

Evolution and natural selection

Self-guided program Stage 5



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 6-15
- *Surviving Australia* exhibition floorplan – page 16
- Australian Museum Guide Map – page 17

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

Illustration: *Thylacinus potens*
Anne Musser, Australian Museum

Evolution and natural selection

Evolution and natural selection is a program for Stage 5 students. The activities are designed for a self-guided visit to the **Surviving Australia** exhibition.

Syllabus links

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

Knowledge and Understanding

Outcome	Content
SC5-14LW: Analyses interactions between components and processes within biological systems	<u>LW1</u> : a) describe some examples of how multicellular organisms respond to changes in their environment <u>LW2</u> : d) analyse how changes in some biotic and abiotic components of an ecosystem affect populations and/or communities <u>LW3</u> : b) identify that during reproduction the transmission of heritable characteristics from one generation to the next involves DNA and genes
SC5-15LW: Explains how biological understanding has advanced through scientific discoveries, technological developments and the needs of society	<u>LW4</u> : The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence. (ACSSU185)
SC5-12ES: Describes changing ideas about the structure of the Earth and the universe to illustrate how models, theories and laws are refined over time by the scientific community	<u>ES2</u> : The theory of plate tectonics explains global patterns of geological activity and continental movement. (ACSSU180)

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>

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 evolution, natural selection and adaptations
- Introduce or revise relevant terminology used in the Evolution and natural selection student activity sheets
- 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.

At the Museum

The Evolution and natural selection program is designed to be conducted in the ***Surviving Australia*** exhibition on Level 2 of the Australian Museum.

On-site activities

The on-site activities enable students to explore concepts related to evolution, natural selection, adaptations and diversity while surrounded by a rich array of live and prepared specimens.

There are six self-guided activities based in different sections of the *Surviving Australia* exhibition (see *Surviving Australia* exhibition floorplan attached). The activities are:

1. The importance of environment
2. Penguin diversity – related but different
3. Adapting to environmental challenges on land and in freshwater
4. Adapt or die: specialists over time
5. Megafauna birds from Australia's past
6. Cloning the Tasmanian Tiger

For more information regarding the content of the *Surviving Australia* exhibition, please follow the Australian Museum internet link on page 3 to the 16-page Exhibition Guide.

Organisational tips

- Guide students to the *Surviving Australia* exhibition on level 2 of the Museum.
- There are six activities. Each one will take students 10-15 minutes to complete.
- If you have limited time e.g. one hour only in the exhibition, you may decide to select four core activities for the students to concentrate on.
- Organise the students to break into small groups. Each group should be given a different activity to start with then asked to rotate through the various activities in order to avoid overcrowding of the displays.
- Advise the students that each activity is located in a different section of the exhibition. A floorplan located at the end of the activity sheets indicates the various sections needed.
- Students should also be allowed some supervised free time to explore any displays that capture their interest. This could be combined with an informal discussion back at school – 'what most captured my interest and why'.

Note: The **Scientists' Stories** presented in the mini theatrette (Activities 5 and 6) are shown in a fixed order, so there could be up to a 10-minute wait for a particular story to begin.

Post-visit activities

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

- Share results from on-site activities in a class discussion
- Undertake further research in an area of interest – search the Australian Museum website for relevant information on Australian wildlife, evolution, natural selection, adaptations and diversity.





Illustration: *Obdurodon dicksoni*.
Anne Musser, Australian Museum.

Evolution and natural selection

Stage 5 - Student Activities




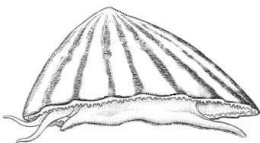
General instructions:

-  Go to the *Surviving Australia* exhibition on Level 2 of the Australian Museum. An exhibition floorplan is located at the end of these activity sheets. It shows the locations of the various sections you will need.
-  Break into small groups. Each group **starts with a different activity** then rotates through the various activities. Otherwise the displays will be crowded and you will not be able to see and explore them properly.

Activity 1: The importance of environment

Living things often evolve features that help them live in their environments. The environment is therefore an important part of natural selection and evolution.
It's not just about genes!

