

Exercise walk-through

Continuing Evolution ■ 7.8

eXercise

You must be able to

- give evidence that evolution is **ongoing** (antibiotic and pesticide resistance)
- explain how resistance evolves by selection
- link the process to public-health concerns

Method — Evolution happens now

Evolution is **ongoing**, not just in the past. Fast examples: bacteria evolving **antibiotic resistance** 抗生素抗性 and insects evolving **pesticide resistance**.

Method — How resistance evolves

- 1 A population has **variation** — a few individuals carry a resistance allele.
2. The antibiotic/pesticide **kills the susceptible** ones.
3. The **resistant** survivors reproduce.
4. Over generations the resistance allele becomes common.

Method — The antibiotic does not create resistance

The drug does not **cause** the mutation; the resistant allele was already present. The drug only **selects** for it by removing the non-resistant individuals.

Method — Public-health link

Overusing antibiotics speeds this selection, producing hard-to-treat “superbugs” — which is why doctors limit antibiotic use.

Practice 2.1 ■ 1 mark

Give one example that shows evolution is ongoing.

Solution 2.1

Method: Evolution happens now

Worked steps

Antibiotic resistance in bacteria (or pesticide resistance in insects) **B1**.

Practice 2.2 ■ 1 mark

Does an antibiotic create the resistance allele?

Solution 2.2

Method: The antibiotic does not create resistance

Worked steps

No **B1**.

Practice 2.3 ■ 1 mark

Which individuals survive antibiotic treatment?

Solution 2.3

Worked steps

The resistant individuals **B1**.

Exam-style 3.1 ■ 1 mark

Antibiotic resistance spreads in a bacterial population because the antibiotic

- A** creates the resistance gene
- B** selects for pre-existing resistant bacteria
- C** kills all bacteria equally
- D** stops reproduction

Solution 3.1

Method: How resistance evolves

- A creates the resistance gene
- B selects for pre-existing resistant bacteria** 
- C kills all bacteria equally
- D stops reproduction

Worked steps

B — selects for pre-existing resistant bacteria.

Exam-style 3.2 ■ 3 marks

A bacterial population is repeatedly treated with an antibiotic.

- (a) Describe how the population becomes resistant over time.
- (b) Explain why overusing antibiotics is a public-health concern.

Solution 3.2

Worked steps

(a) A few bacteria already carry a resistance allele; the antibiotic kills the susceptible ones; the resistant survivors reproduce; over generations resistance becomes common **M1 M1 A1**. (b) It selects for hard-to-treat resistant “superbugs” **B1**.

Exam-style 3.3 ■ 2 marks

Explain why the resistance allele must already exist in the population for resistance to evolve.

Solution 3.3

Worked steps

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 **M1** **A1**.