Marietta City Schools

2025 - 2026 District Unit Planner

Teacher(s)	IB Biology Y1 – Kamau PLC – Kamau/Sappington	**Subject group and course**	Group 4/IB Biology Y1 HL MHS Y1 HL SGO		
Course part and topic **Core Topics are taught by both SL and HL Courses** **Additional HL content inserted in line where it will be taught (orange)**	Unit 1: Cells **HL Core A2.2**.1-2.2.11, **B2.2**.1-2.2.3, **B2.3**.1-2.3.6 **B2.1**.1-2.1.10, **D2.3**.1-2.3.7 **Additional HL** **A2**.1.1 - **2.1**.9 **A2.2**.12-A2.1.14, **A2.3 -2**.3.6, **B2.2**.4-2.2.9, **B2.3**.7-2.3.10, **B2.1**.11-2.1.17, **D2.3**.8-2.3.11	**SL or HL/Year 1 or 2**	HL Y1	**Dates**	9 weeks S1

Unit description and texts	**DP assessment(s) for unit**
Cytology is the study of all aspects of a cell (structure and function). As our understanding of the cell increases, our ability to understand all forms of life, from the smallest to the largest organisms, will also increase. Microscopy is the technical field of using microscopes to view objects and areas of objects that cannot be seen with the naked eye. (Focus: Light and Electron Microscopy) Conceptual Theme for all Units: Sickle Cell Anemia New IB Biology Guide First Assessment 2025	● Unit Formative and Summative assessment(s) – Practice Paper 1 and 2 IB style Questions **Applications of Skills:** ● Microscopy Skills (A2.2): ● Slide preparation ● Staining ● Measuring sizes using an eyepiece graticule ● Focusing using fine and coarse adjustments ● Calculating actual size and magnification ● Producing a scale bar and taking photographs ● Identify cell types and structures in light and electron micrographs (A2.2) ● Draw and annotate (functions) diagrams of organelles and cellular structures based on electron micrographs (A2.2) ● Cell Membrane Modeling and Transport Lab (B2.1) ● Surface Area to Volume Ratios/Cell Size Modeling (B2.3) ● Water Potential Lab – Plants –Measure changes in tissue length and mass and analyze data to deduce isotonic solute concentrations (standard deviation and standard error/error bars) (D2.3)

Topic Abbreviations:
Themes: A = Unity & Diversity, B = Form & Function, C = Interaction & Interdependence, D = Continuity & Change
Level of Organization: 1 = Molecules, 2 = Cells, 3 = Organisms, 4 = Ecosystems

INQUIRY: Establishing the purpose of the unit

NQUIRY: Establishing the purpose of the unit

Statement of Inquiry:
All living things are composed of cells with similar structures and life cycles.

Phenomenon: With sickle cell disease, an inherited group of disorders, red blood cells contort into a sickle shape. The cells die early, leaving a shortage of healthy red blood cells (sickle cell anemia), and can block blood flow causing pain (sickle cell crisis).

Crosscutting Concepts
- Structure and Function
- Interactions
- Stability and Change
- Patterns

CORE IDEAS
- Cellular Structure: Prokaryotic / Eukaryotic Cells/Animal/Plant Cells - Functions of Life
- Membrane and Membrane Transport
- Organelles and Compartmentalization
- Cell Specialization
- Water Potential
- Origins of cells (HL Only)
- Viruses (HL Only)

SEP:
- Asking Questions and Defining Problems
- Developing & Using Models
- Constructing Explanations
- Carrying Out Investigations

ACTION: teaching and learning through inquiry

Content/skills/concepts—essential understandings **Themes: A = Unity & Diversity, B = Form & Function, C = Interaction & Interdependence, D = Continuity & Change**	Learning process *Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.*

