Theory of evolution

4.6.3.1 · Inheritance, variation and evolution · revision notes

How Charles Darwin developed the theory of evolution by natural selection, why it was only gradually accepted, and how Lamarck's idea differed. This is in GCSE Biology only, not in Combined Science. Common questions ask why the theory was controversial or compare Darwin's and Lamarck's explanations.

Key facts

- Darwin: observations on a round-the-world expedition + experimentation + discussion with other scientists + knowledge of geology and fossils
- *On the Origin of Species*, published 1859
- Lamarck: changes during an organism's lifetime are inherited (in the vast majority of cases, this cannot happen)
- Darwin's theory: variation → the most suited are more likely to survive to breed → their characteristics are passed on
- Slowly accepted: challenged the idea that God made all living things; insufficient evidence; mechanism of inheritance unknown for 50 years

Notes

Darwin's theory

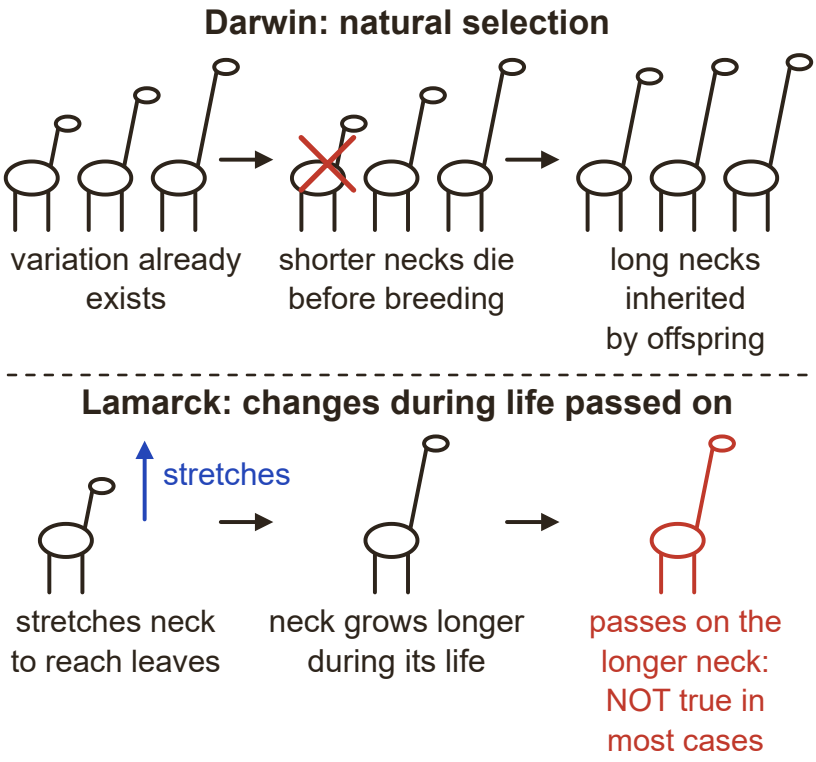
- **Charles Darwin** developed the theory of evolution by **natural selection** as a result of **observations** on a round-the-world expedition, backed by **experimentation** and **discussion with other scientists**, and linked to new knowledge of **geology** and **fossils**.
- Individual organisms within a species show a **wide range of variation** for a characteristic.
- Individuals with characteristics **most suited to the environment** are more likely to **survive to breed successfully**.
- The characteristics that have enabled these individuals to survive are then **passed on to the next generation**.
- Darwin published his ideas in *On the Origin of Species* in **1859**. The theory then developed over time, using information gathered by many scientists.

Why it was only gradually accepted

- There was much controversy about these revolutionary new ideas, and the theory was only gradually accepted, for three reasons.
- It challenged the idea that **God made all the animals and plants** that live on Earth.
- There was **insufficient evidence** at the time the theory was published to convince many scientists.
- The **mechanism of inheritance and variation** was not known until 50 years after the theory was published.

