Biology 20 Course Outline
J.A. Williams High School
2018 - 2019
Ms. St. Louis

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Welcome to Biology 20! In this course, students will be encouraged to think critically about connections between the biology they are learning "in class" and biology in the real world. The major themes developed in this course are diversity, environment, adaptation, and stewardship. There will be four major units of study involving: Energy and Matter Exchange in the Biosphere; Ecosystems and Population Change; Photosynthesis and Cellular Respiration; and Human Systems. By the end of the course, I hope that students will be able to appreciate the biological world in all its wonders and complexities and realize that our every action as a human race and as individuals have tremendous impacts on our society and the world. **Prerequisites** for this course include Science 10.

Course Completion Timeline:

UNIT A: Energy and Matter Exchange in the Biosphere	~4 weeks
UNIT B: Ecosystems and Population Change	~3 weeks
UNIT C: Photosynthesis and Cellular Respiration	~3 weeks
UNIT D: Human Systems	~8 weeks

Unit A: Energy and Matter Exchange in the Biosphere 20% Sept 4 - Sept 28*

Students will demonstrate an understanding of the biosphere and the constant cycling of matter and energy within the biosphere. This balance is achieved through various biogeochemical cycles and the processes of photosynthesis and cellular respiration. Students will also explore how various human activities have affected this balance.

Chapter 1: The Biosphere as a Closed System
Chapter 2: Energy Flow in the Biosphere
Chapter 3: The Cycling of Matter in the Biosphere

Unit B: Ecosystems and Population Change 25% Oct 1 - Oct 26*

Students will be able to demonstrate an understanding of the range of ecosystems in the biosphere by studying their distinctive biotic and abiotic characteristics. Students are introduced to the concept of populations as a basic component of ecosystem structure and complete the unit by examining population change through the process of natural selection.

Chapter 4: Characteristics of Ecosystems
Chapter 5: Evolution

Unit C: Photosynthesis and Cellular Respiration 15% Oct 29 - Nov 16*

The life processes of photosynthesis and cellular respiration allow for the transfer of energy and matter. Students will demonstrate an understanding (in general terms) of the processes of photosynthesis and cellular respiration and how each work interdependently in producing glucose and ATP respectively.

Chapter 6: Photosynthesis
Chapter 7: Cellular Respiration

Unit D: Human Systems 40% Nov 19 - Jan 11*

Students will demonstrate an understanding that the maintenance of metabolic equilibrium in organisms involves a number of physical and biochemical processes. Students will examine the human organism and determine how energy and matter are exchanged with the environment through the processes of digestion, gas exchange, excretion, circulation, and motor functions. Students will also examine the body's defense system which assists in maintaining equilibrium.

Chapter 8: Nutrients, Enzymes, and the Digestive System
Chapter 9: Respiratory System and Motor System
Chapter 10: Circulatory System
Chapter 11: Blood and the Immune System
Chapter 12: Excretory System

Review for Final Exam Jan 14 - 25*

***Subject to Change**

Assessment

A variety of assessments will be used during the course of the semester. Formative board questions and short quizzes will be used multiple times per week; these will be used to ensure students are on track with current concepts and will be recorded as a **formative** mark. It is imperative that students complete these formative assessments as they will help them to master the skills before the summative assessments.

Students will have chapter or outcome tests to test only two or three outcomes at a time. Students will also have unit tests at the end of each unit which can test several outcomes at once. Students will receive a **summative** mark on each of these assessments. Labs will also be given a **summative** mark as required.

Students will be provided with 3 "Zero Days" throughout the semester which are an opportunity to complete a missed summative assessment or improve a previous mark. This assessment will then be graded and replace the students previous mark. The particular summative assessment desired to be redone or completed on the designated zero day will be at the discretion of the teacher.

It is the student's responsibility to seek help. I am always available and willing to arrange a time for assistance. Please come talk to me.

Course Evaluation

Unit A		14%
a)	Assignments, Labs, Quizzes	5.5%
b)	Unit Exam	8.5%
Unit B		17.5%
a)	Assignments, Labs, Quizzes	6.5%
b)	Unit Exam	11%
Unit C		10.5%
a)	Assignments, Labs, Quizzes	3.9%
b)	Unit Exam	6.6%
Unit D		28%
a)	Assignments, Labs, Quizzes	11%
b)	Unit Exam	17%

Final Examination – 30%

Formative Assessments – 0%

You need to bring the following supplies to each class:

- Calculator (TI-83 Plus/TI-84 is recommended)
- Pens/Pencils/Eraser
- Binder with lined paper
- Coiled notebook for work
- **Textbook**: Biology Alberta 20-30 (Nelson, 2007)

