DRAFT ALTERNATE CONTENT EXPECTATIONS FOR LIFE SCIENCE – HIGH SCHOOL (GRADES 9-12)

Topic Bundle 1: Structure and Function

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.			
EE.HS-LS1-1: Demonstrate that the structure of DNA determines the structure of proteins that are used to carry out cell functions.	**EE.HS-LS1-H.1:** Demonstrate that the structure of DNA determines the structure of proteins that are used to carry out cell functions.	**EE.HS-LS1-M.1:** Demonstrate that the cell has specific structures called DNA, which contain information to perform cellular functions.	**EE.HS-LS1-L.1:** Identify which is a living thing and made up of cells.

Topic Bundle 1: Structure and Function

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	**Medium Range**	**Low Range**
Michigan K-12 Science Content Standard: HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.			
EE.HS-LS1-2: Use models to illustrate the interaction of two body systems that provide specific functions.	**EE.HS-LS1-H.2:** Use models to illustrate the interaction of two body systems that provide specific functions.	**EE.HS-LS1-M.2:** Use models to identify the main organs or organ systems of familiar animals.	**EE.HS-LS1-L.2:** Given a model of a human organ system, identify the organ that performs a specific function.

Topic Bundle 1: Structure and Function

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.			
EE.HS-LS1-3: Use evidence from an investigation to provide evidence that organisms react to change to regulate their internal conditions needed to stay alive.	**EE.HS-LS1-H.3:** Use evidence from an investigation to provide evidence that organisms react to change to regulate their internal conditions needed to stay alive.	**EE.HS-LS1-M.3:** Use evidence to identify ways that animals regulate their internal conditions needed to stay alive.	**EE.HS-LS1-L.3:** Given a change, identify one or more ways a human would react to stay alive.

Topic Bundle 2: Matter and Energy in Organisms and Ecosystems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.			
EE.HS-LS1-5: Use a model to describe that the process of photosynthesis transforms light energy, carbon dioxide, and water into chemical energy (sugar) for organisms to use.	**EE.HS-LS1-H.5:** Use a model to describe that the process of photosynthesis transforms light energy, carbon dioxide, and water into chemical energy (sugar) for organisms to use.	**EE.HS-LS1-M.5:** Use a model to communicate that sunlight, carbon dioxide, and water transform into sugar for plants to use as food.	**EE.HS-LS1-L.5:** Use a model to identify that light energy is needed for a plant to make and store food (sugar).

Topic Bundle 2: Matter and Energy in Organisms and Ecosystems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.			
EE.HS-LS1-6: Use models to show that common elements (C, H, O) can form bigger molecules such as carbohydrates, proteins, lipids, and nucleic acids.	**EE.HS-LS1-H.6:** Use models to show that common elements (C, H, O) can form bigger molecules such as carbohydrates, proteins, lipids, and nucleic acids.	**EE.HS-LS1-M.6:** Identify foods that are classified as sources of carbohydrates (carbs) or proteins.	**EE.HS-LS1-L.6:** Sort foods into different groups or identify foods that belong to a given food group.

Topic Bundle 2: Matter and Energy in Organisms and Ecosystems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	**Medium Range**	**Low Range**
Michigan K-12 Science Content Standard: HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.			
EE.HS-LS1-7: Use a model to describe that the process of cellular respiration transforms food molecules and oxygen molecules into a new substance, which results in the energy used by organisms to grow and survive.	**EE.HS-LS1-H.7:** Use a model to describe that the process of cellular respiration transforms food molecules and oxygen molecules into a new substance, which results in the energy used by organisms to grow and survive.	**EE.HS-LS1-M.7:** Use a model to identify that cells break down food into new substances to provide energy for plants or animals to grow and survive.	**EE.HS-LS1-L.7:** Use a model to identity that food is a source of energy for humans to grow and survive.

Topic Bundle 2: Matter and Energy in Organisms and Ecosystems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.			
Not applicable	Not applicable	Not applicable	Not applicable

Topic Bundle 2: Matter and Energy in Organisms and Ecosystems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.			
EE.HS-LS2-4: Use models to describe the flow of energy and conservation of matter among organisms of an ecosystem.	**EE.HS-LS2-H.4:** Use models to describe the flow of energy and conservation of matter among organisms of an ecosystem.	**EE.HS-LS2-M.4:** Use a simple model to describe a simple food chain.	**EE.HS-LS2-L.4:** Given a simple model of a familiar organism, identify one member of a food chain that is consumed by another.

Topic Bundle 2: Matter and Energy in Organisms and Ecosystems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.			
EE.HS-LS2-5: Use models to identify the cycling of carbon among living organisms, air, water, and soil.	**EE.HS-LS2-H.5:** Use models to identify the cycling of carbon among living organisms, air, water, and soil.	**EE.HS-LS2-M.5:** Given a simple carbon cycle model, identify the flow of carbon between air and living organisms.	**EE.HS-LS2-L.5:** Given a familiar model, recognize that plants give humans oxygen and humans give plants carbon dioxide.

*This EE standard is similar to HS-ESS2-6-7.

