Suggested teaching program

Chapter 2: Evolution

Time allocation: 4 weeks

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| Context and overview | | | | |
| In year 10, students explain the theory of evolution by natural selection base to explain the diversity of living things and the scientific evidence which supports evolutionary theory. Students evaluate the validity and reliability of claims made in secondary sources with reference to currently held scientific views, and construct evidence-based arguments to communicate science ideas for specific purposes. | | | | |
| Syllabus outcomes addressed | | | | |
| The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence [(ACSSU185)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSSU185)  Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community [(ACSHE191)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE191)  Advances in scientific understanding often rely on technological advances and are often linked to scientific discoveries [(ACSHE192)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE192)  People use scientific knowledge to [evaluate](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=evaluate) whether they accept claims, explanations or predictions, and advances in science can affect people’s lives, including generating new career opportunities [(ACSHE194)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE194)  Values and needs of contemporary society can influence the focus of scientific [research](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=research) [(ACSHE230)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE230)  Formulate questions or hypotheses that can be investigated scientifically [(ACSIS198)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS198)  Plan, select and use appropriate [investigation](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=investigation) types, including field work and laboratory experimentation, to collect [reliable data](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=reliable+data); assess risk and address ethical issues associated with these methods [(ACSIS199)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS199)  Select and use appropriate equipment, including [digital technologies](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=digital+technologies), to collect and record [data](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=data) systematically and accurately [(ACSIS200)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS200)  [Analyse](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=analyse) patterns and trends in [data](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=data), including describing relationships between variables and identifying inconsistencies [(ACSIS203)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS203)  Use knowledge of scientific concepts to draw conclusions that are consistent with [evidence](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=evidence) [(ACSIS204)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS204)  [Evaluate](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=evaluate) conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the [data](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=data) [(ACSIS205)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS205)  Critically [analyse](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=analyse) the [validity](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=validity) of information in primary and secondary sources, and [evaluate](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=evaluate) the approaches used to solve problems [(ACSIS206)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS206)  Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate [scientific language](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=scientific+language), conventions and representations [(ACSIS208)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS208) | | | | |
| Achievement standards | | | | |
| Students explain that underpin the theory of evolution. Students analyse how the models and theories they use have developed over time and discuss the factors that prompted their review. Students develop questions and hypotheses and independently design and improve appropriate methods of investigation, including field work and laboratory experimentation. They explain how they have considered reliability, safety, fairness and ethical actions in their methods and identify where digital technologies can be used to enhance the quality of data. When analysing data, selecting evidence and developing and justifying conclusions, they identify alternative explanations for findings and explain any sources of uncertainty. Students evaluate the validity and reliability of claims made in secondary sources with reference to currently held scientific views, the quality of the methodology and the evidence cited. They construct evidence-based arguments and select appropriate representations and text types to communicate science ideas for specific purposes. | | | | |
| Student book section | AC Syllabus links | Suggested indicators of learning and understanding | Suggested teaching and learning activities | Resources | |