Classroom Expectations

All students are expected to be respectful of both myself and other students in the classroom. This is a high school academic course and any disruptions or disrespect will not be tolerated. Respect in my classroom includes the following:

Positive Attitude towards Learning:

- Being ON TIME and PREPARED to learn.
- You will have daily work and you will need to keep up with it. Students with missing assignments will have to spend lunch hours with me. If you are absent, make arrangements with me.
- If you are aware of a day that you will be absent, for personal or school-related reasons, please inform me PRIOR to the absence and I will provide you with the work for that day. Students are still responsible for all work missed on such days.
- All students are in my classroom to LEARN and need to do so in an environment free of constant disruption. Collaboration with other students is encouraged however this work must be on task and not a distraction to other students.
- Cheating will NOT be tolerated. Any plagiarized or copied assignment will not be accepted and the student will be required to redo the assignment, including the person who allowed the copying to take place.
- Come see me at lunch or make an appointment if there is anything you need help with.

- Electronic devices such as cell phones and ipods are typically not allowed to be used in the classroom. If any cell phones or ipods (without special permission) are seen, they will be confiscated until the end of class.
- **Always do your best!**

Respect:
- Please do not interrupt when I am speaking
- Students are expected to be courteous and polite. Put downs and sarcasm will not be tolerated. If students cannot respect either myself or others and their behaviour becomes an issue, students will be asked to leave my classroom and we will arrange another time to make up for missed work.
- Class does not end until I dismiss you.

Safety:
- No food or beverages other than water in my classroom are allowed for safety purposes. During labs, no food or drinks are permitted.
- Follow classroom instructions carefully.
- Follow lab safety procedures and wear protective equipment at all times.
- Ask to leave the room so I am aware of your location at all times.
- When in doubt, ASK!

Outcomes for Biology 20

Unit A: Energy and Matter Exchange in the Biosphere ~20%

GLO 1: Students will explain the constant flow of energy through the biosphere and ecosystems.

20–A1.1k explain, in general terms, the one-way flow of energy through the biosphere and how stored energy in the biosphere, as a system, is eventually "lost" as heat; *e.g.,*
• *photosynthesis/chemosynthesis*
• *cellular respiration (muscle-heat generation, decomposition)*
• *energy transfer by conduction, radiation and convection*
20–A1.2k explain how energy in the biosphere can be perceived as a balance between both photosynthetic and chemosynthetic activities and cellular respiratory activities; i.e.,
• energy flow in photosynthetic environments
• energy flow in deep sea vent (chemosynthetic) ecosystems and other extreme environments
20–A1.3k explain the structure of ecosystem trophic levels, using models such as food chains and food webs
20–A1.4k explain, quantitatively, the flow of energy and the exchange of matter in aquatic and terrestrial ecosystems, using models such as pyramids of numbers, biomass and energy.

Activities:
• perform an experiment to demonstrate solar energy storage by plants
• analyze data on the diversity of plants, animals and decomposers of an endangered ecosystem
• compare alternative ways of presenting energy flow data for ecosystems; i.e., pyramids of energy, biomass and numbers

GLO 2: *Students will* explain the cycling of matter through the biosphere.

20–A2.1k explain and summarize the biogeochemical cycling of carbon, oxygen, nitrogen and phosphorus and relate this to general reuse of all matter in the biosphere
20–A2.2k explain water's primary role in the biogeochemical cycles, considering its chemical and physical properties; i.e., universal solvent, hydrogen bonding.

Activities:
• design an experiment to compare the carbon dioxide production of plants with that of animals
• hypothesize how alterations in the carbon cycle, resulting from the burning of fossil fuels, might affect other cycling phenomena; *e.g., sulfur, iron, water*
• predict disruptions in the nitrogen and phosphorus cycles that are caused by human activities
• analyze data collected on water consumption and loss in plants and animals
• measure and record the pH and the amount of nitrates, phosphates, iron or sulfites in water samples

GLO 3: Students will explain the balance of energy and matter exchange in the biosphere, as an open system, and explain how this maintains equilibrium.

20–A3.1k explain the interrelationship of energy, matter and ecosystem productivity (biomass production); *e.g.,*
• *Antarctic Ocean versus tropical seas*
• *tropical rain forest versus desert*
• *taiga versus tundra*
• *intertidal zone versus deep-sea benthos*

• *Arctic versus Antarctic*
20–A3.2k explain how the equilibrium between gas exchanges in photosynthesis and cellular respiration influences atmospheric composition
20–A3.3k describe the geologic evidence (stromatolites) and scientific explanations for change in atmospheric composition, with respect to oxygen and carbon dioxide, from anoxic conditions to the present, and describe the significance to current biosphere equilibrium.

