2022- 2023, HS, Biology, Quarter 1

Big Ideas/Key Concepts:

- **All living things are defined by observable and predictable characteristics.**
- **Cells have very specific molecular and structural organization, resulting in specific functions.**
- **Cells possess the ability to replicate for growth and reproduction.**
- **Cells can convert energy and matter into other biologically useful resources.**

Quick Links within this Document

Quarter 2 Quarter 3 Quarter 4
TN Science Standards Reference Guide
WCS Biology OER

Standards	Student Friendly "I Can" Statements
Characteristics of Life **BIO1.LS1.1** Compare and contrast existing models, identify patterns, and use structural and functional evidence to analyze the characteristics of life. Engage in argument about the designation of viruses as non-living based on these characteristics.	**Characteristics of Life** I can compare and contrast existing models, identify patterns, and use structural and functional evidence to analyze the characteristics of life. I can develop models that describe how viruses interact with cells. I can use evidence to defend the argument that viruses are "nonliving".
Cell Activity: Chemistry of the Cell **BIO1.LS1.2** Evaluate comparative models of various cell types with a focus on organic molecules that make up cellular structures.	**Cell Activity: Chemistry of the Cell** I can describe the four macromolecules and evaluate their structure, function, and location within a cell.

	I can develop comparative models of major cell types (prokaryotic vs. eukaryotic and animal vs. plant). I can investigate the role different macromolecules play within specific cell structures. Using a microscope, I can determine major cell types (prokaryotic vs. eukaryotic and animal vs. plant).
Cell Activity: Cell Transport **BIO1.LS1.7** Utilize a model of a cell plasma membrane to compare the various types of cellular transport and test predictions about the movement of molecules into or out of a cell based on the homeostasis of energy and matter in cells.	**Cell Activity: Cell Transport** I can explain the role phospholipids and proteins in the membrane play in helping a cell maintain homeostasis. I can develop models differentiating the passive and active movement of molecules (including water) into or out of a cell. I can explain the significance of the surface area-to-volume ratio of cells. I can analyze experimental data showing the movement of materials into or out of cells based on environmental conditions.
Cell Activity: Cell Cycle **BIO1.LS1.6** Create a model for the major events of the eukaryotic cell cycle, including mitosis. Compare and contrast the rates of cell division in various eukaryotic cell types in multicellular organisms.	**Cell Activity: Cell Cycle** I can describe the relationships between cell growth, cell division, and organismal growth. I can create a model for the major events of the eukaryotic cell cycle. I can compare and contrast the rates of cell division for various cell types in multicellular organisms.

Energy in Cells: Photosynthesis **BIO1.LS1.8** Create a model of photosynthesis demonstrating the net flow of matter and energy into a cell. Use the model to explain energy transfer from light energy into stored chemical energy in the product.	**Energy in Cells: Photosynthesis** I can create a model that supports the relationship of chloroplast structure to its function. I can develop a model to explain the flow of matter and energy inside chloroplasts during photosynthesis. I can explain how energy is transferred from light energy to chemical energy during photosynthesis. I can explain how matter is transferred from the atmosphere to organic compounds during photosynthesis. I can describe uses for the products of photosynthesis for plants and predict uses of these products for other organisms.

2022 - 2023, HS, Biology, Quarter 2

Big Ideas/Key Concepts:

- **Cells can convert energy and matter into other biologically useful resources.**
- **DNA is a macromolecule that can self-replicate and encodes for instructions to make proteins.**
- **Biological systems are largely composed of proteins, which are encoded by DNA.**
- **The structure of proteins relates to their functional diversity.**

Quick Links within this Document

Quarter 1 Quarter 3 Quarter 4
TN Science Standards Reference Guide
WCS Biology OER

Standards	Student Friendly "I Can" Statements
Energy in Cells Respiration **BIO1.LS1.9** Create a model of aerobic respiration demonstrating flow of matter and energy out of a cell. Use the model to explain energy transfer mechanisms. Compare aerobic respiration to alternative processes of glucose metabolism.	**Energy in Cells Respiration** I can use a model to demonstrate the relationship of mitochondrial structure to its function. I can explain the role glucose plays in the flow of matter and energy through cellular respiration. I can compare and contrast aerobic respiration to anaerobic respiration and fermentation. I can model the flow of carbon and energy through photosynthesis and aerobic respiration.

