

KS3 Science

Independent Learning

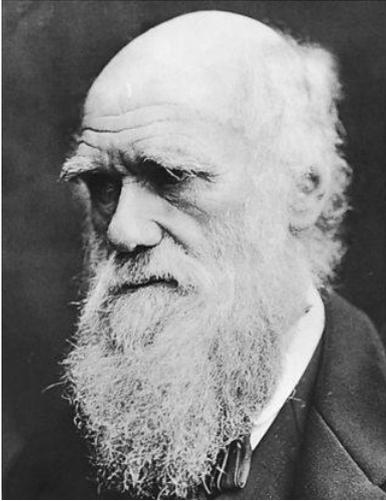
Booklets

Evolution

If you have internet at home, you can use bitesize to help you with some of the activities.

Try your hardest to work through the booklets

Evolution



Scientific analysis of fossils shows that species have changed over long periods of time. This change is evolution. Many theories have been put forward to explain how evolution happens. The theory accepted by most scientists is the theory of natural selection. Charles Darwin first proposed this theory.

Charles Darwin

Charles Darwin was an English naturalist. He studied variation in plants and animals during a five-year voyage around the world in the 19th century. Darwin later studied hundreds more animal and plant species. In 1858, after nearly 30 years of research, he proposed his theory of evolution by natural selection. He explained his ideas about evolution in a book *On the Origin of Species*, published in 1859.

Darwin's ideas caused a lot of controversy at the time. Today, some religious views about the creation of the world and the organisms in it conflict with the scientific consensus about evolution.

Natural selection

These are the key points of evolution by natural selection:

- Individuals in a species show a wide range of variation.
- Inherited variation is due to differences in their genes.
- Individuals with the features that are best suited to the environment are more likely to survive and reproduce.
- The genes that allow these individuals to be successful are passed to their offspring.
- Individuals that are poorly adapted to their environment are less likely to survive and reproduce. This means that their genes are less likely to be passed to the next generation.
- Over many generations these small differences add up to the new evolution of species.

Given enough time, a population may change so much it may even become a new species, unable to reproduce successfully with individuals of the original species.

Natural selection

The accepted theory of **evolution** explains that it happens by natural selection. The key points are:

- Individuals in a species show a wide range of variation and this variation is because of differences in their genes.
- Individuals with characteristics most suited to their environment are more likely to survive and reproduce. This is commonly known as 'survival of the fittest'. The genes that allow these individuals to be successful within their environment are passed on to their offspring, which results in these specific genes becoming more common.
- Those that are poorly adapted to their environment are less likely to survive and reproduce. Their genes are less likely to be passed on to the next generation.
- Over a period of time, a species will gradually evolve.

- Both genes and the environment can cause variation, but only genetic variation can be passed on to the next generation.
- If two populations of one species become increasingly different in phenotype that they can no longer interbreed to form fertile offspring, this can result in the formation of two species.

A simple example can be seen in peacocks:

- females choose a mate based on their colourful tail feathers
- the more colourful the tail of a peacock, the more likely they are to mate and pass on these genes
- over time, the tails of peacocks have become more colourful

1

Why did Darwin's ideas cause the most controversy?

- The Church did not agree with him
- Other scientists disagreed with him
- He was wrong

2

What explains evolution?

- Extinction
- Natural selection
- Global warming

3

Which scientist first proposed the theory of natural selection?

- Watson
- Darwin
- Crick

4

What is the name for changes in organisms over long periods of time?

- Photosynthesis
- Respiration
- Evolution

Extinction

A species becomes extinct when there are no more individuals of that species left. An extinct species has gone forever, although some scientists hope that they might bring back some extinct species using genetic engineering.

Changes in the environment may leave individuals less well adapted to compete successfully for resources such as food, water and mates. Sometimes an entire species may become unable to compete successfully and reproduce. These problems can lead to extinction. Here are some of the changes in the environment that can cause a species to become extinct:

- a new disease
- a new predator
- a change in the physical environment, such as climate change
- competition from another species that is better adapted, including competition from humans

For example, dinosaurs became extinct millions of years ago. This was probably due to changes in the environment, but many species have become extinct more recently because of competition from humans.

