Expectations for SBI4U

OVERALL EXPECTATIONS M. demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and plannin erforming and recording, analysing and interpreting, and communicating); Q. identify and describe careers related to the fields of science under study, and describe contributions of scientists, including anadiums, to those fields. PECIFICENPECTATIONS VI. Scientific Investigation Skills initiating and Planning (IPP) VI.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, an formulate educated hypotheses to focus inquiries or research VI.2 select appropriate instruments (e.g., dialysis tubing, glassware, sphygmomanometer) and materials (e.g., DNA models, plants, lant cutting, molecular models), and identify appropriate methods, techniques, and procedures, for each inquiry VI.3 select appropriate instruments (e.g., dialysis tubing, glassware, sphygmomanometer) and materials (e.g., DNA models, plants, lant cutting, molecular models), and identify appropriate methods, techniques, and procedures, for each inquiry VI.4 sply knowledge and understanding of safe laboratory practices and procedures when planning investigations by correctly <i>information System</i> (WHMS) symbolics, busing appropriate methods, laboratory equipment and materials and disposing of laboratory and biological materials (e.g., plants and invertebrates); and sing appropriate personal protection VI.5 conduct inquiries, controlling relevant variables, adapting or extending procedures as required, and using appropriate material and equipment sadely,	A. SC	IENTIFIC INVESTIGATION SKILLS AND CAREER EXPLORATION
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VERALL EXPECTATIONS	B. Bio	ochemistry
	OVFI	RALLEXPECTATIONS
	O VE	

