Suggestions for teaching the new IB Biology syllabus (2023 –)

The new syllabus has been divided into four themes (Unity and Diversity, Form and Function, Interactions and Interdependencies, Continuity and Change).

- These themes have been further sub-divided into four levels of organisation (Molecules, Cells, Organisms, Ecosystems).

While the use of themes is great for making connections between different topics, there are (in my opinion) a number of limitations with this model:

1. Certain concepts that are closely related may become disconnected across the themes (for example: evolution in A4.1 and natural selection in D4.1).
2. Higher level content is intrinsically embedded into the topics, making it difficult to teach separately from the standard level content.

Many schools have SL and AHL students learning in the same class and may not even start to teach the AHL content until the second year of the diploma.

- This allows students to get a feel for the subject and their own strengths and weaknesses before being made to lock in their SL and HL subject selections.

With this in mind, I have taken the content and reorganised it into traditional topics (similar to the existing Biology syllabus).

- An advantage of this is that all AHL content has been organised into discrete topics to better allow the separation of SL and AHL coursework.

On the following pages, I have included an outline of each teaching structure (Themes and Topics), as well as a possible example of a course plan for each.

- Each course plan is based on the premise that the school year consists of four 10-week terms and so the 2-year Diploma consists of roughly 70 weeks.
- Of the 70 weeks, 64 weeks were allocated for teaching the content (roughly 16 weeks per theme) and 6 weeks allocated to associated assessments.

The goal is to have the new website partially populated with content by the start of 2024 (sorry northern hemisphere teachers, I am from down under!)

- In the meantime, the old website should still be useful and will continue to remain online until all students have finished the old course (November 2024).

IB SYLLABUS: THEMES

Theme	Level of Organisation			
	Molecules	**Cells**	**Organisms**	**Ecosystems**
A Unity and diversity	*Common ancestry has given living organisms many shared features while evolution has resulted in the rich biodiversity of life on Earth.*			
	A1.1 Water **A1.2** Nucleic acids	**A2.1** Origins of cells *[HL only]* **A2.2** Cell structure **A2.3** Viruses *[HL only]*	**A3.1** Diversity of organisms **A3.2** Classification and cladistics *[HL only]*	**A4.1** Evolution and speciation **A4.2** Conservation of diversity
B Form and function	*Adaptations are forms that correspond to function.* *These adaptations persist from generation to generation because they increase the chances of survival.*			
	B1.1 Carbohydrates and lipids **B1.2** Proteins	**B2.1** Membranes and membrane transport **B2.2** Organelles and compartmentalisation **B2.3** Cell specialization	**B3.1** Gas exchange **B3.2** Transport **B3.3** Muscle and motility *[HL only]*	**B4.1** Adaptation to environment **B4.2** Ecological niches
C Interaction and interdependence	*Systems are based on interactions, interdependence and integration of components.* *Systems result in emergence of new properties at each level of biological organization.*			
	C1.1 Enzymes and metabolism **C1.2** Cell respiration **C1.3** Photosynthesis	**C2.1** Chemical signalling *[HL only]* **C2.2** Neural signalling	**C3.1** Integration of body systems **C3.2** Defence against disease	**C4.1** Populations and communities **C4.2** Transfers of energy
D Continuity and change	*Living things have mechanisms for maintaining equilibrium and for bringing about transformation.* *Environmental change is a driver of evolution by natural selection.*			
	D1.1 DNA replication **D1.2** Protein synthesis **D1.3** Mutations / gene editing	**D2.1** Cell and nuclear division **D2.2** Gene expression *[HL only]* **D2.3** Water potential	**D3.1** Reproduction **D3.2** Inheritance **D3.3** Homeostasis	**D4.1** Natural selection **D4.2** Stability and change **D4.3** Climate change

Proposed Weekly Planner – Themes

Semester 1 (20 weeks)

