

Unit Title / Month	Key Concept(s) / Guiding Questions	Content (Syllabus Codes)	Objectives / Learning Outcomes	TOK Links (Theory of Knowledge)	Assessment Tasks	ATL Skills	Sources	Links to Other Subjects
Unit 1: Molecules of Life (Sept - Oct)	Theme A: Unity & Diversity How do water structure and carbon compounds enable life's stability?	A1.1: Water (polarity, hydrogen bonding, properties) B1.1: Carbohydrates & lipids B1.2: Proteins (amino acids, proteome, denaturation)	Understand role of hydrogen bonds. Differentiate structures and functions of lipids/carbs. Explain polypeptide formation and proteome uniqueness.	Is the biological claim that 'all life is carbon-based' an absolute truth, or is it limited by our current observational framework?	Lab: Water thermal properties. Molecular modeling of proteins. Quizzes. End of unit exam (Paper 1A & 1B format).	Thinking skills (structural analysis). Research skills (molecular visualization software).	Oxford IB Biology Course Companion (2023) BioNinja 2025 InThinking Biology	Chemistry: Chemical bonding, condensation, hydrolysis. Physics: Thermal capacity, energy transfer.
Collaborative sciences project (Oct)	Collaboration; interdisciplinary inquiry	Collaborative project involving Biology and at least one other science subject; shared real-world problem, planning, research, communication and reflection.	Collaborate effectively across science disciplines; apply scientific knowledge to a real-world context; communicate evidence-based outcomes.	Project planning, group research/product and reflection.	Collaboration; communication; research; organization; reflection.	How do different areas of knowledge contribute to solving complex problems?	IB Biology Guide FA 2028; IB collaborative sciences project guidance; school/library sources relevant to selected issue.	Chemistry/Physics/ESS: select a shared local or global scientific issue.
Scientific investigation (Oct–Dec)	Inquiry; evidence; evaluation	Student-designed biology investigation: research question, method, data collection/analysis, conclusion and evaluation; maximum 3,000-word report.	Meet Research design, Data analysis, Conclusion and Evaluation criteria.	Research design 6; Data analysis 6; Conclusion 6; Evaluation 6 = 24 marks.	Research; self-management; data literacy; reflection.	How do methods affect the strength of a knowledge claim?	IB Biology Guide FA 2028; Oxford Course Companion; school laboratory safety guidance; appropriate peer-reviewed sources.	Mathematics: uncertainty/statistics. Digital Society: ethical data use.
Unit 2: Nucleic Acids & Gene Expression (Nov)	Theme D: Continuity & Change How does the structural precision of nucleic acids preserve and convey genetic blueprints?	A1.2: Nucleic acids (DNA/RNA structure) D1.1: DNA replication D1.2: Protein synthesis (transcription & translation) D2.2: Gene expression [HL] (epigenetics & methylation) D1.3 Mutation and gene editing	Explain DNA replication mechanism. Outline transcription and translation steps. Understand how methylation regulates gene expression.	To what extent does the language used in genetics (e.g., 'code', 'translation', 'blueprint') shape or limit our actual understanding of biological systems?	DNA replication modeling. Simulation: Transcription / translation. Formative online quizzes. Comprehensive topic test.	Research skills (genetic data analysis). Communication skills (scientific summaries).	Oxford IB Course Companion IB Questionbank	Chemistry: Nucleic acid polymers, ester linkages. Psychology: Biological bases of behavior.
Unit 3: Cells & Viruses (Dec - Jan)	Theme A: Unity & Diversity Theme B: Form & Function What limits cell size, and how did complex eukaryotic systems emerge?	A2.1: Origins of cells [HL] (endosymbiosis) A2.2: Cell structure (prokaryotes vs eukaryotes) A2.3: Viruses [HL] (structural variance, replication cycles)	Evaluate endosymbiotic theory evidence. Discriminate cellular ultrastructures. Categorize structural forms and life cycles of viruses.	Since the shift from prokaryotes to eukaryotes cannot be directly replicated, what criteria do biologists use to judge endosymbiotic theory as a robust explanation?	Lab: Microscopy & cell dimension calculations. Analysis of viral replication graphs. Quizzes. Mid-term examination.	Thinking skills (comparative analysis). Practical skills (microscope calibration).	Oxford IB Course Companion BioNinja 2025	Physics: Surface area to volume ratio limits. Chemistry: Structural polymers.