-  Go to the **Blue edge** section and look at the animals on display. Think about what feature(s)/adaptation(s) they have to help them live in their environment. The limpet has been used as an example below.

name	feature/adaptation	how the feature/adaptation helps the animal survive
Limpet 	<ul style="list-style-type: none">• shell is low and conical in shape• has a strong muscular foot under the shell	<ul style="list-style-type: none">• shell shape makes them difficult to turn over or pick up and helps protect the limpets from predators• foot holds them tightly to the rocks and helps protect the limpets from being washed away by waves

1. What might happen to individual limpets that do not possess (a) a low conical shell or (b) a strong muscular foot?

- a) _____
- b) _____

2. How do you think a limpet's ability to hold tightly onto rocks affects its ability to reproduce?



Using the table above as an example, select two other sea creatures that you can see on display. Name and draw each in the table below. Describe one or more feature(s)/adaptation(s) that help each animal live in its environment. Think about the animal's adaptations and environment and explain how the adaptations help the animal to survive.

animal's name and diagram	feature/adaptation that helps the animal live in its environment	how the feature/adaptation helps the animal survive

3. Select one of your animals above, and describe how evolution may have changed this species' features over many generations.

Name: _____

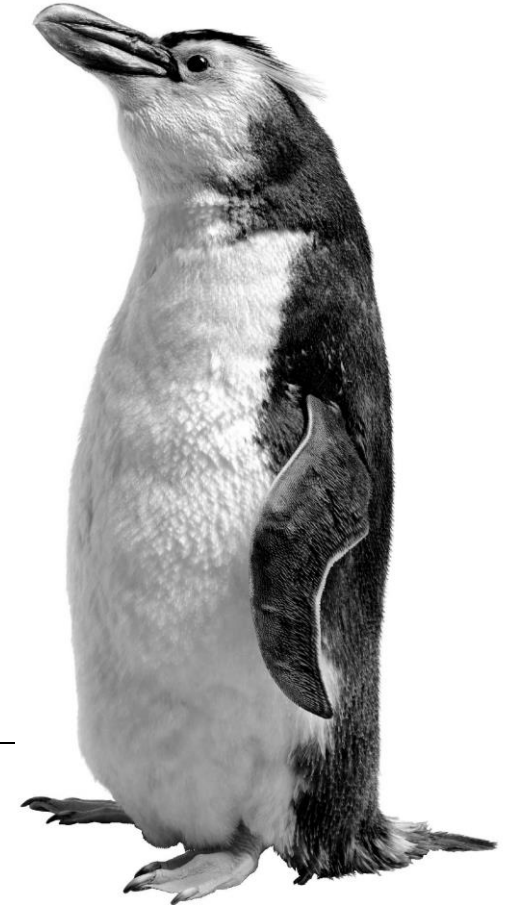
Possible changes over time: _____

Activity 2: Penguin diversity – related but different

Penguins galore

There are 17 species of penguins in the world and they all live in the southern hemisphere.

All penguins came from a common ancestor. Over time, the populations spread to different habitats and diversified. Ultimately different species evolved and we now see today's marvellous penguin diversity.



Go to the **Island homes** section. Look closely at the different penguins – six species are displayed.

1. Describe **at least four** physical characteristics common to all the penguins – some of the features that make a penguin a penguin.



Use the information in the **Penguins galore** display to answer the following questions:

2. What is the largest living penguin and where does it live? _____
3. What is the advantage of being large in a cold environment? _____

4. What is the smallest penguin species and where does it live? _____
5. Do you think the largest and smallest penguins would be able to swap places and live in each other's environments? _____
Explain. _____



Look closely at **three** of the penguins including the smallest, the largest and one other penguin. Complete the table below to describe any differences between them. You might find it easiest to explain some of the differences with simple labelled drawings for each penguin.

	smallest penguin	largest penguin	one other penguin
name			
differences:			
• body size	smallest (40 centimetres tall)	largest (1.1 metres tall)	
• beaks, feet and/or other feature			