cellular biology;	
B2 , investigate the chemical structures, functions, and chemical properties of biological molecules involved in some common	cellular
processes and biochamical reactions;	contaitai
processes and biochemical reactions,	
B3. demonstrate an understanding of the structures and functions of biological molecules, and the biochemical reactions require	red to
maintain normal cellular function.	
SPECIFIC EXPECTATIONS	
R1 Delating Science to Technology Society and the Environment	
D1. Retaining other control and the second state of the first and a home section in the first second state of the second sta	f
B . I analyse technological applications related to enzyme activity in the food and pharmaceutical industries (e.g., the product	
dairy products; breadmaking; the use of enzymes to control reaction rates in pharmaceuticals) [AI, C]	
B1.2 evaluate, on the basis of research, some advances in cellular biology and related technological applications (e.g., new treated technological applications).	atments
for cancer, HIV/AIDS, and hepatitis C: radioisotopic labelling to study the function of internal organs; fluorescence to study ge	enetic
material within calls: foreneic biological techniques to aid in crime resolution)	
matchar within cens, forense oforogran techniques to are in enne resolution	
B2. Developing Skills of Investigation and Communication	
B2.1 use appropriate terminology related to biochemistry, including, but not limited to: <i>active and passive transport, covalent</i>	and ionic
bond allosteric site substrate substrate-enzyme complex and inhibition [C]	
Dona, anosterie sine, substrate chefine compress, and annound [c]	
B2.2 pran and conduct an investigation to demonstrate the movement of substances across a membrane (e.g., the effects of sale	water
and distilled water on a potato) [IP, PR]	
B2.3 construct and draw three-dimensional molecular models of important biochemical compounds, including carbohydrates,	proteins,
lipids, and nucleic acids IPR. Cl	- ′
B24 conduct historical tests to identify historical compounds found in various food complex (a g. use Deredict's solution	to test for
B2.4 conduct biological tests to identify biochemical compounds found in various food samples (e.g., use Benedict's solution	
carbohydrates in food samples), and compare the biochemical compounds found in each food to those found in the others [PR,	AI, C]
B2.5 plan and conduct an investigation related to a cellular process (e.g., factors that affect enzyme activity; factors that affect	transport
of substances across cell membranes), using appropriate laboratory equipment and techniques, and report the results in an appr	opriate
format [IP PR C]	~ F
B3. Understanding Basic Concepts	
B3.1 explain the roles of various organelles, such as lysosomes, vacuoles, mitochondria, internal cell membranes, ribosomes, s	smooth
and rough endoplasmic reticulum and Golgi bodies in cellular processes	
and rough endophastine retreation, and Gorge obtaines, in contain processes	1
B3.2 describe the structure of important biochemical compounds, including carbonydrates, proteins, lipids, and nucleic acids,	and
explain their function within cells	
B3.3 identify common functional groups within biological molecules (e.g., hydroxyl, carbonyl, carboxyl, amino, phosphate), a	ind
explain how they contribute to the function of each molecule	
Plan how they be showing of the transformer of uncircular and the second s	
B3.4 describe the chemical structures and mechanisms of various enzymes	
B3.5 Identify and describe the four main types of biochemical reactions (oxidation-reduction [redox], hydrolysis, condensation	n, and
neutralization)	
B3.6 describe the structure of cell membranes according to the fluid mosaic model, and explain the dynamics of passive transport	ort
fosilisted diffusion and the metament of large periods to not had metame hade hade the appart in a diffusion and the metament of large periods to a call membrane by the processes of anders to is and even the	
activated diffusion, and the movement of large particles across the cen memorane by the processes of endocytosis and exocyto	0818
c. Metabolic Processes	
OVED ALL EVECTATIONS	
UVERALL EATECTATIONS	
U1. analyse the role of metabolic processes in the functioning of biotic and abiotic systems, and evaluate the importance of an	
understanding of these processes and related technologies to personal choices made in everyday life;	
C2. investigate the products of metabolic processes such as cellular respiration and photosynthesis:	
C3 demonstrate an understanding of the chamical changes and anergy conversions that occur in metabolic processes	
•••• demonstrate an understanding of the chemical changes and energy conversions that occur in metabolic processes.	
SPECIFIC EXPECTATIONS	
C1. Relating Science to Technology, Society, and the Environment	
C1.1 analyse the role of metabolic processes in the functioning of and interactions between biotic and abiotic systems (e.g., sp	ecialized
incrohes and entries of inclusion protected and the functioning of and metal entries between brone and automa microhes and entries to the state water with the relation of the state water in the relations in the relation of the relations in the relations in the relations in the relation of the rel	as in
microses and enzymes in order appreciations to treat wastewater in the purp and paper industry; microbes and enzym	105 111
bioremediation, such as in the cleanup of oil spills; energy transfer from producers to consumers) [AI, C]	
C1.2 assess the relevance, to their personal lives and to the community, of an understanding of cell biology and related technol	logies
(e.g., knowledge of metabolic processes is relevant to personal choices about exercise, diet, and the use of pharmacological sul	ostances:
knowledge of cellular processes aids in our understanding and treatment of mitochondrial diseases is group of neuropuscular	disease(1)
knowledge of central processes and in our understanding and realment of intechniqual diseases [a group of neuroinductual (seases])
C2. Developing Skills of Investigation and Communication	
C2 1 use appropriate terminology related to metabolism including, but not limited to anaroy carriers, alreadysis, Krabs cycle	electron
all appropriate terminology related to includentian, including, but not miniculate energy currens, give bysis, Krebs cycle	, encenton

