A-LEVEL BIOLOGY • EXERCISE SHEET

17.3 Evolution

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

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

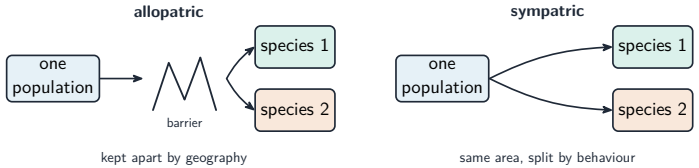
- outline evolution as the change in gene pools producing new species over time
- discuss how DNA sequence data shows evolutionary relationships
- explain allopatric and sympatric speciation

1 Worked examples

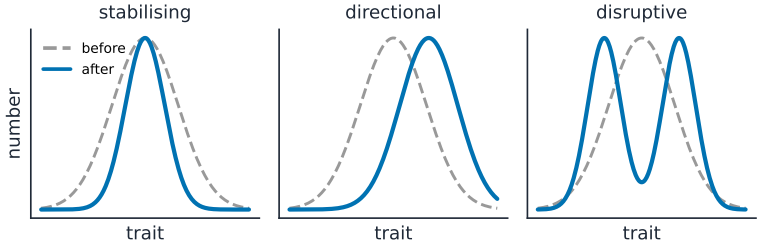
Evolution and DNA evidence

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 B C D

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	B
C	D

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]

3.5 Two populations of a fish species live in one lake. One feeds at the surface, the other on the bottom. They breed at different depths and no longer interbreed, although in the laboratory they can produce fertile young.

(a) Explain, using the biological definition of a species, whether these are one species or two. [3]

(b) Name the type of speciation occurring here, and explain how it differs from the other type. [3]

(c) Describe how DNA sequence data could be used to estimate how long ago the two populations began to diverge. [3]

(d) Explain why comparing DNA sequences is better evidence of relatedness than comparing external appearance. [3]