The dodo



A drawing of a dodo

The dodo was a flightless bird found on the island of Mauritius. It became extinct in the 17th century because of human activities. Humans disturbed the dodo's habitat and also brought new predators to the island, like dogs. The dodo was slow, did not fear humans and was easily caught. It only took about 100 years after its discovery for it to become extinct.

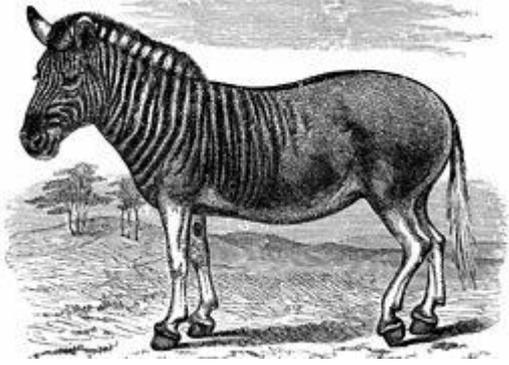
Maintaining biodiversity

Endangered species

An endangered species is at risk of becoming extinct. For example, the panda and gorilla are endangered and may become extinct. A species can become endangered for several reasons, including:

- the number of available habitats falls below a critical level
- the population of the species falls below a critical level

For example, the South African quagga was a type of zebra that became extinct because of hunting. The last wild quagga was shot in the late 1870s. However, a lone female quagga later died in a zoo in Amsterdam in 1883, the last of her species.



A quagga

A species may even be at risk of becoming extinct if there is not enough genetic variation in the population. This can happen even if the population is still quite large.

Biodiversity

Biodiversity means having as wide a range of different species in an ecosystem as possible. It is important to conserve the variety of living organisms on Earth. Not only do we have moral and cultural reasons for conserving endangered species, but conservation:

- maintains the future possibility that plant species might be identified for medicines
- keeps damage to food chains and food webs to a minimum
- protects our future food supply

Conservation measures

Some species in Britain are endangered, including the skylark, red squirrel and grass snake. They could be helped by conservation measures such as:

- education programmes
- captive breeding programmes
- legal protection and protection of their habitats
- making artificial ecosystems for them to live in

Plant species can also be endangered. Seed banks are a conservation measure for plants. Seeds are carefully stored so that new plants may be grown in the future.

Seed banks are an example of a gene bank. Gene banks are increasingly being used to preserve genetic material for use in the future. A cryobank is another type of gene bank. Embryos, sperm or eggs are stored at very low temperatures in liquid nitrogen (which is at a very chilly $-196\text{ }^{\circ}\text{C}$). They can be thawed out later for use in breeding programmes.

5 What can ultimately occur if species do not change?

- Extinction
- Natural selection
- Evolution

6 Which animal is now extinct?

- Panda
- Dodo
- Rhino

7 What does biodiversity mean?

- Species at risk of extinction
- Having as narrow a range of organisms as possible
- Having as wide a range of organisms as possible

8 What is a possible reason for extinction?

- The number of habitats falls below a critical level
- Too many resources
- Less competition

9 Which British species is endangered?

- White rhino
- Red squirrels
- Panda

10 What are seed banks?

- Buildings in which seeds are sold
- Buildings in which seeds are loaned
- Buildings in which seeds are stored

Glossary

These useful terms will help you understand evolution.

- **Adaptation** - How living things are specialised to suit their environment.
- **Evolution** - The process by which living things can gradually change over time.
- **Inheritance** - The process of passing on features from parents to offspring.
- **Species** - A group of living things with very similar characteristics. They can breed together to make more living things of the same type.
- **Variation** - The differences between living things in a species.

Choose two words to fill in the gaps:

Adapted Evolution Inherited Variation

Part 1 of 3

All living things are slightly different from their parents. This is known as

. Some have characteristics that make them better to survive. For example, they might make them better at avoiding predators or catching their prey.

Choose two words to fill in the gaps:

evolve parents Inherited reproduce

Part 2 of 3

Those living things that are better at surviving are more likely to and pass on their characteristics to their offspring. Those characteristics that don't help a living thing to survive are less likely to be .

Choose two words to fill in the gaps:

Species Evolution Inherited offspring

This means that over time living things gradually change and eventually they might become a new altogether. This happens very slowly and usually takes millions of years. The process by which species change over time is called .

Task Sheet: Conservation project

Research an endangered animal and fill in the following information sheet. Once you have done this create a poster on the subject.

Your poster MUST include...