| 2.1 Darwin and Wallace were co-conspirators (pages 40–43) | Science Understanding  ACSSU185  Science as a human endeavour  ACSHE191  ACSHE192  ACSHE230  Science Inquiry Skills ACSIS204  ACSIS206  ACSIS208 | By the end of this unit, students should be able to:  • describe the contributions of Charles Darwin and Alfred Wallace to the theory of natural selection  • describe the evolutionary theories and work of other scientists such as Lamarck and Wiseman  • understand that scientific theories are based on well-substantiated evidence that are contested and refined over time. | Pre-test or discussion to prior knowledge of kingdoms, geological time scales.  Watch: ‘The Origin of Species: The Making of a Theory’. This gives an overview of the voyages of both Darwin and Wallace that led each propose the process of natural selection.  Have a discussion on why evolution will only ever be a theory rather than fact. | Oxford Science 10 resources  • Extend your understanding 2.1 page 43 | |
| Additional resources  Interactive geological timeline showing history of life on earth:  <http://www.bbc.co.uk/nature/history_of_the_earth>  Origin of Species short film:  <http://www.hhmi.org/biointeractive/origin-species-making-theory> | |
| 2.2 Natural selection is the mechanism of evolution (pages 44–45) | Science Understanding  ACSSU185  Science Inquiry Skills  Science as a human endeavour  ACSHE191  ACSHE192  Science Inquiry Skills  ACSIS200  ACSIS203  ACSIS204  ACSIS205  ACSIS206  ACSIS208  ACSIS200 | By the end of this unit, students should be able to:  • define the terms natural selection, allele frequencies, gene pool, and mutations  • describe how natural selection results in permanent changes in the frequency of alleles in a population  • understand how mutations introduce new alleles into a gene pool  • discuss how selection pressures change the allele frequency of populations over time. | Experiment 2.2:  What if the habitat of bean prey was changed? Page 189  Use forks and spoons with snake lollies and m&m’s for students to demonstrate selection pressures, adaptations, natural selection.  Darwin’s finches’ worksheets – pdf from NSTA which has activities involving measure finch beaks, creating beaks from icy pole sticks and using them to “eat” foods. Includes graphing and interpreting data. | Oxford Science 10 resources  • Check your learning 2.2, page 45  • Experiment 2.2: What if the habitat of bean prey was changed? Page 189 | |
| Additional resources    Darwin’s finches pdf worksheets <https://www.nsta.org/publications/press/extras/files/virus/Virus-Activity5.pdf> | |

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| 2.3 Different selection pressures cause divergence. Similar selection pressures cause convergence (pages 46–47) | Science Understanding  ACSSU185  Science as a human endeavour  ACSHE191  ACSHE192  Science Inquiry Skills  ACSIS200  ACSIS203  ACSIS204  ACSIS205  ACSIS206  ACSIS208 | By the end of this unit, students should be able to:  • define the terms divergent evolution, convergent evolution, speciation, homologous structure and analogous structure  • explain how different selection pressures can cause divergence and the formation of new species (speciation)  • explain how similar selection pressures can cause convergence  • identify homologous and analogous structures when comparing the evolution of different organisms. | Brainstorm the meanings of the words converge and diverge. Where have they heard these terms before?  Experiment 2.3:  Divergent and convergent evolution of big beaks and small beaks, page 190  Analyse the wings of different animals on the National Geographic website | Oxford Science 10 resources  • Check your learning 2.3, page 47  • Experiment 2.3: Divergent and convergent evolution of big beaks and small beaks, page 190 |
| Additional resources  Wing analysis activity:  <http://nationalgeographic.org/activity/examining-convergent-evolution/> |
| 2.4 Fossils provide evidence of evolution (pages 48–51) | Science Understanding  ACSSU185  Science as a human endeavour  ACSHE191  ACSHE192  Science Inquiry Skills  ACSIS199  ACSIS200  ACSIS203  ACSIS204  ACSIS205  ACSIS206  ACSIS208 | By the end of this unit, students should be able to:  • explain how the existence of fossils provides evidence to support the process of evolution  • describe how fossils are dated using relative and absolute dating techniques  • explain how transitional fossils and living fossils provide evidence for evolution. | Review previous learning – different types of rocks and processes such as erosion.  Experiment 2.4:  Popcorn dating, page 191  Discuss why fossils are primarily found in sedimentary rocks.  Play an interactive game, placing fossils in the correct order based on their position in rocks.  Watch ‘Great transitions’ video on Archaeopteryx (there is also a pdf worksheet with questions for this video).  Use an image of an Archaeopteryx fossil for students to identify key features which identify it as a transition fossil. Students could make inferences about what these features were used for and the environment it lived in. | Oxford Science 10 resources  • Check your learning 2.4, page 51  • Experiment 2.4: Popcorn dating, page 191 |
| Additional resources    Interactive game: <http://www.amnh.org/ology/features/layersoftime/game.php>  Great transitions short film:  <http://www.hhmi.org/biointeractive/great-transitions-origin-birds>  Student and Teacher worksheet for film:  <http://www.hhmi.org/biointeractive/living-dinosaurs-fact-or-fiction> |
