

Gene expression · 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.

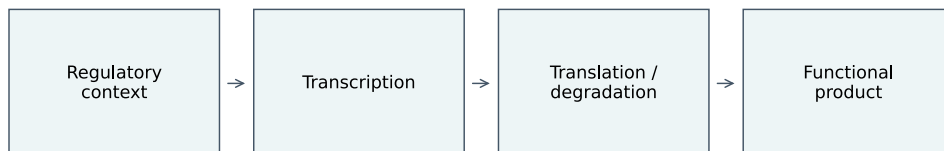
Gene expression: regulate products, not just genes

■ What would explain this observation?

- Two cells with the same genome make different proteins. Regulation changes which information is used and when.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- Gene expression can be regulated at transcription and later stages. A **transcription factor** can affect transcription through interactions with DNA and other proteins. **Epigenetic modifications** can influence expression without changing the underlying DNA sequence.
- transcription factor: A protein that influences transcription; epigenetic modification : A change affecting expression without changing the DNA sequence.



■ Choose evidence that can test it

- Distinguish a measured mRNA change from a protein or functional change. Translation, degradation and protein modification can all intervene. Regulation is specific to a cell context and environmental conditions.
- Compare treated and control expression data after checking normalization and replicates. Use evidence from a supplied perturbation to discuss causal models, rather than equating every association with a direct mechanism.

■ 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: normalized transcript abundance is 12 in treatment and 3 in control. Fold change = $12/3 = 4$. Equal normalized abundance does not require equal absolute cell counts in the two raw samples.

Example:

Transcript abundance is 15 in treatment and 5 in control. Find fold change. Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

■ Check the conclusion and its limits

- An epigenetic change is not automatically a DNA-sequence mutation. More mRNA does not guarantee proportionally more active protein.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Every change in gene expression is a mutation. This claim is false: An epigenetic change is not automatically a DNA-sequence mutation. More mRNA does not guarantee proportionally more active protein.

Key:

Gene expression: regulate products, not just genes: Distinguish a measured mRNA change from a protein or functional change. Translation, degradation and protein modification can all intervene. Regulation is specific to a cell context and environmental conditions.