Level of Organization: 1 = Molecules, 2 = Cells, 3 = Organisms, 4 = Ecosystems GQ - Guiding Questions NOS - Nature of Science (Blue) AOS - Application of Skills (Red) LQ - Linking Question	
Students will know the following content/Students will grasp the following concepts: **HL Only** **A2.1 Origins of Cells (Unity and Diversity - Cells)** **GQ -** ● What plausible hypothesis could account for the origin of life? ● What intermediate stages could there have been between non-living matter and the first living cells? **Guidance:** **A2.1.1—Conditions on early Earth and the prebiotic formation of carbon compounds** Include the lack of free oxygen and therefore ozone, higher concentrations of carbon dioxide and methane, resulting in higher temperatures and ultraviolet light penetration. The conditions may have caused a variety of carbon compounds to form spontaneously by chemical processes that do not now occur. **A2.1.2—Cells as the smallest units of self-sustaining life** Discuss the differences between something that is living and something that is non-living. Include reasons that viruses are considered to be non-living. **A2.1.3—Challenge of explaining the spontaneous origin of cells** Cells are highly complex structures that can currently only be produced by division of pre-existing cells. Students should be aware that catalysis, self-replication of molecules, self-assembly and the emergence of compartmentalization were necessary requirements for the evolution of the first cells. **NOS: Students should appreciate that claims in science, including hypotheses and theories, must be testable. In some cases, scientists have to struggle with hypotheses that are difficult to test. In this case the exact conditions on prebiotic Earth cannot be replicated and the first protocells did not fossilize.** **A2.1.4—Evidence for the origin of carbon compounds** Evaluate the Miller–Urey experiment. **A2.1.5—Spontaneous formation of vesicles by coalescence of fatty acids into spherical bilayers**	Learning experiences and strategies/planning for self-supporting learning: ● Socratic Seminar ● Small Group/Pair Work ● PowerPoint Lecture Notes ● Individual Presentations ● Group Presentations ● Student Lecture/Leading the class ● Interdisciplinary Learning ● Guided and Student Designed Labs and Explorations Modeling, Think/Pair/Share, CER, Writing Prompts, Videos, etc. Accommodations: ● *SWD/504 – Accommodations Provided* ● *ELL – Reading & Vocabulary Support* ● *Intervention Support* ● *Extensions – Enrichment Tasks and Project* **Assessment Objectives:** The assessment objectives for biology reflect those parts of the aims that will be formally assessed either internally or externally. It is the intention of this course that students can fulfill the following assessment objectives.

Formation of a membrane-bound compartment is needed to allow internal chemistry to become different from that outside the compartment. **A2.1.6—RNA as a presumed first genetic material** RNA can be replicated and has some catalytic activity so it may have acted initially as both the genetic material and the enzymes of the earliest cells. Ribozymes in the ribosome are still used to catalyze peptide bond formation during protein synthesis. **A2.1.7—Evidence for a last universal common ancestor** Include the universal genetic code and shared genes across all organisms. Include the likelihood of other forms of life having evolved but becoming extinct due to competition from the last universal common ancestor (LUCA) and descendants of LUCA. **A2.1.8—Approaches used to estimate dates of the first living cells and the last universal common ancestor** Students should develop an appreciation of the immense length of time over which life has been evolving on Earth. **A2.1.9—Evidence for the evolution of the last universal common ancestor in the vicinity of hydrothermal vents** Include fossilized evidence of life from ancient seafloor hydrothermal vent precipitates and evidence of conserved sequences from genomic analysis. **LQ** • For what reasons is heredity an essential feature of living things? • What is needed for structures to be able to evolve by natural selection? **A2.2 Cell Structure (Unity and Diversity - Cells)** **GQ** - ● What are the features common to all cells and the features that differ? ● How is microscopy used to investigate cell structure? **Guidance:** **A2.2.1—Cells as the basic structural unit of all living organisms**	1. Demonstrate knowledge of: A. terminology, facts, and concepts B. skills, techniques, and methodologies. 2. Understand and apply knowledge of: A. terminology and concepts B. skills, techniques, and methodologies. 3. Analyze, evaluate, and synthesize: A. experimental procedures B. primary and secondary data C. trends, patterns, and predictions. 4. Demonstrate the application of skills necessary to carry out insightful and ethical investigations

