Curriculum overview for BIOLOGY, STANDARD LEVEL, 3mn, School Year 2019/2020 Teacher: Biljana Agotić Smital

Unit title / Month	Key concept(s)	Content	Objectives / Learning outcomes	Assessment tasks	ATL skills	Links to other subjects
Unit 1 Molecular biology Sep, Oct, Nov 2019	Living organisms control their composition by a complex web of chemical reactions Water is the medium for life Compound of carbon, hydrogen and oxygen are used to store and supply energy Proteins have a very wide range of functions in living organisms	Molecules to metabolism Structure of water molecule, its polarity and other beneficial properties for Life Carbohydrates and lipids: their structure and function in living beings Formation of polypeptides; variability of polypeptides; uniqueness of the proteome, denaturation of proteins Enzymes are biocatalysts; factors affecting enzymatic activity; use of	All processes inside org are coordinated, and interconnected Water has properties that make it useful for life maintenance Carbohydrate and lipids are mostly energy storing molecules, but have also other functions Proteins play most different functions; cell create only a small fraction of possible proteins; factors that can damage the protein structure and function Lock and key model of enzymatic activity; optimal chemical and physical environment ensures	Practical work: testing water thermal properties Organizing debate: testing claims about use of saturated and trans fats in diet Modelling polypeptide structural variability Quizzes End of unit test Experiment: testing the rate of enzymatic reaction	Thinking skills Research skill	Physics: Topic 2.3 Work, energy and power Physics: Topic 8.1 Energy sources Topic 8.2 Thermal energy transfer Chemistry: Topic C.2 Fossil fuels Topic C.5 Environmental impact global warming

	Enzymes control metabolism of the cell The structure of DNA allows efficient storage of genetic information Genetic information in DNA can be accurately copied and can be translated to make proteins needed for the cell Cell respiration supplies energy Photosynthesis uses light energy to produce chemical energy needed for life	immobilized enzymes in industry Nucleic acids are nucleotide polymers; differences and similarities between DNA and RNA DNA replication, transcription and translation Aerobic and anaerobic cell respiration Energy conversion performed in chlorophyll; 2 stages of photosynthesis; rate of photosynthesis and factors impacting its rate	optimal enz activity; benefits of using immobilized enzymes Understand how the DNA and RNA structure enables efficient storage of genetic information Understand how the precision of the DNA coping accounts for stability of genetic info; the expression of genes Recognise basic steps along cell respiration; advantages and disadvantages of aerobic and anaerobic respiration	Experiment: isolation of DNA from plant tissue Using models Experiment: constructing respirometer and monitoring rate of cell respiration Experiment: Rate pf photosynthesis vs. abiotic factors Quizzes End of topic exam		

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Unit 2: Cells Jan, Feb, March 2020	The evolution of multicellular organisms allowed cell specialization and cell replacement Eukaryotes have a much more complex cell structure than prokaryotes The structure of plasma membrane makes them fluid and dynamic Membranes control the composition of cells by active and passive transport There is an unbroken chain of life from the first cells on Earth to all cells in organisms alive today Cell division is essential but must be controlled	Cell theory; cell specialization and cell replacement Basic features of pro- and eukaryotic cell; Organisation and composition of plasma membrane Passive and active transport Hypothesis about the origin of cell; abiogenesis vs biogenesis Mitosis and the control of the cell cycle	Understanding and questioning the cell theory and functions of life; understanding the limits to the cell size; importance of the stem cells Knowing the differences between pro- and eukaryotic cell and between animal and plant cell Understanding how different components of the plasma membrane account for it function Comparing and distinguishing between the 2 types of transport in relation to the environment and type of the substance Endosymbiotic theory; importance of the Pasteur's experiment on our understanding of the origin of life Stages of mitosis; carcinogenesis	Quizzes End of topic exams Experiment: microscoping living cells Observing micrographs and determination of the cell type Plasma membrane model Experiment: investigation into the relationship between the SA and V of the cell	Thinking skills Observations Practical skills	Chemistry: lipids

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Unit 3: Genetics April, May, June 2020	Every living organism inherits a blueprint for life from its parents Chromosomes carry genes in a linear sequence that is shared by the members of a species Alleles segregate during meiosis allowing new combinations to be formed by the fusion of gametes The inheritance of genes follows patterns Biologists have developed techniques for artificial manipulation of DNA, cells and organisms	What is a gene (and allele) and its location on the chromosome? Mutations; Human genome Prokaryotic vs eukaryotic genome (and chromosomes); 2n and n number of chromosomes; karyogram and karyotype; sex determination Process of meiosis Classical (Mendel's) genetics Genetic modification and biotechnology	Linking the chromosome and DNA structure to the term "gene" and "allele" developments in scientific research follow improvements in technology: gene sequencers used for the sequencing genes Comparison of genome sizes among species Understanding the importance of meiosis in relation to the sexual reproduction Doing monohybrid and test cross; crossing involving multiple genes; heritable disorders in humans Understanding the principle of DNA manipulation (PCR, gel electrophoresis, cloning…)	Quizzes End of unit test Modelling gel electrophoresis Compering the genome sizes-making diagram	Research skills Social skills	Physics: electrical condictivity Chemistry: Topic C6 Electrochemistry Psychology: core, biological level of analysis

Curriculum overview for BIOLOGY, STANDARD LEVEL, 4mn, School Year 2019/2020 **Teacher: Emil Gaal**

