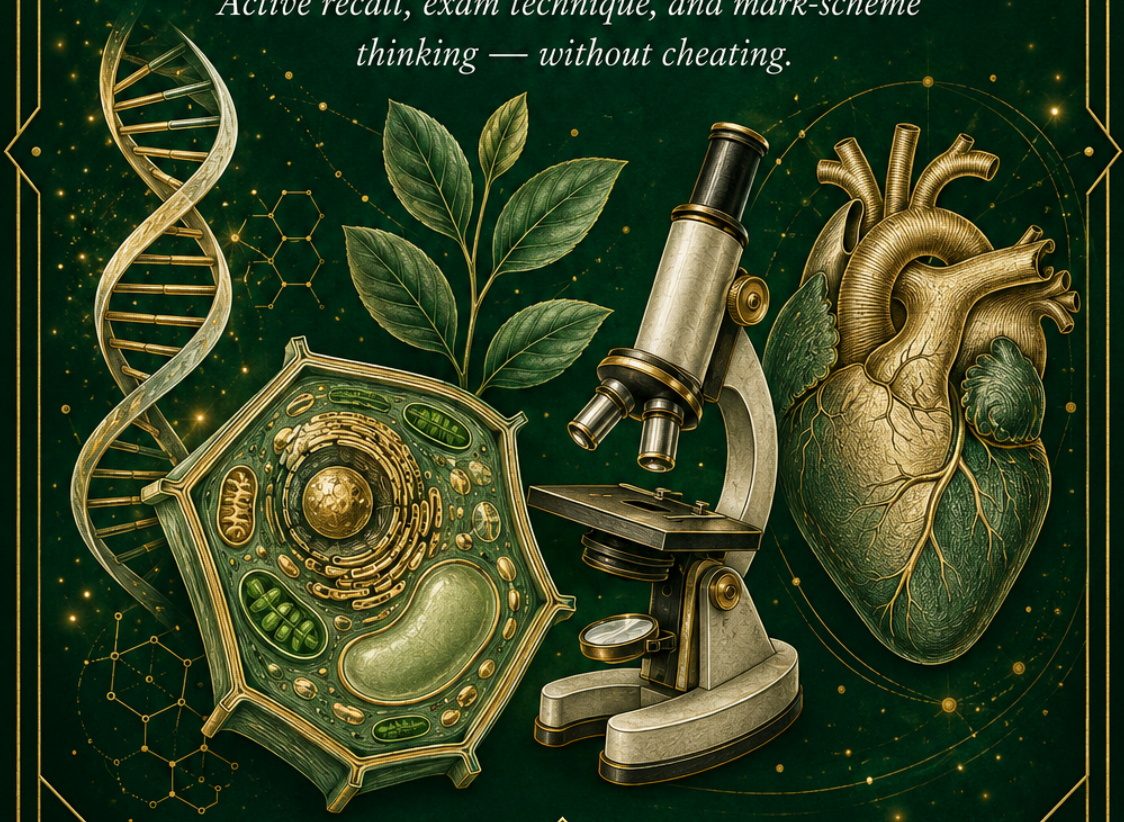
IBDP BIOLOGY

100 AI PROMPTS

for Smarter Revision *and* Exam Prep

Active recall, exam technique, and mark-scheme thinking — without cheating.



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The author has made use of artificial intelligence tools to assist with drafting, structuring, and generating example material. All educational guidance, explanations, and exam-related advice have been reviewed, edited, and curated by the author. Any resemblance to specific published materials is unintentional.

This book is intended to support revision and exam preparation. It does not replace formal teaching, textbooks, or official specifications. Students are responsible for ensuring that all work submitted for assessment is their own.

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How to Use This Book

For a long time, high-quality tutoring has been a major contributor to elite academic achievement. Used well, AI can now act as a powerful tutor that most students and parents could not previously afford.

This book is a **starting point**, not a rulebook. Each prompt is designed to help you revise, test your understanding, and think more clearly — not to give perfect answers. You are encouraged to **adapt, improve, and remix** these prompts.

You are learning how to think carefully about the questions you ask — a skill that will matter far beyond these exams.

Note on Exam Boards and Syllabi

This revision guide is designed for the International Baccalaureate Diploma Programme (IBDP) Biology course, covering both Standard Level (SL) and Higher Level (HL) content. The prompts align with the IB Biology syllabus and reflect the emphasis on conceptual understanding, data analysis, and the interconnected nature of biological systems.

IB Biology assessment consists of Paper 1 (multiple choice questions testing breadth of knowledge), Paper 2 (structured and extended response questions requiring explanations, data analysis, and essay writing), and Paper 3 (HL only, covering options and data-based questions). The Data Booklet contains reference material including statistical tables and diagrams that you should become familiar with before the examination.

The Internal Assessment (IA) is an individual scientific investigation worth 20% of your final grade, assessed against criteria including Personal Engagement, Exploration, Analysis, Evaluation, and Communication. Several prompts specifically target practical skills, experimental design, and IA preparation to support a strong biology investigation.

HL-only topics and extensions are indicated where relevant, including plant biology, further human physiology, detailed biochemistry of cell respiration and photosynthesis, and advanced genetics. SL students should focus on core prompts and use HL-tagged prompts as extension material to develop a deeper understanding of biological concepts.

Throughout your revision, use IB command terms precisely — 'outline', 'describe', 'explain', 'compare', 'discuss', 'evaluate', and 'annotate' each require

different response types. Practise drawing annotated diagrams, interpreting data tables and graphs, and constructing extended response essays that follow a logical structure with clear biological terminology.

Contents

Section 1

Cell Biology

Cell biology forms the foundation of the IB Biology course, establishing the cell as the basic unit of life and exploring its structure, function, and division. Understanding cell theory, the differences between prokaryotic and eukaryotic cells, and the mechanisms of membrane transport are essential for all subsequent topics.

You must be able to draw and annotate diagrams of cell ultrastructure, explain the fluid mosaic model of membrane structure, and describe the processes of mitosis and meiosis. Microscopy skills, including calculating magnification and interpreting electron micrographs, are tested across both papers.

These prompts develop your ability to connect cellular structure to function, interpret microscope images, and explain the dynamic processes that maintain cell viability and enable growth.

Prompt 1: Cell Theory and Its Exceptions

Copy this prompt into your AI tool:

Ask me to state the three principles of cell theory and then present five biological examples that challenge or appear to violate cell theory. For each exception, ask me to explain why it is problematic for the theory and whether it invalidates the theory or requires modification.

What this helps you practise:

Stating cell theory and evaluating its exceptions

How to use it well:

Cell theory exceptions are frequently tested on Paper 1 — practise explaining why structures like

muscle fibres and fungal hyphae challenge the theory.

Prompt 2: Prokaryotic vs Eukaryotic Cell Comparison

Copy this prompt into your AI tool:

Test me on draw and annotate a prokaryotic cell and a eukaryotic cell side by side. Then present a table comparing their features and ask me to explain five key structural differences. Include a question about the endosymbiotic theory and the evidence that supports it.

What this helps you practise:

Comparing prokaryotic and eukaryotic cell structures

How to use it well:

Comparison questions require systematic treatment of differences — practise organising your response by feature rather than describing each cell type separately.

Prompt 3: Organelle Structure and Function

Copy this prompt into your AI tool:

Present electron micrographs or descriptions of eight organelles and ask me to identify each, state its function, and explain how its structure is adapted to that function. Include the nucleus, mitochondria, rough ER, Golgi apparatus, lysosomes, chloroplasts, ribosomes, and cell membrane. At HL, extend your answer to include the role of free ribosomes versus bound ribosomes and the functional relationship between the endomembrane system components.

What this helps you practise:

Linking organelle structure to function

How to use it well:

Structure-function relationships are central to IB

Biology — practise explaining how each organelle's specific features enable its role in the cell.

Prompt 4: Membrane Structure and the Fluid Mosaic Model

Copy this prompt into your AI tool:

Quiz me on draw and annotate a diagram of the fluid mosaic model of membrane structure, labelling the phospholipid bilayer, integral proteins, peripheral proteins, cholesterol, and glycoproteins. Then ask me to explain the function of each component and why the model is described as 'fluid' and 'mosaic'.

What this helps you practise:

Drawing and explaining the fluid mosaic model of cell membranes

How to use it well:

Membrane diagrams must be detailed and correctly labelled — practise including all components and explaining their roles in membrane function.

Prompt 5: Membrane Transport Mechanisms

Copy this prompt into your AI tool:

Present five scenarios involving the movement of substances across cell membranes and ask me to identify the transport mechanism used in each: simple diffusion, facilitated diffusion, osmosis, active transport, or endocytosis/exocytosis. For each, ask me to explain the energy requirements and the role of membrane proteins.

