A-LEVEL BIOLOGY • EXERCISE SHEET

17.3 Evolution

Name: _____ Class: _____ Date: _____ **Total: 12 marks**

KEY WORDS sequence 序列 • speciation 物种形成 • species 物种 • evolution 进化 • allopatric 异域

Objective

Build the skills to answer exam questions on **evolution** — the theory of evolution, **DNA sequence** 序列 evidence, and **speciation** 物种形成 by genetic isolation.

You must be able to:

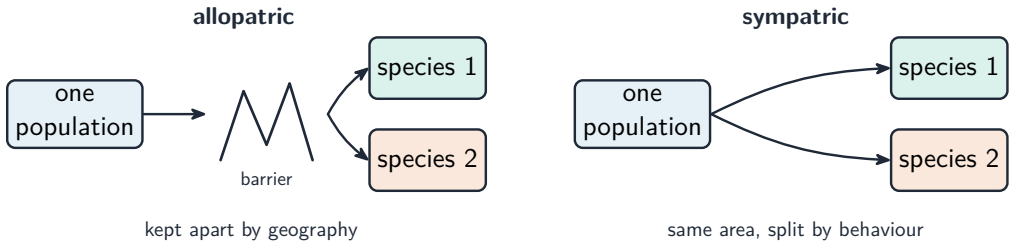
- outline evolution as the change in gene pools producing new species over time
- discuss how DNA sequence data shows evolutionary relationships
- explain allopatric and sympatric speciation

1 Worked examples

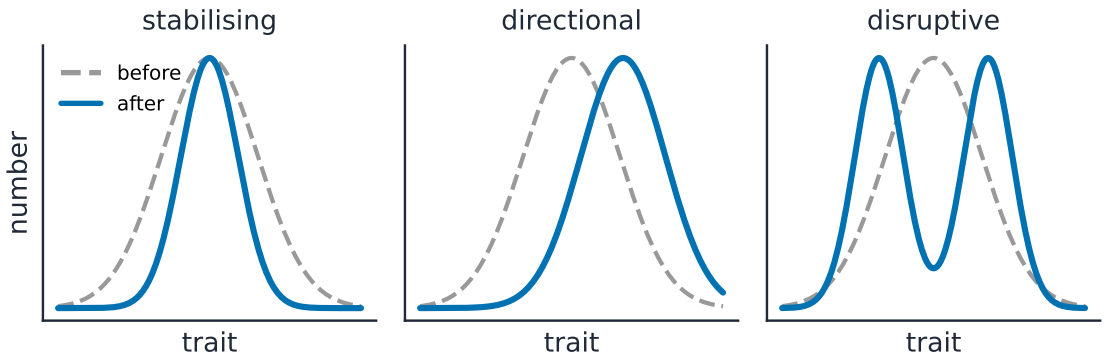
Evolution and DNA evidence

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.

Speciation



Allopatric speciation needs a physical barrier; sympatric speciation happens in the same area



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

Selection drives evolution and 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.

2 Practice

2.1 Define **evolution** in terms of the gene pool. [2]

2.2 State the difference between allopatric and sympatric speciation. [2]

3 Exam-style questions

3.1 Two species share a very similar DNA base sequence. This suggests they: [1]

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

3.2 A mountain range divides a population into two, which slowly become different

species. This is: [1]

- **A** allopatric speciation
- **B** sympatric speciation
- **C** genetic drift
- **D** artificial selection

3.3 Explain how allopatric speciation can lead to the formation of two new species. [4]

3.4 Explain how comparing DNA sequences can be used to show how closely related different species are. [2]

Solutions

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

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

3.1 B. Very similar DNA suggests a recent common ancestor.

3.2 A. A geographical barrier causing speciation is allopatric.

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

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