Activities:
• predict the effects of changes in carbon dioxide and oxygen concentration on the atmospheric equilibrium due to a significant reduction of photosynthetic organisms through human activity
• design and evaluate a model of a closed biological system in equilibrium with respect to carbon dioxide, water and oxygen exchange

Unit B: Ecosystems and Population Change ~ 25 %

GLO 1: Students will explain that the biosphere is composed of ecosystems, each with distinctive biotic and
abiotic characteristics.

20–B1.1k define species, population, community and ecosystem and explain the interrelationships among them
20–B1.2k explain how terrestrial and aquatic ecosystems support a diversity of organisms through a variety of habitats and niches; *e.g.,*
• *terrestrial: canopy, sub-canopy, forest floor, soil*
• *aquatic: littoral, limnetic, profundal and benthic zones*
20–B1.3k identify biotic and abiotic characteristics and explain their influence in an aquatic and a terrestrial ecosystem in the local region; *e.g., stream, lake, prairie, boreal forest, vacant lot, sports field*
20–B1.4k explain how limiting factors influence organism distribution and range; *e.g.,*
• *abiotic factors: soil, relative humidity, moisture, ambient temperature, sunlight, nutrients, oxygen*
• *biotic factors: competitors, predators and parasites*
20–B1.5k explain the fundamental principles of taxonomy and binomial nomenclature, using modes of nutrition at the kingdom level and morphological characteristics at the genus species level.

Activities:
• hypothesize the role of biotic and abiotic factors in
• perform a field study to measure, quantitatively, appropriate abiotic characteristics of an ecosystem and to gather, both quantitatively and qualitatively, evidence for analysis of the diversity of life in the ecosystem studied
• apply classification and binomial nomenclature systems in a field study
• analyze the interrelationship of biotic and abiotic characteristics that make up the ecosystem studied
• evaluate the accuracy and reliability of instruments used for measurement and identify the degree of error in the field-study data

GLO 2: Students will explain the mechanisms involved in the change of populations over time.

20–B2.1k explain that variability in a species results from heritable mutations and that some mutations may have a selective advantage
20–B2.2k discuss the significance of sexual reproduction to individual variation in populations and to the process of evolution

20–B2.3k compare Lamarckian and Darwinian explanations of evolutionary change
20–B2.4k summarize and describe lines of evidence to support the evolution of modern species from ancestral forms; i.e., the fossil record, Earth's history, biogeography, homologous and analogous structures, embryology, biochemistry
20–B2.5k explain speciation and the conditions required for this process
20–B2.6k describe modern evolutionary theories; i.e., punctuated equilibrium, gradualism.

Activities:
• design an investigation to measure or describe an inherited variation in a plant or an animal population
• hypothesize the adaptive significance of the variations in a range of homologous structures in extant and extinct organisms
• analyze data, actual or simulated, on plants and animals to demonstrate how morphology changes over time;

Unit C Photosynthesis and Cellular Respiration ~15%

GLO 1: Students will relate photosynthesis to storage of energy in organic compounds.

20–C1.1k explain, in general terms, how energy is absorbed by pigments, transferred through the reduction of nicotinamide adenine dinucleotide phosphate (NADP) to NADPH, and then transferred as chemical potential energy to ATP by chemiosmosis; and describe where in the chloroplast these processes occur
20–C1.2k explain, in general terms, how the products of the light-dependent reactions, NADPH and ATP, are used to reduce carbon in the light-independent reactions for the production of glucose; and describe where in the chloroplast these processes occur.

Activities:
• collect and interpret data from chromatography experiments and calculate reference flow (*R*f) values

GLO 2: Students will explain the role of cellular respiration in releasing potential energy from organic compounds.

20–C2.1k explain, in general terms, how glucose is oxidized during glycolysis and the Krebs cycle to produce reducing power in NADH and FADH; and describe where in the cell these processes occur **Note**: Detailed knowledge of metabolic intermediates is not required.
20–C2.2k explain, in general terms, how chemiosmosis converts the reducing power of NADH and FADH to store chemical potential energy as ATP; and describe where in the mitochondrion these processes occur **Note**: Detailed knowledge of metabolic intermediates is not required.
20–C2.3k distinguish, in general terms, between aerobic and anaerobic respiration and fermentation in plants, animals and yeast
20–C2.4k summarize and explain the role of ATP in cellular metabolism; *e.g.,*

- *active transport*
- *cytoplasmic streaming*
- *phagocytosis*
- *biochemical synthesis*
- *muscle contraction*

Activities:

- use experimental methods to demonstrate, quantitatively, the oxygen consumption of germinating seeds
- measure temperature change over time of germinating and non-germinating seeds
- investigate and integrate, from print and electronic sources, information on the action of metabolic toxins on cellular respiration

Unit D Human Systems ~40%

GLO 1: Students will explain how the human digestive and respiratory systems exchange energy and matter
with the environment.