transport chain, ATP synthase, oxidative phosphorylation, chemiosmosis, proton pump, photolysi reactions, and cyclic and noncyclic phosphorylation [C]	s, Calvin cycle, light and dark
C2.2 conduct a laboratory investigation into the process of cellular respiration to identify the process	ducts of the process interpret the
qualitative observations, and display them in an appropriate format [PR, AI, C]	aucus of the process, interpret the
C2.3 conduct a laboratory investigation of the process of photosynthesis to identify the products	of the process, interpret the qualitative
observations, and display them in an appropriate format [PR, AI, C]	
C3. Understanding Basic Concepts	
C3.1 explain the chemical changes and energy conversions associated with the processes of aerol	bic and anaerobic cellular respiration
(e.g., in aerobic cellular respiration, glucose and oxygen react to produce carbon dioxide, water, a	and energy in the form of heat and ATP;
in anaerobic cellular respiration, yeast reacts with glucose in the absence of oxygen to produce ca	rbon dioxide and ethanol)
C3.2 explain the chemical changes and energy conversions associated with the process of photos	ynthesis (e.g., carbon dioxide and
water react with sunlight to produce oxygen and glucose)	
C3.3 use the laws of thermodynamics to explain energy transfer in the cell during the processes of	of cellular respiration and
photosynthesis	
C3.4 describe, compare, and illustrate (e.g., using flow charts) the matter and energy transformat	ions that occur during the processes of
cellular respiration (aerobic and anaerobic) and photosynthesis, including the roles of oxygen and	organelles such as mitochondria and
chloroplasts	
D. Molecular Genetics	
OVED ALL EVDECTATIONS	
UVERALL EATEUTATIONS	
D1. analyse some of the social, ethical, and legal issues associated with genetic research and biot	echnology;
D2. investigate, through laboratory activities, the structures of cell components and their roles in	processes that occur within the cell;
D3. demonstrate an understanding of concepts related to molecular genetics, and how genetic mo	dification is applied in industry and
agriculture.	
SPECIFIC EXPECTATIONS	
D1. Relating Science to Technology, Society, and the Environment	
D1.1 analyse, on the basis of research, some of the social, ethical, and legal implications of biotec	chnology (e.g., the bioengineering of
animal species, especially those intended for human consumption; the cultivation of transgenic cr	ops; the patenting of life forms;
cloning) [IP, PR, AI, C]	
U1.2 analyse, on the basis of research, some key aspects of Canadian regulations pertaining to be	otechnology (e.g., current or potential
registration for mandatory DNA ingerprinting, numan cloning, ownership of a genome, patenting	or genetically modified organisms),
and compare them to regulations from another jurisdiction [if , i K, Ai, C]	
D2. Developing Skills of Investigation and Communication	
D2.1 use appropriate terminology related to molecular genetics, including, but not limited to: pol	ymerase I, II, and III, DNA ligase,
helicase, Okazaki fragment, mRNA, rRNA, tRNA, codon, anticodon, translation, transcription, an	d ribosome subunits [C]
D2.2 analyse a simulated strand of DNA to determine the genetic code and base pairing of DNA	(e.g., determine base sequences of
DNA for a protein; analyse base sequences in DNA to recognize an anomaly) [AI]	
D2.3 conduct an investigation to extract DNA from a specimen of plant or animal protein [PR]	
D2 <i>A</i> investigate and analyze the call components involved in the process of protein synthesis us	ing appropriate laboratory aquipment
and techniques or a computer simulation [PR A]]	ing appropriate laboratory equipment
D3. Understanding Basic Concepts	
D3.1 explain the current model of DNA replication, and describe the different repair mechanisms	s that can correct mistakes in DNA
sequencing	
D3.2 compare the structures and functions of RNA and DNA, and explain their roles in the proce	ess of protein synthesis
D3.3 explain the steps involved in the process of protein synthesis and how genetic expression is	controlled in prokaryotes and
eukaryotes by regulatory proteins (e.g., the role of operons in prokaryotic cells; the mechanism of	f gene expression in eukaryotic cells)
D3.4 explain how mutagens, such as radiation and chemicals, can cause mutations by changing the	he genetic material in cells (e.g., the
mechanisms and effects of point mutations and frameshift mutations)	
D3.5 describe some examples of genetic modification, and explain how it is applied in industry a	nd agriculture (e.g., the processes
involved in cloning, or in the sequencing of DNA bases; the processes involved in the manipulati	on of genetic material and protein
synthesis; the development and mechanisms of the polymerization chain reaction)	<u> </u>
D3.6 describe the functions of some of the cell components used in biotechnology (e.g., the roles	of plasmids, restriction enzymes,
recombinant DNA, and vectors in genetic engineering)	duonood our understandingf
11.3 CONSCIONE OF THE DASIS OF RESEARCH, Some of the historical community community that have a	ivanced our inderstanding of