What this helps you practise:

Identifying and explaining different membrane transport mechanisms

How to use it well:

Transport mechanism identification is a core Paper 1 and Paper 2 skill — practise distinguishing between passive and active processes and their protein requirements.

Prompt 6: Osmosis Investigations

Copy this prompt into your AI tool:

Set me a challenge: present an osmosis experiment using plant tissue in solutions of different concentration and ask me to predict the results, explain the observations using the terms hypertonic, hypotonic, and isotonic, and sketch a graph of the expected results. Then ask me to explain how I would determine the solute concentration of the tissue. Incorporate a TOK perspective: Evaluate to what extent cell theory is a 'law' of biology or a working framework, and discuss what counts as sufficient evidence to establish a scientific theory.

What this helps you practise:

Predicting and explaining osmosis experimental results

How to use it well:

Osmosis experiments are a classic IA and Paper 2 topic — practise connecting the theoretical predictions to observable changes in tissue mass or appearance. This also strengthens your TOK connections across the sciences.

Prompt 7: Mitosis Stages and Significance

Copy this prompt into your AI tool:

Present images or descriptions of cells at different stages of mitosis and ask me to identify each stage in the correct order. For each stage, ask me to describe the key events and the state of the chromosomes. Then ask me to explain the biological significance of mitosis for growth, repair, and asexual reproduction. SL students focus on identifying stages and stating significance, while HL students should also address how cyclin-dependent kinases regulate progression through the cell cycle.

What this helps you practise:

Identifying mitosis stages and explaining their biological significance

How to use it well:

Mitosis identification from micrographs appears on Paper 1 — practise recognising chromosome arrangements that characterise each stage.

Prompt 8: Cell Division Index Calculation

Copy this prompt into your AI tool:

Present data from a root tip squash experiment showing cells in different stages of mitosis. Ask me to calculate the mitotic index and estimate the relative duration of each stage. Then ask me to evaluate the limitations of this method and suggest improvements to the experimental design.

What this helps you practise:

Calculating mitotic index from cell count data

How to use it well:

Mitotic index calculations connect practical work to mathematical analysis — practise the calculation and understand how to interpret the result biologically.

Prompt 9: Microscopy and Magnification

Copy this prompt into your AI tool:

Present micrographs with scale bars and ask me to calculate the actual size of structures using the magnification formula. Then give me actual sizes and magnification values and ask me to calculate the image size. Include a question about the differences between light and electron microscopy.

What this helps you practise:

Calculating magnification and actual size from micrographs

How to use it well:

Magnification calculations appear on Paper 1 —

practise the formula magnification = image size / actual size and ensure consistent unit conversions.

Prompt 10: Stem Cells and Differentiation

Copy this prompt into your AI tool:

Give me an IB-style question about define stem cells and explain the difference between totipotent, pluripotent, and multipotent stem cells. Then present the therapeutic use of stem cells and ask me to discuss the ethical considerations involved. Include a question about how gene expression controls cell differentiation.

What this helps you practise:

Explaining stem cell types and evaluating ethical considerations

How to use it well:

Stem cell questions combine biology with ethics — practise constructing balanced arguments that reference both the scientific potential and ethical concerns.

Prompt 11: Cell Biology Exam Question Synthesis

Copy this prompt into your AI tool:

Create an IB Paper 2 style question that combines cell ultrastructure identification with membrane transport and cell division concepts. Include a micrograph interpretation, a diagram to annotate, and an explanation question. Mark my response against IB standards and identify areas for improvement.

What this helps you practise:

Completing multi-part cell biology exam questions

How to use it well:

Use this as an extended practice question to develop the ability to integrate different cell biology concepts within a single coherent exam response.

Section 2

Molecular Biology

Molecular biology explores the chemical compounds that make up living organisms and the molecular processes that sustain life. Understanding the structure and function of water, carbohydrates, lipids, proteins, and nucleic acids provides the biochemical foundation for all biological processes.

You must be able to explain the relationship between molecular structure and biological function for each class of biomolecule, describe DNA replication, transcription, and translation in detail, and explain enzyme kinetics including the effects of inhibitors and environmental factors.

These prompts build your ability to connect molecular structure to biological function and to describe the central dogma of molecular biology with the precision and detail that IB examiners expect in extended response questions.

Prompt 12: Water Properties and Biological Significance

Copy this prompt into your AI tool:

Ask me to explain five properties of water — high specific heat capacity, cohesion, solvent properties, thermal expansion, and surface tension — and for each property, describe how it is biologically significant. Require me to link each property to the molecular structure of water, specifically hydrogen bonding.

What this helps you practise:

Explaining water's properties and their biological significance

How to use it well:

Water properties questions appear on Paper 1 and as part of extended responses — practise making explicit connections between hydrogen bonding and each property.

Prompt 13: Carbohydrate Structure and Function

Copy this prompt into your AI tool:

Present me with questions on draw the structural formulae of glucose, fructose, and ribose, and explain the difference between alpha and beta glucose. Then ask me to describe how monosaccharides join through condensation reactions and how the structures of starch, glycogen, and cellulose relate to their functions.

What this helps you practise:

Relating carbohydrate structure to biological function

How to use it well:

Structure-function questions require precise molecular detail — practise explaining why the beta-1,4 linkages in cellulose create different properties from the alpha linkages in starch.

Prompt 14: Lipid Structure and Membrane Role

Copy this prompt into your AI tool:

Challenge me to explain draw the generalised structure of a triglyceride and a phospholipid and explain how they differ. Then ask me to explain how the amphipathic nature of phospholipids leads to bilayer formation in aqueous environments. Include a comparison between saturated and unsaturated fatty acids.

What this helps you practise:

Explaining lipid structures and their roles in membrane formation

How to use it well:

Lipid questions connect to membrane biology — practise explaining the self-assembly of phospholipid bilayers as a consequence of hydrophobic and hydrophilic interactions.

Prompt 15: Protein Structure Levels

Copy this prompt into your AI tool:

You are an IB examiner: ask me to describe the four levels of protein structure — primary, secondary, tertiary, and quaternary — and explain the types of bonds and interactions that stabilise each level. Then present a specific protein and ask me to explain how its three-dimensional shape is related to its function.

What this helps you practise:

Describing protein structural levels and their functional significance

How to use it well:

Protein structure is a common extended response topic — practise systematic descriptions that progress from amino acid sequence through folding to functional shape.

Prompt 16: Enzyme Kinetics and Inhibition

Copy this prompt into your AI tool:

Present graphs of enzyme activity versus substrate concentration, temperature, and pH, and ask me to interpret each graph. Then describe competitive and non-competitive inhibitors and ask me to sketch their effects on reaction rate graphs. Ask me to explain each effect using the induced fit model.

What this helps you practise:

Interpreting enzyme kinetics data and explaining inhibition types

How to use it well:

Enzyme questions appear on both Paper 1 and Paper

2 — practise sketching and interpreting the characteristic graph shapes for each variable and inhibitor type.

Prompt 17: DNA Structure and Replication

Copy this prompt into your AI tool:

Ask me to draw and annotate the structure of DNA showing the double helix, antiparallel strands, complementary base pairing, and hydrogen bonding. Then ask me to describe the process of semi-conservative DNA replication, naming the enzymes involved at each step. Include a question about Meselson and Stahl's evidence.

What this helps you practise:

Describing DNA structure and the mechanism of replication

How to use it well:

DNA replication descriptions must include specific enzyme names and their roles — practise the sequential process from origin of replication to completed strands.

Prompt 18: Transcription Process

Copy this prompt into your AI tool:

Assess my knowledge of describe the process of transcription, including the role of RNA polymerase, the template strand, and the formation of mRNA. Then present a DNA sequence and ask me to determine the mRNA sequence produced. Include questions about mRNA processing in eukaryotes including splicing.

What this helps you practise:

Describing transcription and determining mRNA sequences

How to use it well:

Transcription questions require precise descriptions

of enzyme action and directionality — practise writing the mRNA sequence from the 5' to 3' end.

Prompt 19: Translation and Protein Synthesis

Copy this prompt into your AI tool:

Probe my understanding of describe the process of translation at the ribosome, including the roles of mRNA, tRNA, amino acids, and the ribosome itself. Present an mRNA codon sequence and ask me to determine the amino acid sequence using the genetic code table from the Data Booklet. Include the role of start and stop codons.

What this helps you practise:

Describing translation and using the genetic code table

How to use it well:

Translation descriptions must cover initiation, elongation, and termination — practise using the Data Booklet codon table to decode mRNA sequences accurately.

Prompt 20: Nucleic Acid Comparison

Copy this prompt into your AI tool:

Put me to the test on construct a comparison table between DNA and RNA covering structure, sugar type, bases, number of strands, location, and function. Then present the three types of RNA and ask me to describe the specific role of each in protein synthesis. Include a question about the anticodon.