Lamarck's theory

- Other theories, including that of **Jean-Baptiste Lamarck**, are based mainly on the idea that **changes that occur in an organism during its lifetime can be inherited**.
- For example, Lamarck would have said that a giraffe that stretched its neck to reach high leaves would pass on a longer neck to its offspring.
- We now know that in the **vast majority of cases** this type of inheritance **cannot occur**: changes to the body during life do not change the genes passed on in gametes.
- The key difference: Darwin said variation already exists and the best-suited individuals survive and breed. Lamarck said organisms change during their lives and pass those changes on.



Darwin versus Lamarck, using giraffes' necks.

How to answer each type of question

Describe how Darwin developed his theory

2 marks | Grade 4

1. Observations on a round-the-world expedition.
2. Experimentation and discussion with other scientists.

Example. Describe how Darwin developed his theory of evolution by natural selection. [2 marks]

Model answer. He made observations of living things on a round-the-world expedition (1). He backed up his ideas with experimentation and discussion with other scientists (1).

Give reasons the theory was only gradually accepted

2 to 3 marks | **Grade 6**

1. Religious reason: it challenged the idea that God made all living things.
2. Evidence reason: there was not enough evidence at the time.
3. Mechanism reason: inheritance and variation were not understood until about 50 years later.

Example. When Darwin published his theory of evolution by natural selection in 1859, many people did not accept it.
Give three reasons why. [3 marks]

Model answer. It challenged the idea that God made all the animals and plants on Earth (1). There was not enough evidence at the time to convince many scientists (1). The mechanism of inheritance and variation was not known (1).

Compare Darwin's and Lamarck's explanations

3 to 4 marks | **Grade 7**

1. Lamarck: the organism changes during its life, then passes on the change.
2. Darwin: variation already exists; the best-suited individuals survive and breed; they pass on their characteristics.
3. Use the organism in the question for both explanations.

Example. Cheetahs can run very fast.
(a) Describe how Lamarck would have explained this.
(b) Describe how Darwin would have explained this. [4 marks]

Model answer.

(a) Cheetahs ran fast to catch prey, so their legs became stronger during their lives (1). They passed on these stronger legs to their offspring (1).
(b) There was variation in running speed among cheetahs, and the fastest were more likely to catch prey and survive to breed (1). They passed on the characteristics that made them fast to their offspring, so over many generations cheetahs became faster (1).

Don’t lose marks

- Describing Lamarck's idea (e.g. 'the giraffe stretched its neck') when the question asks for Darwin's.
- Saying Darwin knew about genes. The mechanism of inheritance was not known until about 50 years after he published.
- Writing 'people didn't believe it' without saying why.
- Getting the date wrong: *On the Origin of Species* was published in 1859.

More tips

Memory tricks

- Three reasons for slow acceptance: God, gaps, genes (religion, not enough evidence, mechanism of inheritance unknown).
- Lamarck = Lifetime changes (both start with L).
- Darwin = variation first, then selection. Lamarck = change during life, then pass it on.

Exam technique

- In Darwin v Lamarck questions, apply both theories to the organism in the question.
- For 'why was it not accepted' questions, give separate reasons, not the same reason reworded.
- Use 'changes during its lifetime' for Lamarck and 'variation' plus 'natural selection' for Darwin.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

Name the scientist behind natural selection

Charles Darwin developed the theory of evolution by natural selection.

Grade 4

Describe how Darwin developed his theory

Observations on a round-the-world expedition, backed by experimentation and discussion with other scientists, linked to knowledge of geology and fossils.

Grade 5

Describe Darwin's theory

Variation exists; the individuals most suited to the environment are more likely to survive to breed and pass on their characteristics.

Grade 6

Explain why the theory was slowly accepted

It challenged the idea that God made all living things, there was too little evidence, and inheritance was not understood.

Grade 7

Describe Lamarck's theory

Changes that happen to an organism during its lifetime can be inherited.

Grade 8

Explain why Lamarck's theory is rejected

Changes during an organism's life do not change the genes passed on in its gametes, so in the vast majority of cases they cannot be inherited.

Free notes, Full packs, practice papers and mock exams at chhetriacademy.com. Written for this site; not taken from past papers. Stuck? 1-to-1 tutoring with a free 30-minute trial lesson.