Alcanta International College
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Curriculum Map for Biology (Group 4) DP1

Unit Title (Time frame)	Standards / Common Core	IB Objectives	Knowledge/Content	Skills	Assessments		Key resources
	What are students expected to know and be able to do (knowledge and skills) by the end of a specific stage in their education?—General statements To be the same across all year levels	***What IB Objectives (as stated in Subject Guides) will this unit address?***	***What key knowledge will students acquire as a result of this unit? This requires a summary of key content for the unit.***	What skills will they acquire in this unit?	***Through what tasks will students demonstrate the desired understanding? What IB criteria will be used to assess the students?*** **Summative Assessments:** All assessment tasks which will be used to calculate a student's semester grade (must be entered on Engage Gradebook). Must be IB type assessment. **Formative Assessment:** All assessment tasks which are used to provide students with periodic feedback so they are aware of their progress. These could include quizzes, posters, etc. (Do not enter on Engage Gradebook).		Textbook Other texts Websites Videos Movies Community as a resource? Trip
					Formative	**Summative**	
Topic 1: Cell Biology (15 hours)	Students will develop an understanding of the facts, concepts, models, terminology and principles that explain the world, through science. Students will develop an understanding of the nature of scientific inquiry. Students will demonstrate an understanding of the history of science and the evolvement of scientific knowledge. RST2, RST3, RST 9 WHST2.a, WHST2.b, WHST2.c, WHST2.d,	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.a., 3.b., 3.c., 3.d. 4.	**1.1 Introduction to cells** -According to the cell theory, living organisms are composed of cells. -Organisms consisting of only one cell carry out all functions of life in that cell. -Surface area to volume ratio is important in the limitation of cell size. -Multicellular organisms have properties that emerge from the interaction of their cellular components. -Specialized tissues can develop by cell differentiation in multicellular organisms. -Differentiation involves the expression of some genes and not others in a cell's genome. -The capacity of stem cells to divide and differentiate along different pathways is necessary in embryonic development and also makes stem cells suitable for therapeutic uses. **1.2 Ultrastructure of cells** - Prokaryotes have a simple cell structure without compartmentalization. - Eukaryotes have a compartmentalized cell structure. - Electron microscopes have a much higher resolution than light microscopes. **1.3 Membrane structure** - Phospholipids form bilayers in water due to the amphipathic properties of phospholipid molecules.	**1.1 Introduction to cells** • To be able to use a light microscope to investigate the structure of cells and tissues, with drawing of cells. Calculation of the magnification of drawings and the actual size of structures and ultrastructures shown in drawings or micrographs. • To be able to question the cell theory using atypical examples, including striated muscle, giant algae and aseptate fungal hyphae. • To be able to investigate of functions of life in *Paramecium* and one named photosynthetic unicellular organism. • To be able to use of stem cells to treat Stargardt's disease and one other named condition. • To be able to evaluate the ethics of the therapeutic use of stem cells from specially created embryos, from the umbilical cord blood of a new-born baby and from an adult's own tissues. **1.2 Ultrastructure of cells** - To be able to make a drawing of the ultrastructure of prokaryotic cells based on electron micrographs. - To be able to make a drawing of the ultrastructure of eukaryotic cells based on electron micrographs. - To be able to interprete of electron micrographs to	- Homework written tasks • Including data-based questions - Revision quizzes - Class work and discussion - Relevant worksheets - Ultrastructure posters - Cancer leaflets - Stem cells presentation/debate	End of Unit 1 Test: Multiple Choice (IB Paper 1 style) mixed with written response (IB Paper 2 style) and data-based question (IB Paper 3 style). A written report detailing the investigation over the surface area to volume ratio (IA style). A written report detailing the investigation over osmorality of a tissue (IA style).	- PowerPoints and worksheets on Server • X:\Acad\Science\IB Biology\1-Cells\1.1 Introduction to Cells • X:\Acad\Science\IB Biology\1-Cells\1.2 Ultrastructure of Cells • X:\Acad\Science\IB Biology\1-Cells\1.3 Membrane Structure • X:\Acad\Science\IB Biology\1-Cells\1.4 Membrane Transport • X:\Acad\Science\IB Biology\1-Cells\1.5 Origin of Cells • X:\Acad\Science\IB Biology\1-Cells\1.6 Cell Division - Oxford IB Diploma Programme Biology (Course Companion) - Video clips • C:\Users\ASIRI\Desktop\I

	WHST2.e, WHST7		- Membrane proteins are diverse in terms of structure, position in the membrane and function. - Cholesterol is a component of animal cell membranes. **1.4 Membrane transport** - Particles move across membranes by simple diffusion, facilitated diffusion, osmosis and active transport. - The fluidity of membranes allows materials to be taken into cells by endocytosis or released by exocytosis. Vesicles move materials within cells. **1.5 The origin of cells** - Cells can only be formed by division of pre-existing cells. - The first cells must have arisen from non-living material. - The origin of eukaryotic cells can be explained by the endosymbiotic theory. **1.6 Cell division** - Mitosis is division of the nucleus into two genetically identical daughter nuclei. - Chromosomes condense by supercoiling during mitosis. - Cytokinesis occurs after mitosis and is different in plant and animal cells. - Interphase is a very active phase of the cell cycle with many processes occurring in the nucleus and cytoplasm. - Cyclins are involved in the control of the cell cycle. - Mutagens, oncogenes and metastasis are involved in the development of primary and secondary tumours.	identify organelles and deduce the function of specialized cells. • To be able to apply the structure to the function of organelles within exocrine gland cells of the pancreas and within palisade mesophyll cells of the leaf. • To be able to describe that prokaryotes divide by binary fission. **1.3 Membrane structure** - To be able to make a drawing of the fluid mosaic model. - To be able to analyse the evidence from electron microscopy that led to the proposal of the Davson-Danielli model. - To be able to analyse the falsification of the Davson-Danielli model that led to the Singer-Nicolson model. - Cholesterol in mammalian membranes reduces membrane fluidity and permeability to some solutes. **1.4 Membrane transport** - To be able to estimate the osmolarity in tissues by bathing samples in hypotonic and hypertonic solutions. - Structure and function of sodium–potassium pumps for active transport and potassium channels for facilitated diffusion in axons. - Tissues or organs to be used in medical procedures must be bathed in a solution with the same osmolarity as the cytoplasm to prevent osmosis. **1.5 The origin of cells** - To be able to evaluate the evidence from Pasteur's experiments that spontaneous generation of cells and organisms does not now occur on Earth. **1.6 Cell division** - To be able to identify the phases of mitosis in cells viewed with a microscope or in a micrograph. - To be able to determine a mitotic index from a micrograph. - To be able to discuss about the correlation between smoking and incidence of cancers.			BDP\1 Cell Biology\1.1 Introduction to cells (*Stephen Hawkings The Meaning of Life (John Conway's Game of Life segment)*) • X:\Acad\Science\IB Biology\1-Cells\1.2 Ultrastructure of Cells • X:\Acad\Science\IB Biology\1-Cells\1.3 Membrane Structure *(membrane_structure)* • X:\Acad\Science\IB Biology\1-Cells\1.4 Membrane Transport • X:\Acad\Science\IB Biology\1-Cells\1.6 Cell Division