Time	Unit	Content	Sample Activities (SL)	Sample Activities (HL)
3 weeks	A1: Molecules *SL: 5 hours* *HL: 3 hours*	A1.1 Water *[SL/HL]* A1.2 Nucleic Acids *[SL/HL]*	DNA Extraction	Molecular Visualisation (Nucleosomes)
3 weeks	A2: Cells *SL: 4 hours* *HL: 5 hours*	A2.1 Origins of Cells *[HL]* A2.2 Cell Structure *[SL/HL]* A2.3 Viruses *[HL]*	Microscopy	
3 weeks	A3: Organisms *SL: 6 hours* *HL: 2 hours*	A3.1 Diversity of organisms *[SL/HL]* A3.2 Classification and cladistics *[HL]*	Karyotyping Activity Genome Databases	Dichotomous Key
3 weeks	A4: Ecosystems *SL: 7 hours* *HL: 1 hours*	A4.1 Evolution and speciation *[SL/HL]* A4.2 Conservation of biodiversity *[SL]*	Phylogeny Tree	
3 weeks	B1: Molecules *SL: 6 hours* *HL: 2 hours*	B1.1 Carbohydrates and lipids *[SL]* B1.2 Proteins *[SL/HL]*	Starch Hydrolysis (Diastase / Amylase)	Molecular Visualisation (Protein Structure)
4 weeks	B2: Cells *SL: 7 hours* *HL: 5 hours*	B2.1 Membranes and Membrane Transport *[SL/HL]* B2.2 Organelles and Compartmentalisation *[SL/HL]* B2.3 Cell specialization *[SL/HL]*	Agar Cube Diffusion (SA:Vol Ratio)	Beetroot Permeability
1 week	End of Semester	Exam Week (Mid-Year)		

Proposed Weekly Planner – Themes

Semester 2 (20 weeks)

Time	Unit	Content	Sample Activities (SL)	Sample Activities (HL)
4 weeks	B3: Organisms *SL: 6 hours* *AHL: 6 hours*	B3.1 Gas exchange *[SL/HL]* B3.2 Transport *[SL/HL]* B3.3 Muscle and motility *[HL]*	Respirometry Stomatal Density Heart Rate Experiment Histology (Blood / Plants)	
3 weeks	B4: Ecosystems *SL: 7 hours*	B4.1 Adaptation to environment *[SL]* B4.2 Ecological niches *[SL]*	Transect Data Model Skull Comparisons	Goniometer
6 weeks	C1: Molecules *SL: 8 hours* *AHL: 8 hours*	C1.1 Enzymes and metabolism *[SL/HL]* C1.2 Cell respiration *[SL/HL]* C1.3 Photosynthesis *[SL/HL]*	Yeast Fermentation Chromatography Leaf Disc Experiment	Enzyme Inhibitor Experiment
4 weeks	C2: Cells *SL: 3 hours* *AHL: 7 hours*	C2.1 Chemical signalling *[HL]* C2.2 Neural signalling *[SL/HL]*		Oscilloscope Traces
3 weeks	End of Year	Collaborative Sciences Project Exam Week (End-Year)	Group Project (10 hours)	

NB: The Collaborative Sciences Project has been scheduled for the end of the first year of study as this is most likely to be the time when the timetable will have suitable flexibility to allow for the cooperative participation of students from the different scientific disciplines (i.e. Biology, Chemistry, Physics).

NB: This schedule is structured for a HL cohort. While a SL cohort will take less time (in hours) to complete each unit, it is expected that they will also have less class time per week in which to undertake their learning. It is expected that the teacher will adjust the time allocations for a SL cohort accordingly.

Proposed Weekly Planner – Themes

Semester 3 (20 weeks)

