

Exercise walk-through

7.8

Continuing Evolution

AP Biology

Evidence and common ancestry

Many independent lines all point to **evolution** :

- **Fossils** : change over time
- **Homologous structures** : same bones
- **Molecular** : shared DNA sequences
- **Biogeography** : where species live

One near-universal genetic code + ATP
+ ribosomes $\Rightarrow$ common ancestry.



Fossils record change and shared ancestry

Speciation, and reading a phylogenetic tree

speciation

the origin of new species, when populations become **reproductively isolated** and diverge

allopatric

a **geographic** barrier separates the populations

sympatric

divergence **without** physical separation – polyploidy, or a shift in habitat or mating time

a phylogenetic tree

a cladogram diagramming evolutionary relationships

branch points

mark **common ancestors**; the shared derived characters define each clade

reading it

relatedness is read from **how recently two lines share a node**, never from proximity across the page

Two tips drawn next to each other can be distantly related. Trace back to the shared node – that is the only thing a tree asserts.

Exam tips

- State natural selection cleanly: **variation** → **differential survival and reproduction** → **helpful traits become common**.
- **Fitness = reproductive success**, not strength or health.
- Evolution is a change in **allele frequencies** in a **population** – individuals do not evolve.
- Use **Hardy–Weinberg** ($p^2 + 2pq + q^2 = 1$): start from the recessive phenotype $q^2 \rightarrow q \rightarrow p$.
- Cite independent **evidence** (fossils, homologous structures, DNA) and explain speciation via reproductive isolation.

Exercises 2.1-2.3

2.1 Give one example that shows evolution is ongoing.

[1]

2.2 Does an antibiotic create the resistance allele?

[1]

2.3 Which individuals survive antibiotic treatment?

[1]

Exercises 2.1-2.3

2.1 Give one example that shows evolution is ongoing. [1]

2.1

- Antibiotic resistance in bacteria (or pesticide resistance in insects)

2.2 Does an antibiotic create the resistance allele? [1]

2.2

- No

2.3 Which individuals survive antibiotic treatment? [1]

2.3

- The resistant individuals

Exercise 3.1

3.1 Antibiotic resistance spreads in a bacterial population because the antibiotic [1]

☐

A creates the resistance gene

B selects for pre-existing resistant bacteria

C kills all bacteria equally

D stops reproduction

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3.1 Antibiotic resistance spreads in a bacterial population because the antibiotic [1]

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3.1 B

- selects for pre-existing resistant bacteria

Exercise 3.2 (a)

3.2 A bacterial population is repeatedly treated with an antibiotic.

(a) Describe how the population becomes resistant over time.

[3]

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(a) Describe how the population becomes resistant over time. [3]

(a)

- A few bacteria already carry a resistance allele; the antibiotic kills the susceptible ones; the resistant survivors reproduce; over generations resistance becomes common

Exercise 3.2 (b)

3.2 A bacterial population is repeatedly treated with an antibiotic.

(b) Explain why overusing antibiotics is a public-health concern.

[1]

Exercise 3.2 (b)

3.2 A bacterial population is repeatedly treated with an antibiotic.

(b) Explain why overusing antibiotics is a public-health concern.

[1]

(b)

- It selects for hard-to-treat resistant “superbugs”

Exercise 3.3

3.3 Explain why the resistance allele must already exist in the population for resistance to evolve. [2]

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3.3

- Selection can only act on existing variation – it favors the resistant allele but cannot create it; if no bacterium carried it, none would survive to reproduce