Meiosis, variation and sex chromosomes

Student activity • observation and reasoning

YEAR 11 / LESSON 91 / BIOLOGY + SCIENCE (DOUBLE AWARD)

The question

How does meiosis support variation while fertilisation restores chromosome number?

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

Equipment

- Student booklet, pencil and ruler
- Paper chromosome models: two homologous pairs and duplicate chromatids

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

Course coverage: Shared Biology / Double Award: 3.26–3.27 and 3.30–3.31. Meiosis and fertilisation.

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. Model a diploid cell with two chromosome pairs, replicate DNA once and represent two divisions producing four haploid products.

2. Compare chromosome number with mitosis and explain how gametes can receive different combinations.

3. Explain how random fusion of gametes adds variation and restores the diploid number.

4. Use the standard XX/XY inheritance model with X-bearing eggs and X- or Y-bearing sperm.

5. Construct a genetic diagram showing the model's equal XX and XY probabilities at each fertilisation.

6. State that the model describes typical chromosomal sex determination and does not capture every biological variation or define gender identity.

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

Meiosis produces genetically varied haploid products. In the standard human model, fertilisation combines 23 chromosomes from each gamete to make 46. A 1:1 probability is not a guarantee of equal numbers in a small family; each event is a new probability.

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. How many haploid products are represented?

2. How does chromosome number change?

3. What restores diploidy?

4. Which gamete contributes X or Y in the model?

5. What is the model probability of XX?

6. Must a family with four children have two of each chromosomal outcome?