NOS: Students should be aware that deductive reason can be used to generate predictions from theories. Based on cell theory, a newly discovered organism can be predicted to consist of one or more cells. **A2.2.2—Microscopy skills** **AOS:** Students should have experience of making temporary mounts of cells and tissues, staining, measuring sizes using an eyepiece graticule, focusing with coarse and fine adjustments, calculating actual size and magnification, producing a scale bar and taking photographs. **NOS:** Students should appreciate that measurement using instruments is a form of quantitative observation. **A2.2.3—Developments in microscopy** Include the advantages of electron microscopy, freeze fracture, cryogenic electron microscopy, and the use of fluorescent stains and immunofluorescence in light microscopy. **A2.2.4—Structures common to cells in all living organisms** Typical cells have DNA as genetic material and a cytoplasm composed mainly of water, which is enclosed by a plasma membrane composed of lipids. Students should understand the reasons for these structures. **A2.2.5—Prokaryotic cell structure** Include these cell components: cell wall, plasma membrane, cytoplasm, naked DNA in a loop and 70S ribosomes. The type of prokaryotic cell structure required is that of Gram-positive eubacteria such as Bacillus and Staphylococcus. Students should appreciate that prokaryotic cell structure varies. However, students are not required to know details of the variations such as the lack of cell walls in phytoplasmas and mycoplasmas. **A2.2.6—Eukaryotic cell structure** Students should be familiar with features common to eukaryotic cells: a plasma membrane enclosing a compartmentalized cytoplasm with 80S ribosomes; a nucleus with chromosomes made of DNA bound to histones, contained in a double membrane with pores; membrane-bound cytoplasmic organelles including mitochondria, endoplasmic reticulum, Golgi apparatus and a variety of vesicles or vacuoles including lysosomes; and a cytoskeleton of microtubules and microfilaments. **A2.2.7—Processes of life in unicellular organisms** Include these functions: homeostasis, metabolism, nutrition, movement, excretion, growth, response to stimuli and reproduction. **A2.2.8—Differences in eukaryotic cell structure between animals, fungi, and plants** Include presence and composition of cell walls, differences in size and function of vacuoles, presence of chloroplasts and other plastids, and presence of centrioles, cilia, and flagella. **A2.2.9—Atypical cell structure in eukaryotes**	

Use numbers of nuclei to illustrate one type of atypical cell structure in aseptate fungal hyphae, skeletal muscle, red blood cells and phloem sieve tube elements. **A2.2.10—Cell types and cell structures viewed in light and electron micrographs.** **AOS:** Students should be able to identify cells in light and electron micrographs as prokaryote, plant, or animal. In electron micrographs, students should be able to identify these structures: nucleoid region, prokaryotic cell wall, nucleus, mitochondrion, chloroplast, sap vacuole, Golgi apparatus, rough and smooth endoplasmic reticulum, chromosomes, ribosomes, cell wall, plasma membrane and microvilli. **A2.2.11—Drawing and annotation based on electron micrographs.** **AOS:** Students should be able to draw and annotate diagrams of organelles (nucleus, mitochondria, chloroplasts, sap vacuole, Golgi apparatus, rough and smooth endoplasmic reticulum, and chromosomes) as well as other cell structures (cell wall, plasma membrane, secretory vesicles, and microvilli) shown in electron micrographs. Students are required to include the functions in their annotations. **LQ -** What explains the use of certain molecular building blocks in all living cells? **HL Content** **A2.2.12—Origin of eukaryotic cells by endosymbiosis** Evidence suggests that all eukaryotes evolved from a common unicellular ancestor that had a nucleus and reproduced sexually. Mitochondria then evolved by endosymbiosis. In some eukaryotes, chloroplasts subsequently also had an endosymbiotic origin. Evidence should include the presence in mitochondria and chloroplasts of 70S ribosomes, naked circular DNA and the ability to replicate. **NOS: Students should recognize that the strength of a theory comes from the observations the theory explains and the predictions it supports. A wide range of observations are accounted for by the theory of endosymbiosis.** **A2.2.13—Cell differentiation as the process for developing specialized tissues in multicellular organisms** Students should be aware that the basis for differentiation is different patterns of gene expression often triggered by changes in the environment. **A2.2.14—Evolution of multicellularity** Students should be aware that multicellularity has evolved repeatedly. Many fungi and eukaryotic algae and all plants and animals are multicellular. Multicellularity has the advantages of allowing larger body size and cell specialization. **HL Content**	

