Natural selection and antibiotic resistance

Student activity • observation and reasoning

YEAR 11 / LESSON 98 / BIOLOGY + SCIENCE (DOUBLE AWARD)

The question

How can inherited variants become more common across generations?

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

Equipment

- Student booklet, pencil and ruler
- Paper population cards labelled susceptible or resistant

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

Course coverage: Shared Biology / Double Award: 3.38–3.39. Biology-only extension: 3.37B mutagens.

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. Use a paper population containing inherited variants and state the environmental selection pressure.

2. Explain differential survival and reproduction, followed by inheritance and changing variant frequencies over generations.

3. Apply the sequence to a bacterial population containing resistant variants before or arising during treatment.

4. Explain that antibiotics select among bacteria rather than teaching individual bacteria to become resistant.

5. Evaluate why resistance can make infections harder to control; distinguish bacterial resistance from a person becoming resistant.

6. Biology extension: identify ionising radiation, ultraviolet radiation and some chemicals as mutagens. Do not classify ordinary UV as ionising radiation.

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

Natural selection acts on heritable variation through differences in reproductive success. Mutation creates variation without foresight. This is a paper model: no bacteria are cultured and no antibiotic exposure is performed. UV can damage DNA even though ordinary ultraviolet radiation is non-ionising. Illustrative paper model: start with 9 susceptible and 1 resistant card. A stated selection event leaves 1 susceptible and 1 resistant survivor; each produces two descendants of its own type. Compare resistant fractions 1/10, 1/2 and 2/4. Counts are invented to explain selection, not treatment predictions.

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

YEAR 11 / LESSON 98 / BIOLOGY + SCIENCE (DOUBLE AWARD)

1. What must be heritable for selection to change a population genetically?

2. Does selection create a needed mutation?

3. What changes over generations?

4. What becomes antibiotic-resistant?

5. Why may resistant bacteria increase after treatment?

6. Biology: is ordinary UV ionising?