Time	Unit	Content	Sample Activities (SL)	Sample Activities (HL)
4 weeks	C3: Organisms *SL: 10 hours* *AHL: 2 hours*	C3.1 Integration of body systems *[SL/HL]* C3.2 Defence against disease *[SL]*	Bacterial Growth (ZoI)	Seedling Phototropism
3 weeks	C4: Ecosystems *SL: 10 hours*	C4.1 Populations and communities *[SL]* C4.2 Transfers of energy and matter *[SL]*	Lincoln Index Activity Yeast Growth Curve Chi-Squared Test Activity Food Chain Activity	
3 weeks	Internal Assessment	Self-designed Investigation and Report	Student Experiments (10 hours)	
6 weeks	D1: Molecules *SL: 8 hours* *AHL: 7 hours*	D1.1 DNA replication *[SL/HL]* D1.2 Protein synthesis *[SL/HL]* D1.3 Mutations and gene editing *[SL/HL]*	Transformation (pGLO)	
3 weeks	D2: Cells *SL: 2 hours* *AHL: 6 hours*	D2.1 Cell and nuclear division *[SL/HL]* D2.2 Gene expression *[HL]* D2.3 Water potential *[SL/HL]*	Potato Cube Osmosis	Mitotic Index Genetic Barley
1 week	End of Semester	Exam Week (Mid-Year)		

NB: The internal assessment (individual scientific investigation) has been scheduled for the end of term 1 of the second year of study. It is expected that by this point students will have had sufficient time to develop the requisite skills, while still being early enough to accommodate unexpected incursions.

Proposed Weekly Planner – Themes

Semester 4 (20 weeks)

Time	Unit	Content	Sample Activities (SL)	Sample Activities (HL)
6 weeks	D3: Organisms *SL: 12 hours* *AHL: 8 hours*	D3.1 Reproduction *[SL/HL]* D3.2 Inheritance *[SL/HL]* D3.3 Homeostasis *[SL/HL]*	Virtual Rat Dissection Gene Database Activity	Chi-Squared Test (Dihybrid Crosses)
4 weeks	D4: Ecosystems *SL: 9 hours* *AHL: 5 hours*	D4.1 Natural selection *[SL/HL]* D4.2 Stability and change *[SL/HL]* D4.3 Climate change *[SL/HL]*	Case Study: Guppies Mesocosm Experiment	Allele Databases (Hardy-Weinberg)
10 weeks	Final Examinations	Revision		

Final Examinations

Level	Paper	Marks		Time	Content
SL	1A	30	55 (36%)	90 min	30 multiple-choice questions on standard level material
	1B	25			Four data-based questions related to experimental work and the syllabus
	2 – Section A	34	50 (44%)	90 min	Data-based question and short-answer questions on standard level material
	2 – Section B	16			Extended-response questions on standard level material (one of two options)
HL	1A	40	75 (36%)	120 min	40 multiple-choice questions on SL and AHL material
	1B	35			Four data-based questions related to experimental work and the syllabus
	2 – Section A	48	80 (44%)	150 min	Data-based question and short-answer questions on SL and AHL material
	2 – Section B	32			Extended-response questions on SL and AHL material (two of three options)