Topic 2: Molecular Biology (21 hours)	Students will develop knowledge of the chemical properties common to all objects and substances, and states of matter, as well as the chemical properties, particulate nature of matter, the Periodic Table of Elements, and of the characteristics of sub-atomic particles and atomic particles. Students will formulate designs to collect data, collect data, and formulate scientific explanations. Students will demonstrate an understanding of the history of science and the evolvement of scientific knowledge. RST4, RST6, RST7 WHST1.a, WHST1.b, WHST1.c, WHST1.d, WHST1.e, WHST7, WHST10	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.a., 3.b., 3.c., 3.d. 4.	**2.1 Molecules to metabolism** - Molecular biology explains living processes in terms of the chemical substances involved. - Carbon atoms can form four covalent bonds allowing a diversity of stable compounds to exist. - Life is based on carbon compounds including carbohydrates, lipids, proteins and nucleic acids. - Metabolism is the web of all the enzyme-catalysed reactions in a cell or organism. - Anabolism is the synthesis of complex molecules from simpler molecules including the formation of macromolecules from monomers by condensation reactions. - Catabolism is the breakdown of complex molecules into simpler molecules including the hydrolysis of macromolecules into monomers. **2.2 Water** - Water molecules are polar and hydrogen bonds form between them. - Hydrogen bonding and dipolarity explain the cohesive, adhesive, thermal and solvent properties of water. - Substances can be hydrophilic or hydrophobic. **2.3 Carbohydrates and lipids** - Monosaccharide monomers are linked together by condensation reactions to form disaccharides and polysaccharide polymers. - Fatty acids can be saturated, monounsaturated or polyunsaturated. - Unsaturated fatty acids can be cis or trans isomers. - Triglycerides are formed by condensation from three fatty acids and one glycerol. **2.4 Proteins** - Amino acids are linked together by condensation to form polypeptides. - There are 20 different amino acids in polypeptides synthesized on ribosomes. - Amino acids can be linked together in any sequence giving a huge range of possible polypeptides. - The amino acid sequence of polypeptides is coded for by genes. - A protein may consist of a single polypeptide or more than one polypeptide linked together. - The amino acid sequence determines the three-dimensional conformation of a protein. - Living organisms synthesize many different proteins with a wide range of functions. - Every individual has a unique proteome.	**2.1 Molecules to metabolism** - To be able to make drawing of molecular diagrams of glucose, ribose, a saturated fatty acid and a generalized amino acid. - To be able to identify the biochemicals such as sugars, lipids or amino acids from molecular diagrams. - Urea as an example of a compound that is produced by living organisms but can also be artificially synthesized. **2.2 Water** - To be able to compare the thermal properties of water with those of methane. - To be able to evaluate the use of water as a coolant in sweat. - To be able to justify modes of transport of glucose, amino acids, cholesterol, fats, oxygen and sodium chloride in blood in relation to their solubility in water. - Comparison of the thermal properties of water with those of methane. - Use of water as a coolant in sweat. **2.3 Carbohydrates and lipids** - To be able to use the molecular visualization software to compare cellulose, starch and glycogen. - To be able to determine the body mass index by calculation or use of a nomogram. - Structure and function of cellulose and starch in plants and glycogen in humans. - Scientific evidence for health risks of trans fats and saturated fatty acids. - Lipids are more suitable for long-term energy storage in humans than carbohydrates. - Evaluation of evidence and the methods used to obtain the evidence for health claims made about lipids. **2.4 Proteins** - To be able to make a drawing molecular diagrams to show the formation of a peptide bond. - Rubisco, insulin, immunoglobulins, rhodopsin, collagen and spider silk as examples of the range of protein functions. - Denaturation of proteins by heat or by deviation of pH from the optimum.	- Homework written tasks • Including data-based questions - Protein posters - Revision quizzes - Class work and discussion - Relevant worksheets	End of Unit 2 Test: Multiple Choice (IB Paper 1 style) mixed with written response (IB Paper 2 style) and data-based question (IB Paper 3 style). A written report detailing the investigation over factors which affect rate of enzymes reactions (IA style). A written report detailing the investigation over the separation of photosynthetic pigments by chromatograph (IA style).	- PowerPoints and worksheets on Server • X:\Acad\Science\IB Biology\2- Molecular Biology\2.1 Molecules to Metabolism • X:\Acad\Science\IB Biology\2- Molecular Biology\2.2 Water • X:\Acad\Science\IB Biology\2- Molecular Biology\2.3 Carbohydrates and Lipids • X:\Acad\Science\IB Biology\2- Molecular Biology\2.4 Proteins • X:\Acad\Science\IB Biology\2- Molecular Biology\2.5 Enzymes • X:\Acad\Science\IB Biology\2- Molecular Biology\2.6 Structure of DNA and RNA • X:\Acad\Science\IB Biology\2- Molecular Biology\2.7 DNA replication, transcription, and translation • X:\Acad\Science\IB Biology\2- Molecular Biology\2.8 Cell Respiration • X:\Acad\Science\IB Biology\2- Molecular Biology\2.9 Photosynthesis - Oxford IB Diploma Programme Biology (Course Companion) - Video clips • X:\Acad\Science\IB Biology\2- Molecular Biology\2.4 Proteins

			2.5 Enzymes - Enzymes have an active site to which specific substrates bind. - Enzyme catalysis involves molecular motion and the collision of substrates with the active site. - Temperature, pH and substrate concentration affect the rate of activity of enzymes. - Enzymes can be denatured. - Immobilized enzymes are widely used in industry. **2.6 Structure of DNA and RNA** - The nucleic acids DNA and RNA are polymers of nucleotides. - DNA differs from RNA in the number of strands present, the base composition and the type of pentose. - DNA is a double helix made of two antiparallel strands of nucleotides linked by hydrogen bonding between complementary base pairs. **2.7 DNA replication, transcription and translation** - The replication of DNA is semi-conservative and depends on complementary base pairing. - Helicase unwinds the double helix and separates the two strands by breaking hydrogen bonds. - DNA polymerase links nucleotides together to form a new strand, using the pre-existing strand as a template. - Transcription is the synthesis of mRNA copied from the DNA base sequences by RNA polymerase. - Translation is the synthesis of polypeptides on ribosomes. - The amino acid sequence of polypeptides is determined by mRNA according to the genetic code. - Codons of three bases on mRNA correspond to one amino acid in a polypeptide. - Translation depends on complementary base pairing between codons on mRNA and anticodons on tRNA. **2.8 Cell respiration** - Cell respiration is the controlled release of energy from organic compounds to produce ATP. - ATP from cell respiration is immediately available as a source of energy in the cell. - Anaerobic cell respiration gives a small yield of ATP from glucose. - Aerobic cell respiration requires oxygen and gives a large yield of ATP from glucose. - **2.9 Photosynthesis**	**2.5 Enzymes** - To be able to design the experiments to test the effect of temperature, pH and substrate concentration on the activity of enzymes. - To be able to design and carry out experimental investigation of a factor affecting enzyme activity. - Methods of production of lactose-free milk and its advantages. **2.6 Structure of DNA and RNA** - To be able to draw simple diagrams of the structure of single nucleotides of DNA and RNA, using circles, pentagons and rectangles to represent phosphates, pentoses and bases. - Crick and Watson's elucidation of the structure of DNA using model making. **2.7 DNA replication, transcription and translation** - To be able to use a table of the genetic code to deduce which codon(s) corresponds to which amino acid. - To be able to analyse of Meselson and Stahl's results to obtain support for the theory of semi-conservative replication of DNA. - To be able to use a table of mRNA codons and their corresponding amino acids to deduce the sequence of amino acids coded by a short mRNA strand of known base sequence. - To be able to deduce the DNA base sequence for the mRNA strand. - Use of Taq DNA polymerase to produce multiple copies of DNA rapidly by the polymerase chain reaction (PCR). - Production of human insulin in bacteria as an example of the universality of the genetic code allowing gene transfer between species. **2.8 Cell respiration** - To be able to analyse the results from experiments involving measurement of respiration rates in germinating seeds or invertebrates using a respirometer. - Use of anaerobic cell respiration in yeasts to produce ethanol and carbon dioxide in baking. - Lactate production in humans when anaerobic			• X:\Acad\Science\IB Biology\2- Molecular Biology\2.6 Structure of DNA and RNA • X:\Acad\Science\IB Biology\2- Molecular Biology\2.7 DNA replication, transcription, and translation • X:\Acad\Science\IB Biology\2- Molecular Biology\2.9 Photosynthesis

