Hazelwood School District

High Expectations For All!

Honors Biology

Grades 10-12

Curriculum Committee Members

Dr. Christina Hughes, Science Curriculum Coordinator

Reviewed by High School Teachers on February 6, 2018

Reviewed by Curriculum Advisory Committee on February 8, 2018

Approved by the Hazelwood School District Board of Education on June 19, 2018

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Hazelwood School District

Mission Statement

We are a collaborative learning community guided by a relentless focus to ensure each student achieves maximum growth

Vision Statement

HSD will foster lifelong learners, productive citizens, and responsible leaders for an ever-evolving society.

Board of Education on January 5, 2010

Goals

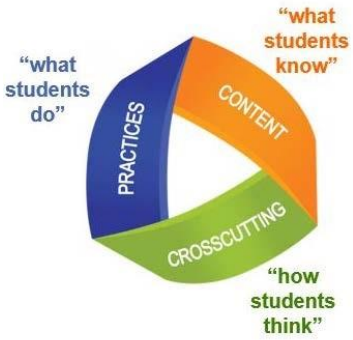
Goal #1: Hazelwood students will meet or exceed state standards in all curricular area with emphasis in reading, writing, mathematics, science and social studies.

Goal #2: Hazelwood staff will acquire and apply skills necessary for improving student achievement.

Goal #3: Hazelwood School District, the community, and all families will support the learning of all children.

Curriculum Overview

In 2014, the Department of Elementary and Secondary Education (DESE) adopted the new Missouri Learning Standards (MLS) for Science. Modeled closely after the Next Generation Science Standards (NGSS), the new standards support a three dimensional learning framework to facilitate science content understanding. The three pillars of the 3-D model include Disciplinary Core Ideas, Crosscutting Concepts, and Science and Engineering Practices. These dimensions are designed to foster a deeper understanding of science through hands-on investigations, engaging in rich discourse and explaining phenomena.



In May 2018, DESE moved forward with a new End of Course (EOC) assessment for Biology that was aligned to the new Missouri Learning standards. The new assessment differs from the previous assessment for Biology which consisted largely of recall and basic application questions. The new assessment format consists of performance tasks that aim to assess students' ability to think critically about phenomena.

Honors Biology is a laboratory-based course that investigates the structure and function of living things, interdependent relationships in the environment, heredity, human impact and adaptations to changing environments. Students will progress through the 5-E instructional model (Engage, Explore, Explain, Elaborate, Evaluate) to develop a comprehensive understanding of organisms and the factors that affect their structure, function, growth, and development.

This course is designed to support transition to Advanced Placement (AP) Biology and AP Environmental Science courses. Students will be responsible for proper use of laboratory equipment, as well as being tasked with experimental design, data collection and data analysis.

COURSE TITLE: Honors Biology

GRADE LEVEL: 10-12

CONTENT AREA: High School Science

Course Description:
This course provides more in-depth knowledge and analysis for students to prepare for the AP Biology course. Biology will establish the principles and foundations for the study of living organisms and life functions. Through the application of the scientific method and other research processes, the following topics will be studied: ecological interactions between organisms and the environment; cellular structure, function, and reproductive processes; and a study of genetics and the field of biotechnology. The second semester continues the study of living organisms and life functions by explorations into the diversity of living things. A study of classification and phylogenetic grouping of protists, fungi, bacteria, viruses, plants, and animals presents the diversity and organizational complexity of life to the student. In-depth investigations using the scientific method and other research processes will be used to study life processes such as photosynthesis, respiration, and plant and animal structure, function, and reproduction.
Course Rationale:
Honors Biology is a fast-paced, rigorous course in which the student is expected to be highly motivated to achieve at an honors level. This course is an in-depth, lab- oriented approach to the biological sciences with emphasis on practical encounters. Honors Biology investigates biological organization starting at a molecular level and culminating with living organisms and their inter-relationships. Students will develop the skills required for using the science and engineering practices and crosscutting concepts with hands-on exercises.

Course Scope and Sequence		
First Semester		
Unit 1: Cellular Reproduction and Differentiation Scopes: • Essential Functions of Life • Cell Division	Unit 2: Homeostasis Scopes: • System Interactions • Feedback Mechanisms)	Unit 3: Energy in Organisms Scopes: • Photosynthesis • Synthesis of Macromolecules • Cellular Respiration

Unit 4: Energy Transfer in Ecosystems Scopes: • Bioenergetics, • Transfer of Energy in Ecosystems • The Carbon Cycle)	Unit 5: Biodiversity and Environmental Change Scopes: • Interdependent Relationships in Ecosystems • Ecosystem Dynamics	Unit Timing: Unit 1: 9 class periods Unit 2: 9 class periods Unit 3:12 class periods Unit 4: 6 class periods Unit 5: 6 class periods