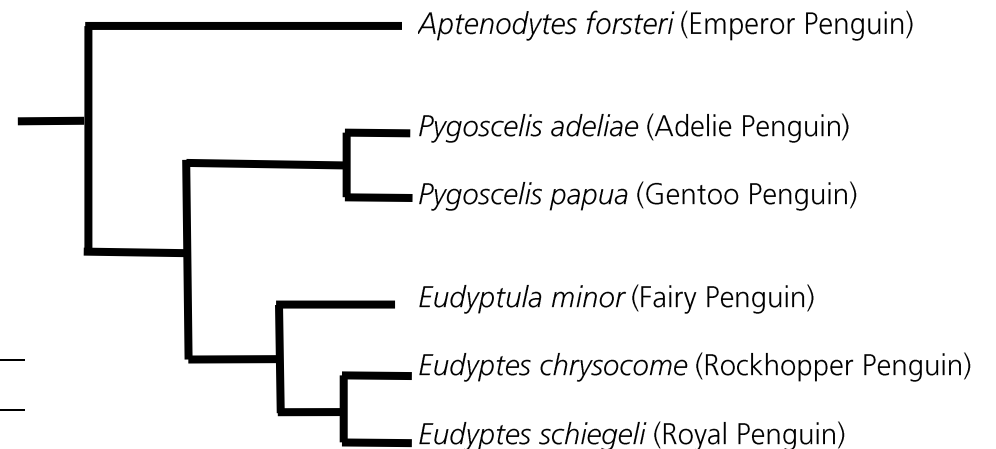


Circle the three penguins you compared in the evolutionary tree below. Then answer the questions.

6. Of your three penguins, which two are most closely related?

7. Are the two closely related penguins more similar in appearance?

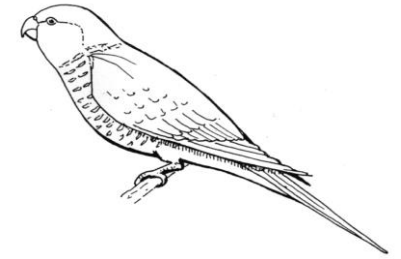
8. Do you think relationships can always be decided using external appearance alone? What other factors could be important?



Activity 3: Adapting to environmental challenges on land and in freshwater



Go to the **Adapt or die: land and freshwater** section. This section of the exhibition looks at some of the strategies animals use to help them survive in land and freshwater environments. Use the information in the displays to learn about the survival strategies listed below. Then draw lines to match each survival strategy (in the boxes on the left) with its correct meaning (in the boxes on the right).



Survival strategy:

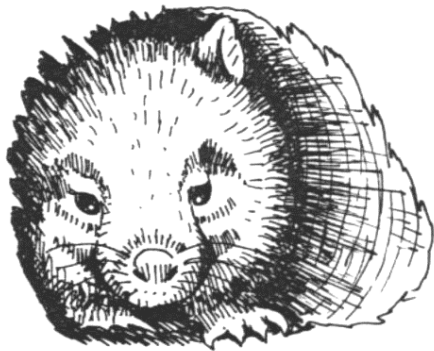
living in freshwater

wandering

boom and bust

living underground

extreme recycling



Meaning:

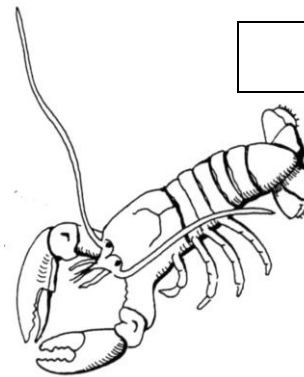
stay cool when it's hot, warm it's cold,
and dry when it's wet

survive in freshwater and move to
new water bodies when necessary

make super-efficient use of water

survive the long wait for rain
then breed quickly when conditions improve

move from place to place
to find water and food





Choose two animals that use different survival strategies (see the list of survival strategies on the previous page). Look closely at the animals and use the information in the displays to complete the table. The first row has been completed as an example.

animal's name	survival strategy	adaptations for this strategy
Freshwater Crocodile	lives in freshwater	<ul style="list-style-type: none">• can lie low in the water with only eyes and nostrils exposed for camouflage• has streamlined body to easily move through water• has strong tail and webbed back feet for fast, quiet swimming



Think about the survival strategies you have been exploring in this activity. Several animals in the **Adapt or die: land and freshwater** section use a combination of survival strategies (although only one strategy has been highlighted for each animal). Find one animal in this section that uses **two** of the listed survival strategies. Then complete the table below.