			- Photosynthesis is the production of carbon compounds in cells using light energy. - Visible light has a range of wavelengths with violet the shortest wavelength and red the longest. - Chlorophyll absorbs red and blue light most effectively and reflects green light more than other colours. - Oxygen is produced in photosynthesis from the photolysis of water. - Energy is needed to produce carbohydrates and other carbon compounds from carbon dioxide. - Temperature, light intensity and carbon dioxide concentration are possible limiting factors on the rate of photosynthesis.	respiration is used to maximize the power of muscle contractions. **2.9 Photosynthesis** - To be able to make a drawing an absorption spectrum for chlorophyll and an action spectrum for photosynthesis. - To be able to design experiments to investigate the effect of limiting factors on photosynthesis. - To be able to separate photosynthetic pigments by chromatograph. - Changes to the Earth's atmosphere, oceans and rock deposition due to photosynthesis.		A written report detailing the investigation over the effect of temperature on transpiration rate (IA style).	
Topic 9: Plant biology (AHL) (13 hours)	Students will develop an understanding of the facts, concepts, models, terminology and principles that explain the world, through science. Students will apply their understanding of the facts, concepts, models, terminology and principles that explain the world,	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.a., 3.b., 3.c., 3.d. 4.	**9.1 Transport in the xylem of plants.** - Transpiration is the inevitable consequence of gas exchange in the leaf. - Plants transport water from the roots to the leaves to replace losses from transpiration. - The cohesive property of water and the structure of the xylem vessels allow transport under tension. - The adhesive property of water and evaporation generate tension forces in leaf cell walls. - Active uptake of mineral ions in the roots causes absorption of water by osmosis. **9.2 Transport in the phloem of plants** - Plants transport organic compounds from sources to sinks. - Incompressibility of water allows transport along hydrostatic pressure	**9.1 Transport in the xylem of plants** - To be able to make a drawing of the structure of primary xylem vessels in sections of stems based on microscope images. - To be able to measure the transpiration rates using potometers. - To be able to design an experiment to test hypotheses about the effect of temperature or humidity on transpiration rates. - Adaptations of plants in deserts and in saline soils for water conservation. - Models of water transport in xylem using simple apparatus including blotting or filter paper, porous pots and capillary tubing.	- Homework written tasks • Including data-based questions - Revision quizzes - Class work and discussion - Relevant worksheets		- PowerPoints and worksheets on Server • X:\Acad\Science\IB Biology\AHL 9- Plant Biology\9.1 Transport in the Xylem of Plants • X:\Acad\Science\IB Biology\AHL 9- Plant Biology\9.2 Transport in the Phloem of Plants • X:\Acad\Science\IB Biology\AHL 9- Plant Biology\9.3 Growth in Plants • X:\Acad\Science\IB

	through science. Students will formulate designs to collect data, collect data, and formulate scientific explanations. RST3, RST4 RST9 WHST4, WHST5, WHST7		gradients. - Active transport is used to load organic compounds into phloem sieve tubes at the source. - High concentrations of solutes in the phloem at the source lead to water uptake by osmosis. - Raised hydrostatic pressure causes the contents of the phloem to flow towards sinks. **9.3 Growth in plants** - Undifferentiated cells in the meristems of plants allow indeterminate growth. - Mitosis and cell division in the shoot apex provide cells needed for extension of the stem and development of leaves. - Plant hormones control growth in the shoot apex. - Plant shoots respond to the environment by tropisms. - Auxin efflux pumps can set up concentration gradients of auxin in plant tissue. - Auxin influences cell growth rates by changing the pattern of gene expression. **9.4 Reproduction in plants** - Flowering involves a change in gene expression in the shoot apex. - The switch to flowering is a response to the length of light and dark periods in many plants. - Success in plant reproduction depends on pollination, fertilization and seed dispersal. - Most flowering plants use mutualistic relationships with pollinators in sexual reproduction.	**9.2 Transport in the phloem of plants** - To be able to analyse the data from experiments measuring phloem transport rates using aphid stylets and radioactively-labelled carbon dioxide. - Structure–function relationships of phloem sieve tubes. **9.3 Growth in plants** - To be able to evaluate the use of micropropagation for rapid bulking up of new varieties, production of virus-free strains of existing varieties and propagation of orchids and other rare species. - To be able to discuss the micropropagation of plants using tissue from the shoot apex, nutrient agar gels and growth hormones. **9.4 Reproduction in plants** - To be able to make a drawing internal structure of seeds. - To be able to make a drawing of half-views of animal-pollinated flowers. - To be able to design experiments to test hypotheses about factors affecting germination. - To be able to explain the methods used to induce short-day plants to flower out of season.			Biology\AHL 9- Plant Biology\9.4 Reproduction in Plants - Oxford IB Diploma Programme Biology (Course Companion)
Topic 4: Ecology (12 hours)	Students will develop an understanding of the nature of scientific inquiry. Students will develop an understanding of the facts, concepts, models, terminology and principles that explain the world, through science. Students will apply their understanding of the facts, concepts, models,	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.b., 3.c., 3.d. 4.	**4.1 Species, communities and ecosystems** - Species are groups of organisms that can potentially interbreed to produce fertile offspring. - Members of a species may be reproductively isolated in separate populations. - Species have either an autotrophic or heterotrophic method of nutrition (a few species have both methods). - Consumers are heterotrophs that feed on living organisms by ingestion. - Detritivores are heterotrophs that obtain organic nutrients from detritus by internal digestion. - Saprotrophs are heterotrophs that obtain organic nutrients from dead organisms by external digestion. - A community is formed by populations of different species living together and interacting with each other. - A community forms an ecosystem by its interactions with the abiotic environment.	**4.1 Species, communities and ecosystems** - To be able to classify species as autotrophs, consumers, detritivores or saprotrophs from a knowledge of their mode of nutrition. - To be able to set up sealed mesocosms to try to establish sustainability. - To be able to test for association between two species using the chi-squared test with data obtained by quadrat sampling. - To be able to recognize and interpret statistical significance. **4.2 Energy flow** - To be able to analyse the quantitative representations of energy flow using pyramids of energy. **4.3 Carbon cycling**	- Homework written tasks • Including data-based questions - Carbon cycle poster - Revision quizzes - Class work and discussion - Relevant worksheets	End of Unit 4 Test: Multiple Choice (IB Paper 1 style) mixed with written response (IB Paper 2 style) and data-based question (IB Paper 3 style).	- PowerPoints and worksheets on Server • X:\Acad\Science\IB Biology\4-Ecology\4.1 Species, Communities, Ecosystems • X:\Acad\Science\IB Biology\4-Ecology\4.2 Energy Flow • X:\Acad\Science\IB Biology\4-Ecology\4.3 Carbon Recycling • X:\Acad\Science\IB Biology\4-Ecology\4.4 Climate Change - Oxford IB Diploma Programme Biology (Course

	terminology and principles that explain the world, through science. RST1, RST5, RST8 WHST4, WHST5, WHST6		- Autotrophs obtain inorganic nutrients from the abiotic environment. - The supply of inorganic nutrients is maintained by nutrient cycling. - Ecosystems have the potential to be sustainable over long periods of time. **4.2 Energy flow** - Most ecosystems rely on a supply of energy from sunlight. - Light energy is converted to chemical energy in carbon compounds by photosynthesis. - Chemical energy in carbon compounds flows through food chains by means of feeding. - Energy released from carbon compounds by respiration is used in living organisms and converted to heat. - Living organisms cannot convert heat to other forms of energy. - Heat is lost from ecosystems. - Energy losses between trophic levels restrict the length of food chains and the biomass of higher trophic levels. **4.3 Carbon cycling** - Autotrophs convert carbon dioxide into carbohydrates and other carbon compounds. - In aquatic ecosystems carbon is present as dissolved carbon dioxide and hydrogencarbonate ions. - Carbon dioxide diffuses from the atmosphere or water into autotrophs. - Carbon dioxide is produced by respiration and diffuses out of organisms into water or the atmosphere. - Methane is produced from organic matter in anaerobic conditions by methanogenic archaeans and some diffuses into the atmosphere or accumulates in the ground. - Methane is oxidized to carbon dioxide and water in the atmosphere. - Peat forms when organic matter is not fully decomposed because of acidic and/or anaerobic conditions in waterlogged soils. - Partially decomposed organic matter from past geological eras was converted either into coal or into oil and gas that accumulate in porous rocks. - Carbon dioxide is produced by the combustion of biomass and fossilized organic matter. - Animals such as reef-building corals and mollusca have hard parts that are composed of calcium carbonate and can become fossilized in limestone. **4.4 Climate change** - Carbon dioxide and water vapour are the most significant greenhouse gases.	- To be able to construct a diagram of the carbon cycle. - Estimation of carbon fluxes due to processes in the carbon cycle **4.4 Climate change** - To be able to evaluate claims that human activities are not causing climate change. - Threats to coral reefs from increasing concentrations of dissolved carbon dioxide. - Correlations between global temperatures and carbon dioxide concentrations on Earth. - Evaluating claims that human activities are not causing climate change.			Companion) - Possible trip out to Baiyun Mountain

