# Practice: evolution and genetic engineering

Student activity • observation and reasoning

YEAR 11 / LESSON 102 / BIOLOGY + SCIENCE (DOUBLE AWARD)

## The question

**Can you support an explanation with a clear causal sequence?**

Use the supplied examples, record your reasoning and correct it using evidence.

## Equipment

- Student booklet, pencil and ruler
- Question booklet and blank gene-transfer diagram

Paper, modelling and written reasoning only. No chemicals or biological samples are handled.

Course coverage: Shared variation, selection and biotechnology; Biology-only mutation/cloning extensions marked.

## Plan, model or apparatus sketch

**Draw and label the apparatus or biological model; identify one limitation.**

# Method and reasoning

Read the whole sequence before starting

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**1.** Answer the six original questions independently; this is not an exam-board paper.

**2.** Use a hypothetical bacterial population with 20 resistant cells in 100 before treatment and 18 resistant cells among 20 survivors after treatment. Calculate proportions without assuming new resistance was induced.

**3.** Explain what further evidence would distinguish selection of existing variants from new mutations.

**4.** Compare the roles of restriction enzyme and ligase in a gene-transfer diagram.

**5.** Evaluate a GM crop claim by naming a measurable benefit and a context-specific potential disadvantage.

**6.** Biology extension: explain why cloning an engineered animal preserves nuclear information but does not replace product purification or welfare assessment.

## Cleanup

- Return models and keep the corrected work.

# Record your evidence

Blank spaces are for your own work

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## Reference and task data

Invented arithmetic data: resistance frequency is 20% initially and 90% among survivors. Counts describe this model only; they do not establish a real clinical treatment effect. This is a hypothetical non-reproducing interval: 18 of the initial 20 resistant cells and 2 of the initial 80 susceptible cells survive.

| Example / trial | Observation / evidence | Explanation / limit |
|---|---|---|
| Evidence / comparison | | |
| Explanation | | |
| Limit / correction | | |

**Show your calculations, labelled model or correction here.**

# Explain and evaluate

Use evidence and show calculation steps where relevant

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**1.** Calculate the initial resistance percentage.

**2.** Calculate the survivor resistance percentage.

**3.** Does the change prove antibiotics caused the mutation?

**4.** Which enzyme joins DNA?

**5.** Give one useful crop comparison measure.

**6.** Biology: does cloning guarantee identical health and performance?