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Unit 4: Cell Membranes & Transport (Feb)	Theme B: Form & Function How does membrane fluid dynamics control internal cell environments?	B2.1: Membranes & membrane transport (phospholipids, proteins, active/passive mechanisms) B2.2 Organelles and compartmentalization B2.3 Cell specialization C2.1 Chemical signaling D2.1 Cell and nuclear division (Mitosis, Meiosis)	Detail fluid mosaic model components. Explain mechanisms of simple diffusion, osmosis, active transport.	How do scientific models, such as the fluid mosaic model, balance accuracy with utility when simplifying complex microscopic realities?	Lab: Osmolarity and tissue water potential. Modeling transport proteins. Data-based analysis questions.	Practical skills (quantitative measurements). Thinking skills (deductive modeling).	Oxford IB Course Companion InThinking Biology	Chemistry: Amphipathic lipids, polarity. Physics: Diffusion rates, pressure gradients.
Unit 5: Metabolism & Cell Respiration (Mar - Apr)	Theme C: Interaction & Interdependence How do complex metabolic pathways harness chemical potential energy?	C1.1: Enzymes & metabolism (activation energy, inhibition pathways) C1.2: Cell respiration (glycolysis, Krebs cycle, chemiosmosis [HL])	Analyze enzyme inhibition types and kinetics. Trace energy yield through stages of aerobic respiration.	Does breaking down respiration into distinct pathways give a true depiction of metabolic continuity, or is knowledge inherently fragmented by classification?	Lab: Enzyme kinetics under variable pH/temp. Respirometer experiments. Paper 1B data analysis prep. End of unit exam.	Thinking skills (kinetic calculations). Research skills (data modeling).	Oxford IB Course Companion BioNinja 2025	Chemistry: Redox reactions, thermodynamics. Physics: Electrochemical gradients.
Unit 6: Photosynthesis (May - June)	Theme C: Interaction & Interdependence How is light energy integrated into biochemical systems?	C1.3: Photosynthesis (light-dependent and independent reactions, limiting factors)	Describe energy conversion within chlorophyll. Evaluate external constraints on photosynthetic pathways.	How do we decide between competing environmental or economic priorities when applying our knowledge of photosynthetic limits to global food security?	Lab: Pigment separation via TLC. Photosynthesis rate simulation variables. End of year trial exams.	Practical skills (thin-layer chromatography). Social skills (collaborative lab setups).	Oxford IB Course Companion IB Guide 2025	Physics: Electromagnetic spectrum, photon absorption. Chemistry: Photolysis, pigment chemistry.

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Unit 1: Genetics & Inheritance Sep - Oct	Theme D: Continuity and change Guiding Question: How does the reshuffling of nucleic acids during meiosis drive variation, and how can we map gene inheritance patterns?	D2.1 Cell & nuclear division (Meiosis, crossing over)- revision D3.2 Inheritance patterns (Dihybrid crosses, gene linkage; chi-squared test [HL])	Understand how independent assortment and crossing over create unique gametes. Solve complex genetic crosses involving autosomal linkage and epistasis. Perform and interpret chi-squared test on genetic data.	How do mathematical models like the chi-squared test alter our certainty in biological observations? To what extent does genetic reductionism oversimplify human behavior?	Modeling phases of meiosis and crossing over. Problem-solving portfolio: Dihybrid and linked crosses. End of Unit Exam (Paper 1A, 1B & Paper 2).	Thinking skills: Application of statistical tools to biological data. Research skills.	Oxford IB Course Companion (2023/2025) BioNinja (2025 Syllabus) InThinking Biology	Mathematics: Probability, statistical testing (chi-squared distribution).
Unit 2: Ecology Nov - Dec	Theme C: Interaction and interdependence Guiding Question: What factors limit population growth, and how do matter and energy move sustainably through biological communities?	B4.1 Adaptations to environment B4.2 Ecological niches C4.1 Populations & communities (Carrying capacity, density factors) C4.2 Transfers of energy & matter (Food webs, ecological pyramids) D4.2 Sustainability and change D4.3 Climate change & Carbon cycle	Analyze population growth curves and factors causing limiting constraints. Explain the limited length of food chains based on thermodynamic loss. Evaluate scientific evidence linking greenhouse gas concentrations to global temperature changes.	How do political or ethical values influence the interpretation of scientific models in climate change? Can a natural system be fully understood by isolating its individual components?	Practical work: Mesocosm sustainability design and monitoring. Fieldwork simulation: Secondary data analysis on population niches. End of Unit Exam.	Research skills: Making accurate quantitative environmental measurements.	Oxford IB Course Companion IB Biology Guide (2025)	Environmental Systems (ESS): Ecosystem dynamics. Chemistry: Carbon oxidation states, greenhouse gas physics.
Unit 3: Evolution & Cladistics Jan	Theme A: Unity and diversity Theme D: Continuity and change Guiding Question: How can molecular sequences help us deduce the shared ancestry of distinct species?	A3.1 Diversity of life A3.2 Cladistics [HL] (Amino acid sequences, structural classifications) A4.1 Evolution and speciation A4.2 Conservation of biodiversity - D4.1 Natural selection	Evaluate homologies (e.g., pentadactyl limb) as structural evidence for evolution. Analyze cladograms to deduce evolutionary relationships and construct dichotomous keys.	When modern genetic data contradicts historical structural classifications, how should scientists decide which paradigm possesses greater authority?	Creation of an evolutionary booklet outlining animal and plant phyla. Software task: Analyzing amino acid mutations to build a phylogenetic tree. Mock Exam preparation.	Thinking skills: Falsification of old taxonomic systems using modern genetic evidence.	Oxford IB Course Companion BioNinja / Cladistics databases	Psychology: Evolutionary roots of behaviors. Computer Science: Computational alignment of gene sequences.