molecular genetics (e.g., discoveries made by Frederick Griffith, Watson and Crick, Hershey and Chase)
E Homeostasis
OVERALL EXPECTATIONS
E1. evaluate the impact on the human body of selected chemical substances and of environmental factors related to human activity;
E2. Investigate the rectorack mechanisms that maintain noneostasis in inving organisms; E3 demonstrate an understanding of the anatomy and physiology of human body systems, and explain the mechanisms that enable the
body to maintain homeostasis
SPECIFIC EXPECTATIONS
F1 Poloting Science to Technology Society and the Environment
E1.1 E1.1 E
performance or improve health (e.g., the risks and benefits of taking large quantities of vitamins or amino acids; the effects on the
human body of substances that people use to cope with stress) [PR, AI, C]
E1.2 evaluate, on the basis of research, some of the human health issues that arise from the impact of human activities on the
from plastic products into soil and water) IIP PP AL Cl
from plastic products into son and water) [if, FK, AI, C]
E2. Developing Skills of Investigation and Communication
E2.1 use appropriate terminology related to homeostasis, including, but not limited to: <i>insulin, testosterone, estrogen, nephron, dialysis,</i>
pituitary, synapse, and acetylcholine [C]
E2.2 plan and construct a model to illustrate the essential components of the homeostatic process (e.g., create a flow chart that illustrates
representative feedback mechanisms in living things) [IP, AI, C]
E2.3 plan and conduct an investigation to study a feedback system (e.g., stimulus response loop) [IP, PR, AI]
E2.4 plan and conduct an investigation to study the response mechanism of an invertebrate to external stimulu (e.g., the instinctive behaviour of an investigation to study the response to a stimulus such as light), using appropriate laboratory equipment and techniques [IP, PR, A]]
benaviour of an invertebrate in response to a stimulus such as right, using appropriate laboratory equipment and teeninques [1, 1 K, 14]
E3. Understanding Basic Concepts
E3.1 describe the anatomy and physiology of the endocrine, excretory, and nervous systems, and explain how these systems interact to
maintain homeostasis
E3.2 explain how reproductive hormones act in human feedback mechanisms to maintain homeostasis (e.g., the actions of male and
female reproductive hormones on their respective body systems)
E3.3 describe the homeostatic processes involved in maintaining water, ionic, thermal, and acid–base equilibrium, and explain now these processes help body systems respond to both a change in environment and the effects of medical treatments (e.g., the role of
feedback mechanisms in water balance or thermoregulation: how the buffering system of blood maintains the body's pH balance: the
effect of medical treatments on the endocrine system; the effects of chemotherapy on homeostasis)
E Denulation Dynamics
F. Population Dynamics
OVERALL EXPECTATIONS
F1. analyse the relationships between population growth, personal consumption, technological development, and our ecological
footprint, and assess the effectiveness of some Canadian initiatives intended to assist expanding populations;
F2. Investigate the characteristics of population growth, and use models to calculate the growth of populations within an ecosystem;
populations of species
F1 Relating Science to Technology, Society, and the Environment
F1.1 analyse the effects of human population growth, personal consumption, and technological development on our ecological footprint
(e.g., the deforestation resulting from expanding development and demand for wood products causes the destruction of habitats that
support biological diversity; the acidification of lakes associated with some industrial processes causes a decrease in fish populations)
►1.2 assess, on the basis of research, the effectiveness of some Canadian technologies and projects intended to nourish expanding
the Canadian International Development Agency [CIDA]) [IP_PR_ALC]
F2 Developing Skills of Investigation and Communication

F2.1 use appropriate terminology related to population dynamics, including, but not limited to: *carrying capacity, population growth, population cycle, fecundity,* and *mortality* [C]

F2.2 use conceptual and mathematical population growth models to calculate the growth of populations of various species in an ecosystem (e.g., use the concepts of exponential, sigmoid, and sinusoidal growth to estimate the sizes of various populations) [PR, AI, C]

F2.3 determine, through laboratory inquiry or using computer simulations, the characteristics of population growth of two different populations (e.g., the different population cycles of a predator and its prey; the population cycles of two populations that compete for food; the increase of Aboriginal compared to non-Aboriginal populations and the significant difference in average age between the two groups) [PR, AI, C]

F3 Understanding Basic Concepts

F3.1 explain the concepts of interaction (e.g., competition, predation, defence mechanism, symbiotic relationship, parasitic relationship) between different species

F3.2 describe the characteristics of a given population, such as its growth, density (e.g., fecundity, mortality), distribution, and minimum viable size

F3.3 explain factors such as carrying capacity, fecundity, density, and predation that cause fluctuation in populations, and analyse the fluctuation in the population of a species of plant, wild animal, or microorganism

F3.4 explain the concept of energy transfer in a human population in terms of the flow of food energy in the production, distribution, and use of food resources

F3.5 explain how a change in one population in an aquatic or terrestrial ecosystem can affect the entire hierarchy of living things in that system (e.g., how the disappearance of crayfish from a lake causes a decrease in the bass population of the lake; how the disappearance of beaver from an ecosystem causes a decrease in the wolf population in that ecosystem)