

Origins of cells · 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.

Origins of cells: evidence and limits

■ What would explain this observation?

- Mitochondria have their own DNA and divide within cells. These features invite an evolutionary explanation that can be tested against other evidence.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- The endosymbiotic model explains mitochondria and chloroplasts as descendants of bacteria living within another cell lineage. Double membranes, ribosomes, DNA and division provide several lines of evidence. This model is distinct from a complete explanation for the origin of the first life.
- **endosymbiosis** : One organism living within another in an evolutionary association; **inference** : An explanation drawn from observations and reasoning.



■ Choose evidence that can test it

- Independent observations strengthen a model when they make a consistent prediction. Similarity is evidence to evaluate alongside ancestry, sequence comparisons and alternative explanations, rather than proof from one feature.
- Use attributed micrographs and sequence data. Separate observations from inferences in a table. Check whether each comparison concerns a mitochondrion, chloroplast, bacterial cell or eukaryotic nucleus.

■ 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: 18 of 24 compared sequence sites are identical. Identity = $18/24 \times 100 = 75\%$. Identity across this short alignment cannot alone date an evolutionary split or establish that one organism is the direct ancestor of another.

Example:

21 of 28 compared sites match. Calculate percentage identity. Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

■ Check the conclusion and its limits

- The endosymbiotic model does not say that every organelle arose from an engulfed bacterium. A laboratory model of early chemistry is not a recreation of the whole historical event.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

One matching sequence proves the complete origin of life. This claim is false: The endosymbiotic model does not say that every organelle arose from an engulfed bacterium. A laboratory model of early chemistry is not a recreation of the whole historical event.

Key:

Origins of cells: evidence and limits: Independent observations strengthen a model when they make a consistent prediction. Similarity is evidence to evaluate alongside ancestry, sequence comparisons and alternative explanations, rather than proof from one feature.