| 2.5 Multiple forms of evidence support evolution (pages 52–55) | Science Understanding  ACSSU185  Science as a human endeavour  ACSHE191  ACSHE192  Science Inquiry Skills  ACSIS204  ACSIS206  ACSIS208 | By the end of this unit, students should be able to:  • explain how continental drift provides a well-supported explanation for the geographical isolation of species that eventually results divergent evolution  • describe similarities during the early stages of embryo development in different species  • identify vestigial structures and explain how they are interpreted as evidence of an ancestral heritage in which these structures once performed other tasks. | Use a map with continents that students can cut out and demonstrate continental drift.  Have images of different flightless birds which students to cut out and stick on their maps to show their positions prior to separation.  Research vestigial structures in humans and compare the function of structure in other organisms. | Oxford Science 10 resources  • Check your learning 2.5, page 55 |
| 2.6 DNA and proteins provide chemical evidence for evolution (pages 56–57) | Science Understanding  ACSSU185  Science Inquiry Skills  ACSIS200  ACSIS203  ACSIS204  ACSIS205  ACSIS206  ACSIS208 | By the end of this unit, students should be able to:  • describe the universal nature of DNA and proteins  • understand how mutations can cause small differences that can accumulate over time  • explain how scientists use the differences in DNA sequences to compare evolutionary relationships between species  • interpret and draw basic phylogenetic trees. | Review protein synthesis – students can practise transcribing DNA into RNA and translating RNA codons into amino acid sequences.  Experiment 2.6:  Who is my cousin? Page 192 | Oxford Science 10 resources  • Check your learning 2.6, page 57  • Experiment 2.6: Who is my cousin? Page 192 |
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| 2.7 Humans artificially select traits (pages 58–59) | Science Understanding  ACSSU185  Science as a human endeavour  ACSHE191  ACSHE192  ACSHE194  ACSHE230  Science Inquiry Skills  ACSIS199  ACSIS200  ACSIS203  ACSIS204  ACSIS205  ACSIS206  ACSIS208 | By the end of this unit, students should be able to:  • describe how the breeding of organisms with desirable traits has led to domestication  • explain how the process of artificial selection occurs in species such as dogs  • explain how the misuse of antibiotics has led to the evolution of super bacteria such as MRSA. | Experiment 2.7:  Selective breeding of dogs, Page 193  Compare and contrast the process of natural selection and artificial selection using a Venn diagram or concept map.  Research artificial selection in crops such as corn, link to molecular evidence for evolution. | Oxford Science 10 resources  • Check your learning 2.7, page 59  • Experiment 2.7: Selective breeding of dogs, page 193 |
| Additional resources  Comparing artificial selection to natural selection  <http://learn.genetics.utah.edu/content/selection/artificial/>  Article – domestication of corn  <http://learn.genetics.utah.edu/content/selection/corn/> |
| 2.8 Natural selection affects the frequency of alleles (pages 60–61) | Science Understanding  ACSSU185  Science as a human endeavour  ACSHE191  ACSHE192  ACSHE194  ACSHE230  Science Inquiry Skills  ACSIS199  ACSIS200  ACSIS203  ACSIS204  ACSIS205  ACSIS206  ACSIS208 | By the end of this unit, students should be able to:  • account for differences in the frequency of the sickle cell allele in different regions around the world  • explain how malaria is a selection pressure for the sickle cell anaemia allele  • outline how the process of natural selection can result in an increase in the frequency of the sickle cell allele in malaria prone regions. | Experiment 2.8:  Selecting for sickle cell anaemia, page 194  Create a crossword using all the key terms used based around natural selection.    Watch a short film about increased frequencies of the sickle cell allele in malaria prone regions around the world. | Oxford Science 10 resources  • Extend your understanding 2.8, page 61  • Experiment 2.8: Selecting for sickle cell anaemia, page 194 |
| Additional resources  14-minute film about natural selection of the sickle cell allele  <http://www.hhmi.org/biointeractive/making-fittest-natural-selection-humans> |
| **Review 2** | Science Understanding  ACSSU185  Science Inquiry Skills  ACSIS208 | By the end of this unit, students should be able to:  • Define all Key Words listed on page 38  • Explain that ecosystem consist of interdependent abiotic and abiotic factors  • Explain how matter and energy flow through ecosystems  • Identify areas of personal strengths and weaknesses in their knowledge and understanding of the topic | **Revision activities**  • Students could play celebrity heads with the Key Words list  • Students can make dominoes with Key Words on one end and definitions/diagrams/examples on the other end  • Students can create mind maps, Venn diagrams or other graphic organisers to summarise the key concepts of this chapter  • Peer teaching: students can work in groups to reteach the content of the unit to the class for the purpose of revision. Each group could be allocated a double-page to summarise | **Oxford Science 10 resources**  • Review questions, pages 62-63  • Research topics, page 63  • Key Words list, page 64 |