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Unit 4: Plant Form & Function Feb	Theme B: Form and function Guiding Question: How do plants utilize physical gradients to transport resources without a centralized mechanical pump?	B2.2 Organism structure (Plant tissues: xylem, phloem) D2.3 Water potential gradients & translocation Plant reproduction (Phytochromes, photoperiodism, pollination)	Correlate the structure of plant vessels (xylem and phloem) with their mechanical transport functions. Deduce the effect of day length on flowering via phytochrome interconversion.	Does the classification of plant responses as 'behavior' imply consciousness, or is it merely a metaphorical use of language in natural sciences?	Practical lab: Constructing a potometer to test water uptake in varied environments. Microscopic identification of tissue layers in stem and root cross-sections. End of Unit Test.	Practical skills: High-precision tool alignment. Observation skills.	Oxford IB Course Companion Walpole: Biology for the IB Diploma	Physics: Fluid dynamics, transpiration pull, capillary action, and water potential physics.
Unit 5: Human Physiology & Control Systems Mar - Apr	Theme B: Form and function Theme C: Interaction & interdependence Guiding Question: How do electrochemical impulses and hormonal secretions coordinate structural responses across distant tissues?	B3.1 Gas exchange & ventilation B3.2 Transport (Cardiovascular system) B3.3 Muscle and motility [HL] (Sliding filament theory) C2.2 Neural signaling (Action potentials, synapses)	Explain electrical transmission along a neuron and modulation at chemical synapses. Describe how internal nervous and hormonal feedback loops control homeostatic mechanisms. Analyze blood pressure, heart rates, and typical ECG traces.	If human emotions and thoughts are fundamentally electrochemical impulses, what are the implications for our concept of free will?	Laboratory task: Monitoring ventilation rates at rest vs. vigorous exercise. Analysis of simulated electron micrographs of the intestinal mucosa and exocrine cells. End of Unit Exam.	Thinking skills: Interpreting abstract wave patterns (ECG). Communication skills.	Oxford IB Course Companion InThinking Physiology units	Chemistry: Electrochemical potentials, pH regulation in digestion. Psychology: Core biological levels of neural processing.
Unit 6: Specialized Physiology & Final Revision Apr - May	Theme B: Form and function Guiding Question: How do specific physiological adaptations protect the organism from pathogens and structural failures?	C3.1 Integration of body systems (Endocrine, nervous) C3.2 Defense against disease (Specific vs. non-specific, antibody production) D3.1 Reproduction D3.3 Homeostasis (excretory system, skin) [HL] Final Review & Exam Prep	Understand the structural synergy between skeletal, muscular, and nerve networks during movement. Explain the role of the loop of Henle and ADH in ultrafiltration and human osmoregulation.	How does the medical community reach a consensus on what constitutes a 'normal' homeostatic range versus a pathological condition?	Comprehensive mock papers (Paper 1A, 1B, Paper 2). Peer-review workshops using official IB assessment criteria.	Self-management skills: Time allocation under strict assessment conditions.	Official IB Questionbank Oxford IB Study Guide	Chemistry: Antibody-antigen affinity. Physics: Levers, torque, and physical forces in joint movement.

Biology, ATL Skills, TOK, Academic Integrity and International-Mindedness

Through the study of biology, students develop research, communication, thinking, collaboration and self-management skills through inquiry, experimentation, fieldwork and data analysis. The course promotes international-mindedness by exploring global issues including biodiversity conservation, climate change, health, sustainability and advances in biotechnology. Connections with TOK encourage students to examine the role of models, evidence, ethics and uncertainty in the construction of scientific knowledge. Academic integrity underpins all learning through ethical research practices, responsible data collection, accurate citation of sources and honest reporting of scientific findings. The course supports the development of IB Learner Profile attributes including Inquirers, Thinkers, Knowledgeable, Communicators, Principled, Open-minded and Reflective learners.