What this helps you practise:

Comparing DNA and RNA structures and functions

How to use it well:

Comparison questions require systematic organisation — practise structuring your response as a clear table or paired comparison rather than separate descriptions.

Prompt 21: Metabolic Reactions and ATP

Copy this prompt into your AI tool:

Ask me to explain the role of ATP as the universal energy currency of cells, including how it is produced and how it provides energy through hydrolysis. Then present examples of anabolic and catabolic reactions and ask me to classify each, explaining how ATP links the two types of metabolism.

What this helps you practise:

Explaining the role of ATP in cellular metabolism

How to use it well:

ATP connects energy topics across the syllabus — practise explaining both the structure of ATP and its functional role in coupling exergonic and endergonic reactions.

Prompt 22: Molecular Biology Exam Question Synthesis

Copy this prompt into your AI tool:

Construct an IB Paper 2 extended response question that requires me to describe DNA replication, transcription, and translation as a connected sequence. Include a data interpretation component involving gene expression and a diagram annotation task. Mark my response against IB standards.

What this helps you practise:

Completing extended molecular biology exam questions

How to use it well:

Use this as a comprehensive practice question to develop the ability to describe the central dogma as a connected process with appropriate molecular detail.

Section 3

Genetics and Evolution

Genetics and evolution covers the inheritance of traits, the molecular basis of genetic variation, and the mechanisms that drive evolutionary change. This topic connects molecular biology to whole-organism biology, explaining how DNA sequences determine phenotypes and how populations change over time.

You must understand Mendelian inheritance including monohybrid and dihybrid crosses, the chromosomal basis of inheritance, meiosis, and gene linkage. You should also be able to explain the mechanisms of evolution including natural selection, speciation, and the evidence from cladistics.

These prompts develop your ability to solve genetics problems systematically, interpret pedigree diagrams and karyotypes, and construct evolutionary arguments supported by evidence from multiple sources.

Prompt 23: Monohybrid Cross Problem Solving

Copy this prompt into your AI tool:

Present three monohybrid genetics problems of increasing difficulty — one involving complete dominance, one codominance, and one sex-linked inheritance. For each, ask me to define the alleles, construct a Punnett square, determine genotypic and phenotypic ratios, and predict offspring probabilities.

What this helps you practise:

Solving monohybrid crosses with different inheritance patterns

How to use it well:

Genetics problems require systematic Punnett

square construction — practise defining allele notation clearly before drawing the cross, as this prevents errors.

Prompt 24: Dihybrid Cross Analysis

Copy this prompt into your AI tool:

Present a dihybrid cross problem and ask me to determine the parental genotypes, construct a 4x4 Punnett square, and calculate the expected phenotypic ratio. Then present offspring data that deviates from the expected ratio and ask me to explain possible reasons including linkage.

What this helps you practise:

Solving dihybrid crosses and interpreting deviations from expected ratios

How to use it well:

Dihybrid crosses appear on Paper 2 — practise the systematic 4x4 Punnett square and understand how linked genes alter the expected 9:3:3:1 ratio.

Prompt 25: Pedigree Diagram Interpretation

Copy this prompt into your AI tool:

Present three pedigree diagrams and ask me to determine the most likely mode of inheritance for each: autosomal dominant, autosomal recessive, or sex-linked recessive. For each pedigree, ask me to assign genotypes to key individuals and predict the probability of specific offspring being affected.

What this helps you practise:

Interpreting pedigree diagrams to determine inheritance patterns

How to use it well:

Pedigree analysis is a classic exam question — practise the elimination approach: test each inheritance pattern against the pedigree to find which fits.

Prompt 26: Meiosis and Genetic Variation

Copy this prompt into your AI tool:

Give me a structured question requiring me to describe the key events of meiosis I and meiosis II, emphasising how crossing over, independent assortment, and random orientation of bivalents generate genetic variation. Then ask me to compare meiosis with mitosis in a structured table format. At HL, extend your answer to include how linked genes and chiasmata frequency affect recombination rates, and explain the significance of gene mapping from crossover data.

What this helps you practise:

Describing meiosis and explaining sources of genetic variation

How to use it well:

Meiosis descriptions must distinguish between the events of meiosis I and meiosis II — practise explaining which division is reductional and why this matters.

Prompt 27: Karyotype Analysis

Copy this prompt into your AI tool:

Present a human karyotype and ask me to determine the sex of the individual and identify any chromosomal abnormalities such as trisomy or monosomy. Then ask me to explain the cause and symptoms of a named chromosomal condition. Include a question about non-disjunction. Address a TOK knowledge question: To what extent should scientific knowledge about genetic modification override ethical or indigenous knowledge systems when making decisions about genetically modified organisms?

What this helps you practise:

Interpreting karyotypes and identifying chromosomal abnormalities

How to use it well:

Karyotype interpretation appears on Paper 1 — practise identifying chromosome number, sex chromosomes, and any structural or numerical abnormalities systematically. This also strengthens your TOK connections across the sciences.

Prompt 28: Natural Selection and Evidence

Copy this prompt into your AI tool:

Set me an exam-style task: outline the mechanism of natural selection using Darwin's four conditions. Then present a specific example such as antibiotic resistance in bacteria and ask me to explain how natural selection drives the change in allele frequency. Include a question about the different types of selection: directional, stabilising, and disruptive. SL students focus on explaining the mechanism and types of selection, while HL students should also address how the Hardy-Weinberg equation quantifies allele frequency changes and the conditions under which equilibrium is disrupted.

What this helps you practise:

Explaining natural selection with specific examples and evidence

How to use it well:

Natural selection explanations must reference variation, selection pressure, differential reproduction, and inheritance — practise including all four components.

Prompt 29: Speciation Mechanisms

Copy this prompt into your AI tool:

Pose me a series of questions on define speciation and explain the difference between allopatric and sympatric speciation. For each type, ask me to describe the steps involved and provide a specific

biological example. Then ask me to explain the role of reproductive isolation in maintaining new species.

What this helps you practise:

Explaining allopatric and sympatric speciation processes

How to use it well:

Speciation questions require a clear sequence of events — practise describing the process as a series of steps from initial population to reproductively isolated species.

Prompt 30: Cladistics and Classification

Copy this prompt into your AI tool:

Present a cladogram and ask me to interpret the evolutionary relationships it shows. Then ask me to identify shared derived characteristics, determine which species are most closely related, and explain what the branch points represent. Include a question about the use of molecular evidence in cladistics.

What this helps you practise:

Interpreting cladograms and explaining evolutionary relationships

How to use it well:

Cladogram interpretation is tested on Paper 1 — practise reading cladograms correctly by identifying the most recent common ancestor for different species pairs.

Prompt 31: Gene Modification and Biotechnology

Copy this prompt into your AI tool:

Ask me to outline the process of gene transfer using plasmid vectors, including the roles of restriction enzymes, ligase, and selection markers. Then present a GMO application and ask me to discuss the potential benefits and risks. Include a question about PCR and gel electrophoresis.

What this helps you practise:

Describing gene modification techniques and evaluating applications

How to use it well:

Biotechnology questions combine process description with ethical evaluation — practise the technical steps precisely and construct balanced arguments about applications.

Prompt 32: Chi-Squared Test Application

Copy this prompt into your AI tool:

Present genetics cross data showing observed and expected offspring ratios. Ask me to perform a chi-squared test to determine whether the difference between observed and expected values is statistically significant. Require me to state hypotheses, calculate the test statistic, compare with the critical value, and state my conclusion.

What this helps you practise:

Performing chi-squared tests on genetics data

How to use it well:

Chi-squared tests connect genetics to statistical analysis — practise the complete calculation sequence and understand how to interpret the result in biological terms.

Prompt 33: Genetics and Evolution Exam Question Synthesis

Copy this prompt into your AI tool:

Create an IB Paper 2 extended response question that combines Mendelian genetics with evolutionary concepts. Include a genetics cross to solve, a pedigree to interpret, and a question about natural selection or speciation. Mark my response against IB standards.

What this helps you practise:
Completing integrated genetics and evolution exam questions
How to use it well:
Use this as an extended practice question to develop the ability to connect inheritance patterns to population-level evolutionary change in a single exam response.

Section 4

Ecology and Conservation

Ecology examines the relationships between organisms and their environment at the levels of species, communities, and ecosystems. Understanding energy flow, nutrient cycling, and the factors that affect population dynamics is essential for addressing contemporary environmental challenges.

You must be able to explain food webs and trophic levels, calculate energy transfer efficiency, describe biogeochemical cycles, and evaluate the impact of human activities on ecosystems. Climate change, habitat loss, and conservation strategies are important application areas.

