Evolution and Biotechnology

Teacher Toolkit

Stage 5

OUTCOMES CONTRIBUTED TO:

SC5-14LW

SC5-15LW

New Syllabus

SC5-GEV-01

SC5-ENV-01

Welcome to the Sydney Zoo Teacher Toolkit

Our vision is to secure a sustainable future for wildlife through making connections between your students and our animals.

'Bringing Nature into a classroom can kindle a fascination and passion for the diversity of life on earth and can motivate a sense of responsibility to safeguard it'.

Sir David Attenborough

What is in this toolkit:

- Syllabus-linked pre-visit activities
- Resources for guided and self-guided visits to the Zoo to ensure your students get the most out of their visit – see Student Booklet for printable worksheets for your excursion.
- Links to provide further information

Resources required to best use this toolkit:

- Computer and screen or smartboard
- Internet access
- Tools and 'food' types for evolution activity (see full list on page 4)

Sydney Zoo acknowledges the Darug nation, their people, past, present and their future generations.

Outcomes and content

Stage	Outcomes	Content
Stage 5	A student: - analyses interactions between components and processes within biological systems (SC5-14LW) - explains how biological understanding has advanced through scientific discoveries, technological developments and the needs of society (SC5-15LW)	**Content contributed to** LW3: Advances in scientific understanding often rely on developments in technology, and technological advances are often linked to scientific discoveries. e. describe, using examples, how developments in technology have advanced biological understanding, eg vaccines, biotechnology, stem-cell research and in-vitro fertilisation f. discuss some advantages and disadvantages of the use and applications of biotechnology, including social and ethical considerations LW4 The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence. Students: a. describe scientific evidence that present-day organisms have evolved from organisms in the past b. relate the fossil record to the age of the Earth and the time over which life has been evolving c. explain, using examples, how natural selection relates to changes in a population, eg in the development of resistance of bacteria to antibiotics and insects to pesticides d. outline the roles of genes and environmental factors in the survival of organisms in a population
New Syllabus	A student: describes the relationship between the diversity of living things and the theory of evolution **SC5-GEV-01** analyses the impact of human activity on the natural world **SC5-ENV-01**	**Variation and inheritance** - Identify that multiple genes and multiple environmental factors interact in the development of most traits - Explain how DNA mutation can result in genetic variation with beneficial, harmful or minimal effects on the functioning of an organism **The theory of evolution and evidence of natural selection** - Explain how the processes of natural selection and isolation can lead to changes within and between species - Discuss how scientists developed and refined the theory of evolution, and explain why an understanding of the origins of species is important

Optional pre-visit activities – Defining Natural Selection and Conservation

Outcomes	Learning Activity	Resources
	Share the definition of evolution by natural selection.	
SC5-14LW **SC5-GEV-01**	**Activity 1:** Galapagos Beaks – to share the theory of natural selection, we will be mimicking toothpicks Island Finches that led Charles Darwin to this theory. In small groups, students will be posing as the bird's toothpicks trying to 'eat' different foods. Each student will need a tool that will act as their 'beak' and a bowl or cup to collect their food. E,g, pegs, tweezers, chop sticks, bobby pins, forks Each group will need different types of 'food' e.g. dried beans, toothpicks, flower petals or other small items that are easily used in the lab. The aim is for students to start 'eating' the different kinds of foods, they will find their tool is better suited for certain food types or they may be a generalist and able to easily eat all types of food. Students can collate their data and create a graph showing which kinds of foods were more easily consumed by each 'beak' type to compare success rates. Explanation: In the Galapagos Islands, the speciation that occurred was determined by environmental and genetic factors. Founder populations of birds arrived on each island from the mainland, but the food options on each island differed. The birds that survived to reproduce were able to eat the specific food types more easily on each island, leading to the evolution of specifically adapted beak types as the offspring of successful birds inherited those characteristics that made their parents successful. The competition for food (scarcity on some islands) would have added pressure to the selection process.	Pegs, bobby pins, tweezers and other grabbing/stab/shovel tools for students. Food types e.g. Dried beans Toothpicks Flower petals Dried lengths of spaghetti Short video by Fuse Education explaining the Galapagos Finches https://youtu.be/s64Y8sVYfFY?si=6LGnByKt4yG0n50x
SC5-ENV-01	**Activity 2:** What is sustainability? What is conservation? At the zoo, the word conservation will be used. What does this mean? Take answers from students and brainstorm as a class – what does it mean to them? What ways to humans try to conserve wild places? How do we try to live more sustainably – brainstorm. Can include ideas such as national parks, global protection for endangered species (CITES), breeding programs for release back to the wild, working with communities that live alongside wild places to minimize conflict between humans and wildlife. There are many ways!	Board or paper for a brainstorm Front | CITES

Visiting Sydney Zoo

Students will learn about the theory of evolution by natural selection, the diversity of living things and the evidence behind the theory.

Students will also learn about different technologies used in the zoo industry to aid in conservation and how important they can be for the survival of species.

Pre-visit checklist:

- Pre-visit activities
- Behaviour expectations of students while visiting Sydney Zoo
  - Students must always be accompanied by a teacher
  - Follow instructions of your teacher and zoo staff
  - Take only photographs and memories, leave only footprints and smiles
  - If you get lost, find a staff member in uniform and tell them you need help
  - Have a lot of fun and ask lots of questions!
- Ask students to prepare low waste/waste free lunches if possible. We love seeing the students' being low waste/waste free – please brag about this to us
- Wet-weather preparation if the forecast is not favourable (some of our animals love wet days so don't worry about them hiding away)

Upon arrival::

- Check in with our wonderful Visitor Experience team
- Enjoy your visit with us and please ask any staff for assistance if required
- Students must always be accompanied by a teacher

We recommend allocating small groups to adult supervisors. **Download** our '**survival guide for teachers**'

What is a low or no waste lunch?

- **Sourcing foods that have minimal or no packaging and using reusable containers to carry food.**
- **Bringing your own reusable drink bottle and refill it.**
- **Carrying your own reusable cutlery set.**

Examples

- Sandwiches - without clingwrap, they can stay fresh in a suitable reusable container or beeswax reusable wrap.

- **Fruit** - apples, bananas and mandarins are easy to eat and/or peel at school or the Zoo, the core and skin can go in the organic bins.
- **Nuts, dried fruit, biscuits, popcorn etc.** in a small reusable container, buy them in bulk to reduce packaging and put servings into small containers for snacks.

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