From DNA to Protein **BIO1.LS1.3** Integrate evidence to develop a structural model of a DNA molecule. Using the model, develop and communicate an explanation for how DNA serves as a template for self-replication and encodes biological information. **BIO1.LS1.4** Demonstrate how DNA sequence information is decoded through transcriptional and translational processes within the cell in order to synthesize proteins. Examine the relationship of structure and function of various types of RNA and the importance of this relationship in these processes. **Protein Structure and Function** **BIO1.LS1.5** Research examples that demonstrate the functional variety of proteins and construct an argument based on evidence for the importance of the molecular structure to its function. Plan and carry out a controlled investigation to test predictions about factors, which should cause an effect on the structure and function of a protein.	**From DNA to Protein** I can use historical evidence to identify patterns and model the structure of the DNA molecule. I can use models to explain how DNA serves as a template for self-replication. I can explain the role nucleotides play in encoding biological information, including how mutations may cause changes. I can model transcriptional and translational processes used to make proteins. I can describe the relationship between structure and function of various types of RNA in transcription and translation. **Protein Structure and Function** I can research examples that demonstrate the functional variety of proteins. I can use evidence of changing traits (phenotypes) to relate the structure of a protein to its specific function. I can plan and conduct a controlled investigation that tests factors affecting the structure and function of a protein.

2022 - 2023, HS, Biology, Quarter 3

Big Ideas/Key Concepts:

- **Traits are inherited through the passing of DNA.**
- **Phenotypic diversity can result from a variety of changes in DNA.**
- **The genome can be artificially manipulated with various biotechnologies.**
- **Multiple lines of evidence demonstrate the evolution of species.**
- **The genes of better adapted organisms are more likely to be passed on.**
- **Bioengineers design tools and techniques to investigate and find biomolecular solutions to problems.**

Quick Links within this Document

Quarter 1 Quarter 2 Quarter 4
TN Science Standards Reference Guide
WCS Biology OER

Standards	Student Friendly "I Can" Statements
Chromosomal Inheritance **BIO1.LS3.1** Model chromosome progression through meiosis and fertilization in order to argue how the processes of sexual reproduction lead to both genetic similarities and variation in diploid organisms. Compare and contrast the processes of sexual and asexual reproduction, identifying the advantages and disadvantages of each.	**Chromosomal Inheritance** I can compare and contrast sexual and asexual reproduction, identifying the advantages and disadvantages of each. I can model chromosome progression through meiosis and fertilization and use these models to demonstrate possible chromosomal errors. I can evaluate evidence to support the argument that the processes of sexual reproduction leads to both genetic similarities and variation in diploid organisms.

BIO1.LS3.2 Explain how protein formation results in phenotypic variation and discuss how changes in DNA can lead to somatic or germline mutations.	Given a genetic sequence, I can predict how mutations in the DNA nucleotides can lead to somatic or germline mutations. I can explain how changes in gene expression can result in changes in phenotype. I can use evidence to show cases where mutations might not impact phenotype. Using data, I can explain the results of different modes of inheritance (sex linkage, co-dominance, incomplete dominance, multiple alleles, and polygenic traits). I can determine the probability of a particular trait in offspring based on the genotype of the parents.
BIO1.LS3.3 Through pedigree analysis, identify patterns of trait inheritance to predict family member genotypes. Use mathematical thinking to predict the likelihood of various types of trait transmission.	I can use pedigree analysis to identify patterns of trait inheritance in order to predict family member genotypes.
BIO1.ETS2.2 Investigate the means by which karyotypes are utilized in diagnostic medicine.	I can identify patterns in common gene disorders (monosomy, trisomy, etc.) given a karyotype. I can make a prediction (or diagnosis) using karyotype patterns and patient phenotypes.