			- Other gases including methane and nitrogen oxides have less impact. - The impact of a gas depends on its ability to absorb long wave radiation as well as on its concentration in the atmosphere. - The warmed Earth emits longer wavelength radiation (heat). - Longer wave radiation is absorbed by greenhouse gases that retain the heat in the atmosphere. - Global temperatures and climate patterns are influenced by concentrations of greenhouse gases. - There is a correlation between rising atmospheric concentrations of carbon dioxide since the start of the industrial revolution 200 years ago and average global temperatures. - Recent increases in atmospheric carbon dioxide are largely due to increases in the combustion of fossilized organic matter.				
Topic 8: Metabolism, cell respiration and photosynthesis (AHL) (14 hours)	Students will develop an understanding of the facts, concepts, models, terminology and principles that explain the world, through science. Students will apply their understanding of the facts, concepts, models, terminology and principles that explain the world, through science. RST1, RST2, RST5 WHST5, WHST8, WHST9	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.c., 3.d.	**8.1 Metabolism** - Metabolic pathways consist of chains and cycles of enzyme-catalysed reactions. - Enzymes lower the activation energy of the chemical reactions that they catalyse. - Enzyme inhibitors can be competitive or non-competitive. - Metabolic pathways can be controlled by end-product inhibition. **8.2 Cell respiration** - Cell respiration involves the oxidation and reduction of electron carriers. - Phosphorylation of molecules makes them less stable. - In glycolysis, glucose is converted to pyruvate in the cytoplasm. - Glycolysis gives a small net gain of ATP without the use of oxygen. - In aerobic cell respiration pyruvate is decarboxylated and oxidized, and converted into acetyl compound and attached to coenzyme A to form acetyl coenzyme A in the link reaction. - In the Krebs cycle, the oxidation of acetyl groups is coupled to the reduction of hydrogen carriers, liberating carbon dioxide. - Energy released by oxidation reactions is carried to the cristae of the mitochondria by reduced NAD and FAD. - Transfer of electrons between carriers in the electron transport chain in the membrane of the cristae is coupled to proton pumping. - In chemiosmosis protons diffuse through ATP synthase to generate ATP. - Oxygen is needed to bind with the free protons to maintain the hydrogen gradient, resulting in the formation of water. - The structure of the mitochondrion is adapted to the function it performs. **8.3 Photosynthesis**	**8.1 Metabolism** - To be able to calculate and plot rates of reaction from raw experimental results. - To be able to distinguish the different types of inhibition from graphs at specified substrate concentration. - End-product inhibition of the pathway that converts threonine to isoleucine. - Use of databases to identify potential new anti-malarial drugs. **8.2 Cell respiration** - To be able to analyse the diagrams of the pathways of aerobic respiration to deduce where decarboxylation and oxidation reactions occur. - To be able to annotate a diagram of a mitochondrion to indicate the adaptations to its function. - Electron tomography used to produce images of active mitochondria.	- Homework written tasks • Including data-based questions - Revision quizzes - Class work - Any relevant worksheets		- Oxford IB Diploma Programme Biology (Course Companion) - PowerPoints and worksheets on server • X:\Acad\Science\IB Biology\AHL 8 - Metabolism, Cell Respiration, Photosynthesis\8.1 Metabolism • X:\Acad\Science\IB Biology\AHL 8 - Metabolism, Cell Respiration, Photosynthesis\8.2 Cell Respiration • X:\Acad\Science\IB Biology\AHL 8 - Metabolism, Cell Respiration, Photosynthesis\8.3 Photosynthesis

			- Light-dependent reactions take place in the thylakoid membranes and the space inside them. - Light-independent reactions take place in the stroma. - Reduced NADP and ATP are produced in the light-dependent reactions. - Absorption of light by photosystems generates excited electrons. - Photolysis of water generates electrons for use in the light-dependent reactions. - Transfer of excited electrons occurs between carriers in thylakoid membranes. - Excited electrons from Photosystem II are used to contribute to generate a proton gradient. - ATP synthase in thylakoids generates ATP using the proton gradient. - Excited electrons from Photosystem I are used to reduce NADP. - In the light-independent reactions a carboxylase catalyses the carboxylation of ribulose bisphosphate. - Glycerate 3-phosphate is reduced to triose phosphate using reduced NADP and ATP. - Triose phosphate is used to regenerate RuBP and produce carbohydrates. - Ribulose bisphosphate is reformed using ATP. - The structure of the chloroplast is adapted to its function in photosynthesis.	**8.3 Photosynthesis** - To be able to annotate a diagram to indicate the adaptations of a chloroplast to its function. - Calvin's experiment to elucidate the carboxylation of RuBP.			
Topic 6: Physiology (20 hours)	Students will formulate designs to collect data, collect data, and formulate scientific explanations. Students will apply their understanding of the facts, concepts, models, terminology and principles that explain the world, through science. Students will develop an understanding of the nature of scientific inquiry.	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.a., 3.b., 3.c., 3.d. 4.	**6.1 Digestion and absorption** - The contraction of circular and longitudinal muscle of the small intestine mixes the food with enzymes and moves it along the gut. - The pancreas secretes enzymes into the lumen of the small intestine. - Enzymes digest most macromolecules in food into monomers in the small intestine. - Villi increase the surface area of epithelium over which absorption is carried out. - Villi absorb monomers formed by digestion as well as mineral ions and vitamins. - Different methods of membrane transport are required to absorb different nutrients. **6.2 The blood system** - Arteries convey blood at high pressure from the ventricles to the tissues of the body. - Arteries have muscle cells and elastic fibres in their walls. - The muscle and elastic fibres assist in maintaining blood pressure between pump cycles. - Blood flows through tissues in capillaries. Capillaries have permeable	**6.1 Digestion and absorption** - Production of an annotated diagram of the digestive system. - Identification of tissue layers in transverse sections of the small intestine viewed with a microscope or in a micrograph. - Processes occurring in the small intestine that result in the digestion of starch and transport of the products of digestion to the liver. - Use of dialysis tubing to model absorption of digested food in the intestine. **6.2 The blood system** - To be able to identify the blood vessels as arteries, capillaries or veins from the structure of their walls. - To be able to recognise the chambers and valves of the heart and the blood vessels connected to it in dissected hearts or in diagrams of heart structure. - William Harvey's discovery of the circulation of the blood with the heart acting as the pump.	- Homework written tasks • Including data-based questions - Revision quizzes - Class work and discussion - Relevant worksheets	End of Unit 6 Test: Multiple Choice (IB Paper 1 style) mixed with written response (IB Paper 2 style) and data-based question (IB Paper 3 style). A written report detailing the investigation over the effect exercise on ventilation (IA style).	- PowerPoints and worksheets on Server • X:\Acad\Science\IB Biology\6 - Human Physiology\6.1 Digestion and Absorption • X:\Acad\Science\IB Biology\6 - Human Physiology\6.2 Blood System • X:\Acad\Science\IB Biology\6 - Human Physiology\6.3 Defence against Infectious Disease • X:\Acad\Science\IB Biology\6 - Human Physiology\6.4 Gas Exchange • X:\Acad\Science\IB Biology\6 - Human

