

Cell and nuclear division · supported focus

International Baccalaureate · IB Diploma · Biology · HL

Scope and prerequisites

Supported HL focus. First assessment 2025; current subject brief acquired; full Biology guide not acquired. Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

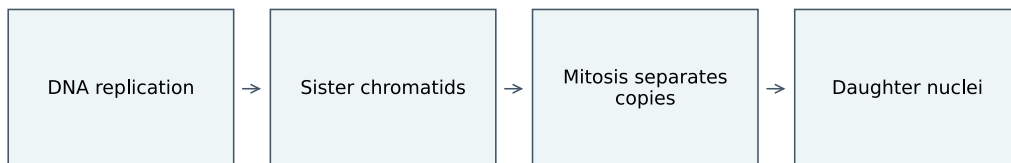
Cell division: count nuclei and chromosomes carefully

■ What would explain this observation?

- A root-tip image contains cells at different stages of mitosis. A snapshot can estimate the fraction of cells dividing, but it does not time one observed cell directly.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- DNA replication occurs before mitosis. Mitosis separates sister **chromatids**, preserving chromosome number in daughter nuclei. Meiosis includes homologous chromosome separation and normally halves the chromosome number while generating variation.
- **mitotic index** : Fraction of scored cells undergoing mitosis; chromatid : One copy of a replicated chromosome before separation.



■ Choose evidence that can test it

- Count chromosomes by centromeres under the stated convention. DNA amount and chromosome number are different quantities. Crossing over and independent assortment contribute to meiotic variation.
- Use a prepared root-tip slide or a labelled image. Define a counting rule and field selection before counting. Distinguish dividing cells from damaged or ambiguous cells and report exclusions.

■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: 25 dividing cells among 200 scored cells. Mitotic index = $25/200 = 0.125$, or 12.5%. Estimating phase duration from this proportion requires assumptions about a steady, representative cell population.

Example:

18 of 120 scored cells are dividing. Calculate mitotic index as a percentage. Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

■ Check the conclusion and its limits

- Replication doubles DNA amount without immediately doubling the chromosome count. Meiosis does not simply produce two identical diploid cells.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

DNA replication immediately doubles chromosome number under the centromere convention. This claim is false: Replication doubles DNA amount without immediately doubling the chromosome count. Meiosis does not simply produce two identical diploid cells.

Key:

Cell division: count nuclei and chromosomes carefully: Count chromosomes by centromeres under the stated convention. DNA amount and chromosome number are different quantities. Crossing over and independent assortment contribute to meiotic variation.