These prompts develop your ability to analyse ecological data, construct and interpret food webs and energy pyramids, and evaluate conservation strategies using ecological principles.

Prompt 34: Energy Flow Through Ecosystems

Copy this prompt into your AI tool:

Present an ecosystem and ask me to construct a food chain identifying producers, primary consumers, secondary consumers, and tertiary consumers. Then ask me to explain why energy decreases at each trophic level, calculate the efficiency of energy transfer between two levels, and explain the significance of the 10% rule.

What this helps you practise:

Tracing energy flow and calculating transfer efficiency in ecosystems

How to use it well:

Energy transfer calculations appear on Paper 2 —

practise explaining where energy is lost at each trophic level and how this limits food chain length.

Prompt 35: Carbon Cycle Analysis

Copy this prompt into your AI tool:

Walk me through a test of draw and annotate a diagram of the carbon cycle, showing the processes of photosynthesis, respiration, combustion, decomposition, and fossilisation. Then ask me to explain how human activities have disrupted the carbon cycle and the consequences for atmospheric CO_2 levels and climate.

What this helps you practise:

Drawing and explaining the carbon cycle and human impacts

How to use it well:

Carbon cycle diagrams must show both natural and human-influenced pathways — practise including specific processes at each transfer point.

Prompt 36: Nitrogen Cycle Processes

Copy this prompt into your AI tool:

Have me demonstrate my understanding of describe the key processes of the nitrogen cycle: nitrogen fixation, nitrification, denitrification, and assimilation. For each process, ask me to name the organisms involved and state the nitrogen compounds transformed. Then ask me to explain why farmers use crop rotation with legumes. At HL, extend your answer to include how human disruption of the nitrogen cycle through fertiliser use leads to eutrophication and analyse the ecological consequences at each trophic level.

What this helps you practise:

Describing nitrogen cycle processes and their biological agents

How to use it well:

The nitrogen cycle involves specific bacterial processes — practise naming the correct type of bacteria and the chemical transformations at each step.

Prompt 37: Population Ecology and Sampling

Copy this prompt into your AI tool:

Present me with a field study scenario and ask me to explain how I would estimate population size using the capture-mark-recapture method, including the Lincoln index formula. Then ask me to identify the assumptions of the method and evaluate whether they are met in the given scenario.

What this helps you practise:

Estimating population size using capture-mark-recapture techniques

How to use it well:

Mark-recapture calculations appear on Paper 2 — practise the formula and critically evaluate the assumptions, as exam questions often ask about limitations.

Prompt 38: Species Interactions and Communities

Copy this prompt into your AI tool:

Present five types of species interactions — predation, competition, mutualism, parasitism, and commensalism — and ask me to define each and provide a specific biological example. Then describe an ecological scenario and ask me to identify which interactions are occurring and predict their effects on population sizes.

What this helps you practise:

Identifying and explaining species interactions within communities

How to use it well:

Species interaction questions test your ability to apply definitions to unfamiliar examples — practise categorising interactions based on their effects on each species.

Prompt 39: Ecological Succession

Copy this prompt into your AI tool:

Fire questions at me about describe the process of primary succession from bare rock to climax community, identifying pioneer species and explaining how each stage modifies the environment for the next. Then describe a disturbance event and ask me to explain secondary succession. Compare the two types.

What this helps you practise:

Describing primary and secondary succession processes

How to use it well:

Succession questions require a clear sequential description — practise explaining how abiotic conditions change at each stage and how this enables new species to establish.

Prompt 40: Climate Change Evidence and Impacts

Copy this prompt into your AI tool:

Present data on global temperature changes, CO_2 concentrations, and ice core records. Ask me to interpret the data as evidence for climate change and explain the greenhouse effect mechanism. Then ask me to discuss the biological impacts of climate change on species distribution, phenology, and coral reef bleaching. Connect this to TOK: Discuss whether indigenous ecological knowledge constitutes valid scientific knowledge, and evaluate

the extent to which traditional land management practices can inform modern conservation biology.

What this helps you practise:

Interpreting climate change data and evaluating biological impacts

How to use it well:

Climate change questions combine data interpretation with ecological knowledge — practise constructing evidence-based arguments about causes and biological consequences. This also strengthens your TOK connections across the sciences.

Prompt 41: Biodiversity and Conservation Strategies

Copy this prompt into your AI tool:

Ask me to explain why biodiversity is important at the genetic, species, and ecosystem levels. Then present a conservation scenario and ask me to evaluate different strategies: protected areas, captive breeding, seed banks, and habitat restoration. Include a question about the role of international agreements. SL students focus on evaluating the strategies, while HL students should also address the Simpson reciprocal index for quantifying biodiversity and explain how edge effects and habitat fragmentation influence species richness in conservation planning.

What this helps you practise:

Evaluating conservation strategies using ecological principles

How to use it well:

Conservation questions require balanced evaluation — practise discussing both the strengths and limitations of each strategy rather than simply describing them.

Prompt 42: Biomagnification and Pollution

Copy this prompt into your AI tool:

Give me an IB-style question about biomagnification: present a food chain contaminated with a persistent pollutant such as DDT or mercury. Ask me to explain the process of biomagnification, predict the relative concentrations at each trophic level, and discuss the ecological consequences. Include a question about indicator species and their role in monitoring pollution.

What this helps you practise:

Explaining biomagnification and evaluating pollution impacts

How to use it well:

Biomagnification connects food web ecology to environmental chemistry — practise explaining why non-biodegradable substances accumulate at higher trophic levels.

Prompt 43: Ecological Footprint Analysis

Copy this prompt into your AI tool:

Test me on define ecological footprint and explain how it is calculated. Then present data comparing ecological footprints of different countries and ask me to explain the factors that contribute to differences. Include a discussion of strategies for reducing ecological footprints and their feasibility.

What this helps you practise:

Analysing ecological footprint data and evaluating sustainability

How to use it well:

Ecological footprint questions test your ability to connect lifestyle choices to environmental impact — practise providing specific examples of how different factors contribute.

Prompt 44: Ecology Exam Question Synthesis

Copy this prompt into your AI tool:

Draft an IB Paper 2 style question that combines ecosystem energy flow with nutrient cycling and human impact analysis. Include a food web to interpret, a calculation component, and a discussion question about conservation. Mark my response against IB standards.

What this helps you practise:

Completing multi-part ecology and conservation exam questions

How to use it well:

Use this as an extended practice question to develop the ability to integrate ecological concepts with data analysis and evaluative discussion.

Section 5

Human Physiology

Human physiology explores the structure and function of the major organ systems, connecting cellular processes to whole-body function. Understanding how the digestive, circulatory, immune, respiratory, nervous, and endocrine systems work together to maintain homeostasis is central to this topic.

You must be able to describe the structure of key organs, explain physiological processes at the molecular and cellular level, and understand the hormonal and nervous control mechanisms that coordinate body functions. Diagrams and annotations are essential skills for this topic.

These prompts develop your ability to explain complex physiological processes clearly, connect structure to function at multiple levels of organisation, and apply your understanding to clinical and health-related contexts.

Prompt 45: Digestive System Structure and Function

Copy this prompt into your AI tool:

Quiz me on draw and annotate a diagram of the human digestive system, labelling the major organs and their functions. Then ask me to trace the digestion of a meal containing starch, protein, and fat, naming the enzymes, their sources, and optimal pH at each stage.

What this helps you practise:

Describing the digestive system and tracing nutrient digestion

How to use it well:

Digestion questions require specific enzyme names and locations — practise the sequential breakdown of each macronutrient from mouth to absorption in the small intestine.

Prompt 46: Heart Structure and Cardiac Cycle

Copy this prompt into your AI tool:

Give me an IB-style question about draw and annotate a diagram of the human heart, showing all four chambers, valves, and major blood vessels. Then ask me to describe the cardiac cycle, explaining the sequence of atrial and ventricular systole and diastole. Include a question about the regulation of heart rate by the sinoatrial node.

What this helps you practise:

Describing heart structure and the cardiac cycle

How to use it well:

Heart diagrams must show the correct orientation and blood flow direction — practise drawing the heart from the standard anterior view with all labels in the correct positions.

Prompt 47: Blood Vessel Comparison

Copy this prompt into your AI tool:

Ask me to compare the structure of arteries, veins, and capillaries in terms of wall thickness, lumen size, valves, and blood pressure. For each vessel type, ask me to explain how its structure is adapted to its function. Include a question about the exchange of substances at capillary beds.

What this helps you practise:

Comparing blood vessel structures and linking to function

How to use it well:

Blood vessel comparison questions require systematic treatment — practise organising your

response by structural feature and explaining the functional significance of each.