Topic Bundle 3: Interdependent Relationships in Ecosystems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standards: HS-LS2-1, HS-LS2-2, and HS-LS2-6 **HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.** **HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.** **HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.**			
EE.HS-LS2-1-2-6: Use graphs and/or data to explain the cause and effect relationship among population sizes and available resources (food, shelter, water).	**EE.HS-LS2-H.1-2-6:** Use graphs and/or data to explain the cause and effect relationship among population sizes and available resources (food, shelter, water).	**EE.HS-LS2-M.1-2-6:** Use graphs and/or data to recognize the dependence of one animal population on another organism for food or the environment (shelter, water).	**EE.HS-LS2-L.1-2-6:** Use a simple graph to identify a cause for the change in a population of organisms.

Topic Bundle 3: Interdependent Relationships in Ecosystems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standards: HS-LS2-7 and HS-LS4-6 **HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.** **HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.**			
EE.HS-LS2-7_4-6: Use data to select a solution for reducing the impact of human activities on a given an environmental condition.	**EE.HS-LS2-7_4-H.6:** Use data to select a solution for reducing the impact of human activities on a given environmental condition.	**EE.HS-LS2-7_4-M.6:** Differentiate between human activities that are harmful or beneficial to the environment.	**EE.HS-LS2-7_4-L.6:** Identify a human activity that helps the environment .

Topic Bundle 3: Interdependent Relationships in Ecosystems

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.			
EE.HS-LS2-8: Use evidence to describe how group behavior affects the survival of groups of animals and individual animals.	**EE.HS-LS2-H.8:** Use evidence to describe how group behavior affects the survival of groups of animals and individual animals.	**EE.HS-LS2-M.8:** Given information or a scenario, identify the group behavior that is beneficial to groups of animals and individual animals.	**EE.HS-LS2-L.8:** Identify a group behavior that increases an individual animals' chances for survival.

Topic Bundle 4: Inheritance and Variation of Traits

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standard: HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.			
EE.HS-LS1-4: Use a model to identify the role of cellular division and specialization of cells as the body grows and develops.	**EE.HS-LS1-H.4:** Use a model to identify the role of cellular division and specialization of cells as the body grows and develops.	**EE.HS-LS1-M.4:** Use a model to identify the role of cellular division in growing or maintaining the body.	**EE.HS-LS1-L.4:** Recognize that body growth and/or repair is a result of dividing cells

Topic Bundle 4: Inheritance and Variation of Traits

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standards: HS-LS3-1 and HS-LS3-2 **HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.** **HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.**			
EE.HS-LS3-1-2: Use models and/or illustrations to explain that offspring receive half of their genetic information from each parent resulting in offspring that look similar but not identical to the parents.	**EE.HS-LS3-H.1-2:** Use models and/or illustrations to explain that offspring receive half of their genetic information from each parent resulting in offspring that look similar but not identical to the parents.	**EE.HS-LS3-M.1-2:** Use models or illustrations to identify or predict physical traits passed from parent to offspring.	**EE.HS-LS3-L.1-2:** Identify parent and offspring combinations.

Topic Bundle 5: Natural Selection and Evolution

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	**Medium Range**	**Low Range**
Michigan K-12 Science Content Standard: HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.			
EE.HS-LS4-1: Use data to find patterns in the fossil record that demonstrate similarities and/or differences as organisms change over time. (Same as EE.MS-LS4-1-2)	**EE.HS-LS4-H.1:** Use data to find patterns in the fossil record that demonstrate similarities and/or differences as organisms change over time. (Same as EE.MS-LS4-1-2)	**EE.HS-LS4-M.1:** Given pictures of fossils and their modern decedents, identify similarities or differences in their traits. (Same as EE.MS-LS4-1-2)	**EE.HS-LS4-L.1:** Given a fossil and two organisms, match the fossil to the organism that is related. (Same as EE.MS-LS4-1-2)

Topic Bundle 5: Natural Selection and Evolution

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standards: HS-LS4-2 and HS-LS4-3 **HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.** **HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.**			
EE.HS-LS4-2-3: Use models or evidence to describe how the traits of particular species allow them to survive in their specific environments.	**EE.HS-LS4-H.2-3:** Use models or evidence to describe how the traits of particular species allow them to survive in their specific environments.	**EE.HS-LS4-M.2-3:** Given either traits of a species or conditions of a specific environment, match the environmental condition and species traits that go together.	**EE.HS-LS4-L.2-3:** Given an environment and two vastly different organisms, identify which organism has the ability to survive in that environment.

Topic Bundle 5: Natural Selection and Evolution

Target Alternate Expectation	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan K-12 Science Content Standards: HS-LS4-4 and HS-LS4-5 **HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.** **HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.**			
EE.HS-LS4-4-5: Use evidence to describe how changes in an environment over time contribute to changes in populations of organisms, the evolution of new species, and the extinction of some species.	**EE.HS-LS4-H.4-5:** Use evidence to describe how changes in an environment over time contribute to changes in populations of organisms, the evolution of new species, and the extinction of some species.	**EE.HS-LS4-M.4-5:** Use evidence to identify whether a population will grow, evolve into a new species, or go extinct in a changing environment.	**EE.HS-LS4-L.4-5:** Identify a result of a change in an environment that causes the population of an animal or plant organism to increase or decrease.