animal's name	survival strategies	adaptations for these strategies

Activity 4: Adapt or die: specialists over time

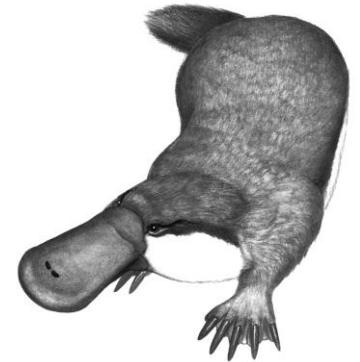
Gondwana

The continents that are found in today's southern hemisphere were once joined together in a massive supercontinent called Gondwana. Over many millions of years Gondwana slowly broke apart. The last three continents to separate were South America, Antarctica and Australia.

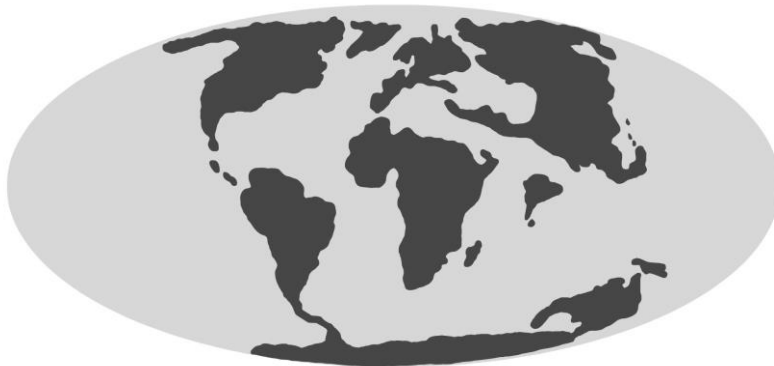


Go to the **Adapt or die: specialists over time** section where you can see some weird and wonderful animals from Australia's past. Find **The puzzle of the Platypus** display and use the information in the display to answer the following questions.

1. In the 1990s platypus fossils were found in South America. When did this platypus live? _____
2. Do you think that the existence of an ancient South American platypus provides **evidence** that South America and Australia were once joined? Explain.



Look closely at the world maps shown below. Use the maps and information above to answer the following question.



3. Which world map do you think provides the best description of the continents at the time the South American platypus lived? Place a **tick** next to the map you chose and explain why you chose that map.



Find the **Echidnas – beaks long and short** display. Use the information in the display to answer the following.

4. Draw lines to match each echidna beak length with the correct diet and then the correct environment that it lives in.



Echidna beak length:

long-beaked

short-beaked

Diet:

ants and termites

insect larvae and
earthworms

Environment:

dry environments

moist rainforests

Echidnas first evolved about 15 million years ago. Over their long history in Australia, most echidnas had long-beaks. Short-beaked Echidnas evolved about 100,000 years ago. Fossils show that both long-beaked echidnas and Short-beaked Echidnas used to live in Australia. Then about 15,000 years ago, long-beaked echidnas became extinct in Australia although they still live in the rainforests of New Guinea.



Use the information in the **Echidnas – beaks long and short** display, the information above and your answer to question 4 to answer the following questions.

5. (a) Using echidnas as evidence, how have environments in Australia changed over the last 15 million years? _____
- (b) How did the environmental changes affect the types of foods available to echidnas? _____
- (c) What effects did these changes have on the different echidnas? Were they able to adapt to the changes? _____

