

The understanding of genetics

4.6.3.3 · Inheritance, variation and evolution · revision notes

How our understanding of inheritance developed: Mendel's experiments on pea plants, the link between his 'units' and chromosomes, and the discovery of the structure of DNA. This is in GCSE Biology only, not in Combined Science. Questions test the order of events and why Mendel's work was not recognised in his lifetime.

Key facts

- Mendel: mid-19th century, breeding experiments on pea plants
- Late 19th century: behaviour of chromosomes during cell division observed
- Mid-20th century: structure of DNA determined; how genes work explained
- Mendel's 'units' (now called genes) are passed on to descendants unchanged
- Early 20th century: 'units' (genes) are located on chromosomes
- Mendel not recognised in his lifetime: no knowledge of chromosomes, genes or DNA; his work was little read

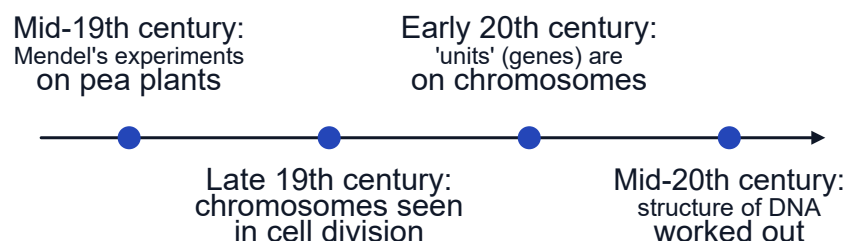
Notes

Mendel's experiments

- In the **mid-19th century**, **Gregor Mendel** carried out breeding experiments on **pea plants**.
- He crossed plants with different characteristics (e.g. tall and short stems) and counted the offspring with each characteristic over several generations.
- One of his observations was that the inheritance of each characteristic is determined by **'units'** that are **passed on to descendants unchanged**. We now call these units **genes**.

From 'units' to gene theory

- **Late 19th century**: the behaviour of **chromosomes during cell division** was observed.
- **Early 20th century**: scientists saw that chromosomes and Mendel's 'units' behaved in similar ways. This led to the idea that the units, now called **genes**, were located on **chromosomes**.
- **Mid-20th century**: the **structure of DNA** was determined and the mechanism of gene function was worked out.
- This scientific work by **many scientists** led to the **gene theory** being developed.



From Mendel's 'units' to gene theory.

Why Mendel's work was not recognised

- The importance of Mendel's discovery was not recognised until after his death.
- Chromosomes, genes and DNA were unknown, so there was no mechanism to explain his 'units'.
- His work was published in a little-known journal, and he was not a well-known scientist, so few people read it or saw its importance.
- This shows how scientific theories develop over time as new evidence is found.

How to answer each type of question

Put the discoveries in order

2 marks

Grade 5

1. Mendel's breeding experiments came first (mid-19th century).
2. Then chromosomes were seen during cell division (late 19th century).
3. Then genes were linked to chromosomes (early 20th century).
4. The structure of DNA came last (mid-20th century).

Example. Put these events in order, starting with the earliest.

A The structure of DNA was worked out.

B Mendel carried out breeding experiments on pea plants.

C Scientists suggested that Mendel's 'units' are located on chromosomes.

D The behaviour of chromosomes during cell division was observed. [2 marks]

Model answer. B, D, C, A. All four in the correct order (2); two in the correct positions (1).

Don't lose marks

- ✗ Saying Mendel discovered genes, chromosomes or DNA. He described 'units' of inheritance; the word 'gene' came later.
- ✗ Putting the structure of DNA before the link between genes and chromosomes.
- ✗ Saying Mendel's work was ignored because it was wrong. His results were correct, but they could not be explained at the time.

More tips

Memory tricks

- One step per period: mid-1800s Mendel's units → late 1800s chromosomes seen → early 1900s genes on chromosomes → mid-1900s DNA structure.
- Mendel = peas and 'units' (units = genes).
- Why not recognised? Nobody knew the mechanism, and few people read his work.

Exam technique

- Learn the order of events by period; ordering questions are common.
- When asked why an idea was not accepted, think: no mechanism, not enough evidence, not widely known.
- Link this topic to how science works: theories develop as many scientists find new evidence.

What each grade needs

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

Grade 3

Name Mendel and the plants he used

Gregor Mendel carried out breeding experiments on pea plants in the mid-19th century.

Grade 4

State Mendel's key observation

The inheritance of each characteristic is determined by 'units' that are passed on to descendants unchanged.

Grade 5

Put the development of gene theory in order

Mendel's units, chromosomes seen in cell division, units linked to chromosomes, then the structure of DNA.

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