A Planned Course Statement
for
Biology 1, Honors

<table>
<thead>
<tr>
<th>Course #</th>
<th>Grades</th>
<th>Department</th>
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<tbody>
<tr>
<td>#402</td>
<td>9-10</td>
<td>Science</td>
</tr>
</tbody>
</table>

Length of Period (mins): 40 mins
Total Clock Hours: 140
Periods per Cycle: 7
Length of Course (years): 1 year
Type of Offering: Elective
Credit: 1.2
Adopted: May 2014

Developed by:
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Tracy Dreher
Rachel Kramer
Corinna Kramer-Hinks
Kelly Musselman
Description of Course:

Course Title: Biology 1, Honors

Description: This course is designed for students who have a strong interest in science and have demonstrated outstanding achievement in previous science courses. The students’ understanding and appreciation for the living world will be enhanced through the study of the concepts involved in cell theory, classification, ecology, heredity, and molecular genetics. The development and applications of biotechnology will be discussed in the context of their impact on the living world. An in-depth experimental research project is required. During the course, students are expected to develop the skills of an independent learner.

Goals: The students will be able to...
- Describe the interdependencies that exist between all living things and the interactions that occur among them and their environment.
- Explain the fundamental life processes and characteristics shared by all living things: cells, cell processes, energy relationships, and genetics.
- Describe speciation using their understanding of genetic principles.
- Describe techniques and explain how biotechnology plays an increasingly important role in society.
- Write lab reports that include extensions of the class experiments.
- Gain an appreciation of the living world and their significant place in it.

Requirements: Prerequisite 84% or better in 8th grade Honors Science or recommendation of guidance counselor, or teacher/counselor approval.


Key to Levels of Achievement
(Listed with each learning objective)

- **Awareness (A)** Students are introduced to concepts, forms, and patterns.
- **Learning (L)** Students are involved in a sequence of steps and practice activities which involved further development and allow evaluation of process.
- **Understanding (U)** Students demonstrate ability to apply acquired concepts and skills to individual assignments and projects on an independent level.
- **Reinforcement (R)** Students maintain and broaden understanding of concepts and skills to accomplish tasks at a greater level of sophistication.
<table>
<thead>
<tr>
<th>Big Idea</th>
<th>Eligible Content STD or EC code</th>
<th>Grade Level</th>
<th>Concepts (What students should know)</th>
<th>Competencies (What students should be able to do)</th>
<th>Suggested Assessments</th>
<th>Suggested Learning Activities</th>
<th>Duration</th>
</tr>
</thead>
</table>
| 1. Cell and Cell Processes | Bio.A.1.1.1 Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms. | HS | - What is a living thing?  
- What characteristics do all living things share? (ch 1)  
- What are prokaryotes and eukaryotes? (ch 7) | - Define what an organism is.  
- Identify the characteristics of life shared by all organisms.  
- Compare/contrast prokaryotes and eukaryotes. (ch 7) | Test/quiz  
Lab  
Homework: On-Line Online Text | Lab  
Demonstration  
In-class activities  
Discussion | First Semester |
| 2. Cell and Cell Processes | Bio.A.1.2.1 Compare and contrast cellular structures and their functions in prokaryotic and eukaryotic cells. | HS | - How do all cellular structures, each with their unique functions, work as a collective living unit? | - Describe and identify the role and general structure of the cell nucleus, nuclear membrane, nucleolus, vacuoles, lysosomes, plasma membrane, cytoplasm, golgi apparatus, endoplasmic reticulum, mitochondria, chloroplast, cell wall, centrioles, cilia, flagella, pili, and cytoskeleton.  
- Compare/contrast prokaryotic and eukaryotic cells.  
- Compare/contrast plant and animal eukaryotic cells. | Test/quiz  
Lab  
Homework: On-Line Online Text | Lab  
Demonstration  
In-class activities  
Discussion  
Analogy | First Semester |
| 3. Cell and Cell Processes | BASIC BIOLOGICAL PRINCIPLES | Bio.A.1.2.2 Describe and interpret relationships between structure and function at various levels of biological organization (i.e., organelles, cells, tissues, organs, organ systems, and multicellular organisms). | HS | - What are the levels of biological organization? | - Construct and interpret the hierarchy of levels of biological organization from smallest to largest. | - Evaluate the levels of biological organization based upon structure and function. | - Test/quiz | - Lab | - Homework: On-Line Online Text | - Lab | - Demonstration | - In-class activities | - Discussion | First Semester |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Cells and Cell Processes | THE CHEMICAL BASIS FOR LIFE | Bio.A.2.1.1 Describe the unique properties of water and how these properties support life on Earth (e.g., freezing point, high specific heat, adhesion, cohesion, and transpiration). | HS | - How does the structure of water result in its unique properties and how it supports life on Earth? | - Define water as a solvent. | - Summarize how water’s polarity affects its properties as a solvent. | - Identify and explain properties of water (i.e. adhesion, cohesion, high specific heat, transpiration, freezing point) | - Analyze how these properties of water relate to life processes and survival of organisms. | - Test/quiz | - Lab | - Homework: On-Line Online Text | - Lab | - Demonstration | - In-class activities | - Discussion | First Semester |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Cells and Cell Processes | THE CHEMICAL BASIS FOR LIFE | Bio.A.2.2.1 Explain how carbon is uniquely suited to form biological macromolecules. | HS | - How does carbon bond with other molecules to form the molecules of life? | - Describe how the atomic properties of carbon allow it to form the skeleton of organic molecules. | - Test/quiz | - Lab | - Homework: On-Line Online Text | - Lab | - Demonstration | - In-class activities | - Discussion | First Semester |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Cells and Cell Processes | THE CHEMICAL BASIS FOR LIFE | Bio.A.2.2.2 Describe how biological macromolecules form from monomers. | HS | - How are the processes of dehydration synthesis and hydrolysis essential in the building and breakdown of biological macromolecules? | - Define and explain the relationship between a monomer and a polymer. | - Define and identify the four major biological macromolecules of life. | - Test/quiz | - Lab | - Homework: On-Line Online Text | - Lab | - Demonstration | - In-class activities | - Discussion | First Semester |
### 7. Cells and Cell Processes
**THE CHEMICAL BASIS FOR LIFE**