IB SYLLABUS: TOPICS

Cell Contents	**Cells**				**Molecules**			
	A2.2 Introduction *[SL]*		B2.1 Membrane Transport *[SL]*		A1.1 Water *[SL]*		B1.1 Lipids *[SL]*	
	A2.2 Cell Types *[SL]*		A2.1 Origins of Cells *[HL]*		B1.1 Organic Compounds *[SL]*		A1.2 Nucleic Acids *[SL]*	
	B2.3 Specialisation *[SL]*		B2.2 Cell Structure *[HL]*		B1.1 Carbohydrates *[SL]*		B1.2 Proteins *[SL]*	
	B2.1 Membrane Structure *[SL]*		B2.1 Cell Membranes *[HL]*					
Cell Processes	**Metabolism**				**Genetics**			
	C1.1 Enzymes *[SL/HL]*		D1.1 DNA Replication *[SL/HL]*		D1.3 Genes *[SL]*		D2.2 Epigenetics *[HL]*	
	C1.2 Cell Respiration *[SL/HL]*		D1.2 Transcription *[SL/HL]*		D2.1 Cell Division *[SL]*		D3.2 Gene Linkage *[HL]*	
	C1.3 Photosynthesis *[SL/HL]*		D1.2 Translation *[SL/HL]*		D3.2 Inheritance *[SL]*		D1.3 Biotechnology *[HL]*	
Living Systems	**Equilibrium**		**Body Systems**				**Plant Systems**	
	C3.1 Integration *[SL]*		B3.2 Blood *[SL/HL]*		C3.2 Immunity *[SL]*		B3.1 Structure *[SL]*	
	D3.3 Regulation *[SL]*		B3.1 Respiratory *[SL/HL]*		B3.3 Muscles *[HL]*		D2.3 Transport *[SL/HL]*	
	C2.1 Communication *[HL]*		C2.2 Nerves *[SL/HL]*		D3.3 Kidneys *[HL]*		D3.1 Germination *[SL]*	
	A2.3 Disease *[HL]*		D3.1 Reproduction *[SL/HL]*				C3.1 Plant Signalling *[HL]*	
Environment	**Biodiversity**		**Nutrition**		**Ecosystems**		**Human Impacts**	
	A4.1 Evolution *[SL]*		B4.2 Niches *[SL]*		C4.1 Populations *[SL]*		D4.2 Pollution *[SL]*	
	D4.1 Natural Selection *[SL]*		C4.2 Energy Transfer *[SL]*		C4.1 Communities *[SL]*		D4.3 Climate Change *[SL]*	
	A3.1 Diversity *[SL]*		C4.2 Nutrient Cycling *[SL]*		B4.1 Habitats *[SL]*			
	A4.2 Extinction *[SL]*				D4.2 Ecosystems *[SL]*			
	A4.1 Speciation *[HL]*				D4.2 Succession *[HL]*			
	D4.1 Gene Pools *[HL]*				D4.3 Phenology *[HL]*			
	A3.2 Cladistics *[HL]*							

Proposed Weekly Planner – Topics

Semester 1 (20 weeks)

Time	Unit	Associated Content	Sub-Topics	Sample Activities (HL)
4 weeks	Cells *SL: 11 hours*	A2.2 Cell Structure B2.1 Membranes and Membrane Transport B2.2 Organelles and Compartmentalisation B2.3 Cell specialization D2.3 Water potential	Introduction to Cells Cell Types Specialisation	Membrane Structure Membrane Transport
4 weeks	Biomolecules *SL: 11 hours*	A1.1 Water A1.2 Nucleic Acids B1.1 Carbohydrates and lipids B1.2 Proteins	Water Organic Molecules Carbohydrates	Lipids Nucleic Acids Proteins
5 weeks	Metabolism *SL: 15 hours*	C1.1 Enzymes and metabolism C1.2 Cell respiration C1.3 Photosynthesis D1.1 DNA replication D1.2 Protein synthesis	Enzymes DNA Replication Transcription	Translation Cell Respiration Photosynthesis
3 weeks	Genetics *SL: 7 hours*	D1.3 Mutations and gene editing D2.1 Cell and nuclear division D3.2 Inheritance	Genes Cell Division	Inheritance
3 weeks	Equilibrium *SL: 8 hours*	C3.1 Integration of body systems D3.3 Homeostasis	Systems Integration	Systems Regulation
1 week	End of Semester	Exam Week (Mid-Year)		

Proposed Weekly Planner – Topics

Semester 2 (20 weeks)

Time	Unit	Associated Content	Sample Activities (SL)	Sample Activities (HL)
6 weeks	Body Systems *SL: 15 hours*	B3.1 Gas exchange B3.2 Transport C2.2 Neural signalling C3.2 Defence against disease D3.1 Reproduction	Respiratory System Blood System Nervous System	Immune System Reproductive System
2 weeks	Plant Systems *SL: 5 hours*	B3.1 Gas exchange B3.2 Transport D3.1 Reproduction	Plant Structure Transpiration	Germination
5 weeks	Biodiversity *SL: 13 hours*	A3.1 Diversity of organisms A4.1 Evolution and speciation A4.2 Conservation of biodiversity D4.1 Natural selection	Evolution Natural Selection	Classification Extinction
4 weeks	Nutrition *SL: 10 hours*	B4.2 Ecological niches C4.2 Transfers of energy and matter	Niches Energy Transfer	Nutrient Cycling
3 weeks	End of Year	Collaborative Sciences Project Exam Week (End-Year)	Group Project (10 hours)	

NB: The Collaborative Sciences Project has been scheduled for the end of the first year of study as this is most likely to be the time when the timetable will have suitable flexibility to allow for the cooperative participation of students from the different scientific disciplines (i.e. Biology, Chemistry, Physics).

