

8.4 Life on Earth

Contextual Outline

Life has evolved over millions of years from the common elements found in the cosmos. Simple terrestrial life has been found to exist in the most hostile of conditions on Earth and evidence from Australian scientists has shown that bacteria exist kilometres deep in the Earth's crust and have done so for millions of years.

Organic molecules formed on Earth in an environment that is very different to that existing today. When these organic molecules were separated from their environment by a membrane, they began to carry out the chemical reactions of life in such a way as to sustain their existence and allow reproduction. The evolution of photosynthesis caused a change from an anoxic to an oxic environment that continues to support most of the living things on Earth today.

Fossil evidence indicates changes in complexity and diversity of life forms. It is the diversity of living organisms that has led scientists to develop classification systems that group these organisms according to their structural or genetic similarity. Recent advances in molecular biology and biochemistry have allowed scientists to better describe the origins, processes and evolution of life.

This module increases students' understanding of the history, nature and practice of biology and current issues, research and developments in biology.

Assumed Knowledge

Domain: knowledge and understanding

Refer to the *Science Years 7–10 Syllabus* for the following:

- 5.8.3a) discuss evidence that present-day organisms have evolved from organisms in the distant past
- 5.9.4b) describe conditions under which fossils form
- 5.9.4c) relate the fossil record to the age of Earth and the time over which life has been evolving.

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| | <i>Students learn to:</i> | <i>Students:</i> |
| 1. Analysis of the oldest sedimentary rocks provides evidence for the origin of life | <ul style="list-style-type: none">▪ identify the relationship between the conditions on early Earth and the origin of organic molecules▪ discuss the implications of the existence of organic molecules in the cosmos for the origin of life on Earth▪ describe two scientific theories relating to the evolution of the chemicals of life and discuss their significance in understanding the origin of life▪ discuss the significance of the Urey and Miller experiments in the debate on the composition of the primitive atmosphere▪ identify changes in technology that have assisted in the development of an increased understanding of the origin of life and evolution of living things | <ul style="list-style-type: none">▪ gather information from secondary sources to describe the experiments of Urey and Miller and use the available evidence to analyse the:<ul style="list-style-type: none">– reason for their experiments– result of their experiments– importance of their experiments in illustrating the nature and practice of science– contribution to hypotheses about the origin of life |
| 2. The fossil record provides information about the subsequent evolution of living things | <ul style="list-style-type: none">▪ identify the major stages in the evolution of living things, including the formation of:<ul style="list-style-type: none">– organic molecules– membranes– procaryotic heterotrophic cells– procaryotic autotrophic cells– eucaryotic cells– colonial organisms– multicellular organisms▪ describe some of the palaeontological and geological evidence that suggests when life originated on Earth▪ explain why the change from an anoxic to an oxic atmosphere was significant in the evolution of living things▪ discuss the ways in which developments in scientific knowledge may conflict with the ideas about the origins of life developed by different cultures | <ul style="list-style-type: none">▪ process and analyse information to construct a timeline of the main events that occurred during the evolution of life on Earth▪ gather first-hand or secondary information to make observations of a range of plant and animal fossils▪ identify data sources, gather, process, analyse and present information from secondary sources to evaluate the impact of increased understanding of the fossil record on the development of ideas about the history of life on Earth |

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| 3. Further developments in our knowledge of present-day organisms and the discovery of new organisms allows for better understanding of the origins of life and the processes involved in the evolution of living things | <i>Students learn to:</i> <ul style="list-style-type: none">▪ describe technological advances that have increased knowledge of procaryotic organisms▪ describe the main features of the environment of an organism from one of the following groups and identify its role in that environment:<ul style="list-style-type: none">– Archaea– Bacteria | <i>Students:</i> <ul style="list-style-type: none">▪ use the available evidence to outline similarities in the environments past and present for a group of organisms within one of the following:<ul style="list-style-type: none">– Archaea– Bacteria▪ analyse information from secondary sources to discuss the diverse environments that living things occupy today and use available evidence to describe possible alternative environments in which life may have originated |
| 4. The study of present-day organisms increases our understanding of past organisms and environments | <i>Students learn to:</i> <ul style="list-style-type: none">▪ explain the need for scientists to classify organisms▪ describe the selection criteria used in different classification systems and discuss the advantages and disadvantages of each system▪ explain how levels of organisation in a hierarchical system assist classification▪ discuss, using examples, the impact of changes in technology on the development and revision of biological classification systems▪ describe the main features of the binomial system in naming organisms and relate these to the concepts of genus and species▪ identify and discuss the difficulties experienced in classifying extinct organisms▪ explain how classification of organisms can assist in developing an understanding of present and past life on Earth | <i>Students:</i> <ul style="list-style-type: none">▪ perform a first-hand investigation and gather information to construct and use simple dichotomous keys and show how they can be used to identify a range of plants and animals using live and preserved specimens, photographs or diagrams of plants and animals |