

The development of understanding of genetics and evolution

Revision notes • The evidence for evolution, how fossils form and what they show, evolutionary trees, extinction and antibiotic-resistant bacteria.

For AQA GCSE Combined Science: Trilogy 8464. **Higher tier** is only on the Higher paper.

The development of understanding of genetics and evolution Spec 4.6.3

Evidence for evolution Spec 4.6.3.4

The theory of evolution by natural selection is now **widely accepted**. Evidence for Darwin's theory is now available. You need to be able to describe the evidence, including fossils and antibiotic resistance in bacteria.

- It has been shown that **characteristics are passed on to offspring in genes**.
- The **fossil record** provides further evidence (see the next section).
- Knowledge of how **resistance to antibiotics evolves in bacteria** provides evidence that natural selection happens and can be seen in a short time (see Resistant bacteria).

Exam tip: Link your evidence to the theory. Say what is seen (for example fossils show how organisms have changed), then say how it supports evolution by natural selection.

Fossils Spec 4.6.3.5

Fossils are the 'remains' of organisms from millions of years ago, which are found in rocks.

How fossils may form

- From parts of organisms that have **not decayed** because one or more of the conditions needed for decay are absent.
- When parts of the organism are **replaced by minerals** as they decay.
- As **preserved traces** of organisms, such as footprints, burrows and rootlet traces.

We can learn from fossils how much or how little different organisms have changed as life developed on Earth.

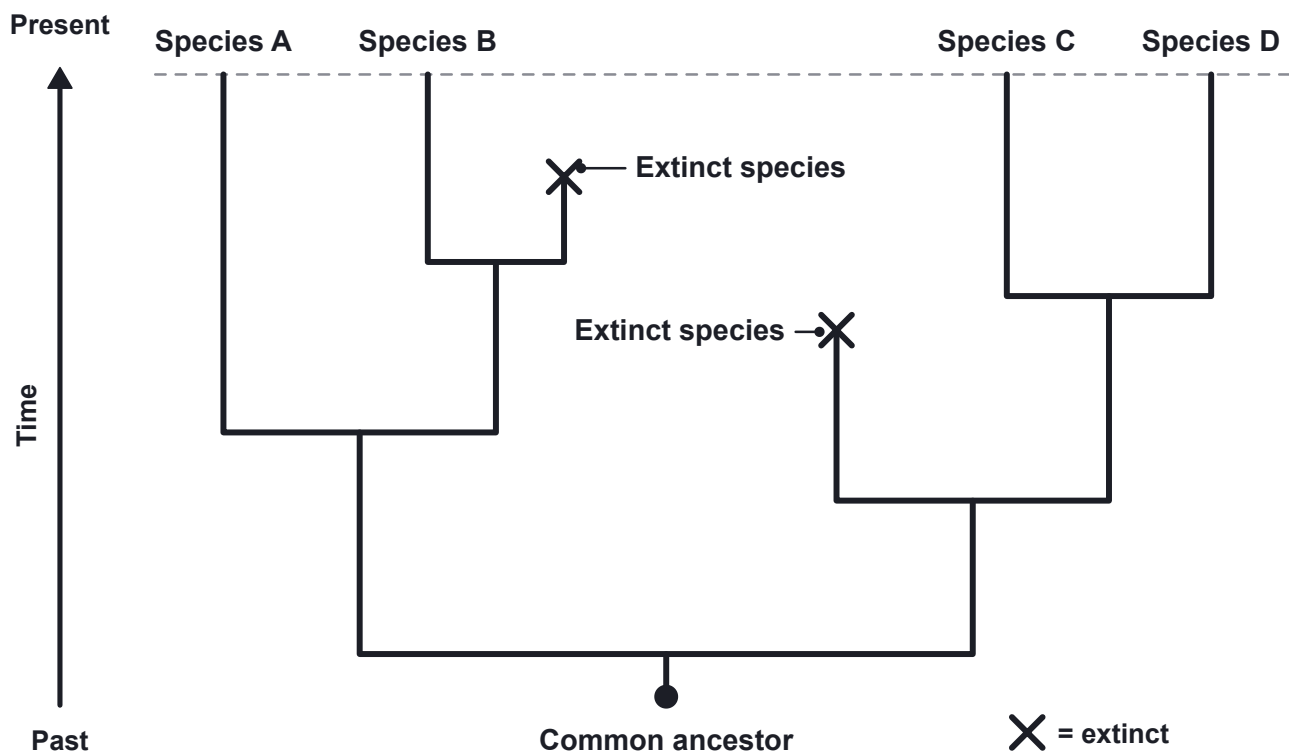
Why the fossil record is incomplete

Many early forms of life were **soft-bodied**, which means that they have left few traces behind. What traces there were have been mainly **destroyed by geological activity**. This is why scientists cannot be certain about how life began on Earth.

Evolutionary trees

You may need to extract and interpret information from charts, graphs and tables, such as evolutionary trees. Evolutionary trees use fossil data for extinct organisms and current classification data for living organisms.

Exam tip: Fossils are evidence for how organisms have changed over time, but gaps mean the record is incomplete. Quote both ideas in an evaluation.



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Branches ending in a cross are **extinct** species, known only from fossils.

Extinction Spec 4.6.3.6

Extinction occurs when there are no remaining individuals of a species still alive.

You need to be able to describe factors that may contribute to the extinction of a species. A species may become extinct because of:

- a change to the environment over geological time
- new **predators**
- new **diseases**
- new, more successful **competitors**
- a single catastrophic event, such as a massive volcanic eruption or an asteroid collision.

Exam tip: Always link the factor to the species: for example, a new disease kills individuals faster than they can reproduce, so the numbers fall until none are left.

Resistant bacteria Spec 4.6.3.7

Bacteria can evolve rapidly because they **reproduce at a fast rate**. Mutations of bacterial pathogens produce new strains.

1. A mutation produces a strain that is resistant to antibiotics.
2. When antibiotics are used, non-resistant bacteria are killed. The resistant bacteria are not killed.
3. The resistant bacteria **survive and reproduce**, so the population of the resistant strain rises.
4. The resistant strain spreads, because people are not immune to it and there is no effective treatment.

MRSA is resistant to antibiotics.

Reducing the rate of development of resistant strains

- Doctors should not prescribe antibiotics inappropriately, such as for non-serious or viral infections.
- Patients should complete their course of antibiotics so all bacteria are killed and none survive to mutate and form resistant strains.
- The agricultural use of antibiotics should be restricted.

The development of new antibiotics is costly and slow. It is unlikely to keep up with the emergence of new resistant strains.

Common mistake: People do not become resistant to antibiotics. The bacteria are resistant. The resistant bacteria survive and reproduce, passing on the resistance.

Quick check

1. Why is the fossil record incomplete?
2. Why do resistant strains of bacteria spread so quickly?
3. Give one way to reduce the development of antibiotic resistance.

Quick check answers

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- 1 . Early life was soft-bodied and left few traces, and many traces were destroyed by geological activity.
- 2 . Bacteria reproduce quickly, people are not immune and there is no effective treatment.
- 3 . Do not prescribe antibiotics inappropriately, complete the course, or restrict agricultural use.