Proposed Weekly Planner – Topics

Semester 3 (20 weeks)

Time	Unit	Associated Content	Sample Activities (SL)	Sample Activities (HL)
4 weeks	Ecosystems *SL: 12 hours*	B4.1 Adaptation to environment C4.1 Populations and communities D4.2 Stability and change	Populations Communities	Habitats Ecosystems
1 week	Human Impacts *SL: 3 hours*	D4.3 Climate change	Pollution	Climate Change
3 weeks	Internal Assessment	Self-designed Investigation and Report	Student Experiments (10 hours)	
3 weeks	AHL: Cells *HL: 15 hours*	A2.1 Origins of Cells A2.2 / B2.1 / B2.2 /B2.3 – Assorted Content	Origins of Cells Cell Structure	Cell Membrane SL: Review Cells
6 weeks	AHL: Metabolism *HL: 25 hours*	C1.1 / C1.2 / C1.3 / D1.1 / D1.2 – Assorted Content	Enzymes DNA Replication Transcription SL: Review Biomolecules	Translation Cell Respiration Photosynthesis SL: Review Metabolism
2 weeks	AHL: Genetics *HL: 10 hours*	D2.2 Gene expression D1.3 / D3.2 – Assorted Content	Epigenetics Gene Linkage	Biotechnology SL: Review Genetics
1 week	End of Semester	Exam Week (Mid-Year)		

NB: The internal assessment (individual scientific investigation) has been scheduled for the end of term 1 of the second year of study. It is expected that by this point students will have had sufficient time to develop the requisite skills, while still being early enough to accommodate unexpected incursions.

NB: If students of both levels (SL and AHL) are being taught in the same class in the second year, it is expected that the AHL students will have additional lessons to meet the higher workload. When AHL topics are eventually covered, SL students would be expected to revise the concomitant SL content.
This planner allocates 3 hours per week for SL content and 5 hours per week for AHL content in year two (3 hours per week for SL content in year one).

Proposed Weekly Planner – Topics

Semester 4 (20 weeks)

Time	Unit	Associated Content	Sample Activities (SL)	Sample Activities (HL)
2 weeks	AHL: Equilibrium *HL: 10 hours*	C2.1 Chemical signalling *[HL]* C2.2 / C3.1 / D3.3 – Assorted Content	Cell Signalling Viruses	Cancer **SL: Review Equilibrium**
4 weeks	AHL: Body Systems *HL: 20 hours*	B3.3 Muscle and motility B3.1 / B3.2 / C2.2 / C3.2 / D3.1 – Assorted Content	Respiratory System Blood System Nervous System SL: Review Body Systems	Reproductive System Muscular System Excretory System
1 week	AHL: Plant Systems *HL: 5 hours*	C3.1 / D2.3 – Assorted Content	Translocation SL: Review Plant Systems	Plant Signalling
2 weeks	AHL: Biodiversity *HL: 10 hours*	A3.2 Classification and cladistics A3.1 / A4.1 / A4.2 / D4.1 – Assorted Content	Speciation Gene Pools	Cladistics SL: Review Biodiversity
1 weeks	AHL: Ecosystems *HL: 5 hours*	D4.2 / D4.3 – Assorted Content	Succession SL: Review Ecology	Seasonal Changes SL: Review Human Impact
10 weeks	Final Examinations	Revision		

Final Examinations

Level	Paper	Marks	Time	Content
SL	1A + 1B	55 (36%)	90 min	30 multiple-choice questions and 4 data-based questions on standard level material
	2 (Sections A + B)	50 (44%)	90 min	Data-based, short-answer and extended-response questions on standard level material
HL	1A + 1B	75 (36%)	120 min	40 multiple-choice questions and 4 data-based questions on SL and AHL material
	2 (Sections A + B)	80 (44%)	150 min	Data-based, short-answer and extended-response questions on SL and AHL material