A2.3 Viruses (Unity and Diversity: Cells) **GQ -** **• How can viruses exist with so few genes?** **• In what ways do viruses vary?** **Guidance:** **A2.3.1—Structural features common to viruses** Relatively few features are shared by all viruses: small, fixed size; nucleic acid (DNA or RNA) as genetic material; a capsid made of protein; no cytoplasm; and few or no enzymes. **A2.3.2—Diversity of structure in viruses** Students should understand that viruses are highly diverse in their shape and structure. Genetic material may be RNA or DNA, which can be either single- or double-stranded. Some viruses are enveloped in the host cell membrane and others are not. Virus examples include bacteriophage lambda, coronaviruses and HIV. **A2.3.3—Lytic cycle of a virus** Students should appreciate that viruses rely on a host cell for energy supply, nutrition, protein synthesis and other life functions. Use bacteriophage lambda as an example of the phases in a lytic cycle. **A.2.3.4—Lysogenic cycle of a virus** Use bacteriophage lambda as an example. **A2.3.5—Evidence for several origins of viruses from other organisms** The diversity of viruses suggests several possible origins. Viruses share an extreme form of obligate parasitism as a mode of existence, so the structural features that they have in common could be regarded as convergent evolution. The genetic code is shared between viruses and living organisms. **A2.3.6—Rapid evolution in viruses** Include reasons for very rapid rates of evolution in some viruses. Use two examples of rapid evolution:evolution of influenza viruses and of HIV. Consider the consequences for treating diseases caused by rapidly evolving viruses. **LQ -** **• What mechanisms contribute to convergent evolution?** **• To what extent is the natural history of life characterized by increasing complexity or simplicity?** **B2.2 Organelles and Compartmentalization (Form and Function - Cells)**	

GQ- ● **How are organelles in cells adapted to their functions?** ● **What are the advantages of compartmentalization in cells?** **Guidance:** **B2.2.1—Organelles as discrete subunits of cells that are adapted to perform specific functions** Students should understand that the cell wall, cytoskeleton and cytoplasm are not considered organelles, and that nuclei, vesicles, ribosomes and the plasma membrane are. **NOS: Students should recognize that progress in science often follows the development of new techniques.** For example, study of the function of individual organelles became possible when ultracentrifuges were invented and methods of using them for cell fractionation had been developed. **B2.2.2—Advantage of the separation of the nucleus and cytoplasm into separate compartments** Limit to separation of the activities of gene transcription and translation—post-transcriptional modification of mRNA can happen before the mRNA meets ribosomes in the cytoplasm. In prokaryotes this is not possible that mRNA may immediately meet ribosomes. **B2.2.3—Advantages of compartmentalization in the cytoplasm of cells** Include concentration of metabolites and enzymes and the separation of incompatible biochemical processes. Include lysosomes and phagocytic vacuoles as examples. **HL Content** **B2.2.4—Adaptations of the mitochondrion for production of ATP by aerobic cell respiration** Include these adaptations: a double membrane with a small volume of intermembrane space, large surface area of cristae and compartmentalization of enzymes and substrates of the Krebs cycle in the matrix. **B2.2.5—Adaptations of the chloroplast for photosynthesis** Include these adaptations: the large surface area of thylakoid membranes with photosystems, small volumes of fluid inside thylakoids, and compartmentalization of enzymes and substrates of the Calvin cycle in the stroma. **B2.2.6—Functional benefits of the double membrane of the nucleus** Include the need for pores in the nuclear membrane and for the nucleus membrane to break into vesicles during mitosis and meiosis. **B2.2.7—Structure and function of free ribosomes and of the rough endoplasmic reticulum** Contrast the synthesis by free ribosomes of proteins for retention in the cell with synthesis by membrane- bound ribosomes on the rough endoplasmic reticulum of proteins for transport within the cell and secretion.	