**Bio.A.2.2.3** Compare and contrast the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms. 

**HS**
- How are the four groups of macromolecules (i.e. carbohydrates, lipids, proteins, and nucleic acids) essential and supportive to life on Earth?
- Identify the sources from which carbohydrates, lipids, proteins, and nucleic acids can be found.
- Describe the general structure of each of the four groups of macromolecules.
- Compare and contrast the unique functions of carbohydrates, lipids, proteins, and nucleic acids in living things?

**Test/quiz**
- Lab
- Homework: On-Line Online Text

**Lab**
- Demonstration
- In-class activities
- Discussion

**First Semester**

### 8. Cells and Cell Processes
**THE CHEMICAL BASIS FOR LIFE**

**Bio.A.2.3.1** Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction.

**HS**
- How do enzymes carry out essential biochemical reactions in living things?
- Describe the specific roles enzymes play in living things.
- Explain how enzymes speed up specific biochemical reactions by lowering activation energy.
- Analyze a graphical representation of the effects of enzymes activity on chemical reactions.

**Test/quiz**
- Lab
- Homework: On-Line Online Text

**Lab**
- Demonstration
- In-class activities
- Discussion

**First Semester**

### 9. Cells and Cell Processes
**THE CHEMICAL BASIS FOR LIFE**

**Bio.A.2.3.2** Explain how factors such as pH, temperature, and concentration levels can affect enzyme function.

**HS**
- What conditions affect enzyme activity in living things?
- Identify factors such as pH, temperature, and concentration levels and how they influence enzyme activity.

**Test/quiz**
- Lab
- Homework: On-Line Online Text

**Lab**
- Demonstration
- In-class activities
- Discussion

**First Semester**

### 10. Cell and Cell Processes
**BIOENERGETICS**

**Bio.A.3.1.1** Describe the fundamental roles of plastids (e.g. chloroplasts) and mitochondria in energy transformations.

**HS**
- What roles do plastids (e.g. chloroplasts) and mitochondria play in energy transformations in living things?
- Define photosynthesis and cellular respiration.
- Differentiate between the processes that occur in chloroplasts and mitochondria?