Prompt 48: Immune System Defence Mechanisms

Copy this prompt into your AI tool:

Present me with questions on describe the body's three lines of defence: physical barriers, non-specific immune responses, and specific (adaptive) immune responses. Then ask me to explain the roles of B lymphocytes and T lymphocytes in specific immunity, including antibody production and cell-mediated responses. Include a question about vaccination. Link this to a TOK discussion: Evaluate the ethical implications of using controlled experiments on human subjects in physiological research, and discuss whether there are areas of biological knowledge that should remain unexplored.

What this helps you practise:

Explaining immune defence mechanisms and specific immunity

How to use it well:

Immune system questions test detailed knowledge of cellular responses — practise explaining the roles of different lymphocyte types and the mechanism of immune memory. This also strengthens your TOK connections across the sciences.

Prompt 49: Gas Exchange in the Lungs

Copy this prompt into your AI tool:

Challenge me to explain describe the structure of the alveoli and explain how their features maximise gas exchange efficiency. Then ask me to explain the process of ventilation including the roles of the diaphragm and intercostal muscles. Include a question about oxygen transport by haemoglobin and the oxygen dissociation curve.

What this helps you practise:

Explaining gas exchange structure, ventilation, and oxygen transport

How to use it well:

Gas exchange questions combine structural description with physiological explanation — practise linking surface area, concentration gradients, and blood flow to exchange efficiency.

Prompt 50: Neuron Structure and Synaptic Transmission

Copy this prompt into your AI tool:

You are an IB examiner: ask me to draw and annotate a motor neuron, labelling the cell body, dendrites, axon, myelin sheath, and synaptic terminal. Then ask me to describe how a nerve impulse is transmitted along the axon and across a synapse. Include the roles of sodium and potassium ions, neurotransmitters, and receptors.

What this helps you practise:

Describing neuron structure and the mechanism of synaptic transmission

How to use it well:

Nerve impulse questions require precise description of ion movements and neurotransmitter release — practise the sequence from depolarisation to synaptic transmission.

Prompt 51: Hormonal Regulation and Homeostasis

Copy this prompt into your AI tool:

Ask me to explain the regulation of blood glucose concentration by insulin and glucagon, including the roles of the pancreas, liver, and muscle cells. Then present a disruption such as Type 1 or Type 2 diabetes and ask me to explain the physiological

basis and management strategies. Include negative feedback.

What this helps you practise:

Explaining hormonal homeostasis with specific regulatory examples

How to use it well:

Homeostasis questions test understanding of negative feedback — practise tracing the complete feedback loop from stimulus through response to correction.

Prompt 52: Reflex Arc and Response

Copy this prompt into your AI tool:

You are an IB examiner: present a reflex response scenario and ask me to trace the pathway from stimulus to response through a reflex arc, identifying the receptor, sensory neuron, relay neuron, motor neuron, and effector. Then ask me to explain the biological advantage of reflex responses being involuntary.

What this helps you practise:

Tracing reflex arcs from stimulus to response

How to use it well:

Reflex arc questions require clear sequential description — practise identifying each component in the pathway and explaining the role of the spinal cord.

Prompt 53: Kidney Function and Osmoregulation

Copy this prompt into your AI tool:

Assess my knowledge of describe the structure of the nephron and explain the processes of ultrafiltration, selective reabsorption, and osmoregulation. Then ask me to explain the role of ADH in controlling water balance and describe how

the loop of Henle creates the concentration gradient in the medulla.

What this helps you practise:

Explaining kidney structure and osmoregulatory function

How to use it well:

HL students should practise the detailed nephron physiology — trace the filtrate through each region of the nephron and explain what happens to its composition.

Prompt 54: Muscle Contraction Mechanism

Copy this prompt into your AI tool:

Probe my understanding of describe the structure of skeletal muscle including sarcomeres, actin, and myosin. Then ask me to explain the sliding filament theory of muscle contraction, including the roles of calcium ions, troponin, tropomyosin, and ATP. Include a question about the neuromuscular junction.

What this helps you practise:

Explaining the sliding filament mechanism of muscle contraction

How to use it well:

HL students should practise the detailed molecular mechanism — trace the sequence from nerve impulse arrival to cross-bridge cycling and filament sliding.

Prompt 55: Human Physiology Exam Question Synthesis

Copy this prompt into your AI tool:

Create an IB Paper 2 extended response question on human physiology that requires a diagram with annotations, a process description, and a discussion of a related health condition. Include components covering at least two organ systems and their

coordination. Mark my response against IB standards.

What this helps you practise:

Completing extended human physiology exam questions

How to use it well:

Use this as a comprehensive practice question to develop the ability to connect different physiological systems and demonstrate understanding through annotated diagrams.

Section 6

Plant Biology

Plant biology at HL covers the transport of water and minerals through xylem, the translocation of organic compounds through phloem, plant reproduction, and the hormonal control of plant growth. Understanding how plants solve the challenges of life as sessile organisms is a distinctive feature of HL Biology.

You must be able to explain the cohesion-tension theory of water transport, describe the pressure-flow hypothesis of phloem translocation, and understand the structures and processes involved in sexual reproduction in flowering plants.

These prompts develop your ability to explain plant physiological processes using physical and chemical principles, and to connect plant structure at the cellular level to function at the whole-organism level.

Prompt 56: Xylem Transport and Transpiration

Copy this prompt into your AI tool:

Put me to the test on explain the cohesion-tension theory of water transport in xylem, including the roles of transpiration, cohesion, adhesion, and root pressure. Then describe environmental conditions and ask me to predict their effect on transpiration rate. Include a question about xerophyte adaptations.

What this helps you practise:

Explaining the cohesion-tension theory and factors affecting transpiration

How to use it well:

HL students should practise explaining each component of the cohesion-tension theory and how

environmental factors alter the water potential gradient.

Prompt 57: Phloem Translocation

Copy this prompt into your AI tool:

Ask me to describe the structure of phloem tissue and explain the pressure-flow (mass flow) hypothesis of translocation. Then ask me to describe the experimental evidence for translocation, including aphid stylet and radioactive tracer experiments. Assess whether I can explain the active loading of sucrose at source.

What this helps you practise:

Explaining phloem translocation using the pressure-flow hypothesis

How to use it well:

HL students should practise the complete mechanism from source loading to sink unloading, explaining how osmotic pressure differences drive mass flow.

Prompt 58: Flower Structure and Pollination

Copy this prompt into your AI tool:

Give me a structured question requiring me to draw and annotate a diagram of a generalised flower, labelling the sepals, petals, stamens, and carpel. Then ask me to compare wind-pollinated and insect-pollinated flowers, explaining the structural adaptations for each pollination mechanism. Include a question about co-evolution between flowers and pollinators.

What this helps you practise:

Describing flower structure and pollination mechanisms

How to use it well:

HL flower structure questions require detailed

labelling — practise annotating diagrams with both structural names and functional descriptions.

Prompt 59: Plant Growth Regulators

Copy this prompt into your AI tool:

Set me an exam-style task: describe the roles of auxin in phototropism and gravitropism, including the experimental evidence from Darwin, Boysen-Jensen, and Went. Then ask me to explain the effects of auxin, gibberellin, and ethylene on plant growth and development. Include a question about commercial applications.

What this helps you practise:

Explaining plant hormone functions and their experimental evidence

How to use it well:

HL students should practise describing the classic auxin experiments in sequence, explaining how each experiment contributed to our understanding of phototropism.

Prompt 60: Seed Structure and Germination

Copy this prompt into your AI tool:

Pose me a series of questions on draw and annotate the structure of a dicotyledonous seed, labelling the testa, cotyledon, embryo root, and embryo shoot. Then ask me to describe the conditions required for germination and the metabolic processes that occur during germination. Include a question about the role of gibberellin.

What this helps you practise:

Describing seed structure and the germination process

How to use it well:

HL students should practise connecting the structural features of seeds to their survival

functions and explaining the hormonal control of germination.

Prompt 61: Leaf Structure and Photosynthetic Adaptations

Copy this prompt into your AI tool:

Ask me to draw and annotate a cross-section of a dicotyledonous leaf, identifying the epidermis, palisade mesophyll, spongy mesophyll, vascular bundles, and stomata. Then ask me to explain how each tissue is adapted for photosynthesis, gas exchange, and water conservation. Include guard cell function.

What this helps you practise:

Relating leaf tissue structure to photosynthetic function

How to use it well:

Leaf cross-section diagrams appear on Paper 2 — practise drawing a proportionally accurate section with correct tissue arrangement and functional annotations.

Prompt 62: Root Structure and Mineral Uptake

Copy this prompt into your AI tool:

Walk me through a test of describe the structure of a root tip, including root hairs and their role in absorption. Then ask me to explain how water and mineral ions are absorbed by roots, distinguishing between the apoplast and symplast pathways. Include the role of the Casparian strip in the endodermis.