B2.2.8—Structure and function of the Golgi apparatus Limit to the roles of the Golgi apparatus in processing and secretion of protein. **B2.2.9—Structure and function of vesicles in cells** Include the role of clathrin in the formation of vesicles. **LQ** - ● What are examples of structure–function correlations at each level of biological organization? ● What separation techniques are used by biologists? **B2.3 Cell Specialization (Form and Function - Cells)** **GQ-** ● **What are the roles of stem cells in multicellular organisms?** ● **How are differentiated cells adapted to their specialized functions?** **Guidance:** **B2.3.1—Production of unspecialized cells following fertilization and their development into specialized cells by differentiation** Students should understand the impact of gradients on gene expression within an early-stage embryo. **B2.3.2—Properties of stem cells** Limit to the capacity of cells to divide endlessly and differentiate along different pathways. **B2.3.3—Location and function of stem cell niches in adult humans** Limit to two example locations and the understanding that the stem cell niche can maintain the cells or promote their proliferation and differentiation. Bone marrow and hair follicles are suitable examples. **B2.3.4—Differences between totipotent, pluripotent, and multipotent stem cells** Students should appreciate that cells in early-stage animal embryos are totipotent but soon become pluripotent, whereas stem cells in adult tissue such as bone marrow are multipotent. **B2.3.5—Cell size as an aspect of specialization** Consider the range of cell size in humans including male and female gametes, red and white blood cells, neurons, and striated muscle fibers. **B2.3.6—Surface area-to-volume ratios and constraints on cell size** Students should understand the mathematical ratio between volume and surface area and that exchange of materials across a cell surface depends on its area whereas the need for exchange	

depends on cell volume. **NOS: Students should recognize that models are simplified versions of complex systems.** **In this case, the surface-area-to-volume relationship can be modeled using cubes of different side lengths. Although the cubes have a simpler shape than real organisms, scale factors operate in the same way.** **HL Content** **B2.3.7—Adaptations to increase surface area-to-volume ratios of cells** Include flattening of cells, microvilli and invagination. Use erythrocytes and proximal convoluted tubule cells in the nephron as examples. **B2.3.8—Adaptations of type I and type II pneumocytes in alveoli** Limit to extreme thinness to reduce distances for diffusion in type I pneumocytes and the presence of many secretory vesicles (lamellar bodies) in the cytoplasm that discharge surfactant to the alveolar lumen in type II pneumocytes. Alveolar epithelium is an example of a tissue where more than one cell type is present, because different adaptations are required for the overall function of the tissue. **LB2.3.9—Adaptations of cardiac muscle cells and striated muscle fibers** Include the presence of contractile myofibrils in both muscle types and hypotheses for these differences: branching (branched or unbranched), and length and numbers of nuclei. Also include a discussion of whether a striated muscle fiber is a cell. **B2.3.10—Adaptations of sperm and egg cells** Limit to gametes in humans. **LQ -** ● What are the advantages of small size and large size in biological systems? ● How do cells become differentiated? **B2.1 Membranes and Membrane Transport (Form and Function - Cells)** **GQ -** ● How do molecules of lipid and protein assemble into biological membranes? ● What determines whether a substance can pass through a biological membrane? **Guidance:** **B2.1.1—Lipid bilayers as the basis of cell membranes** Phospholipids and other amphipathic lipids naturally form continuous sheet-like bilayers in water.	