**Test/quiz**
- Lab
- Homework: On-Line Online Text

**Lab**
- Demonstration
- In-class activities
- Discussion

**Second Semester**
<table>
<thead>
<tr>
<th>Name of the Process</th>
<th>Description of the Process</th>
<th>Skills</th>
<th>Resources</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photosynthesis and Cellular Respiration</td>
<td>Summarize the processes and identify the end product(s) of photosynthesis and cellular respiration as they occur in plants and animals. Explain the relationship between photosynthesis and cellular respiration in plants.</td>
<td>HS</td>
<td>Test/quiz, Lab, Homework: On-Line Online Text</td>
<td>Second Semester</td>
</tr>
<tr>
<td>Photosynthesis and Cellular Respiration</td>
<td>Describe where the energy for all life come from? How do potential energy, kinetic energy, and thermal energy transform through the processes of photosynthesis and cellular respiration? What are the parts/stages of photosynthesis and cellular respiration? Describe the role of the sun with respect to energy in all living things. Differentiate between different types of energy (potential, kinetic, and thermal) and relate them to photosynthesis and cellular respiration. Describe the role of glucose in organisms. Define glycolysis, Krebs cycle, electron transport chain, light reaction and Calvin cycle.</td>
<td>HS</td>
<td>Test/quiz, Lab, Homework: On-Line Online Text</td>
<td>Second Semester</td>
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<td>ATP in Biochemical Reactions</td>
<td>Describe the role of ATP in biochemical reactions.</td>
<td>HS</td>
<td>Test/quiz, Lab, Homework: On-Line Online Text</td>
<td>Second Semester</td>
</tr>
<tr>
<td>13. Cells and Cell Processes</td>
<td>HOMEOSTASIS AND TRANSPORT</td>
<td>BIO.A.4.1.1 Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell.</td>
<td>HS</td>
<td>• What is the function of the cell membrane? (ch 7)</td>
</tr>
<tr>
<td>14. Cells and Cell Processes</td>
<td>HOMEOSTASIS AND TRANSPORT</td>
<td>BIO.A.4.1.2 Compare and contrast the mechanisms that transport materials across the plasma membrane (i.e., passive transport -- diffusion, osmosis, facilitated diffusion; active transport -- pumps, endocytosis, exocytosis).</td>
<td>HS</td>
<td>• What is passive transport? (ch 7)</td>
</tr>
<tr>
<td>15. Cells and Cell Processes</td>
<td>HOMEOSTASIS AND TRANSPORT</td>
<td>BIO.A.4.1.3 Describe how membrane-bound cellular organelles (e.g., endoplasmic reticulum, Golgi apparatus) facilitate the transport of materials within a cell.</td>
<td>HS</td>
<td>• What organelles help make and transport proteins? (ch 7)</td>
</tr>
<tr>
<td>16. Cells and Cell Processes</td>
<td>HOMEOSTASIS AND TRANSPORT</td>
<td>BIO.A.4.2.1 Explain how organisms maintain homeostasis (e.g., thermoregulation, water regulation, oxygen regulation).</td>
<td>HS</td>
<td>• How do individual cells maintain homeostasis? (ch 7)</td>
</tr>
</tbody>
</table>
| 17. Continuity and Unity of Life | CELL GROWTH & REPRODUCTION | BIO.B.1.1.1 Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis. | HS | - Describe the significant events in Prophase, Metaphase, Anaphase and Telophase/Cytokinesis  
- (ch 9 iguana)  
- Summarize the major events that occur during each phase of mitosis.  
- Explain how cytokinesis differs in plant and animal cells | - Test/quiz  
- Lab  
- Homework: On-Line Online Text | - Lab  
- Demonstration  
- In-class activities  
- Discussion | First Semester |