20–D1.1k identify the principal structures of the digestive and respiratory systems; i.e.,
• mouth, esophagus, stomach, sphincters, small and large intestines, liver, pancreas, gallbladder
• nasal passages, pharynx, larynx, epiglottis, trachea, bronchi, bronchioles, alveoli, diaphragm, rib muscles, pleural membranes
20–D1.2k describe the chemical nature of carbohydrates, lipids and proteins and their enzymes; i.e., carbohydrases, lipases and proteases
20–D1.3k explain enzyme action and factors influencing their action; i.e., temperature, pH, substrate concentration, feedback inhibition, competitive inhibition
20–D1.4k describe the chemical and physical processing of matter through the digestive system into the circulatory system
20–D1.5k explain the exchange of matter and the transfer of thermal energy between the body and the environment, using the mechanism of breathing in gas exchange, removal of foreign material and heat loss.

Activities
• observe, through dissection or computer simulations, the digestive and respiratory systems of a representative mammal and identify the major structural components (PR–NS2, PR–NS4, PR–NS5)
• perform experiments, using qualitative tests, to detect the presence of carbohydrates, proteins and lipids

GLO 2: Students will explain the role of the circulatory and defence systems in maintaining an internal equilibrium.

20–D2.1k identify the principal structures of the heart and associated blood vessels; i.e., atria, ventricles, septa, valves, aorta, venae cavae, pulmonary arteries and veins, sinoatrial node, atrioventricular node, Purkinje fibres
20–D2.2k describe the action of the heart, blood pressure and the general circulation of blood through coronary, pulmonary and systemic pathways
20–D2.3k describe the structure and function of blood vessels; i.e., arteries, veins and capillaries
20–D2.4k describe the main components of blood and their role in transport, clotting and resisting the influence of pathogens; i.e., plasma, erythrocytes, platelets, leukocytes
20–D2.5k explain the role of the circulatory system at the capillary level in aiding the digestive, excretory, respiratory and motor systems' exchange of energy and matter with the environment
20–D2.6k explain the role of blood in regulating body temperature
20–D2.7k describe and explain, in general terms, the function of the lymphatic system
20–D2.8k list the main cellular and noncellular components of the human defence system and describe their role; i.e., skin, macrophage, helper T cell, B cell, killer T cell, suppressor T cell, memory T cell

20–D2.9k describe the ABO and Rh blood groups on the basis of antigens and antibodies.

Activities:
• measure blood pressure and observe blood flow in capillaries in an organism or through demonstration in a virtual laboratory (PR–NS2, PR–NS3)
• determine the morphology and abundance of cellular components in a prepared human blood slide (PR–NS2, PR–NS3)
• select and integrate information from various sources to observe the principal features of a mammalian circulatory system and the direction of blood flow, and identify structures from drawings; *e.g., valves, chambers* (PR–NS1)
• research and design a simulation or model of the functioning of the main components of the human immune system

GLO 3: Students will explain the role of the excretory system in maintaining an internal equilibrium in humans through the exchange of energy and matter with the environment.

20–D3.1k identify the principal structures in the excretory system; i.e., kidneys, ureters, urinary bladder, urethra
20–D3.2k identify the major and associated structures of the nephron, including the glomerulus, Bowman's capsule, tubules, loop of Henle, collecting duct, afferent and efferent arterioles, and capillary net, and explain their function in maintaining plasma compositions (i.e., water, pH, ions)
20–D3.3k describe the function of the kidney in excreting metabolic wastes and expelling them into the environment
20–D3.4k identify the role of antidiuretic hormone (ADH) and aldosterone in water and sodium ion reabsorption, excretion and blood pressure regulation.

Activities:
• research and create a flowchart to describe how humans maintain homeostasis with respect to water and ions
●observe the principal features of a mammalian excretory system and identify structures from drawings obtained from various print and electronic sources (AI–NS1) [ICT C1–4.1**]**
• collect and interpret data in analysis of simulated urine, identify limitations of the data, compare the data to theoretical values and produce a generalization

GLO 4: Students will explain the role of the motor system in the function of other body systems.

20–D4.1k explain how the motor system supports body functions (i.e., digestive, circulatory, respiratory, excretory and locomotory), referencing smooth, cardiac and striated muscle
20–D4.2k describe, in general, the action of actin and myosin in muscle contraction and heat production.
Activities:
• identify smooth, cardiac and striated muscle tissue under magnification