- The animal's habitat
 - A food web
- An explanation of how the animal gets its energy to survive
 - Adaptations of the animal to survive
 - At least 2 things humans can do to help

Initial questions: *Write these in the space below. The first one has been done for you.*

1) Which animals are endangered?

Research sheet

Name of student

Name of animal studied

Description of habitat

Food Web

How the animal gets energy

Adaptations (labelled picture)

What we can do to help

1) _____

2) _____

Species

A species is a group of similar organisms that can breed with one another to produce fertile offspring. For example, humans are one species and dogs are another species.

Individuals of the same species can reproduce to make more individuals of the same species. Two individuals belonging to different species cannot normally reproduce together. If they do, their offspring is often infertile and unable to reproduce.



Sometimes individuals from two different species can reproduce. For example, animals called **ligers** are produced when a male lion and a female tiger reproduce. **Tigons** are produced when a female lion and male tiger have cubs. Unlike many young from different species, ligers and tigons can have offspring.



A liger looks like a lion but has stripes like a tiger

Species and selective breeding

Nicola Hallot from Knowsley Safari Park explains the five species of Rhino. There are five species of Rhino: there is the White, Black, Indian, Javan and Sumatran. The White and Black are found in Africa and the other three species, the Indian, Javan and Sumatran, are all found in Asia.

The main difference between them is what they eat, so the White Rhino likes to eat grass so has a very wide mouth, the other species tend to eat trees and shrubs and things like that so they have a pointy lip and some of them like to eat a little bit of both so their mouth is half pointy, half wide.

The similarities between the species would be their social structure. Rhinos are mainly solitary, the males just pass through areas when they want to mate with the females.

The Black Rhino are perhaps the most social out of all of them but even those prefer to be on their own most of the time.

We have White Rhino at Knowsley Safari Park and we have one of the most successful breeding programmes for them in Europe with 14 calves being born in the last ten years.

The role of zoos and safari parks with endangered animals is captive breeding and breeding programmes and also conservation so that means supporting field programmes abroad, in country and also educating our visitors about animals and what they can do to help.

Wordsearch for Evolution

D	E	L	A	N	E	M	T	S	E	T	T	I	F	E
S	A	A	I	B	R	E	E	D	I	N	G	S	V	D
E	T	R	D	D	O	I	R	E	P	G	N	O	L	N
L	E	U	W	A	A	O	T	C	A	G	L	A	E	A
E	S	T	D	I	P	R	S	D	N	U	V	T	N	O
C	O	A	R	E	N	T	T	I	T	I	S	C	L	R
T	T	N	E	M	N	O	R	I	V	N	E	A	I	N
I	C	D	O	A	T	P	O	R	F	S	O	T	S	O
V	S	N	R	I	S	N	U	E	T	I	C	E	S	I
E	E	T	M	F	T	S	D	O	M	N	C	L	O	T
A	I	C	F	E	G	A	R	A	I	E	R	I	F	C
R	C	O	M	P	E	T	I	T	I	O	N	T	A	E
S	E	C	D	A	N	S	X	R	S	D	I	R	E	L
I	P	T	N	I	E	E	R	O	A	C	R	E	A	E
A	S	E	R	O	S	A	I	D	E	V	N	F	O	S