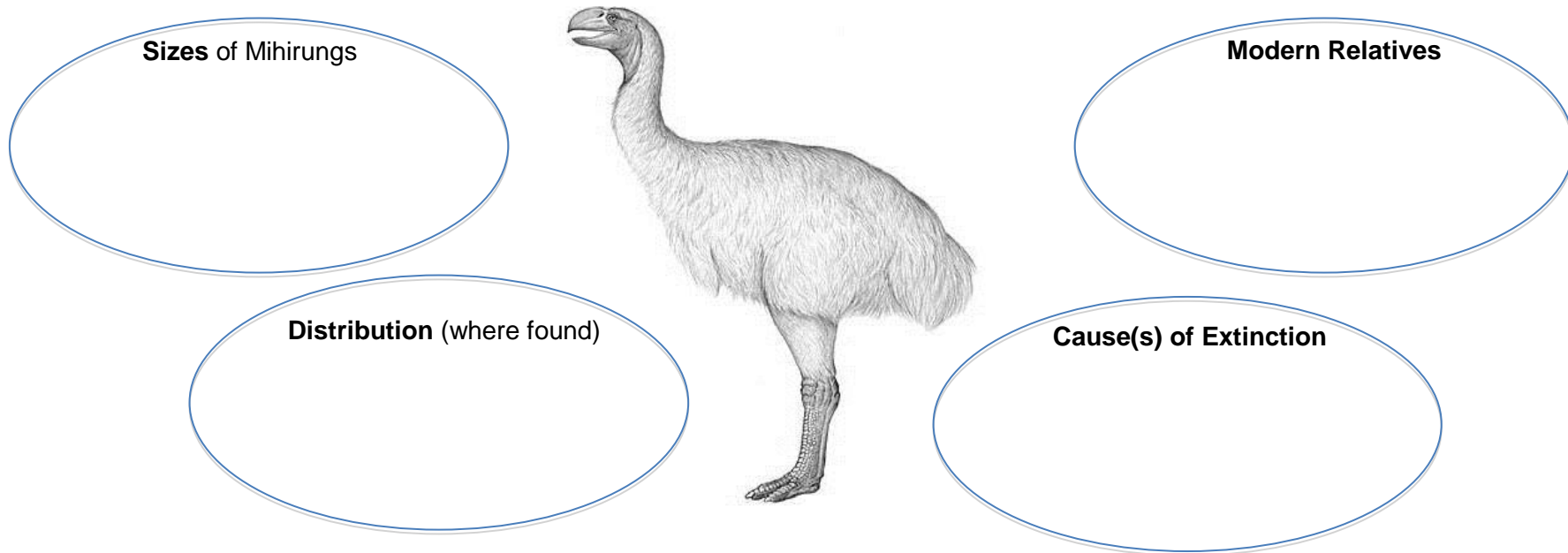
Activity 5: Megafauna birds from Australia's past

👉 Go to the **Scientists' stories** mini theatrette to watch the story about the extinct **Demon Duck of Doom** (you may need to come back*).

*Story loop times: Ibis (3min 39s), Insects (3min 35s), Fish (4min 9s), **Demon duck of doom** (3min 23s) and Tasmanian tiger (2min 41s).

👉 Watch the story presented by Australian Museum scientist Dr Walter Bowles to learn about an extinct group of giant birds, the mihirungs.

1. While you watch the film, **listen** for information about the four topics below and **write** notes in each egg to summarise the story.



2. What subjects do you think the scientist in this story might have studied at school or University to end up in his job?

STAY IN THE THEATRETTE. TURN TO ACTIVITY 6 and WATCH THE NEXT FILM ON CLONING THE TASMANIAN TIGER

Activity 6: Cloning the Tasmanian Tiger

Have you done Activity 5 yet? The film about the Demon Duck of Doom is immediately before this one!







Go to the **Scientists' stories** mini theatrette and watch the story about **Cloning the Tasmanian Tiger***. It features Australian Museum scientist Dr Les Christidis, and reveals some of the problems behind the attempts to bring the extinct Tasmanian Tiger back to life.

*Story loop times: Ibis (3min 39s), Insects (3min 35s), Fish (4min 9s), Demon duck of doom (3min 23s) and **Tasmanian tiger** (2min 41s).



While you watch the film, write a note in each box below to provide a synopsis of the storyline.