Biotechnology and Bioengineering **BIO1.ETS2.1** Obtain, evaluate, and communicate information on how molecular biotechnology may be used in a variety of fields. **BIO1.ETS2.3** Analyze scientific and ethical arguments to support the pros and cons of application of a specific biotechnology technique such as stem cell usage, in vitro fertilization, or genetically modified organisms. **Change Over Time** **BIO1.LS4.1** Evaluate scientific data collected from analysis of molecular sequences, fossil records, biogeography, and embryology. Identify chronological patterns of change and communicate that biological evolution is supported by multiple lines of empirical evidence that identify similarities inherited from a common ancestor (homologies). **BIO1.LS4.2** Using a model that demonstrates the change in allele frequencies resulting in evolution of a population over many generations, identify causative agents of change.	**Biotechnology and Bioengineering** Using scientific literature, I can research, evaluate, and communicate information about applications of molecular biotechnology. I can conduct, analyze and interpret the results from a biotechnology investigation (gel electrophoresis, transformation, etc.). I can conduct an ethical argument to support the pros and cons of specific biotechnology techniques. **Change Over Time** I can communicate that biological evolution is supported by multiple lines of empirical evidence that identify similarities inherited from a common ancestor. I can evaluate scientific data showing chronological patterns of change (molecular sequences, fossil records, biogeography, or embryology). I can construct and interpret cladograms and phylogenetic using a data table of characteristics. I can identify mechanisms (such as isolation and genetic drift) that can result in changes in allelic frequency within populations. I can use models to show how changes in allele frequencies cause population change over many generations. I can relate allele frequencies to population change over many generations. I can use natural selection to model the relationship between phenotype and environment. I can explain how adaptations accumulate in a population.

2022 - 2023, HS, Biology, Quarter 4

Big Ideas/Key Concepts:

- **Population size can be limited by biotic and abiotic factors.**
- **Matter flows through the environment in biogeochemical cycles.**
- **Disturbances in an ecosystem have far reaching effects.**
- **Biodiversity must be maintained and recovered through the work of human initiatives.**

Quick Links within this Document

Quarter 1 Quarter 2 Quarter 3
TN Science Standards Reference Guide
WCS Biology OER

Standards	Student Friendly "I Can" Statements
Populations **BIO1.LS2.1** Analyze mathematical and/or computational representations of population data that support explanations of factors that affect population size and carrying capacities of populations within an ecosystem. Examine a representative ecosystem and based on interdependent relationships present, predict population size effects due to a given disturbance. **Biogeochemical Cycles** **BIO1.LS2.2** Create a model tracking carbon atoms between inorganic and organic molecules in an ecosystem. Explain human impacts on climate based on this model.	**Populations** I can analyze a representative ecosystem to predict the effects of a disturbance on population size. I can use quantitative evidence such as graphs, to explain factors that affect population size and carrying capacity within an ecosystem. **Biogeochemical Cycles** Using a model, I can explain how carbon atoms cycle through an ecosystem.

	I can use a model of the carbon cycle to analyze human impacts on climate.
BIO1.LS2.3 Analyze through research the cycling of matter in our biosphere and explain how biogeochemical cycles are critical for ecosystem function.	I can research the cycling of water, nitrogen, and phosphorus in our biosphere, and analyze representative models. I can predict how changes in a biogeochemical cycle can affect an ecosystem.
Ecology	**Ecology**
BIO1.LS2.4 Analyze data demonstrating the decrease in biomass observed in each successive trophic level. Construct an explanation considering the laws of conservation of energy and matter and represent this phenomenon in a mathematical model to describe the transfer of energy and matter between trophic levels.	I can analyze data demonstrating decreasing biomass and energy between trophic levels. I can construct a mathematical model to describe the transfer of energy and matter between trophic levels and explain the laws of conservation of energy and matter.
BIO1.LS2.5 Analyze examples of ecological succession, identifying and explaining the order of events responsible for the formation of a new ecosystem in response to extreme fluctuations in environmental conditions or catastrophic events. **BIO1.LS4.3** Identify ecosystem services and assess the role of biodiversity in support of these services. Analyze the role human activities have on disruption of these services.	I can analyze examples of ecological succession in order to differentiate between primary and secondary models of succession. I can identify and explain the order of events responsible for forming a new ecosystem in response to environmental disruptions. I can identify ecosystem services and assess their role in supporting biodiversity. I can analyze the role of human activity on disruption of ecological services and predict the effect it could have on future generations.