B2.1.2—Lipid bilayers as barriers Students should understand that the hydrophobic hydrocarbon chains that form the core of a membrane have low permeability to large molecules and hydrophilic particles, including ions and polar molecules, so membranes function as effective barriers between aqueous solutions. **B2.1.3—Simple diffusion across membranes** Use movement of oxygen and carbon dioxide molecules between phospholipids as an example of simple diffusion across membranes. **B2.1.4—Integral and peripheral proteins in membranes** Emphasize that membrane proteins have diverse structures, locations, and functions. Integral proteins are embedded in one or both lipid layers of a membrane. Peripheral proteins are attached to one or another surface of the bilayer. **B2.1.5—Movement of water molecules across membranes by osmosis and the role of aquaporins** Include an explanation in terms of random movement of particles, impermeability of membranes to solutes and differences in solute concentration. **B2.1.6—Channel proteins for facilitated diffusion** Students should understand how the structure of channel proteins makes membranes selectively permeable by allowing specific ions to diffuse through when channels are open but not when they are closed. **B2.1.7—Pump proteins for active transport** Students should appreciate that pumps use energy from adenosine triphosphate (ATP) to transfer specific particles across membranes and therefore that they can move particles against a concentration gradient. **B2.1.8—Selectivity in membrane permeability** Facilitated diffusion and active transport allow selective permeability in membranes. Permeability by simple diffusion is not selective and depends only on the size and hydrophilic or hydrophobic properties of particles. **B.2.1.9—Structure and function of glycoproteins and glycolipids** Limit to carbohydrate structures linked to proteins or lipids in membranes, location of carbohydrates on the extracellular side of membranes, and roles in cell adhesion and cell recognition. **B2.1.10—Fluid mosaic model of membrane structure** Students should be able to draw a two-dimensional representation of the model and include peripheral and integral proteins, glycoproteins, phospholipids, and cholesterol. They should also be able to indicate hydrophobic and hydrophilic regions. **HL Content** **B2.1.11—Relationships between fatty acid composition of lipid bilayers and their fluidity**	

Unsaturated fatty acids in lipid bilayers have lower melting points, so membranes are fluid and therefore flexible at temperatures experienced by a cell. Saturated fatty acids have higher melting points and make membranes stronger at higher temperatures. Students should be familiar with an example of adaptations in membrane composition in relation to habitat. **B2.1.12—Cholesterol and membrane fluidity in animal cells** Students should understand the position of cholesterol molecules in membranes and also that cholesterol acts as a modulator (adjustor) of membrane fluidity, stabilizing membranes at higher temperatures and preventing stiffening at lower temperatures. **B2.1.13—Membrane fluidity and the fusion and formation of vesicles** Include the terms "endocytosis" and "exocytosis", and examples of each process. **B2.1.14—Gated ion channels in neurons** Include nicotinic acetylcholine receptors as an example of a neurotransmitter-gated ion channel and sodium and potassium channels as examples of voltage-gated channels. **B2.1.15—Sodium–potassium pumps as an example of exchange transporters** Include the importance of these pumps in generating membrane potentials. **B2.1.16—Sodium-dependent glucose cotransporters as an example of indirect active transport** Include the importance of these cotransporters in glucose absorption by cells in the small intestine and glucose reabsorption by cells in the nephron. **B2.1.17—Adhesion of cells to form tissues** Include the term "cell-adhesion molecules" (CAMs) and the understanding that different forms of CAM are used for different types of cell–cell junction. Students are not required to have detailed knowledge of the different CAMs or junctions. **LQ -** ● **What processes depend on active transport in biological systems?** ● **What are the roles of cell membranes in the interaction of a cell with its environment?** **D2.3 Water Potential (Continuity and Change - Cells)** **GQ -** ● What factors affect the movement of water into or out of cells? ● How do plant and animal cells differ in their regulation of water movement? **Guidance:** **D2.3.1—Solvation with water as the solvent**	