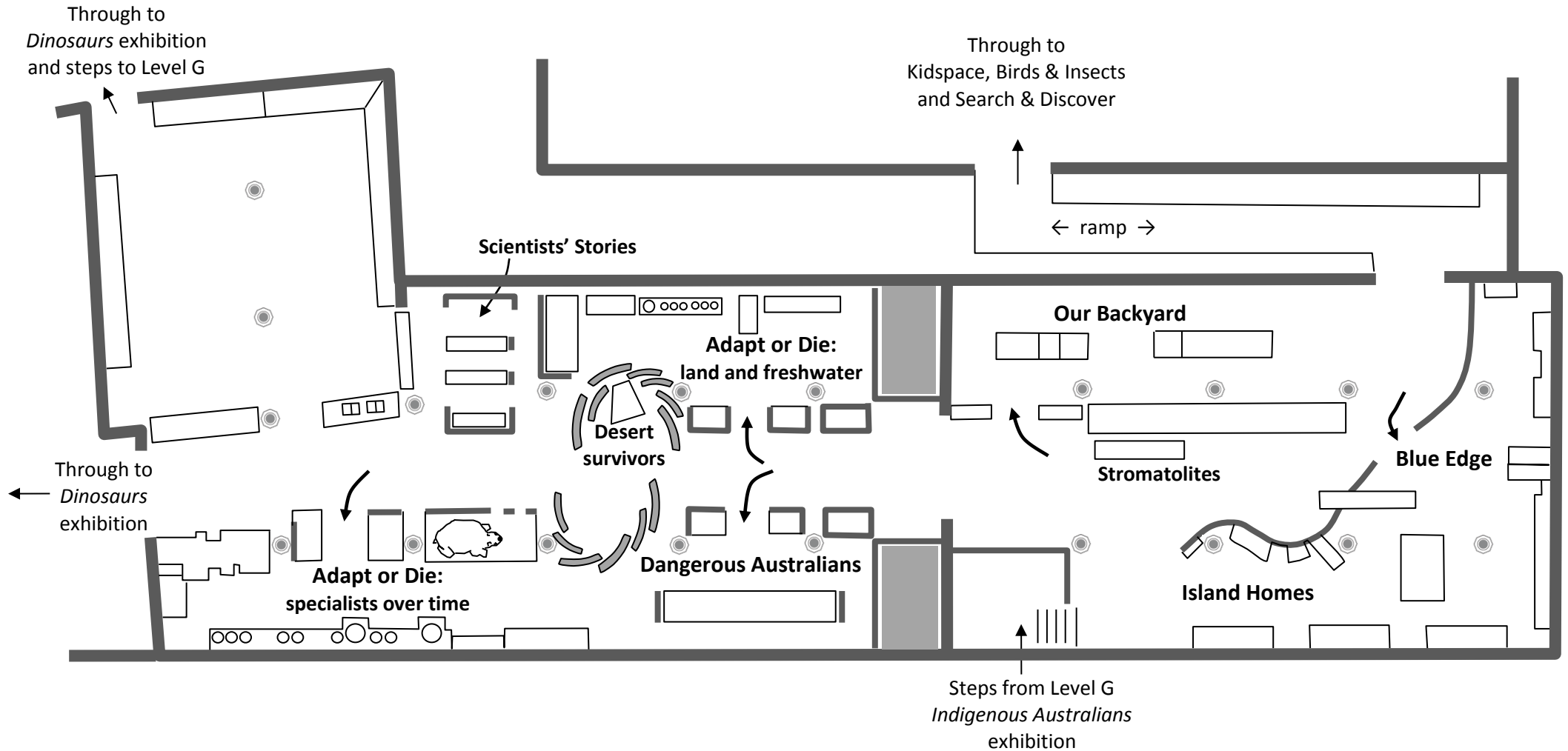
<p>Can we bring back the extinct <i>Thylacine</i>?</p> 	<p>1. The story begins in Year...</p>	<p>2.  →  DOLLY</p>
<p>3. </p>	<p>4. ?? Surrogate mother??</p>	<p>5. <i>The most important lesson learnt ...</i></p>



Go to the **Adapt or die** section of the exhibition. Look at the displays on the Tasmanian Tiger.