What this helps you practise:

Explaining root absorption mechanisms and transport pathways

How to use it well:

HL students should practise tracing the pathway of water from soil to xylem, explaining how the

Casparian strip forces water through the symplast at the endodermis.

Prompt 63: Tropisms and Plant Responses

Copy this prompt into your AI tool:

Quiz me on plant tropisms: present scenarios involving phototropism, gravitropism, and thigmotropism and ask me to explain the plant's response in each case. For phototropism and gravitropism, ask me to describe the role of auxin redistribution and differential cell elongation. Include an experiment I could design to demonstrate one tropism.

What this helps you practise:

Explaining plant tropisms through auxin redistribution mechanisms

How to use it well:

HL students should practise connecting auxin concentration to cell elongation rates, explaining why unequal distribution causes bending in a specific direction.

Prompt 64: Stomatal Opening and Closing

Copy this prompt into your AI tool:

Have me demonstrate my understanding of explain the mechanism of stomatal opening and closing, including the role of potassium ions, water potential changes in guard cells, and the effect of light and carbon dioxide concentration. Then ask me to discuss the dilemma plants face between gas exchange and water conservation.

What this helps you practise:

Explaining the mechanism of stomatal control

How to use it well:

Stomatal function connects cellular osmosis to whole-plant water balance — practise explaining the

ion-driven mechanism that controls guard cell turgor.

Prompt 65: Xerophyte and Hydrophyte Adaptations

Copy this prompt into your AI tool:

Present cross-sections of leaves from a xerophyte and a hydrophyte and ask me to identify structural adaptations in each. For the xerophyte, ask me to explain how features such as thick cuticle, sunken stomata, and rolled leaves reduce water loss. Compare these with the adaptations of hydrophytes for aquatic life.

What this helps you practise:

Comparing structural adaptations of xerophytes and hydrophytes

How to use it well:

HL students should practise linking each structural adaptation to its functional advantage in the specific environment, using precise anatomical terminology.

Prompt 66: Plant Biology Exam Question Synthesis

Copy this prompt into your AI tool:

Design an HL Paper 2 style question that combines plant transport with reproduction or growth regulation. Include a diagram annotation task, a process explanation, and a data interpretation component about transpiration or translocation. Mark my response against IB standards.

What this helps you practise:

Completing extended plant biology exam questions

How to use it well:

HL students should use this as a comprehensive practice question to develop the ability to connect plant anatomy with physiological processes in extended responses.

Section 7

Further Human Physiology

Further human physiology at HL extends the core human physiology topic to include detailed study of the immune system, locomotion, kidney function, and human reproduction. These topics require a deeper understanding of the cellular and molecular mechanisms that underpin whole-body physiological processes.

You must explain the detailed adaptive immune response including clonal selection and immune memory, the sliding filament theory of muscle contraction, the nephron's role in osmoregulation, and the hormonal control of the menstrual cycle and pregnancy. Each topic connects cellular mechanisms to clinical applications.

These prompts build your ability to describe HL-level physiological processes with molecular precision, interpret clinical data, and connect normal function to pathological conditions in the way that IB extended response questions demand.

Prompt 67: Detailed Immune Response

Copy this prompt into your AI tool:

Fire questions at me about describe the specific immune response in detail, including antigen presentation, clonal selection, and the roles of helper T cells, cytotoxic T cells, and B cells. Then ask me to explain the difference between active and passive immunity, and between natural and artificial immunity. Include the mechanism of monoclonal antibody production.

What this helps you practise:

Describing the detailed adaptive immune response

How to use it well:

HL immune response questions require step-by-step descriptions of cellular interactions — practise the sequence from antigen recognition to effector cell activation.

Prompt 68: Antibody Structure and Function

Copy this prompt into your AI tool:

Ask me to draw and annotate the structure of an antibody molecule, identifying the heavy chains, light chains, variable regions, and constant regions. Then ask me to explain how the variable region provides specificity and how different antibody classes perform different functions. Include the concept of antigenic determinants.

What this helps you practise:

Explaining antibody structure and the basis of immune specificity

How to use it well:

HL students should practise linking antibody structure to function — the variable region determines specificity while the constant region determines the type of immune response.

Prompt 69: Muscle Contraction Mechanism

Copy this prompt into your AI tool:

Test me on describing the structure of skeletal muscle including sarcomeres, actin, and myosin. Then ask me to explain the sliding filament theory of muscle contraction, including the roles of calcium ions, troponin, tropomyosin, and ATP. Include a question about the neuromuscular junction.

What this helps you practise:

Explaining the sliding filament mechanism of muscle contraction

How to use it well:

HL students should practise the detailed molecular

mechanism — trace the sequence from nerve impulse arrival to cross-bridge cycling and filament sliding.

Prompt 70: Kidney Function and Osmoregulation

Copy this prompt into your AI tool:

Quiz me on describing the structure of the nephron and explain the processes of ultrafiltration, selective reabsorption, and osmoregulation. Then ask me to explain the role of ADH in controlling water balance and describe how the loop of Henle creates the concentration gradient in the medulla.

What this helps you practise:

Explaining kidney structure and osmoregulatory function

How to use it well:

HL students should practise the detailed nephron physiology — trace the filtrate through each region of the nephron and explain what happens to its composition.

Prompt 71: Reproductive Physiology

Copy this prompt into your AI tool:

Give me an IB-style question about describe the hormonal control of the menstrual cycle, including the roles of FSH, LH, oestrogen, and progesterone. Then ask me to explain how these hormones interact in negative and positive feedback loops. Include a question about the mechanism of action of hormonal contraceptives and IVF treatment.

What this helps you practise:

Explaining hormonal regulation of the menstrual cycle

How to use it well:

HL students should practise tracing hormone levels

through the cycle and explaining how each hormone triggers the next event in the sequence.

Prompt 72: Spermatogenesis and Oogenesis Comparison

Copy this prompt into your AI tool:

Ask me to compare spermatogenesis and oogenesis in terms of location, timing, cell division stages, and the number of functional gametes produced. Then ask me to explain how meiosis during gametogenesis contributes to genetic variation. Include a diagram annotation task for each process.

What this helps you practise:

Comparing male and female gamete production processes

How to use it well:

HL students should practise systematic comparisons of the two processes, noting key differences in timing, cytoplasmic division, and the fate of polar bodies.

Prompt 73: Kidney Dialysis and Transplant

Copy this prompt into your AI tool:

Present me with questions on explain how haemodialysis works as a treatment for kidney failure, comparing the principles of dialysis to normal kidney function. Then ask me to discuss the advantages and disadvantages of dialysis versus kidney transplantation. Include the role of immunosuppressant drugs and tissue matching.

What this helps you practise:

Explaining kidney failure treatments and evaluating options

How to use it well:

HL students should practise connecting the physics of dialysis membranes to the biology of nephron

function and constructing balanced evaluations of treatment options.

Prompt 74: Synaptic Transmission and Drug Effects

Copy this prompt into your AI tool:

Challenge me to explain describe the events of synaptic transmission in detail, including vesicle fusion, neurotransmitter release, receptor binding, and signal termination. Then present examples of excitatory and inhibitory synapses and ask me to explain how drugs such as benzodiazepines or SSRIs alter synaptic function.

What this helps you practise:

Describing synaptic transmission and explaining drug mechanisms

How to use it well:

HL students should practise the molecular sequence of synaptic events and explain how specific drugs modify each step to produce their pharmacological effects.

Prompt 75: Blood Clotting and Wound Healing

Copy this prompt into your AI tool:

You are an IB examiner: ask me to describe the process of blood clotting, including the roles of platelets, clotting factors, fibrinogen, and fibrin. Then ask me to explain the cascade nature of the clotting mechanism and why this amplification is biologically important. Include conditions where clotting is impaired or excessive.

What this helps you practise:

Explaining the blood clotting cascade and its regulation

How to use it well:

HL students should practise describing the clotting cascade as a series of enzyme activations and

explaining why defects in single factors can have serious consequences.

Prompt 76: Pregnancy and Early Development

Copy this prompt into your AI tool:

Ask me to describe the roles of HCG, oestrogen, and progesterone during pregnancy, including how the placenta takes over hormone production from the corpus luteum. Then ask me to explain the process of implantation and the exchange of materials across the placenta. Include a question about the role of oxytocin in birth.

What this helps you practise:

Explaining hormonal control during pregnancy and birth

How to use it well:

HL students should practise the hormone timeline of pregnancy, from HCG maintenance of the corpus luteum through to oxytocin-driven positive feedback during labour.