Unit title / Month	Key concept(s)	Content	Objectives / Learning outcomes	Assessment tasks	ATL skills	Sources	Links to other subjects
Unit 1 Ecology September, October 2019	The continued survival of living organisms depends on sustainable communities Ecosystems require a continuous supply of energy to fuel life processes Continued availability of carbon in ecosystems depends on carbon cycling Concentrations of gases in the atmosphere affects climates	Species communities and ecosystems Energy flow and trophic levels Carbon cycle and fossil fuels Climate change	Looking for patterns, trends and discrepancies (example: plants are mostly autotrophic but some are not) Use theories to explain natural phenomena (example: the concept of energy flow explains limited length of food chains) Making accurate, quantitative measurements (example: the concentration of gases in the atmosphere)	Practical work: setting up sealed mesocosms to try to establish sustainability G4 project: quadrat sampling End of unit test	Thinking skills Research skill G4 project: self-management skills (organization and affective skills), communication and social skills	Allott, A.: Biology for the IB diploma, study guide, Oxford University Press, 2014 Allott, A., Mindorff, D. : Biology course companion, Oxford University Press, 2014 Walpole, Brenda: Biology for the IB Diploma, Cambridge University Press, 2014	Physics: Topic 2.3 Work, energy and power Physics: Topic 8.1 Energy sources Topic 8.2 Thermal energy transfer Chemistry: Topic C.2 Fossil fuels Topic C.5 Environmental impact global warming

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Unit 2: Evolution and biodiversity November 2019	There is overwhelming evidence for the evolution of life on Earth The diversity of life has evolved and continues to evolve by natural selection Species are named and classified using an internationally agreed system The ancestry of groups of species can be deduced by comparing their base or amino acid sequences	Evidence for evolution Natural selection Classification, determination and naming of species Modern cladistics and changes in classification	Looking for patterns (example: common features in the bone structure of vertebrate limbs despite their varied use) Cooperation in science (example: scientists use the binomial system rather than many different local names) Falsification of theories (example: plant families have been reclassified as a result of evidence from cladistics)	Comparison of the pentadactyl limb of mammals, birds, amphibians and reptiles Construction of dichotomous keys for use in identifying specimens Creation of booklet about recognition features of four main phyla of plants and seven large phyla of animals Analysis of cladograms to deduce evolutionary relationships	Thinking skills	Allott, A.: Biology for the IB diploma, study guide, Oxford University Press, 2014 Allott, A., Mindorff, D. : Biology course companion, Oxford University Press, 2014 Walpole, Brenda: Biology for the IB Diploma, Cambridge University Press, 2014	Physics: Topic 7.1 Discrete energy and radioactivity

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Unit 3: Human physiology December 2019, January, February 2020	The structure of the digestive system allows it to move, digest and absorb food The blood system transports substances to cells and collects waste products The human body has mechanisms that resist the continuous threat of invasion by pathogens The lungs are actively ventilated to ensure that gas exchange can occur passively Neurons transmit the message, synapses modulate the message Hormones are used when signals need to be widely distributed	The main structure of the digestive system and enzymes produced by it The blood system: arteries, veins, capillaries The heart Immunity (specific and non-specific) Gas exchange and lungs Neurons, synapses and nerve impulses (action potential) Hormones, diabetes and glucose in blood	Use models (example: dialysis tubing can be used to model absorption in the intestine) Theories are regarded as uncertain (example: William Harvey overturned theories on movement of blood in the body) Obtain evidence for theories (example: epidemiological studies have contributed to our understanding of the causes of lung cancer)	Design an experiment to model absorption of digested food in the intestine Practical task: identification of tissue layers viewed with a microscope Monitoring of ventilation in humans at rest and after mild and vigorous exercise (practical work) End of unit test	Research skills Social skills	Allott, A.: Biology for the IB diploma, study guide, Oxford University Press, 2014 Allott, A., Mindorff, D. : Biology course companion, Oxford University Press, 2014 Walpole, Brenda: Biology for the IB Diploma, Cambridge University Press, 2014	Chemistry: Topic D2 Aspirin and penicillin Physics: Topic 3.2 Modelling a gas Chemistry: Topic C6 Electrochemistry Psychology: core, biological level of analysis

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Unit 3: Human physiology December 2019, January, February 2020		Hormones and appetite control: obesity, hormones and circadian rhythms, jet lag, hormones + reproductive system, puberty and menstrual cycle	Risk associated with scientific research (ex.: Florey and Chain's tests on the safety of penicillin would not be compliant with current protocol on testing)				
Unit 4: Option D: Human physiology March 2020	A balanced diet is essential to human health Digestion is controlled by nervous and hormonal mechanisms The chemical composition of the blood is regulated by the liver Internal and external factors influence heart function	Nutrients and obesity, Digestive juices, acid indigestion, ulcers Structure and function: how is the small intestine adapted for the absorption of food liver structure + functions The heart: structure, stimulation of ventricular contractions, heart sounds, causes and consequences of hypertension and thrombosis	Serendipity and scientific discov. (ex.: the role of gastric acid established by W. Beaumont) Educating the public on scient. claims (ex.: HDL could be 'good' cholesterol) Developments in science followed imp. in techn. (ex.: stethoscope invention led to improved knowledge of the workings of the heart)	Task:databases use of nutritional content of foods + software to calculate intakes of essential nutrients from a daily diet, analyse normal ECG trace Identification of exocrine gland cells, villus epithelium + other tissues of digestive system from electron micrograph End of unit test	Thinking skills Communication skills	Allott, A.: Biology for the IB diploma, study guide, Oxford University Press, 2014 Walpole, Brenda: Biology for the IB Diploma, Cambridge University Press, 2014	Chemistry: Topic B.5 Vitamins Topic D4 pH regulation of stomach

Sources:

Allott, A.: Biology for the IB diploma, study guide, Oxford University Press, 2014

Allott, A., Mindorff, D. : Biology course companion, Oxford University Press, 2014

Walpole, Brenda: Biology for the IB Diploma, Cambridge University Press, 2014