Second Semester		
Unit 6: Inheritance and Variation Scopes: • Inheritance of Traits • Variation of Traits • Genetics	Unit 7: Evidence of Common Ancestry and Natural Selection Scopes: • Evidence of Common Ancestry • Natural Selection • Evolution	Unit 8: Adaptations Scopes: • Animal Behavior • Environmental Influences on Adaptation • Extinction
Unit 9: Biodiversity and Humans Scopes: • Human Impact on the Environment • Human Impacts on Biodiversity	Unit Timing: Unit 6: 10 class periods Unit 7: 12 class periods Unit 8: 10 class periods Unit 9: 10 class periods	

Proposed Course Materials and Resources:

STEMScopes

Essential Terminology/Vocabulary

Unit 1:
Cell, Cell Cycle, Cell Division, Differentiation, Diploid, DNA, Haploid, Meiosis, Mitosis, Nitrogenous Bases, Nucleotide, Organisms, Protein Synthesis, and RNA

Unit 2:
Feedback, Feedback Mechanisms, Function, Hierarchical, Homeostasis, Negative Feedback, Organ, Phloem, Positive Feedback, System, Tissue, Xylem, and Structure

Unit 3:
Amino Acid, ATP, Carbohydrate, Catabolic Process, Cellular Respiration, Chemical Bonds, Chemical Energy, Dehydration Synthesis, DNA, Energy, Hydrocarbon, Hydrolysis, Light Energy, Lipid, Macromolecule, Matter, Mitochondria, Nucleic Acid, Organisms, Photosynthesis, Polymer, and Protein

Unit 4:
Aerobic Cellular, Anaerobic Cellular Respiration, Bioenergetics, Biomass Pyramid, Biosphere, Carbon Cycle, Cellular Respiration, Food Web, Geosphere, Photosynthesis, Respiration, Trophic Energy Loss, and Trophic Level.

Unit 5:
Biodiversity, Carrying Capacity, Climax Community, Commensalism, Competition, Ecosystem, Interdependent Relationship, Keystone Species, Limiting Factors, Mutualism, Parasitism, Pioneer Species, Predation, Primary Succession, Resilience, Secondary Succession, Succession, and Symbiosis.

Unit 6:
Chromosome, Codon, Complementary Base Pair, Crossing Over, Deletion, Diploid, DNA, DNA Replication, Empirical Evidence, Environmental Factors, Gamete, Gene, Gene Expression, Genetic Variation, Haploid, Inherit, Karyotype, Meiosis, Mutation, Random Assortment, Substitution, Trait, Transcription, Translation, and Variation of Traits.

Unit 7:
Diversity, Common Ancestor, Evolution, Anatomical Homologies, Developmental Homologies, Molecular Homologies, Chordate, Cladogram, Natural Selection, Genetic Variation, Trait Variation, Heritable, Adaptation, Natural Selection, Heterozygous, Homozygous, Allele, Dominant, Recessive, Genotype, Phenotype, and Reproductive Success.

Unit 8:
Adaptation, Biodiversity, Convergent Evolution, Correlation, Divergent Evolution, Empirical Evidence, Extinction, Group Behavior, Mitigate, and Speciation.

Unit 9:
Anthropogenic Changes, Biodiversity, Climate Change, Habitat, Invasive Species, Overexploitation, Overpopulation, and Pollution.

Unit Objectives:

Unit 1:

1. I can observe and describe the structural differences between different types of cells.
2. I can conduct an experiment to extract DNA from cells.
3. I can describe the structure of the DNA molecule.
4. I can explore a genetic disorder to explain how DNA is responsible for creating proteins and identify some of the problems that may arise if errors or mutations occur.
5. I can explore how mitosis is a process of predictable steps, and examine reasons why organisms undergo mitosis.
6. I can model how cell differentiation creates complex organisms.
7. I can examine specialized cells to explain how differentiation helps produce and maintain complex organisms.

Unit 2:

1. I can develop a model to display and explain the levels of organization in organisms.
2. I can refine a model to show interactions between systems in organisms.
3. I can compare and contrast system interactions in plants and in animals.
4. I can distinguish between positive and negative feedback
5. I can create a map/diagram of a feedback system and explain how it regulates
6. functions in living things
7. I can demonstrate how different body systems react to changing conditions.
8. I can explain how homeostasis is regulated in both plants and animals.

Unit 3:

1. I can create a model to show how radiant energy from the sun is transformed into chemical energy through the process of photosynthesis
2. I can conduct an investigation to evaluate factors that affect the rate of photosynthesis
3. I can conduct an investigation to explain factors that influence the amount of carbon dioxide produced by the human body.
4. I can use a model to show how glucose is broken down into carbon dioxide and water during cellular respiration.