Include hydrogen bond formation between solute and water molecules, and attractions between both positively and negatively charged ions and polar water molecules. **D2.3.2—Water movement from less concentrated to more concentrated solutions** Students should express the direction of movement in terms of solute concentration, not water concentration. Students should use the terms "hypertonic", "hypotonic" and "isotonic" to compare concentration of solutions. **D2.3.3—Water movement by osmosis into or out of cells** Students should be able to predict the direction of net movement of water if the environment of a cell is hypotonic or hypertonic. They should understand that in an isotonic environment there is dynamic equilibrium rather than no movement of water. **D2.3.4—Changes due to water movement in plant tissue bathed in hypotonic and those bathed in hypertonic solutions** **AOS: Students should be able to measure changes in tissue length and mass, and analyze data to deduce isotonic solute concentration. Students should also be able to use standard deviation and standard error to help in the analysis of data. Students are not required to memorize formulae for calculating these statistics. Standard deviation and standard error could be determined for the results of this experiment if there are repeats for each concentration. This would allow the reliability of length and mass measurements to be compared. Standard errors could be shown graphically as error bars.** **D2.3.5—Effects of water movement on cells that lack a cell wall** Include swelling and bursting in a hypotonic medium, and shrinkage and crenation in a hypertonic medium. Also include the need for removal of water by contractile vacuoles in freshwater unicellular organisms and the need to maintain isotonic tissue fluid in multicellular organisms to prevent harmful changes. **D2.3.6—Effects of water movement on cells with a cell wall** Include the development of turgor pressure in a hypotonic medium and plasmolysis in a hypertonic medium. **D2.3.7—Medical applications of isotonic solutions** Include intravenous fluids given as part of medical treatment and bathing of organs ready for transplantation as examples. **HL Content** **D2.3.8—Water potential as the potential energy of water per unit volume** Students should understand that it is impossible to measure the absolute quantity of the potential energy of water, so values relative to pure water at atmospheric pressure and 20°C are used. The units are usually kilopascals (kPa).	

D2.3.9—Movement of water from higher to lower water potential Students should appreciate the reasons for this movement in terms of potential energy. **D2.3.10—Contributions of solute potential and pressure potential to the water potential of cells with walls** Use the equation $\psi_w = \psi_s + \psi_p$. Students should appreciate that solute potentials can range from zero downwards and that pressure potentials are generally positive inside cells, although negative pressure potentials occur in xylem vessels where sap is being transported under tension. **D2.3.11—Water potential and water movements in plant tissue** Students should be able to explain in terms of solute and pressure potentials the changes that occur when plant tissue is bathed in either a hypotonic or hypertonic solution. **LQ -** ● What variables influence the direction of movement of materials in tissues? ● What are the implications of solubility differences between chemical substances for living organisms?	
Students will be assessed daily with classwork, discussions, group work, and reflections using a variety of formats with a focus on the applications and skills provided in the syllabus.	**Formative assessment:** Quiz/Test Project/Model CER/Reflection Essay/Writing Assignment

Students will be assessed per subtopic and then at the end of the unit to ensure understanding using IB exam style questions, modeling, reflection, lab reports, and writing prompts. The material may be assessed in multiple sections to ensure understanding. For larger units, the assessments may be split to ensure comprehension and understanding of materials. Students may be aware of many of the concepts within this unit, so building on prior knowledge	**Summative assessment:** Quiz/Test Project/Model CER/Reflection Essay/Writing Assignment

using scaffolding techniques to aid students in a deeper understanding and extending learning to ensure that students can meet the goals set by the unit.	Differentiation: Affirm Identity - build self-esteem Value Prior Knowledge Scaffold Learning Extend Learning Details: Many concepts may be familiar to the students and others will need more scaffolding and extension.

Approaches to learning (ATL)

Check the boxes for any explicit approaches to learning connections made during the unit. For more information on ATL, please see the guide.

Thinking
Social Communication
Self-management
Research

***Each one will be focused on individually (~2 weeks per ATL)**

Details: This unit will provide students with an overview of cellular biology and allow them to explore new horizons within the expanding world of cytology.

Students will need to be able to make connections between structure and function, differentiate between the cell types, and explain how all these components help us understand living things.

Students will learn at the beginning of this course to keep organized notebooks, complete assignments in a timely manner, and learn to use time management to aid them in being successful in the course (self-management).

Since this is the beginning of a new course, the students will have opportunities to get to know each other, me, and the classroom via individual and group assignments.

There will be research components embedded into the content to allow students to dig deeper into the content.

