Review: variation, evolution and biotechnology

Student activity • observation and reasoning

YEAR 11 / LESSON 101 / BIOLOGY + SCIENCE (DOUBLE AWARD)

The question

Can you distinguish the source of variation from selection and deliberate engineering?

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

Equipment

- Student booklet, pencil and ruler
- Variation and recombinant-DNA recap cards

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

Course coverage: Shared variation, selection and genetic engineering; Biology-only cloning and molecular mutation detail 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. Compare mutation, environmental effects and sexual reproduction as contributors to variation.

2. Explain natural selection in a fictional population using inheritance and differential reproduction.

3. Explain antibiotic resistance without claiming that individual bacteria change because they need to.

4. Sequence restriction enzyme, vector, ligase, recipient and expression in a paper recombinant-DNA model.

5. Compare selective breeding with genetic engineering.

6. Biology extension: distinguish mammalian cloning from gene insertion and explain why a clone's phenotype need not be identical.

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

Use mechanism-specific language. Selection changes variant frequencies; it does not direct the mutation that would be useful. Detailed cloned-transgenic-animal applications are Biology-only. Fictional selection example: 8 pale and 2 dark beetles occur on dark ground; after a stated predation event, 2 pale and 2 dark beetles survive and reproduce. Assume colour is inherited and other factors equal; explain the model without treating it as field data.

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. Does selection create needed variants?

2. What does a restriction enzyme do?

3. What does ligase do?

4. What is selected in breeding?

5. Does transgenic mean genetically identical?

6. Biology: why can clones differ?