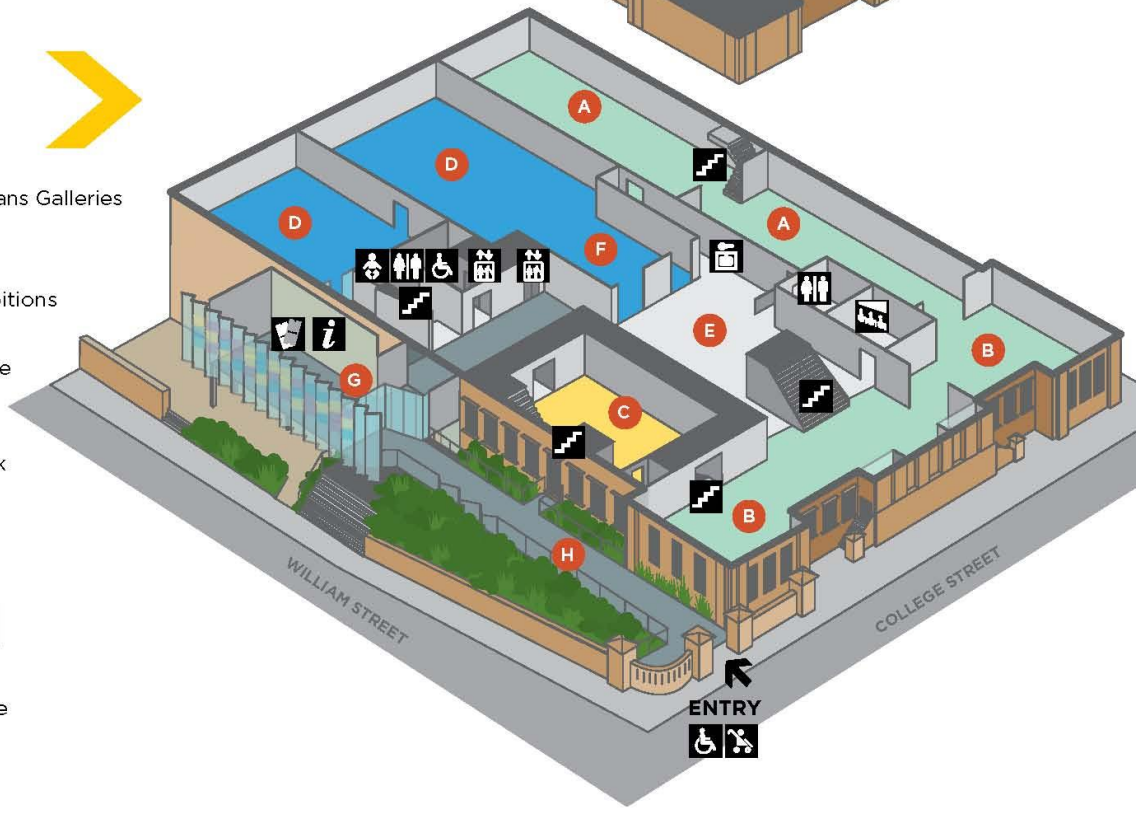
- A Surviving Australia
- B Pacific Spirit
- C Dinosaurs
- D Birds & Insects
- E Kidspace
- F Search & Discover
- G Education Rooms

1



- A Planet of Minerals
- B Chapman Mineral Collection
- C Meteorites & Gemstones

G



- A First Australians Galleries
- B Wild Planet
- C Long Gallery
- D Special Exhibitions
- E Atrium
- F Museum Store
- G Crystal Hall Entrance
- H Museum Walk

LG

Members Lounge