Language and learning	TOK connections	CAS connections
Check the boxes for any explicit language and learning connections made during the unit. For more information on the IB's approach to language and learning, please see the guide.	*Check the boxes for any explicit TOK connections made during the unit*	*Check the boxes for any explicit CAS connections. If you checked any of the boxes, provide a brief note in the "details" section explaining how students engaged in CAS for this unit.*

Activating Background Knowledge Scaffolding for new learning Acquisition of new learning through practice Demonstrating proficiency Details: Students may be proficient in many of the concepts within this unit so the focus will be on activating background knowledge and providing students opportunities to learn and practice new applications and skills.	Personal and Shared Knowledge Ways of Knowing Areas of Knowledge The Knowledge Framework Details: Biology is one of the natural sciences, an area of knowledge. The natural sciences can sometimes be placed in false conflict with the arts or religious and indigenous knowledge systems. The *natural sciences* tend to rely on ways of knowing sense perception, reason, language, memory. There are many examples of discoveries made or inspired by imagination, intuition, and emotion – however these are then rigorously tested and explained using the scientific method (falsification). Students will have a writing prompt covering the following items: ▪ There is a difference between the living and the non-living environment. How are we able to know the difference? ▪ The world that we inhabit is limited by the world that we see. Is there any distinction to be drawn between knowledge claims dependent upon observations made by sense perception and knowledge claims dependent upon observations assisted by technology? ▪ The explanation of the structure of the plasma membrane has changed over the years as new evidence and ways of analysis have come to light. Under what circumstances is it important to learn about theories that were later discredited? ▪ Biology is the study of life, yet life is an emergent property. Under what circumstances is systems	Creativity Activity Service Details: Modeling and active participation in the learning process. Creating materials to aid their fellow classmates in understanding a particular concept through peer interaction and team/group activities.

	approach productive in biology and under what circumstances is a reductionist approach more appropriate? How do scientists decide between competing approaches?	

International Mindedness/Aims:

International Mindedness: (Research/Reflections/Writing)

- Stem cell research has depended on the work of teams of scientists in many countries who share results thereby speeding up the rate of progress. However, national governments are influenced by local, cultural, and religious traditions that impact on the work of scientists and the use of stem cells in therapy.
- Microscopes were invented simultaneously in different parts of the world at a time when information traveled slowly. Modern-day communications have allowed for improvements in the ability to collaborate, enriching scientific endeavors.
- Biologists in laboratories throughout the world are researching the causes and treatment of cancer.

Aims: (Labs/Activities/Student Reflections/CER Activities)
The course enables students, through the overarching theme of the NOS, to:

1. **develop conceptual understanding that allows connections to be made between different areas of the subject, and to other DP sciences subjects**
2. **acquire and apply a body of knowledge, methods, tools, and techniques that characterize science**
3. **develop the ability to analyze, evaluate and synthesize scientific information and claims**
4. **develop the ability to approach unfamiliar situations with creativity and resilience**
5. **design and model solutions to local and global problems in a scientific context**
6. **develop an appreciation of the possibilities and limitations of science**
7. **develop technology skills in a scientific context**
8. **develop the ability to communicate and collaborate effectively**
9. **develop awareness of the ethical, environmental, economic, cultural, and social impact of science**

Resources

MCS Science Resources

- Textbook Pearson Biology for the IB Diploma Standard and Higher Level
- IB Biology Guide First Assessment 2025
- Van de Lagemaat, R. www.inthinking.net: Andorra la Vella, Andorra, 2019.
- IB Biology Schoology Course
- Discovery Education Biology and Chemistry Resources

Stage 3: Reflection—considering the planning, process and impact of the inquiry

What worked well *List the portions of the unit (content, assessment, planning) that were successful*	**What didn't work well** *List the portions of the unit (content, assessment, planning) that were not as successful as hoped*	**Notes/changes/suggestions:** *List any notes, suggestions, or considerations for the future teaching of this unit*
Made changes to the order based on the content flow for example moved B2.1, before D2.3	Pacing has been slower since the Pandemic - improving slowly but still need to improve	Flipped Classroom will be used to increase pacing and improve classroom engagement