	RST6, RST7, RST9 WHST6, WHST8, WHST10		walls that allow exchange of materials between cells in the tissue and the blood in the capillary. - Veins collect blood at low pressure from the tissues of the body and return it to the atria of the heart. - Valves in veins and the heart ensure circulation of blood by preventing backflow. - There is a separate circulation for the lungs. - The heart beat is initiated by a group of specialized muscle cells in the right atrium called the sinoatrial node. - The sinoatrial node acts as a pacemaker. - The sinoatrial node sends out an electrical signal that stimulates contraction as it is propagated through the walls of the atria and then the walls of the ventricles. - The heart rate can be increased or decreased by impulses brought to the heart through two nerves from the medulla of the brain. - Epinephrine increases the heart rate to prepare for vigorous physical activity. **6.3 Defence against infectious diseases** - The skin and mucous membranes form a primary defence against pathogens that cause infectious disease. - Cuts in the skin are sealed by blood clotting. - Clotting factors are released from platelets. - The cascade results in the rapid conversion of fibrinogen to fibrin by thrombin. - Ingestion of pathogens by phagocytic white blood cells gives non-specific immunity to diseases. - Production of antibodies by lymphocytes in response to particular pathogens gives specific immunity. - Antibiotics block processes that occur in prokaryotic cells but not in eukaryotic cells. - Viruses lack a metabolism and cannot therefore be treated with antibiotics. Some strains of bacteria have evolved with genes that confer resistance to antibiotics and some strains of bacteria have multiple resistance. **6.4 Gas exchange** - Ventilation maintains concentration gradients of oxygen and carbon dioxide between air in alveoli and blood flowing in adjacent capillaries. - Type I pneumocytes are extremely thin alveolar cells that are adapted to carry out gas exchange. - Type II pneumocytes secrete a solution containing surfactant that creates a moist surface inside the alveoli to prevent the sides of the alveolus adhering to each other by reducing surface tension.	- Pressure changes in the left atrium, left ventricle and aorta during the cardiac cycle. - Causes and consequences of occlusion of the coronary arteries. **6.3 Defence against infectious diseases** - To be able to evaluate Florey and Chain's experiments to test penicillin on bacterial infections in mice. - Causes and consequences of blood clot formation in coronary arteries. - Effects of HIV on the immune system and methods of transmission. **6.4 Gas exchange** - To be able to monitor the ventilation in humans at rest and after mild and vigorous exercise. - Causes and consequences of lung cancer. - Causes and consequences of emphysema. - External and internal intercostal muscles, and diaphragm and abdominal muscles as examples of antagonistic muscle action. **6.5 Neurones and synapses** - To be able to analyse the oscilloscope traces showing resting potentials and action potentials. - Secretion and reabsorption of acetylcholine by neurons at synapses. - Blocking of synaptic transmission at cholinergic synapses in insects by binding of neonicotinoid pesticides to acetylcholine receptors. **6.6 Hormones, homeostasis and reproduction** - To be able to make annotate diagrams of the male and female reproductive system to show names of structures and their functions. - Causes and treatment of Type I and Type II diabetes. - Testing of leptin on patients with clinical obesity and reasons for the failure to control the disease. - Causes of jet lag and use of melatonin to alleviate it. - The use in IVF of drugs to suspend the normal secretion of hormones, followed by the use of artificial doses of hormones to induce superovulation and establish a pregnancy. - William Harvey's investigation of sexual reproduction in deer.			Physiology\6.6 Hormones, Homeostasis, Reproduction - Oxford IB Diploma Programme Biology (Course Companion) - Video clips • X:\Acad\Science\IB Biology\6 - Human Physiology\6.1 Digestion and Absorption • X:\Acad\Science\IB Biology\6 - Human Physiology\6.2 Blood System • X:\Acad\Science\IB Biology\6 - Human Physiology\6.4 Gas Exchange • X:\Acad\Science\IB Biology\6 - Human Physiology\6.6 Hormones, Homeostasis, Reproduction

			- Air is carried to the lungs in the trachea and bronchi and then to the alveoli in bronchioles. - Muscle contractions cause the pressure changes inside the thorax that force air in and out of the lungs to ventilate them. - Different muscles are required for inspiration and expiration because muscles only do work when they contract. **6.5 Neurones and synapses** - Neurons transmit electrical impulses. - The myelination of nerve fibres allows for saltatory conduction. - Neurons pump sodium and potassium ions across their membranes to generate a resting potential. - An action potential consists of depolarization and repolarization of the neuron. - Nerve impulses are action potentials propagated along the axons of neurons. - Propagation of nerve impulses is the result of local currents that cause each successive part of the axon to reach the threshold potential. - Synapses are junctions between neurons and between neurons and receptor or effector cells. - When presynaptic neurons are depolarized they release a neurotransmitter into the synapse. - A nerve impulse is only initiated if the threshold potential is reached. **6.6 Hormones, homeostasis and reproduction** - Insulin and glucagon are secreted by β and α cells of the pancreas respectively to control blood glucose concentration. - Thyroxin is secreted by the thyroid gland to regulate the metabolic rate and help control body temperature. - Leptin is secreted by cells in adipose tissue and acts on the hypothalamus of the brain to inhibit appetite. - Melatonin is secreted by the pineal gland to control circadian rhythms. - A gene on the Y chromosome causes embryonic gonads to develop as testes and secrete testosterone. - Testosterone causes pre-natal development of male genitalia and both sperm production and development of male secondary sexual characteristics during puberty. - Estrogen and progesterone cause pre-natal development of female reproductive organs and female secondary sexual characteristics during puberty. - The menstrual cycle is controlled by negative and positive feedback mechanisms involving ovarian and pituitary hormones.			

Alcanta International College
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Curriculum Map for Biology (Group 4) DP2

Unit Title (Time frame)	Standards	IB Objectives	Knowledge/Content	Skills	Assessments		Key resources
	What are students expected to know and be able to do (knowledge and skills) by the end of a specific stage in their education?—General statements To be the same across all year levels	***What IB Objectives (as stated in Subject Guides) will this unit address?***	***What key knowledge will students acquire as a result of this unit? This requires a summary of key content for the unit.***	What skills will they acquire in this unit?	***Through what tasks will students demonstrate the desired understanding? What IB criteria will be used to assess the students?*** **Summative Assessments:** All assessment tasks which will be used to calculate a student's semester grade (must be entered on Engage Gradebook). Must be IB type assessment. **Formative Assessment:** All assessment tasks which are used to provide students with periodic feedback so they are aware of their progress. These could include quizzes, posters, etc. (Do not enter on Engage Gradebook).		Textbook Other texts Websites Videos Movies Community as a resource? Trip
					Formative	**Summative**	
Topic 3: Genetics (15 hours)	Students will demonstrate an understanding of the history of science and the evolvement of scientific knowledge. Students will develop an understanding of the nature of scientific inquiry. Students will develop an understanding of the facts, concepts, models, terminology and principles that explain the world, through science. RST4, RST6, RST8 WHST2.a, WHST2.b, WHST2.c, WHST2.d, WHST2.e, WHST4, WHST5	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.a., 3.b., 3.c., 3.d. 4.	**3.1 Genes** - A gene is a heritable factor that consists of a length of DNA and influences a specific characteristic. - A gene occupies a specific position on a chromosome. - The various specific forms of a gene are alleles. - Alleles differ from each other by one or only a few bases. - New alleles are formed by mutation. - The genome is the whole of the genetic information of an organism. - The entire base sequence of human genes was sequenced in the Human Genome Project. **3.2 Chromosomes** - Prokaryotes have one chromosome consisting of a circular DNA molecule. - Some prokaryotes also have plasmids but eukaryotes do not. - Eukaryote chromosomes are linear DNA molecules associated with histone proteins. - In a eukaryote species there are different chromosomes that carry different genes. - Homologous chromosomes carry the same sequence of genes but not necessarily the same alleles of those genes. - Diploid nuclei have pairs of homologous chromosomes. - Haploid nuclei have one chromosome of each pair. - The number of chromosomes is a characteristic feature of members of a species. - A karyogram shows the chromosomes of an organism in homologous	**3.1 Genes** - To be able to use a database to determine differences in the base sequence of a gene in two species. - To be able to explain the causes of sickle cell anemia, including a base substitution mutation, a change to the base sequence of mRNA transcribed from it and a change to the sequence of a polypeptide in hemoglobin. - To be able to make a comparison of the number of genes in humans with other species. **3.2 Chromosomes** - To be able to use databases to identify the locus of a human gene and its polypeptide product. - To be able to explain the Cairns' technique for measuring the length of DNA molecules by autoradiography. - To be able to make the	- Homework written tasks • Including data-based questions - Revision quizzes	End of Unit 3 Test: Multiple Choice (IB Paper 1 style) mixed with written response (IB Paper 2 style) and data-based question (IB Paper 3 style).	- PowerPoints and worksheets on Server • X:\Acad\Science\IB Biology\3-Genetics\3.1 Genes • X:\Acad\Science\IB Biology\3-Genetics\3.2 Chromosomes • X:\Acad\Science\IB Biology\3-Genetics\3.3 Meiosis • X:\Acad\Science\IB Biology\3-Genetics\3.4 Inheritance • X:\Acad\Science\IB Biology\3-Genetics\3.5 Genetic Modification and Biotechnology - Oxford IB Diploma Programme Biology (Course Companion)