Prompt 77: Musculoskeletal System and Joint Function

Copy this prompt into your AI tool:

Assess my knowledge of describe the structure of a synovial joint, identifying the roles of cartilage, synovial fluid, ligaments, and tendons. Then ask me to explain how antagonistic muscle pairs produce movement at a joint, using the biceps and triceps as an example. Include a question about the role of fast and slow twitch muscle fibres.

What this helps you practise:

Explaining joint structure and antagonistic muscle action

How to use it well:

HL students should practise annotating joint diagrams and explaining how different muscle fibre

types are adapted for sustained versus explosive activity.

Prompt 78: Further Human Physiology Exam Question Synthesis

Copy this prompt into your AI tool:

Create an IB Paper 2 extended response question that integrates at least two HL human physiology topics — such as immunity and the kidney, or reproduction and hormonal control. Include a diagram task, a detailed process description, and a clinical application question. Mark my response against IB standards.

What this helps you practise:

Completing integrated HL human physiology exam questions

How to use it well:

Use this as a comprehensive practice question to develop the ability to connect different physiological systems and apply knowledge to clinical scenarios.

Section 8

Biochemistry and Cell Respiration/Photosynthesis

This section covers the detailed biochemistry of cellular energy metabolism, focusing on the pathways of aerobic cell respiration and photosynthesis. Understanding how cells convert energy from one form to another through enzyme-catalysed reactions is fundamental to biology at all levels.

At HL, you must explain glycolysis, the link reaction, the Krebs cycle, and oxidative phosphorylation in cell respiration, as well as the light-dependent reactions and the Calvin cycle in photosynthesis. The chemiosmotic theory connecting electron transport to ATP synthesis is a unifying concept across both processes.

These prompts develop your ability to describe complex metabolic pathways with precision, interpret experimental data on metabolic rates, and connect the biochemistry of energy metabolism to ecological concepts such as productivity and energy flow.

Prompt 79: Glycolysis and Anaerobic Respiration

Copy this prompt into your AI tool:

Probe my understanding of describe the process of glycolysis, including the substrate, products, net ATP yield, and cellular location. Then ask me to explain what happens to pyruvate under anaerobic conditions in both animals and yeast. Include a comparison of ATP yield between aerobic and anaerobic respiration.

What this helps you practise:
Describing glycolysis and comparing aerobic and anaerobic pathways
How to use it well:
Respiration questions require precise knowledge of substrates, products, and locations — practise summarising each stage with these key details.

Prompt 80: Link Reaction and Krebs Cycle
Copy this prompt into your AI tool:
Put me to the test on describe the link reaction converting pyruvate to acetyl CoA and then outline the Krebs cycle, identifying the key substrates, products, and the number of carbon atoms at each stage. Then ask me to calculate the total yield of NADH, $FADH_2$, and ATP from one glucose molecule through these stages.
What this helps you practise:
Describing the link reaction and Krebs cycle in detail
How to use it well:
HL students should practise tracing carbon atoms through the Krebs cycle and keeping an accurate tally of all reduced coenzymes and ATP produced.

Prompt 81: Electron Transport Chain and Chemiosmosis
Copy this prompt into your AI tool:
Ask me to describe the electron transport chain in the inner mitochondrial membrane, explaining how electrons from NADH and $FADH_2$ pass through protein complexes. Then ask me to explain chemiosmosis and the role of ATP synthase in generating ATP. Include the role of oxygen as the terminal electron acceptor and why cyanide is lethal. Examine this through a TOK lens: Discuss whether the scientific method, as applied in biochemical research, is the most reliable way of knowing about

metabolic processes, or whether models and simulations now play an equally valid epistemological role.

What this helps you practise:

Explaining oxidative phosphorylation through the electron transport chain

How to use it well:

HL students should practise explaining the proton gradient mechanism clearly — understanding chemiosmosis is essential for both respiration and photosynthesis questions. This also strengthens your TOK connections across the sciences.

Prompt 82: Light-Dependent Reactions of Photosynthesis

Copy this prompt into your AI tool:

Give me a structured question requiring me to describe the light-dependent reactions, including the roles of photosystem II, photosystem I, the electron transport chain, and chemiosmosis in the thylakoid membrane. Then ask me to explain photolysis of water and the production of ATP and NADPH. Include non-cyclic and cyclic photophosphorylation.

What this helps you practise:

Describing the light-dependent reactions of photosynthesis

How to use it well:

HL students should practise tracing the path of electrons from water through both photosystems to $NADP^+$, explaining energy transfers at each stage.

Prompt 83: Calvin Cycle and Carbon Fixation

Copy this prompt into your AI tool:

Set me an exam-style task: describe the Calvin cycle, including carbon fixation by RuBisCO, reduction of GP to G3P, and regeneration of RuBP. Then ask me to explain the relationship between the light-

dependent and light-independent reactions. Include a question about the effect of temperature and CO_2 concentration on the Calvin cycle.

What this helps you practise:

Describing the Calvin cycle and its dependence on light reactions

How to use it well:

HL students should practise explaining how the Calvin cycle uses ATP and NADPH from the light reactions, and what happens to the cycle when light intensity changes.

Prompt 84: Limiting Factors in Photosynthesis

Copy this prompt into your AI tool:

Present graphs showing the effect of light intensity, CO_2 concentration, and temperature on photosynthesis rate. Ask me to interpret each graph, identify the limiting factor at different points, and explain why the rate plateaus. Then ask me to predict the graph shape when two factors change simultaneously.

What this helps you practise:

Interpreting limiting factor graphs for photosynthesis

How to use it well:

Limiting factor questions combine graph interpretation with biological explanation — practise identifying which factor is limiting at each point on the curve.

Prompt 85: Respirometer and Photosynthesis Experiments

Copy this prompt into your AI tool:

Test me on experimental methods: present a respirometer experiment and ask me to explain how it measures respiration rate, including the role of the carbon dioxide absorber. Then present a

photosynthesis rate experiment using aquatic plants and ask me to explain how bubble count or oxygen production relates to photosynthetic rate.

What this helps you practise:

Explaining experimental methods for measuring respiration and photosynthesis

How to use it well:

Experimental methods for measuring metabolic rates appear in IA and exam contexts — practise explaining the principles behind each measurement technique.

Prompt 86: ATP Synthesis Comparison

Copy this prompt into your AI tool:

Pose me a series of questions on compare ATP production in mitochondria during cell respiration and in chloroplasts during photosynthesis. For each, ask me to describe the electron transport chain, the chemiosmotic mechanism, and the role of ATP synthase. Then ask me to explain the similarities and differences between the two processes.

What this helps you practise:

Comparing chemiosmotic ATP synthesis in respiration and photosynthesis

How to use it well:

HL students should practise the structural comparison — both processes use electron transport and proton gradients, but in different organelles with different electron sources.

Prompt 87: Chloroplast and Mitochondria Structure

Copy this prompt into your AI tool:

Ask me to draw and annotate diagrams of a mitochondrion and a chloroplast, identifying the key structures involved in energy metabolism. Then ask me to explain how the structure of each organelle is

adapted for its role in ATP production. Include a question about the endosymbiotic theory and its evidence.

What this helps you practise:

Relating organelle ultrastructure to metabolic function

How to use it well:

Structure-function questions require precise labelling — practise drawing both organelles with correct membrane arrangements and linking each structure to its metabolic role.

Prompt 88: Respiratory Quotient Calculations

Copy this prompt into your AI tool:

Walk me through a test of define the respiratory quotient (RQ) and calculate it for the aerobic respiration of glucose, lipids, and proteins. Then present experimental RQ data and ask me to deduce which substrate is being respired. Include a question about what an RQ greater than one indicates.

What this helps you practise:

Calculating and interpreting respiratory quotient values

How to use it well:

RQ calculations connect biochemistry to experimental data — practise using balanced equations to derive theoretical RQ values for different substrates.

Prompt 89: Biochemistry and Metabolism Exam Question Synthesis

Copy this prompt into your AI tool:

Build an IB Paper 2 style question that connects cell respiration with photosynthesis through the carbon cycle and cellular energy metabolism. Include a biochemical pathway description, a data interpretation task involving metabolic rate

measurements, and a question connecting metabolism to ecological productivity. Mark against IB standards.

What this helps you practise:

Completing integrated metabolism and biochemistry exam questions

How to use it well:

Use this as a comprehensive practice question to develop the ability to connect biochemical pathways to whole-organism and ecosystem-level energy flow.

Section 9

Practical Skills and Internal Assessment

The Internal Assessment (IA) is an individual scientific investigation worth 20% of your IB Biology grade, assessed against five criteria: Personal Engagement, Exploration, Analysis, Evaluation, and Communication. Developing strong practical skills throughout the course is essential for both your IA and your performance on data-based questions.

A successful biology IA requires a focused research question investigating a biological phenomenon, a well-designed methodology with appropriate controls, thorough data analysis including statistical tests, critical evaluation of results and methodology, and clear scientific communication.