EVOLUTION

EXTINCT

ADAPT

LONG PERIOD

ENVIRONMENT

SPECIES

OFFSPRING

COMPETITION

FERTILE

NATURAL

ARTIFICIAL

SELECTION

FOSSIL

ANCESTOR

GENE

VARIATION

SURVIVAL

DARWIN

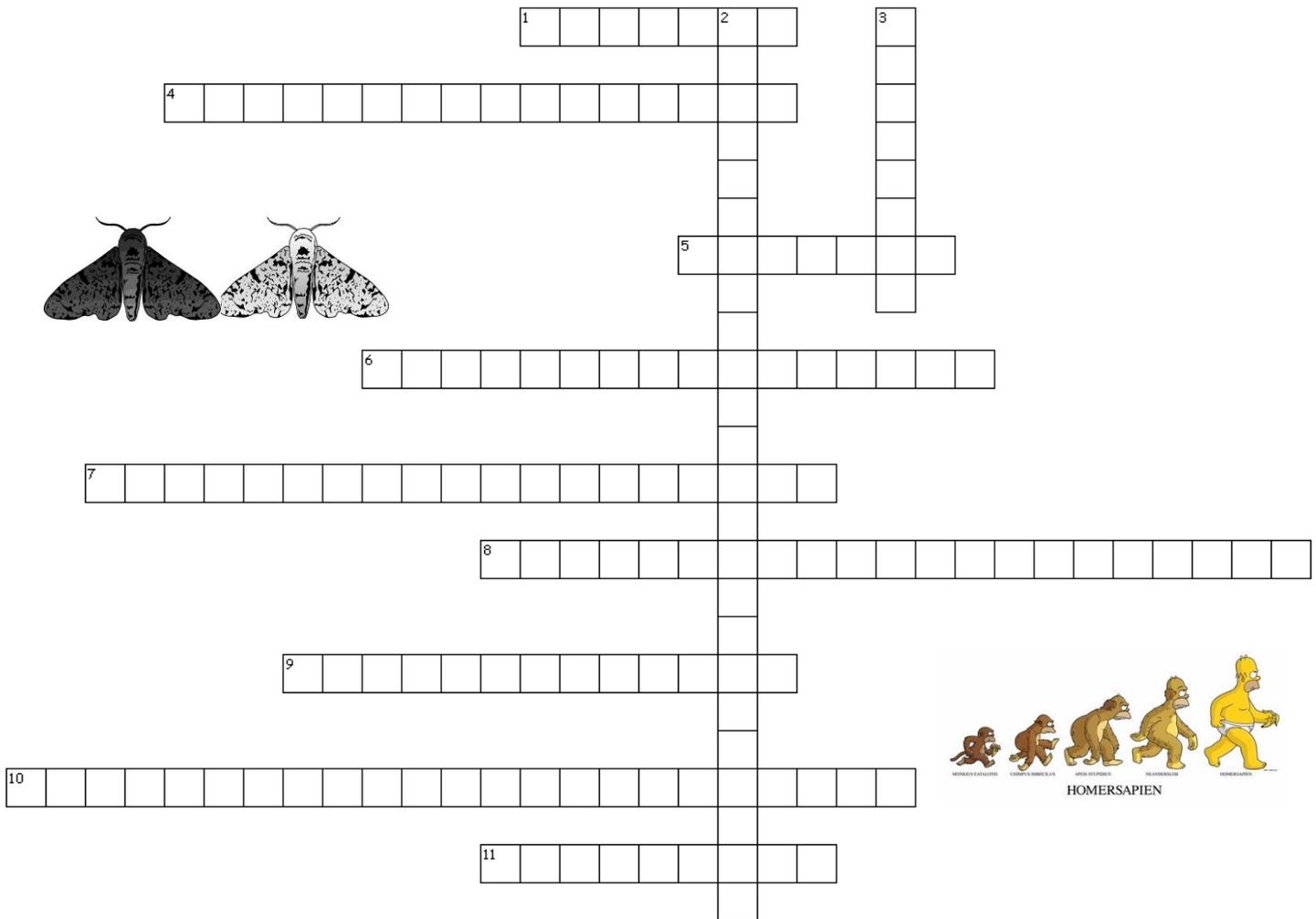
FITTEST

SELECTIVE

BREEDING

DNA

CODE



Across

1. A group of organisms with many features in common which can breed successfully producing fertile offspring. (7)
4. The process by which evolution takes place. Organisms produce more offspring than the environment can support so only those which are most suited to their environment - the 'fittest' - will survive to breed and pass on their useful characteristics. (7,9)
5. The highest group in the classification system, e.g. animals, plants. (7)
6. Model of the evolutionary relationships between different organisms based on their appearance, and increasingly, on DNA evidence. (12,4)
7. French biologist who developed a theory based on the inheritance of acquired characteristics. (4,8,7)
8. Classification system based on the similarities between different living organisms. (7,14)
9. The Victorian scientist who developed the theory of evolution by a process of natural selection. (7,6)
10. Jean-Baptiste Lamarck's theory of how evolution took place. (8,15)
11. The process of slow change in living organisms over long periods of time as those best adapted to survive and breed successfully. (9)

Down

2. Model of the relationships between organisms, often based on DNA evidence, which suggest how long ago they evolved away from each other and how closely related they are in evolutionary terms. (12,12)
3. A change in the genetic material of an organism. (8)