			pairs of decreasing length. - Sex is determined by sex chromosomes and autosomes are chromosomes that do not determine sex. **3.3 Meiosis** - One diploid nucleus divides by meiosis to produce four haploid nuclei. - The halving of the chromosome number allows a sexual life cycle with fusion of gametes. - DNA is replicated before meiosis so that all chromosomes consist of two sister chromatids. - The early stages of meiosis involve pairing of homologous chromosomes and crossing over followed by condensation. - Orientation of pairs of homologous chromosomes prior to separation is random. - Separation of pairs of homologous chromosomes in the first division of meiosis halves the chromosome number. - Crossing over and random orientation promotes genetic variation. - Fusion of gametes from different parents promotes genetic variation. **3.4 Inheritance** - Mendel discovered the principles of inheritance with experiments in which large numbers of pea plants were crossed. - Gametes are haploid so contain only one allele of each gene. - The two alleles of each gene separate into different haploid daughter nuclei during meiosis. - Fusion of gametes results in diploid zygotes with two alleles of each gene that may be the same allele or different alleles. - Dominant alleles mask the effects of recessive alleles but co-dominant alleles have joint effects. - Many genetic diseases in humans are due to recessive alleles of autosomal genes, although some genetic diseases are due to dominant or co-dominant alleles. - Some genetic diseases are sex-linked. The pattern of inheritance is different with sex-linked genes due to their location on sex chromosomes. - Many genetic diseases have been identified in humans but most are very rare. - Radiation and mutagenic chemicals increase the mutation rate and can cause genetic diseases and cancer. **3.5 Genetic modification and biotechnology** - Gel electrophoresis is used to separate proteins or fragments of DNA according to size. - PCR can be used to amplify small amounts of DNA. - DNA profiling involves comparison of DNA.	comparison of genome size in T2 phage, *Escherichia coli*, *Drosophila melanogaster*, *Homo sapiens* and *Paris japonica.* - To be able to make comparison of diploid chromosome numbers of *Homo sapiens*, *Pan troglodytes*, *Canis familiaris*, *Oryza sativa*, *Parascaris equorum.* - To be able to use of karyograms to deduce sex and diagnose Down syndrome in humans. **3.3 Meiosis** - To be able to draw diagrams to show the stages of meiosis resulting in the formation of four haploid cells. - To be able to explain that the non-disjunction can cause Down syndrome and other chromosome abnormalities. - To be able to discuss the studies showing age of parents influences chances of non-disjunction. - To be able to describe the methods used to obtain cells for karyotype analysis e.g. chorionic villus sampling and amniocentesis and the associated risks. **3.4 Inheritance** - To be able to construct Punnett grids for predicting the outcomes of monohybrid genetic crosses. - To be able to compare predicted and actual outcomes of genetic crosses using real data. - To be able to analyse pedigree charts to deduce the pattern of inheritance of genetic diseases. - To be able to explain the			

			- Genetic modification is carried out by gene transfer between species. - Clones are groups of genetically identical organisms, derived from a single original parent cell. - Many plant species and some animal species have natural methods of cloning. - Animals can be cloned at the embryo stage by breaking up the embryo into more than one group of cells. - Methods have been developed for cloning adult animals using differentiated cells.	inheritance of ABO blood groups. - To be able to explain the red-green colour blindness and hemophilia as examples of sex-linked inheritance. - To be able to explain the inheritance of cystic fibrosis and Huntington's disease. - To be able to discuss the consequences of radiation after nuclear bombing of Hiroshima and accident at Chernobyl. **3.5 Genetic modification and biotechnology** - To be able to design an experiment to assess one factor affecting the rooting of stem-cuttings. - To be able to analyse examples of DNA profiles. - To be able to analyse data on risks to monarch butterflies of Bt crops. - To be able to use the DNA profiling in paternity and forensic investigations. - To be able to describe the gene transfer to bacteria using plasmids makes use of restriction endonucleases and DNA ligase. - To be able to make assessment of the potential risks and benefits associated with genetic modification of crops. - To be able to describe the production of cloned embryos produced by somatic-cell nuclear transfer.			
Topic 11: Animal physiology *(AHL)* (16 hours)	Students will apply their understanding of the facts, concepts, models, terminology and principles that explain the world,	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.a., 3.b., 3.c., 3.d.	**11.1 Antibody production and vaccination** - Every organism has unique molecules on the surface of its cells. - Pathogens can be species-specific although others can cross species barriers. - B lymphocytes are activated by T lymphocytes in mammals.	**11.1 Antibody production and vaccination** - To be able to analyse the epidemiological data related to vaccination programmes.	- Homework written tasks • Including data-based questions		- PowerPoints and worksheets on Server • X:\Acad\Science\IB Biology\AHL 11- Animal Physiology\11.1

	through science. Students will develop an understanding of the nature of scientific inquiry. RST2, RST4, RST8 WHST6, WHST8, WHST9		- Activated B cells multiply to form clones of plasma cells and memory cells. - Plasma cells secrete antibodies. - Antibodies aid the destruction of pathogens. - White cells release histamine in response to allergens. - Histamines cause allergic symptoms. - Immunity depends upon the persistence of memory cells. - Vaccines contain antigens that trigger immunity but do not cause the disease. - Fusion of a tumour cell with an antibody-producing plasma cell creates a hybridoma cell. - Monoclonal antibodies are produced by hybridoma cells. **11.2 Movement** - Bones and exoskeletons provide anchorage for muscles and act as levers. - Synovial joints allow certain movements but not others. - Movement of the body requires muscles to work in antagonistic pairs. - Skeletal muscle fibres are multinucleate and contain specialized endoplasmic reticulum. - Muscle fibres contain many myofibrils. - Each myofibril is made up of contractile sarcomeres. - The contraction of the skeletal muscle is achieved by the sliding of actin and myosin filaments. - ATP hydrolysis and cross bridge formation are necessary for the filaments to slide. - Calcium ions and the proteins tropomyosin and troponin control muscle contractions. **11.3 The kidney and osmoregulation** - Animals are either osmoregulators or osmoconformers. - The Malpighian tubule system in insects and the kidney carry out osmoregulation and removal of nitrogenous wastes. - The composition of blood in the renal artery is different from that in the renal vein. - The ultrastructure of the glomerulus and Bowman's capsule facilitate ultrafiltration. - The proximal convoluted tubule selectively reabsorbs useful substances by active transport. - The loop of Henle maintains hypertonic conditions in the medulla. - ADH controls reabsorption of water in the collecting duct. - The length of the loop of Henle is positively correlated with the need for water conservation in animals. - The type of nitrogenous waste in animals is correlated with evolutionary history and habitat.	**11.2 Movement** - Annotation of a diagram of the human elbow. - To be able to draw labelled diagrams of the structure of a sarcomere. - To be able to analyse the electron micrographs to find the state of contraction of muscle fibres. **11.3 The kidney and osmoregulation** - To be able to draw and label a diagram of the human kidney. - To be able to make annotated diagrams of the nephron. **11.4 Sexual reproduction** - To be able to make annotation of diagrams of seminiferous tubule and ovary to show the stages of gametogenesis. - To be able to make annotation of diagrams of mature sperm and egg to indicate functions.	- Revision quizzes	End of Unit 3 and 11 Test: Multiple Choice (IB Paper 1 style) mixed with written	Antibody Production and Vaccination • X:\Acad\Science\IB Biology\AHL 11- Animal Physiology\11.2 Movements • X:\Acad\Science\IB Biology\AHL 11- Animal Physiology\11.3 Kidney and Osmoregulation • X:\Acad\Science\IB Biology\AHL 11- Animal Physiology\11.4 Sexual Reproduction - Oxford IB Diploma Programme Biology (Course Companion)