Unit 4:

1. I can investigate how the reactants of photosynthesis and products of cellular respiration cycle between plants and animals.
2. I can design and construct a scaled prototype of an algae growth chamber to accelerate the production of green algae as a source of energy.
3. I can distinguish between aerobic and anaerobic respiration.
4. I can engage in argumentation and discourse to develop a sorting scheme for carbon cycle cards.
5. I can use a model to explain the movement of carbon throughout an ecosystem.
6. I can use a specific model to explain the path a carbon atom would take from one organism to another.
7. I can describe how carbon cycles through different parts of the Earth spheres.
8. I can describe how humans impact the carbon cycle and carbon availability.
9. I can use a model to demonstrate the transfer and flow of energy in a food web.
10. I can create a model to display 3 types of ecological relationships.
11. I can explore ecological pyramids, and describe and calculate the energy and matter flow through trophic levels.

Unit 5:

1. I can differentiate between symbiotic relationships in ecosystems
2. I can predict how environmental or population changes in the ecosystem might affect other populations.
3. I will use a presentation to provide a solution to an environmental issue.
4. I can use a computational model to explain factors that impact the carrying capacity of ecosystems.
5. I can sort a set of succession cards and discuss
6. I can use a simulated ecological succession model to describe the effects of primary and secondary succession on plant and animal life.
7. I will research and design a Natural Disaster Recovery Announcement based on specific constraints and criteria using the Engineering Design Process.
8. I will compare and contrast different biomes.
9. I can use a mathematical model to provide evidence on the effect of changing environmental conditions on ecosystem stability.
10. I can distinguish between density dependent and density independent limiting factors.
11. I can use a model to explain how ecosystems are impacted as a result of complex interactions between organisms (e.g., predation, crowding, disease, density dependent and density independent limiting factors.)

Unit 6:

1. I can create an analogy for each part of the genome.
2. I can distinguish between transcription and translation.
3. I can use a model to simulate protein synthesis.
4. I can explain how differential gene expression occurs.

5. I can explain how small changes in instructions relate to the genetic diversity among species.
6. I can model meiosis and compare and contrast it to mitosis.
7. I explain how meiosis leads to genetic variation.
8. I can discuss the impact of mutations during meiosis leads to genetic variation among species.
9. I can explain how different environmental factors cause mutations.
10. I can predict genotypic and phenotypic Mendelian crosses.
11. I can predict genotypic and phenotypic non-Mendelian crosses.
12. I can conduct an investigation using plants to show how traits are inherited from parent generations to second generations.
13. I can model and demonstrate co-dominance in traits.

Unit 7:

1. I can create and explain a simple cladogram.
2. I can analyze the 3 types of homologies (anatomical, developmental, and molecular) in provide evidence to support common ancestry.
3. I can use data to investigate common ancestry among species by comparing illustrations of prehistoric mammals to present day mammals.
4. I can determine how the amino acid sequence of several organisms compare and, I can use that information to construct a cladogram as evidence of common descent.
5. I can engage in a Socratic dialogue to communicate scientific evidence supporting common ancestry and biological evolution.
6. I can analyze allele frequencies in a population to understand the effects of natural selection on the population.
7. I can examine the process of differential reproductive success by analyzing its flaws and successes.
8. I can show how the change of allele frequencies in a population indicate differential reproductive success
9. I can explore how natural selection and mutations can change the allele frequencies of the distribution of the sickle cell trait in humans.
10. I can conduct research on one of five different studies on the process of evolution in specific populations.

Unit 8:

1. I can explore individual animal behaviors and describe their benefits to animal survival.
2. I can gather evidence and develop scientific explanations for how animal group behavior benefits reproduction and survival of the species.
3. I can determine the effects of long-term and short term environmental changes on organisms and the traits they pass to future generations.
4. I can differentiate between convergent and divergent evolution.
5. I can identify the type of natural selection occurring in a population and provide evidence for my claim.
6. I can analyze evidence to classify several species as threatened, endangered,

critical, or extinct.

7. I can propose a solution to protect an endangered species.
8. I can explain how catastrophic events play a role in extinction.
9. I can evaluate how conservation efforts affect local and regional communities, as well as conduct a cost-benefit analysis to argue whether these costs are justified.

Unit 9:

1. I can create a list of human impacts on the environment and propose solutions to mitigate these effects.
2. I will explain ways in which environmental changes have affected organisms in ecosystems.
3. I can work with a partner to use argumentation and discourse to create a graphic organizer on the benefits of biodiversity.
4. I can research threats to biodiversity and create a fictional organization whose goal is to prevent that specific biodiversity threat.
5. I will use the Engineering design process to design a solution to defend an endangered species (plant or animal).