| 18. Continuity and Unity of Life | CELL GROWTH & REPRODUCTION | BIO.B.1.1.2 Compare and contrast the processes and outcomes of mitotic and meiotic nuclear divisions. | HS | - What are the processes of mitosis and meiosis used for?  
- Compare/contrast mitosis and meiosis.  
- Relate haploid and diploid structures in organisms.  
- Describe the main phases involved including chromosome number, # of cells at the beginning and end, names of the resulting cells, location, and functions. | - Test/quiz  
- Lab  
- Homework: On-Line Online Text | - Lab  
- Demonstration  
- In-class activities  
- Discussion | First Semester |
| 19. Continuity and Unity of Life | CELL GROWTH & REPRODUCTION | BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information. | HS | - What is the purpose of DNA replication in the cell?  
- Identify the structures of DNA and how complementary base pairing occurs in DNA.  
- Formulate the importance of DNA replication.  
- Outline the steps of DNA replication and its result.  
- Explain how the process of DNA Replication is semi-conservative in nature. | - Test/quiz  
- Lab  
- Homework: On-Line Online Text | - Lab  
- Demonstration  
- In-class activities  
- Discussion | First Semester |
| 20. Continuity and Unity of Life | CELL GROWTH & REPRODUCTION | BIO.B.1.2.2 Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in | HS | - How are genes and chromosomes inherited?  
- Construct a flowchart summarizing the functional relationship between DNA, genes, and chromosomes as part of inheritance. | - Test/quiz  
- Lab  
- Homework: On-Line Online Text | - Lab  
- Demonstration  
- In-class activities  
- Discussion | First Semester |
| 21. Continuity and Unity of Life | BIO.B.2.1.1 Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, codominance, incomplete dominance, sex-linked, polygenic, and multiple alleles). | HS | - How are Mendelian and Non-Mendelian patterns of inheritance predicted? | - Define dominant, recessive, homozygous, heterozygous, allele, phenotype and genotype. | - Explain Mendel’s Principles of Dominance, Independent Assortment, and Segregation. | - Demonstrate how a Punnett Square is used to predict outcomes in crossing of two parents. | - Identify how alleles interact in intermediate inheritance. | - Describe inheritance patterns involving multiple alleles. | - Analyze how polygenic inheritance results in a wide range of phenotypes. | - Explain how the difference in the structures of the X and Y chromosomes result in different inheritance patterns in males and females. | - Describe how environmental conditions can affect phenotypic expression. | - Test/quiz | - Lab | - Homework: On-Line Online Text | - Lab | - Demonstration | - In-class activities | - Discussion | First Semester | - Online Text | - Demonstration | - Lab | - Online Text | - Lab | - Demonstration | - In-class activities | - Discussion | First Semester |
| 22. Continuity and Unity of Life | BIO.B.2.1.2 Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, | HS | - What are the effects of errors in meiosis? | - Explain the effects of crossing over and nondisjunction in Meiosis I and Meiosis II. | - Test/quiz | - Lab | - Homework: On-Line Online Text | - Lab | - Demonstration | - In-class activities | - Discussion | First Semester | - Online Text | - Demonstration | - Lab | - Online Text | - Lab | - Demonstration | - In-class activities | - Discussion | First Semester |
nondisjunction, duplication, translocation, deletion, insertion, and inversion).