			11.4 Sexual reproduction - Spermatogenesis and oogenesis both involve mitosis, cell growth, two divisions of meiosis and differentiation. - Processes in spermatogenesis and oogenesis result in different numbers of gametes with different amounts of cytoplasm. - Fertilization in animals can be internal or external. - Fertilization involves mechanisms that prevent polyspermy. - Implantation of the blastocyst in the endometrium is essential for the continuation of pregnancy. - HCG stimulates the ovary to secrete progesterone during early pregnancy. - The placenta facilitates the exchange of materials between the mother and fetus. - Estrogen and progesterone are secreted by the placenta once it has formed. - Birth is mediated by positive feedback involving estrogen and oxytocin.			response (IB Paper 2 style) and data-based question (IB Paper 3 style).	
Topic 5 Evolution and biodiversity (12 hours)	Students will develop an understanding of the nature of scientific inquiry. Students will demonstrate an understanding of the history of science and the evolvement of scientific knowledge. RST1, RST7, RST10 WHST1.a, WHST1.b, WHST1.c, WHST1.d, WHST1.e, WHST6, WHST9	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.a., 3.b., 3.c., 3.d.	**5.1 Evidence for evolution** - Evolution occurs when heritable characteristics of a species change. - The fossil record provides evidence for evolution. - Selective breeding of domesticated animals shows that artificial selection can cause evolution. - Evolution of homologous structures by adaptive radiation explains similarities in structure when there are differences in function. - Populations of a species can gradually diverge into separate species by evolution. - Continuous variation across the geographical range of related populations matches the concept of gradual divergence. **5.2 Natural selection** - Natural selection can only occur if there is variation among members of the same species. - Mutation, meiosis and sexual reproduction cause variation between individuals in a species. - Adaptations are characteristics that make an individual suited to its environment and way of life. - Species tend to produce more offspring than the environment can support. - Individuals that are better adapted tend to survive and produce more offspring while the less well adapted tend to die or produce fewer offspring. - Individuals that reproduce pass on characteristics to their offspring. - Natural selection increases the frequency of characteristics that make individuals better adapted and decreases the frequency of other characteristics leading to changes within the species.	**5.1 Evidence for evolution** - To be able to explain the development of melanistic insects in polluted areas. - To be able to compare the pentadactyl limb of mammals, birds, amphibians and reptiles with different methods of locomotion. **5.2 Natural selection** - To be able to explain thec hanges in beaks of finches on Daphne Major. - To be able to explain the evolution of antibiotic resistance in bacteria. **5.3 Classification and biodiversity** - To be able to construct of dichotomous keys for use in identifying specimens. - To be able to classify one plant and one animal species from domain to species level. - To be able to recognize features	- Homework written tasks o Including data-based questions - Revision quizzes - A dichotomous key	End of Unit 5 Test: Multiple Choice (IB Paper 1 style) mixed with written response (IB Paper 2 style) and data-based question (IB Paper 3 style).	- PowerPoints and worksheets on Server • X:\Acad\Science\IB Biology\5 -Evolution and Biodiversity\5.1 Evidence for Evolution • X:\Acad\Science\IB Biology\5 -Evolution and Biodiversity\5.2 Natural Selection • X:\Acad\Science\IB Biology\5 -Evolution and Biodiversity\5.3 Classification of Biodiversity • X:\Acad\Science\IB Biology\5 -Evolution and Biodiversity\5.4 Cladistics - Oxford IB Diploma Programme Biology (Course Companion)

			5.3 Classification and biodiversity - The binomial system of names for species is universal among biologists and has been agreed and developed at a series of congresses. - When species are discovered they are given scientific names using the binomial system. - Taxonomists classify species using a hierarchy of taxa. - All organisms are classified into three domains. - The principal taxa for classifying eukaryotes are kingdom, phylum, class, order, family, genus and species. - In a natural classification, the genus and accompanying higher taxa consist of all the species that have evolved from one common ancestral species. - Taxonomists sometimes reclassify groups of species when new evidence shows that a previous taxon contains species that have evolved from different ancestral species. - Natural classifications help in identification of species and allow the prediction of characteristics shared by species within a group. **5.4 Cladistics** - A clade is a group of organisms that have evolved from a common ancestor. - Evidence for which species are part of a clade can be obtained from the base sequences of a gene or the corresponding amino acid sequence of a protein. - Sequence differences accumulate gradually so there is a positive correlation between the number of differences between two species and the time since they diverged from a common ancestor. - Traits can be analogous or homologous. - Cladograms are tree diagrams that show the most probable sequence of divergence in clades. - Evidence from cladistics has shown that classifications of some groups based on structure did not correspond with the evolutionary origins of a group or species.	of bryophyta, filicinophyta, coniferophyta and angiospermophyta. - To be able to recognize features of porifera, cnidaria, platylhelmintha, annelida, mollusca, arthropoda and chordata. - To be able to recognise of features of birds, mammals, amphibians, reptiles and fish. **5.4 Cladistics** - To be able to analyse cladograms to deduce evolutionary relationships. - To be able to construct cladograms including humans and other primates. - To be able to reclassify the figwort family using evidence from cladistics.		End of Unit 5 and 10 Test: Multiple Choice (IB Paper 1 style) mixed with written response (IB Paper 2 style) and data-based question (IB Paper 3 style).	
Topic 10: Genetics and evolution *(AHL*) (8 hours)	Students will apply their understanding of the facts, concepts, models, terminology and principles that explain the world, through science. RST7, RST10 WHST7, WHST10	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.a., 3.b., 3.c., 3.d.	**10.1 Meiosis** - Chromosomes replicate in interphase before meiosis. - Crossing over is the exchange of DNA material between non-sister homologous chromatids. - Crossing over produces new combinations of alleles on the chromosomes of the haploid cells. - Chiasmata formation between non-sister chromatids can result in an exchange of alleles. - Homologous chromosomes separate in meiosis I. - Sister chromatids separate in meiosis II.	**10.1 Meiosis** - To be able to draw diagrams to show chiasmata formed by crossing over. **10.2 Inheritance** - To be able to calculate of the predicted genotypic and phenotypic ratio of offspring of dihybrid crosses involving	- Homework written tasks • Including data-based questions - Revision quizzes		- PowerPoints on Server • X:\Acad\Science\IB Biology\AHL 10 - Genetics and Evolution\10.1 Meiosis • X:\Acad\Science\IB Biology\AHL 10 - Genetics and Evolution\10.2 Inheritance

			- Independent assortment of genes is due to the random orientation of pairs of homologous chromosomes in meiosis I. **10.2 Inheritance** - Gene loci are said to be linked if on the same chromosome. - Unlinked genes segregate independently as a result of meiosis. - Variation can be discrete or continuous. - The phenotypes of polygenic characteristics tend to show continuous variation. - Chi-squared tests are used to determine whether the difference between an observed and expected frequency distribution is statistically significant. **10.3 Gene pool and speciation** - A gene pool consists of all the genes and their different alleles, present in an interbreeding population. - Evolution requires that allele frequencies change with time in populations. - Reproductive isolation of populations can be temporal, behavioural or geographic. - Speciation due to divergence of isolated populations can be gradual. - Speciation can occur abruptly.	unlinked autosomal genes. - To be able to identify the recombinants in crosses involving two linked genes. - To be able to use a chi-squared test on data from dihybrid crosses. **10.3 Gene pool and speciation** - To be able to make comparison of allele frequencies of geographically isolated populations.			• X:\Acad\Science\IB Biology\AHL 10 - Genetics and Evolution\10.3 Gene pools and speciation - Oxford IB Diploma Programme Biology (Course Companion)
Topic 7: Nucleic Acids *(AHL)* (9 hours)	Students will apply their understanding of the facts, concepts, models, terminology and principles that explain the world, through science. Students will develop an understanding of the nature of scientific inquiry. Students will demonstrate an understanding of the history of science and the evolvement of scientific knowledge. RST7, RST10 WHST7, WHST10	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.b., 3.c., 3.d. 4	**7.1 DNA structure and replication** • Nucleosomes help to supercoil the DNA. • DNA structure suggested a mechanism for DNA replication. • DNA polymerases can only add nucleotides to the 3’ end of a primer. • DNA replication is continuous on the leading strand and discontinuous on the lagging strand. • DNA replication is carried out by a complex system of enzymes. • Some regions of DNA do not code for proteins but have other important functions. **7.2 Transcription and gene expression** • Transcription occurs in a 5’ to 3’ direction. • Nucleosomes help to regulate transcription in eukaryotes. • Eukaryotic cells modify mRNA after transcription. • Splicing of mRNA increases the number of different proteins an organism	**7.1 DNA structure and replication** • To be able to discuss about Rosalind Franklin’s and Maurice Wilkins’ investigation of DNA structure by X-ray diffraction. • To be able to explain the use of nucleotides containing dideoxyribonucleic acid to stop DNA replication in preparation of samples for base sequencing. • To be able to explain that the tandem repeats are used in DNA profiling. • To be able to analyse the results of the Hershey and Chase experiment providing evidence that DNA is the genetic material. • To be able to use the molecular visualization software to analyse the association between protein and DNA	- Homework written tasks • Including data-based questions - Revision quizzes	End of Unit 7 Test: Multiple Choice (IB Paper 1 style) mixed with written response (IB Paper 2 style) and data-based question (IB Paper 3 style).	- Oxford IB Diploma Programme Biology (Course Companion) - PowerPoints and worksheets on server o X:\Acad\Science\IB Biology\AHL 7- Nucleic Acids\7.1 DNA structure and replication o X:\Acad\Science\IB Biology\AHL 7- Nucleic Acids\7.2 Transcription and gene expression o X:\Acad\Science\IB Biology\AHL 7- Nucleic Acids\7.3 Translation

