

# EVERYTHING CHANGES

## INTRODUCTION

This is a challenging module in which children build on their knowledge of living things and how they are adapted to particular environments. They are introduced to the idea that variation in organisms can result in the species becoming better adapted to its environment and that the process of natural selection, over a long period of time, leads to evolution. Although children may have been introduced to the concept of adaptation during their time at school, natural selection and evolution will not have been formally discussed at school prior to this unit. Children learn about how inherited characteristics are passed on from parents to offspring and that environmental variables also affect how organisms look and behave. They explore the process of selective breeding, through which humans can select particular characteristics in different plants and animals to meet specific requirements. They also explore how those individuals in a population that are best adapted to the environment are more likely to live long enough to reproduce and so maintain the population and the survival of the species.

Children learn that it is a combination of inherited characteristics and the effect of environmental variables that ultimately mould the appearance and behaviour of living things through the process of natural selection. Children analyse fossil records, which show that organisms have changed over millions of years and that many have become extinct. Fossils provide evidence for natural selection and evolution. If appropriate, children may complete the module by using their knowledge of natural selection to explain the process of speciation, through which one or more populations of the same species can become separated and change over time to become different species. In this module children carry out investigations to measure the variation between individual organisms of the same species, model the process of dog breeding by selecting parents that have the desired characteristics for producing useful offspring, and design their own animal to suit a specific environment.

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### National Curriculum:

Recognise that living things produce offspring of the same kind, but that offspring normally vary and are not identical to their parents

Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution

Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago

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### Working Scientifically:

Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, and/or bar and line graphs

Identifying scientific evidence that has been used to support or refute ideas or arguments

Planning different types of scientific enquiries to answer questions, including recognising and controlling variables

Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of results, in oral and written forms such as displays and other presentations

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### Scientific Enquiry:

Grouping and classifying

Finding things out using a wide range of secondary sources of information

Carrying out comparative and fair tests

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### Key vocabulary:

population, variation, environment, inheritance, adaptation, selective breeding, generation, survival, natural selection, evolution, fossils, genes, genetics, DNA, extinct, extinction, speciation, question, investigation, fair test, change, measure, predict, prediction, explanation, observations, draw conclusions

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### FACT FILE:

Through sexual reproduction living things produce offspring that are similar to but not exactly the same as the parents. The offspring are also not identical to each other; even 'identical twins' show slight differences. Each individual has some characteristics of its father, some of its mother and some which appear to be from neither parent. Genes, which are composed of DNA, carry the

information that leads to the different characteristics. Each individual gets half of its genes from its male parent and half from its female parent. The variation between individuals occurs because of the different combinations of genes each individual acquires at fertilisation. It is important to note that this variation occurs regardless of the environment in which the organism finds itself.

Humans have been able to use their knowledge of how natural variation occurs to carry out selective breeding in many different types of organism, including food crops such as wheat and apples, animals such as cattle and horses, and pets of different types.

Organisms are also affected by the environments in which they live. The impact of environmental variables can cause variation in the ways in which living things grow, for example, if an animal cannot get much food it is likely to be smaller than if it had access to more food. If food is very scarce then the animal will not survive. Other variables that affect survival include physical and chemical requirements (nutrients, shelter, space, light, etc.) and the likelihood of being eaten (for example, if there are too many predators).

To be able to live, grow and eventually reproduce, individuals in a population are in constant competition with other individuals of the same species as well as with individuals of other species. Organisms that display characteristics that make them better adapted to the environment are more likely to survive and reproduce. These organisms pass their characteristics on to the next generation and so increase the proportion of individuals in the population that have the same beneficial characteristics. Conversely, individual organisms that are not well adapted tend not to survive long enough to reproduce, so the proportion of individuals with these characteristics in a population tends to decrease. Over many generations more and more of the organisms become better adapted to their current environment. This process is called natural selection, and over thousands of years can lead to changes in organisms and ultimately to the evolution of new species.

If the environment changes significantly (either slowly or rapidly) the size of the populations of each species will vary depending on how well the organisms can cope with the new conditions or find another suitable environment. In extreme cases the population decreases in size, as fewer and fewer individuals have the characteristics necessary for survival, and eventually the species becomes extinct. The fossil record provides evidence that over millions of years living things of many types have lived on the Earth and that many have changed. This process of change is called evolution, and natural selection is the scientifically accepted explanation of how evolution comes about. It was the studies of Charles Darwin and Alfred Russell Wallace that first proposed the theory of evolution through the mechanism of natural selection.

When a population of single species is separated into different groups by a geographical barrier, and each group is subject to different changes in their environment, they can evolve differently over many generations to the extent that the individuals from one group cannot breed with individuals from the other group. As a result, two new species are established through a process called speciation. It is because of speciation that the number of species increases, creating the variety of species on the planet. Over millions of years some species survive better than others and many have become extinct. It is appropriate to emphasise that evolution is not a sequential process, but occurs in stages that lead to one species diverging into two different species. So it is incorrect to say chimps evolved into humans. Rather, it is correct to say that a common ancestor evolved into two distinct species (chimps and humans).