These prompts guide you through every stage of the IA process and build the broader practical skills — experimental design, data collection, statistical analysis, and scientific writing — that underpin success in both the IA and Paper 3.

Prompt 90: IA Topic Brainstorming

Copy this prompt into your AI tool:

Have me demonstrate my understanding of my interests in biology and everyday biological phenomena I find fascinating. Based on my responses, suggest five potential IA investigation topics that allow for quantitative data collection, appropriate biological analysis, and genuine personal engagement. For each, outline the independent and dependent variables and the biology concepts involved.

What this helps you practise:
Generating personally engaging biology IA topic ideas
How to use it well:
Start early with this prompt to find a topic where your curiosity will drive a genuine investigation — authentic personal engagement is immediately apparent to moderators.

Prompt 91: Research Question and Hypothesis
Copy this prompt into your AI tool:
I will share my IA topic idea. Help me refine it into a focused, testable research question with a clear hypothesis. Evaluate whether the question allows for quantitative data collection, meaningful statistical analysis, and connection to IB Biology syllabus content. Suggest modifications to improve scope and feasibility.
What this helps you practise:
Formulating a focused research question and testable hypothesis
How to use it well:
A sharp research question is the foundation of a strong IA — use this prompt to ensure yours is specific enough to investigate thoroughly within the available time.

Prompt 92: Experimental Design and Controls
Copy this prompt into your AI tool:
Test me on describing my planned IA experiment. Evaluate my design by checking: are independent, dependent, and controlled variables correctly identified? Is the sample size sufficient for statistical testing? Are appropriate controls included? Are ethical and safety considerations addressed? Suggest specific improvements.

What this helps you practise:

Designing valid biology experiments with appropriate controls

How to use it well:

Use this prompt before data collection to identify design weaknesses — statistical validity requires adequate sample sizes and proper controls that cannot be added retrospectively.

Prompt 93: Statistical Analysis Selection

Copy this prompt into your AI tool:

Present different types of biology IA data sets and ask me to select the most appropriate statistical test for each: t-test, chi-squared, correlation coefficient, or ANOVA. For each choice, ask me to justify why that test is appropriate given the data type and research question. Include hypothesis formulation for each test.

What this helps you practise:

Selecting appropriate statistical tests for biological data

How to use it well:

Statistical test selection is a key IA Analysis skill — practise matching data types to tests and explaining why your choice is valid for your specific data.

Prompt 94: Data Processing and Presentation

Copy this prompt into your AI tool:

Present raw biology data and ask me to process it appropriately: calculate means and standard deviations, construct appropriate graphs with error bars, and describe the trends visible in the processed data. Evaluate whether my choice of graph type and data presentation meets IB IA Analysis criterion standards.

What this helps you practise:
Processing and presenting biological data to IB standards
How to use it well:
Data presentation is assessed under both Analysis and Communication — practise producing clear, correctly labelled graphs with appropriate error representations.

Prompt 95: IA Evaluation Writing Practice
Copy this prompt into your AI tool:
Present a set of biology IA results with clear strengths and weaknesses in the methodology. Ask me to write an evaluation that identifies sources of error, assesses the reliability and validity of the data, and proposes specific, realistic improvements. Grade my response against the IB Evaluation criterion markband descriptors.
What this helps you practise:
Writing thorough evaluations that meet top markband standards
How to use it well:
Strong evaluations connect specific weaknesses to specific improvements — practise going beyond generic criticism to propose modifications that would genuinely improve the investigation.

Prompt 96: Microscopy Practical Skills
Copy this prompt into your AI tool:
Fire questions at me about describe how to prepare a temporary mount slide of plant tissue, including staining techniques. Then present micrographs and ask me to identify cell structures, estimate cell sizes using scale bars, and explain the differences between what light and electron microscopes can reveal.

What this helps you practise:
Performing microscopy techniques and interpreting micrographs
How to use it well:
Microscopy skills support both practical work and exam questions — practise the preparation steps and interpretation skills that demonstrate competence.

Prompt 97: Ethical Considerations in Biology
Copy this prompt into your AI tool:
Present five biology investigation scenarios involving animals, human subjects, or environmental impact. Ask me to identify the ethical considerations in each and explain how I would address them in my IA. Include questions about informed consent, animal welfare, and environmental responsibility.
What this helps you practise:
Identifying and addressing ethical issues in biological investigations
How to use it well:
Ethical considerations must be addressed in your IA methodology — practise identifying relevant ethical issues and explaining how your design minimises harm.

Prompt 98: IA Draft Review Session
Copy this prompt into your AI tool:
I will share a section of my biology IA draft. Provide detailed feedback against all five IB criteria: Personal Engagement, Exploration, Analysis, Evaluation, and Communication. For each criterion, suggest specific improvements and estimate the current markband level. Identify the single change that would most improve my overall score.
What this helps you practise:
Receiving structured feedback on biology IA drafts

How to use it well:

Submit sections of your IA iteratively to improve each criterion — address the lowest-scoring criterion first for maximum overall mark improvement.

Prompt 99: Paper 3 Data-Based Question Practice

Copy this prompt into your AI tool:

Simulate an HL Paper 3 data-based question by presenting unfamiliar biological data with a description of the experimental methodology. Ask me to analyse the data, draw conclusions, evaluate the experimental design, and suggest improvements. Include questions about statistical significance and sources of error.

What this helps you practise:

Completing Paper 3 data-based questions under exam conditions

How to use it well:

HL students should practise data-based questions regularly — they test the same analytical and evaluative skills as the IA but in a timed examination format.

Prompt 100: IA Final Quality Check

Copy this prompt into your AI tool:

Present the five IB IA criteria with their top markband descriptors. Ask me to self-assess my IA draft against each criterion, identifying specific evidence in my draft that meets or falls short of the top descriptors. For any gaps, guide me to create an action plan with concrete steps to reach the highest achievable markband.

What this helps you practise:

Self-assessing IA quality against IB markband descriptors

How to use it well:
Use this prompt as a final check before submission to ensure every criterion has been addressed with specific evidence and that no easy marks have been overlooked.

Final Closing Note

You have now worked through 100 prompts designed to help you think more clearly, revise more effectively, and prepare more confidently for your GCSE.

Remember: the goal was never to rely on AI for answers. The goal was to use it as a tool to test, challenge, and strengthen your own understanding.

The strongest students are not those who avoid difficulty, but those who engage with it deliberately. Each mistake you identified, each explanation you improved, and each gap you filled has strengthened your thinking.

As you continue your studies, aim to depend less on prompts and more on your own judgement. AI can support you — but your reasoning, clarity, and persistence are what earn marks.
Approach your exams calmly. Think carefully. Write clearly.
You are more prepared than you think.

Using AI Beyond This Book

The prompts in this book are starting points, not final forms.

As you grow more confident, begin modifying them:

- Add constraints (for example, “limit to three key points”).
- Increase difficulty gradually.
- Ask the AI to challenge your reasoning.
- Request alternative explanations.
- Ask it to critique your thinking rather than provide answers.

The most powerful use of AI is not asking it to tell you things — it is asking it to test and refine your thinking.

In the future, those who understand how to use tools intelligently will have an advantage. Treat AI as a tutor, not a shortcut. The skill of asking better questions will continue to matter long after your exams are over.

About the Author

James R. Martin holds an MSci in Physics from the University of Bristol and a PGCE with a Physics focus from the University of Oxford. He has over a decade of experience teaching and tutoring students aged 11–18 across a range of subjects, including Physics, Biology, Chemistry, Mathematics, Economics, and Electronics.

He has worked with multiple syllabi, including GCSE, A-Level, KS3, and the International Baccalaureate Diploma Programme (IBDP), supporting students of varying abilities to develop clarity, confidence, and exam success.

His work focuses on effective revision strategies, independent thinking, and the responsible use of artificial intelligence as a tool to strengthen — not replace — understanding.

Other Titles in This Series

The *100 AI Prompts for Smarter Revision* series supports students across GCSE, A-Level, and IBDP subjects.

GCSE
• English Language
• English Literature
• Mathematics
• Physics
• Biology
• Chemistry
• Geography
• History
• Computer Science
• Economics
• Business Studies
• Religious Studies
• Psychology
• French
• Spanish
• German

A-Level
• Mathematics
• Further Mathematics
• Physics
• Chemistry
• Biology
• Economics
• History
• Geography
• English Literature
• Psychology
• Computer Science

• Politics
• Business

IBDP

• Mathematics: Analysis & Approaches
• Mathematics: Applications & Interpretation
• Physics
• Chemistry
• Biology
• Economics
• Geography
• History
• English A: Literature
• English A: Language & Literature
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• Computer Science