9. When did the Tasmanian Tiger die out on the Australian mainland? _____

10. What was one possible cause of this? _____



Surviving Australia exhibition floorplan

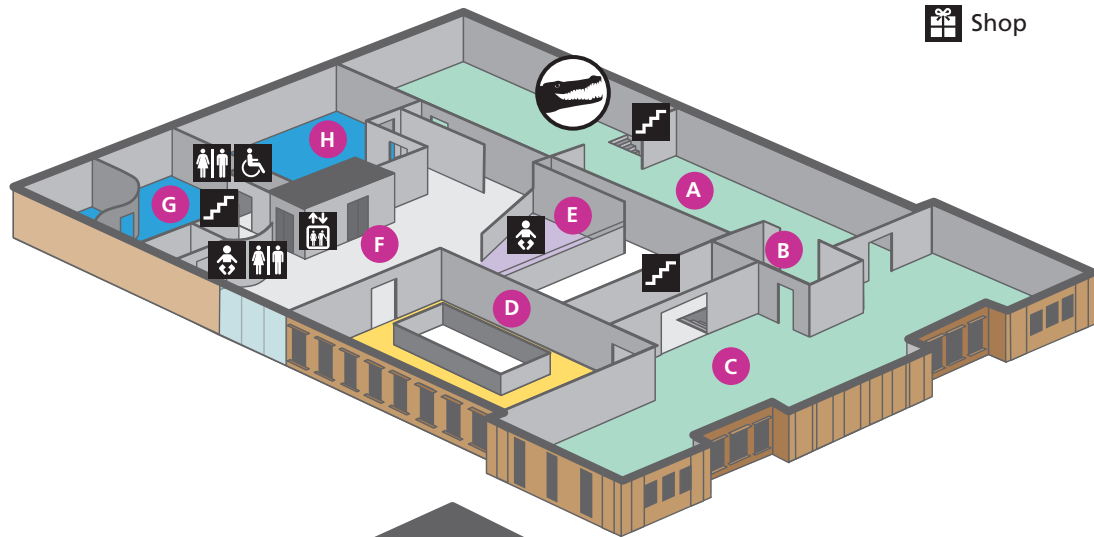
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Rooftop Cafe

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

2

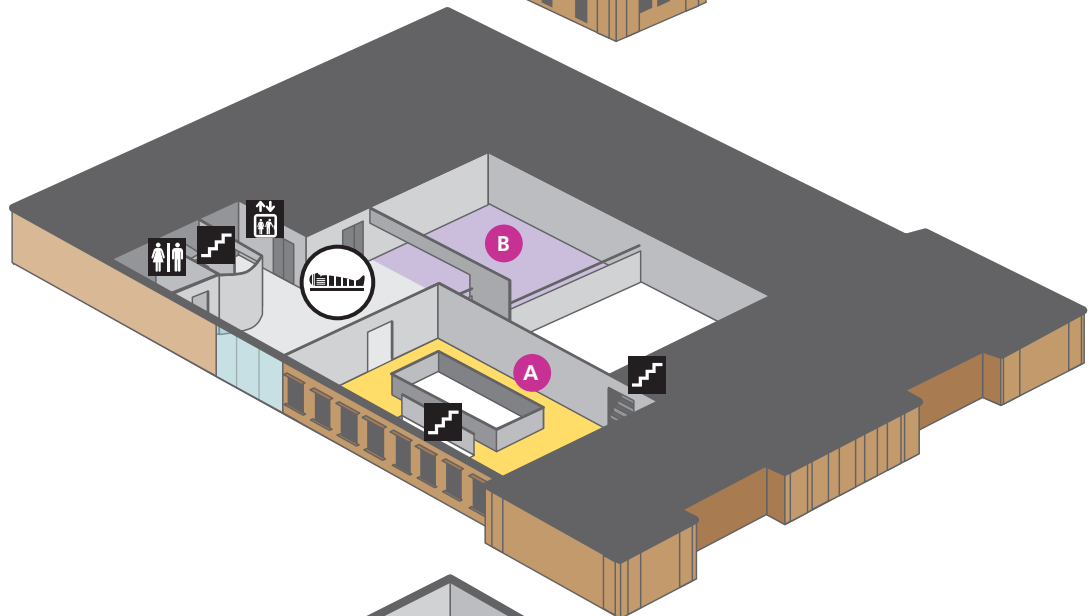
- A Surviving Australia
- B Pacific
- C Dinosaurs
- D Birds & Insects
- E Kidspace
- F Group meeting point
- G Search & Discover
- H Event space



- Admissions
- Information
- Toilets
- Accessible
- Baby care
- Theatre
- Stairs
- Lifts
- Lockers
- Strollers
- Shop