<table>
<thead>
<tr>
<th>23. Continuity and Unity of Life</th>
<th>BIO.B.2.2.1 Describe how the processes of transcription and translation are similar in all organisms.</th>
<th>HS</th>
<th>Test/quiz, Lab, Homework: On-Line Online Text, Lab, Demonstration, In-class activities, Discussion</th>
<th>First Semester</th>
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<tbody>
<tr>
<td></td>
<td>chromosomes?</td>
<td>• Compare and contrast the different types of chromosomal damage such as duplication, deletion, insertion, inversion, and translocation and give examples of disorders in which this occurs.</td>
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<td></td>
<td>What is the central dogma of molecular biology?</td>
<td>• Trace the information flow from DNA to protein including the processes of transcription and translation.</td>
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<td>What are the steps involved in making a protein?</td>
<td>• List the three main types of RNA and describe what they do.</td>
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<td>• Compare and contrast RNA and DNA.</td>
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<td>• Explain the relevance of a triplet code.</td>
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<td>• Discuss why the genetic code is universal.</td>
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<td>• Define the following terms:</td>
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<td>o RNA polymerase</td>
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<td>o translation</td>
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<td>• Utilize an mRNA codon chart to identify amino acids specified by codons to produce a polypeptide.</td>
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<tr>
<td>Topic</td>
<td>BIO.B.2.2.2</td>
<td>Description of roles of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins.</td>
<td>HS</td>
<td>How are specific types of proteins produced in a cell?</td>
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<tr>
<td>Topic</td>
<td>BIO.B.2.3.1</td>
<td>Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).</td>
<td>HS</td>
<td>What are mutations?</td>
</tr>
<tr>
<td>Topic</td>
<td>BIO.B.2.4.1</td>
<td>Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g., selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy).</td>
<td>HS</td>
<td>What is the impact of genetic engineering in real world applications?</td>
</tr>
<tr>
<td>27. Continuity and Unity of Life</td>
<td>BIO.B.3.1.1 Explain how natural selection can impact allele frequencies of a population.</td>
<td>HS</td>
<td>• What is natural selection?</td>
<td>• Define the terms adaptation, natural selection, evolution, gene pool, allele frequencies, and population.</td>
</tr>
<tr>
<td>28. Continuity and Unity of Life</td>
<td>BIO.B.3.1.2 Describe the factors that can contribute to the development of new species (e.g., isolating mechanisms, genetic drift, founder effect, migration).</td>
<td>HS</td>
<td>• How are new species formed? (Ch17)</td>
<td>• Define the biological species concept.</td>
</tr>
<tr>
<td>29. Continuity and Unity of Life</td>
<td>THEORY OF EVOLUTION</td>
<td>BIO.3.1.3 Explain how genetic mutations may result in genotypic and phenotypic variations within a population.</td>
<td>HS</td>
<td>How do genetic mutations lead to genetic variation in terms of evolution?</td>
</tr>
<tr>
<td>30. Continuity and Unity of Life</td>
<td>THEORY OF EVOLUTION</td>
<td>BIO.3.2.1 Interpret evidence supporting the theory of evolution (i.e., fossil, anatomical, physiological, embryological, biochemical, and universal genetic code).</td>
<td>HS</td>
<td>What are the main pieces of scientific evidence that support Darwin's theory of evolution by natural selection? (Ch 16.4)</td>
</tr>
<tr>
<td>31. Continuity and Unity of Life</td>
<td>ECOLOGY</td>
<td>BIO.A.3.3.1 Distinguish among the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation.</td>
<td>HS</td>
<td>How do the aspects of the scientific process make it successful?</td>
</tr>
<tr>
<td>32. Continuity and Unity of Life</td>
<td>ECOLOGY</td>
<td>BIO.4.1.1 Describe the levels of ecological organization (i.e., organism, population, community, ecosystem, biome, biosphere).</td>
<td>HS</td>
<td>● What are the levels of ecological organization?</td>
</tr>
<tr>
<td>33. Continuity and Unity of Life</td>
<td>ECOLOGY</td>
<td>BIO.B.4.1.2 Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems.</td>
<td>HS</td>
<td>● What is the difference between biotic and abiotic factors?</td>
</tr>
<tr>
<td>34. Continuity and Unity of Life</td>
<td>ECOLOGY</td>
<td>BIO.B.4.2.1 Describe how energy flows through an ecosystem (e.g., food chains, food webs, energy pyramids).</td>
<td>HS</td>
<td>● How does energy flow through an ecosystem?</td>
</tr>
</tbody>
</table>
| 35. Continuity and Unity of Life | Bio.B.4.2.2 Describe biotic interactions in an ecosystem (e.g., competition, predation, symbiosis). | HS | • How do organisms interact in an ecosystem?  
• What is symbiosis? | • Test/quiz  
• Lab  
• Homework: On-Line  
Online Text | Lab  
Demonstration  
In-class activities  
Discussion | Second Semester |
|---|---|---|---|---|---|---|
| 36. Continuity and Unity of Life | BIO.B.4.2.3 Describe how matter recycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle, nitrogen cycle). | HS | • How does matter move through the biosphere? | • Test/quiz  
• Lab  
• Homework: On-Line  
Online Text | Lab  
Demonstration  
In-class activities  
Discussion | Second Semester |
| 37. Continuity and Unity of Life | BIO.B.4.2.4 Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires). | HS | • How do human activities impact ecosystems?  
• Compare primary and secondary succession? | • Test/quiz  
• Lab  
• Homework: On-Line  
Online Text | Lab  
Demonstration  
In-class activities  
Discussion | Second Semester |
| 38. Continuity and Unity of Life | BIO. B.4.2.5 Describe the effects of limiting factors on population dynamics and potential species extinction | HS | • What is the role of limiting factors in controlling population growth? | • Test/quiz  
• Lab  
• Homework: On-Line  
Online Text | Lab  
Demonstration  
In-class activities | Second Semester |
| What are density-dependent and density-independent limiting factors? | Compare and contrast exponential (J) and logistic (S) growth curves. | Explain the difference between density-independent and density-dependent limiting factors. | Relate the role of limiting factors to carrying capacity. | Online Text | Discussion |

**Materials and Resources:**