			can produce. • Gene expression is regulated by proteins that bind to specific base sequences in DNA. • The environment of a cell and of an organism has an impact on gene expression. **7.3 Translation** • Initiation of translation involves assembly of the components that carry out the process. • Synthesis of the polypeptide involves a repeated cycle of events. • Disassembly of the components follows termination of translation. • Free ribosomes synthesize proteins for use primarily within the cell. • Bound ribosomes synthesize proteins primarily for secretion or for use in lysosomes. • Translation can occur immediately after transcription in prokaryotes due to the absence of a nuclear membrane. • The sequence and number of amino acids in the polypeptide is the primary structure. • The secondary structure is the formation of alpha helices and beta pleated sheets stabilized by hydrogen bonding. • The tertiary structure is the further folding of the polypeptide stabilized by interactions between R groups. • The quaternary structure exists in proteins with more than one polypeptide chain.	within a nucleosome. **7.2 Transcription and gene expression** • To be able to use the promoter as an example of non-coding DNA with a function. • To be able to analyse of changes in the DNA methylation patterns. **7.3 Translation** • To be able to use the tRNA-activating enzymes to illustrate enzyme–substrate specificity and the role of phosphorylation. • To be able to identify the polysomes in electron micrographs of prokaryotes and eukaryotes. • To be able to use the molecular visualization software to analyse the structure of eukaryotic ribosomes and a tRNA molecule.			
Option D: Human physiology (15 hours)	Students will apply their understanding of the facts, concepts, models, terminology and principles that explain the world, through science. Students will formulate designs to collect data, collect data, and formulate scientific explanations. Students will develop an understanding of the nature of scientific inquiry. RST6, RST9, RST10	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.a., 3.b., 3.c., 3.d.	**D.1 Human nutrition** - Essential nutrients cannot be synthesized by the body, therefore they have to be included in the diet. - Dietary minerals are essential chemical elements. - Vitamins are chemically diverse carbon compounds that cannot be synthesized by the body. - Some fatty acids and some amino acids are essential. - Lack of essential amino acids affects the production of proteins. - Malnutrition may be caused by a deficiency, imbalance or excess of nutrients in the diet. - Appetite is controlled by a centre in the hypothalamus. - Overweight individuals are more likely to suffer hypertension and type II diabetes. - Starvation can lead to breakdown of body tissue. **D.2 Digestion** - Nervous and hormonal mechanisms control the secretion of digestive juices.	**D.1 Human nutrition** - To be able to determine the energy content of food by combustion. - To be able to make use of databases of nutritional content of foods and software to calculate intakes of essential nutrients from a daily diet. **D.2 Digestion** - To be able to identify the exocrine gland cells that secrete digestive juices and villus epithelium cells that absorb digested foods from electron micrographs.	- Homework written tasks • Including data-based questions - Revision quizzes	End of Option D Test: Multiple Choice (IB Paper 1 style) mixed with written response (IB Paper 2 style) and data-based question (IB Paper 3 style).	- Oxford IB Diploma Programme Biology (Course Companion)

	WHST7, WHST8, WHST10		- Exocrine glands secrete to the surface of the body or the lumen of the gut. - The volume and content of gastric secretions are controlled by nervous and hormonal mechanisms. - Acid conditions in the stomach favour some hydrolysis reactions and help to control pathogens in ingested food. - The structure of cells of the epithelium of the villi is adapted to the absorption of food. - The rate of transit of materials through the large intestine is positively correlated with their fibre content. - Materials not absorbed are egested. **D.3 Functions of the liver** - The liver removes toxins from the blood and detoxifies them. - Components of red blood cells are recycled by the liver. - The breakdown of erythrocytes starts with phagocytosis of red blood cells by Kupffer cells. - Iron is carried to the bone marrow to produce hemoglobin in new red blood cells. - Surplus cholesterol is converted to bile salts. - Endoplasmic reticulum and Golgi apparatus in hepatocytes produce plasma proteins. - The liver intercepts blood from the gut to regulate nutrient levels. - Some nutrients in excess can be stored in the liver. **D.4 The heart** - Structure of cardiac muscle cells allows propagation of stimuli through the heart wall. - Signals from the sinoatrial node that cause contraction cannot pass directly from atria to ventricles. - There is a delay between the arrival and passing on of a stimulus at the atrioventricular node. - This delay allows time for atrial systole before the atrioventricular valves close. - Conducting fibres ensure coordinated contraction of the entire ventricle wall. - Normal heart sounds are caused by the atrioventricular valves and semilunar valves closing causing changes in blood flow.	**D.3 Functions of the liver** - To be able to explain the dual blood supply to the liver and differences between sinusoids and capillaries. **D.4 The heart** - To be able to make measurement and interpretation of the heart rate under different conditions. - To be able to make interpretation of systolic and diastolic blood pressure measurements. - To be able to make mapping of the cardiac cycle to a normal ECG trace. - To be able to analyse the epidemiological data relating to the incidence of coronary heart disease.			
Option D: Human physiology *(AHL)* (10 hours)	Students will apply their understanding of the facts, concepts, models, terminology and principles that explain the world, through science.	1.a., 1.b., 1.c. 2.a., 2.b., 2.c. 3.a., 3.b., 3.c., 3.d.	**D.5 Hormones and metabolism** - Endocrine glands secrete hormones directly into the bloodstream. - Steroid hormones bind to receptor proteins in the cytoplasm of the target cell to form a receptor–hormone complex. - The receptor–hormone complex promotes the transcription of specific genes. - Peptide hormones bind to receptors in the plasma membrane of the	**D.5 Hormones and metabolism** - To be able to explain why some athletes take growth hormones to build muscles. - To be able to explain the control of milk secretion by oxytocin and prolactin.	- Homework written tasks • Including data-based questions - Revision quizzes		- Oxford IB Diploma Programme Biology (Course Companion)

	Students will develop an understanding of the nature of scientific inquiry. RST8, RST10 WHST10		target cell. - Binding of hormones to membrane receptors activates a cascade mediated by a second messenger inside the cell. - The hypothalamus controls hormone secretion by the anterior and posterior lobes of the pituitary gland. - Hormones secreted by the pituitary control growth, developmental changes, reproduction and homeostasis. **D.6 Transport of respiratory gases** - Oxygen dissociation curves show the affinity of hemoglobin for oxygen. • Carbon dioxide is carried in solution and bound to hemoglobin in the blood. • Carbon dioxide is transformed in red blood cells into hydrogencarbonate ions. • The Bohr shift explains the increased release of oxygen by hemoglobin in respiring tissues. • Chemoreceptors are sensitive to changes in blood pH. • The rate of ventilation is controlled by the respiratory control centre in the medulla oblongata. • During exercise the rate of ventilation changes in response to the amount of CO2 in the blood. - • Fetal hemoglobin is different from adult hemoglobin allowing the transfer of oxygen in the placenta onto the fetal hemoglobin.	**D.6 Transport of respiratory gases** - To be able to analyse of dissociation curves for hemoglobin and myoglobin. - To be able to identify the pneumocytes, capillary endothelium cells and blood cells in light micrographs and electron micrographs of lung tissue.		