

Exercise walk-through

Evolution ■ 17.3

eXercise

You must be able to

- outline evolution as the change in gene pools producing new species over time
- discuss how DNA sequence data shows evolutionary relationships
- explain allopatric and sympatric speciation

Method — Evolution and DNA evidence

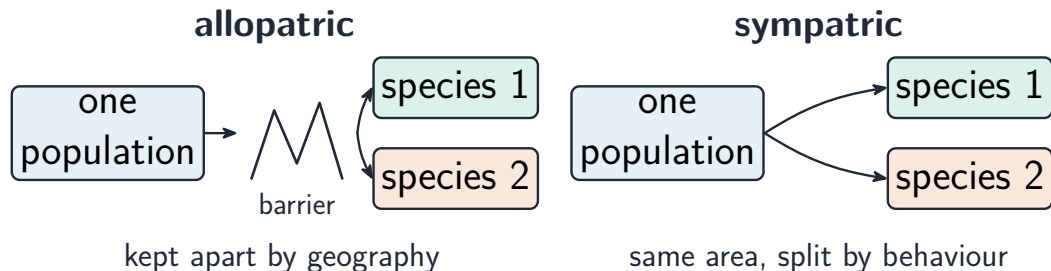
Evolution 进化 is the formation of new **species 物种** from earlier ones as the **gene pool 基因库** (all the alleles in a population) changes over generations. **DNA sequence data** shows relationships: the more similar two species' DNA, the more recently they shared a common ancestor.

Method — Speciation

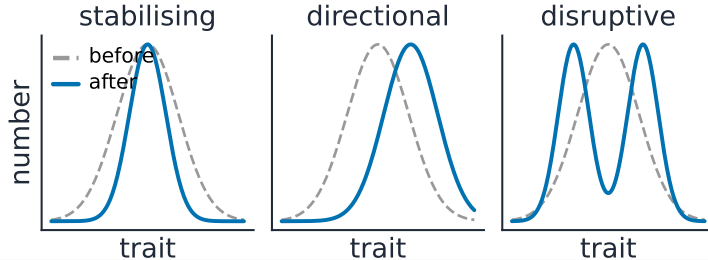
Speciation happens when two populations become genetically **isolated** 隔离 so they can no longer interbreed:

- **allopatric** 异域 — separated by a **geographical** barrier (sea, mountain).
- **sympatric** 同域 — in the same area, separated by behaviour or way of life.

Method — Speciation



Method — Speciation



directional: favors one extreme · stabilising: favors mean · disruptive: favors both extremes

Selection drives evolution and speciation

Practice 2.1 ■ 2 marks

Define **evolution** in terms of the gene pool.

Solution 2.1

Method: Evolution and DNA evidence

Worked steps

evolution is the change in the gene pool / allele frequencies of a population **M1**
over many generations, leading to new species **A1**.

Practice 2.2 ■ 2 marks

State the difference between allopatric and sympatric speciation.

Solution 2.2

Method: Speciation

Worked steps

allopatric — populations separated by a geographical barrier **B1**; sympatric — populations in the same area separated by behaviour/ecology **B1**.

Exam-style 3.1 ■ 1 mark

Two species share a very similar DNA base sequence. This suggests they:

- A** are not related
- B** shared a recent common ancestor
- C** live in the same habitat
- D** have the same number of chromosomes

Solution 3.1

Method: Evolution and DNA evidence

- A** are not related
- B** shared a recent common ancestor 
- C** live in the same habitat
- D** have the same number of chromosomes

Worked steps

B. Very similar DNA suggests a recent common ancestor.

Exam-style 3.2 ■ 1 mark

A mountain range divides a population into two, which slowly become different species. This is:

A allopatric speciation

B sympatric speciation

C genetic drift

D artificial selection

Solution 3.2

Method: Speciation

A allopatric speciation



B sympatric speciation

C genetic drift

D artificial selection

Worked steps

A. A geographical barrier causing speciation is allopatric.

Exam-style 3.3 ■ 4 marks

Explain how allopatric speciation can lead to the formation of two new species.

Solution 3.3

Method: Speciation

Worked steps

a geographical barrier separates the population into two (B1); each population faces different conditions and undergoes different selection / mutations / drift (B1); their gene pools change in different ways (B1); eventually they are so different they can no longer interbreed to produce fertile offspring — two species (B1).

Exam-style 3.4 ■ 2 marks

Explain how comparing DNA sequences can be used to show how closely related different species are.

Solution 3.4

Worked steps

the more similar the DNA base sequences, the more recently the species shared a common ancestor **M1**; large differences indicate they diverged longer ago **A1**.