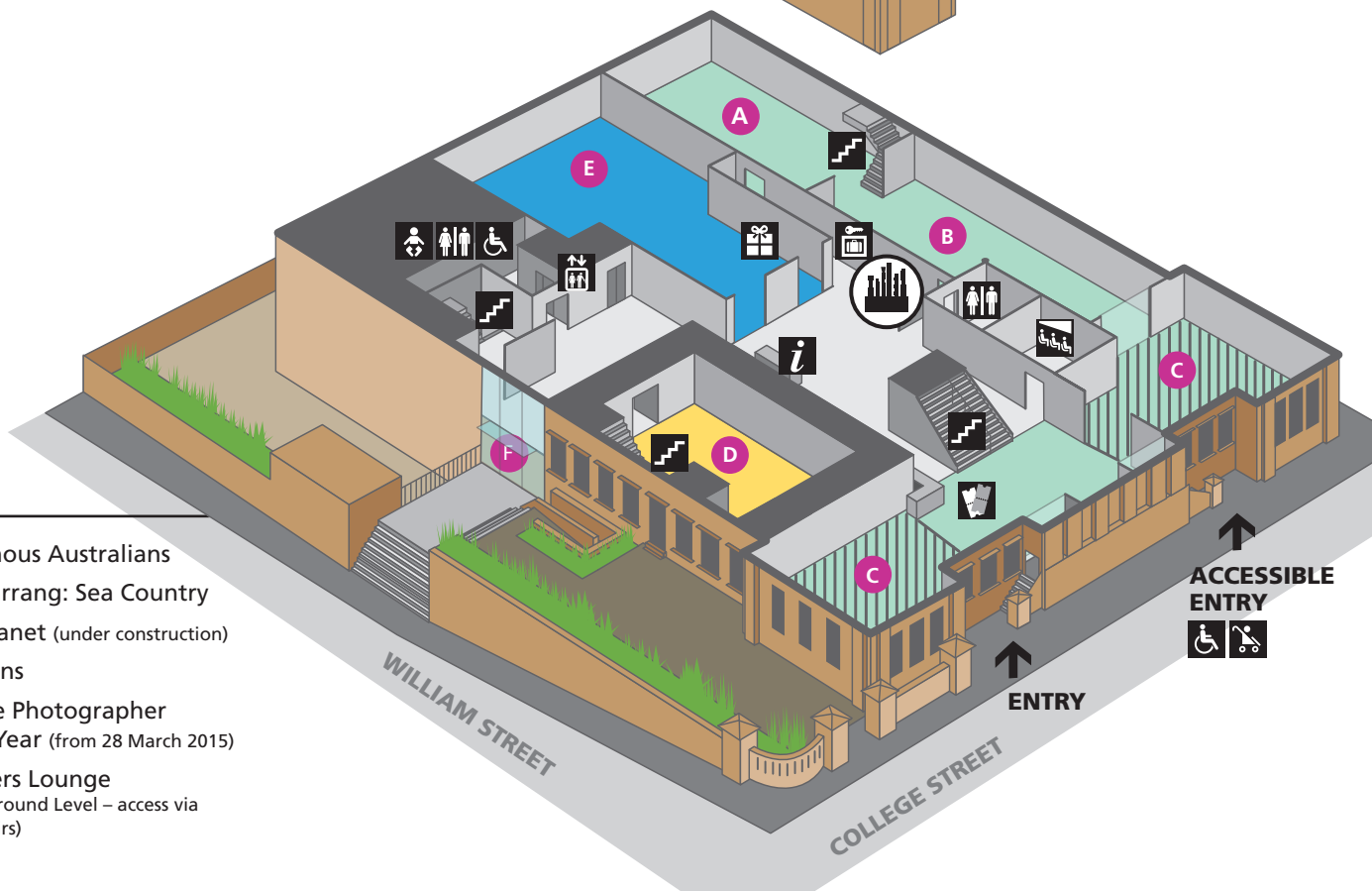
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- A Planet of Minerals
- B Chapman Mineral Collection



G

- A Indigenous Australians
- B Garrigarrang: Sea Country
- C Wild Planet (under construction)
- D Skeletons
- E Wildlife Photographer of the Year (from 28 March 2015)
- F Members Lounge (Lower Ground Level – access via lift or stairs)



ACCESSIBLE ENTRY
♿️

ENTRY

WILLIAM STREET

COLLEGE STREET