Content: Life Science	**Grade or Course:** Honors Biology	**Date Developed:** 7/30/2018

Overview:

Honors Biology is a year-long course worth 1.5 credits, and is open to both sophomore and juniors who have successfully completed at least Global Science. The class meets each day for alternating blocks of 80 and 40 minutes. The intent of Honors Biology is to provide students with the depth and breadth of biological knowledge required for the continued examination of content and processes at the college level.

Honors level biology is taught by the molecular approach, where students strive to understand the interconnections of biological concepts. These concepts are divided into twelve units of study, including the broad themes of Experimental Design, Metabolism, Cancer Biology, Immune system, Meiosis, Mendelian Genetics, Molecular Genetics, Biotechnology, and Evolutionary Biology. Each unit of study provides the student with lab inquiries that are linked to the concepts being taught. Lab inquiries require much organization, work outside the classroom, good writing skills, attention to detail and analytical thinking. Honors Biology is taught at an accelerated pace and investigates biological concepts on a fine scale. Students are expected to independently problem solve, demonstrate the ability to think in an abstract manner, and be able to make connections among distinct phenomena. Students are responsible for regularly completing in-depth and sophisticated analysis of data-based investigations.

Essential Questions:

CC: How are the structures of biological components related to their functions?
CC: How and why do living systems maintain stability or respond to change?
CC: How can we use cause and effect relationships to explain biological phenomena?
CC: How does energy flow and matter cycle among and within biological systems?

- How do cells acquire and manipulate energy and matter?
- How does photosynthesis use light energy to rearrange simple matter into complex biomolecules?
- How does cell respiration transfer energy stored in complex bio molecules to molecules of ATP?
- How does cell size and shape affect rates of transport?
- How and why do cells replicate to maintain complex organisms?
- What are the consequences of failing to regulate the cell life cycle?
- How do organisms differentially regulate cell division to guard against disease?
- How are cells used for reproduction fundamentally different from somatic cells?
- How are predictions of inheritance explained by meiotic events?
- How is biological information recorded, communicated, and transferred?

- How does the structure of DNA account for its high fidelity?
- What is the relationship between nucleic acids, proteins, and phenotypes?
- How can changes in DNA coding (natural and artificial) affect the phenotypes of organisms?
- How can evolution account for the development and modification of all species?
- How does the environment act as the mechanism to induce evolutionary change?
- How can reproductive isolation account for the development of new species?
- What evidence supports evolution is a powerful and continuous natural process that explains the unity and diversity of life?
- How is biology relevant to everyday life?

EO's addressed to proficiency level:

Students will understand, demonstrate, and be evaluated on the following Scientific Practices:

- P1: Asking Questions and Defining Problems
- P4: Analyzing and Interpreting Data
- P5: Using Math and Computational Thinking
- P6: Constructing Explanations
- P8: Obtaining, Evaluating, and Communicating Information

Standards:

Students will understand and use the following additional Scientific Practices:

- P2: Developing and Using Models
- P3: Planning and Carrying out Investigations
- P7: Engaging in Argument over Evidence

Students will understand and use the following Cross-Cutting Concepts:

- Systems and system models
- Energy and matter
- Stability and change
- Structure and Function

Students will understand, use, and be evaluated on the following Disciplinary Core Ideas:

1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins that carry out the essential functions of life through systems of specialized cells. HS-LS1-1
2. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. HS-LS1-4
3. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. HS-LS1-5
4. 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. HS-LS1-7

5. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. HS-LS2-4
6. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. HS-LS2-5
7. 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-LS3-1
8. 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. HS-LS3-2
9. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. HS-LS3-3
10. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS4-1
11. 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-LS4-2
12. 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. HS-LS4-3

Units:

Unit 1	**Nature of Science- Logical thought and Experimental Design**
Unit 2	**Fundamental properties of Energy and Matter**
Unit 3	**Cell respiration and Photosynthesis**
Unit 4	**Cell Transport- Movement Across a Membrane**
Unit 5	**Cell Cycle Control- Cancer**
Unit 6	**Cell Cycle Systems Regulation- Immune system**
Unit 7	**Genetic Variability- Meiosis and Ploidy Reduction**
Unit 8	**Genetic Predictions- Heritability and Mendelian Genetics**
Unit 9	**Molecular Genetics- Structure of DNA and Central Dogma**
Unit 10	**Genetic Edits- Mutations and Biotechnology**
Unit 11	**Evolution- Natural Selection**
Unit 12	**Evolution- Speciation**

EO Assessments:

- Cell Respiration Exercise CER
- Cell Size Efficiency CER
- Fast Plant Mendelian Genetics CER
- Natural Selection CER