Biology is a comprehensive Life Science course that includes Cell Biology, Genetics, Anatomy & Physiology, Plant Biology, Ecology, Evolution, and Investigation & Experimentation. This course is assessed locally using the materials contained within, and by the California Standardized Test. This class is a 10 unit, year-long college-preparatory course created by TRUSD teachers for use at the High School level. Explicit instruction in Reading and Writing will be incorporated in preparation for the coming of the Common Core Standards. Students will be provided access to a wide variety of informational texts coming from different sources.

Included:

♦ Biology Course Outline [Syllabus]
♦ Pacing Guide
♦ Maps of Standards
♦ District Assessment Guide
♦ Appendix Section -Graphic Organizers -Table of Prefixes and Suffixes in Science
Dear TRUSD Educator,

Welcome to a new Academic Year!

This curriculum package has been created to help teachers and other instructional support personnel plan instruction and prepare students for the subject area summative assessments. Additionally, this curriculum package was written to promote high quality, standards-based instruction in all core subject areas.

Included you will find: Expected Learning Outcomes, Course Outline [may be printed and distributed to teachers], Unpacked Standards [to help establish the breadth and depth to which each content standard must be addressed], District Assessment Guides, Sample pacing calendars, and an appendix. The appendix (a separate section) contains a selection of helpful, subject-specific, instructional resources.

Curriculum development is a continuous process. As such, these packages are subject to periodic revisions to reflect possible changes in student population and future amendments as the State Educational Frameworks are being rewritten. Through the hard work and commitment of passionate educators over many years, this curriculum package was made a reality. This document reflects the common vision of these dedicated educators.

For questions about any section of this package, or to offer comments and suggestions for improvements, please contact the Curriculum and Instruction Office, Secondary Division.

Thank you.

Curriculum and Instruction
Secondary Division
Bay C, TRUSD District Office
McClellan, CA 95652
916-566-1600
1.0 COURSE DESCRIPTION:
This course fulfills the Life Science graduation requirements as well as the University of California’s ‘A→G’ requirement as a Life Science Laboratory Course. This Comprehensive Biology course includes the topics of ecology, cell biology, genetics, evolution, anatomy and physiology, current research, and bioethics. Students will work individually and in small groups. Inquiry-based laboratory investigations are an integral part of the Course. Explicit instruction in reading and writing will be incorporated in preparation for the coming of the Common Core Standards. Students will be provided access to a wide variety of informational texts coming from different sources.

2.0 COURSE GOALS:
At the end of this year-long course, students will...
- achieve a practical knowledge of laboratory skills
- be able to design experiments to solve problems solve using the scientific method
- gain an understanding and appreciation of the relationship between organisms and their environment.
- understand the relationship between structure and function at the cellular and organism levels
- be able to explain the processes of photosynthesis, cellular respiration and protein synthesis
- be able to explain how genetic traits are inherited
- understand how evolution can explain the diversity of organisms on Earth, and
- be able to explain how populations of species have changed over time

3.0 Textbook:
4.0 Supplementary Materials:
Supplementary materials provided by the publisher including the lab manual and teacher’s edition of the textbook, and various electronic resources.
Electronic Resources available at: www.ca.biologygmh.com

5.0 California Content Standards

<table>
<thead>
<tr>
<th>Standard Cluster 1: Cell Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism’s cells. As a basis for understanding this concept:</td>
</tr>
<tr>
<td>a. Students know cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.</td>
</tr>
<tr>
<td>b. Students know enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings.</td>
</tr>
<tr>
<td>c. Students know how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure.</td>
</tr>
<tr>
<td>d. Students know the central dogma of molecular biology outlines the flow of information from transcription of ribonucleic acid (RNA) in the nucleus to translation of proteins on ribosomes in the cytoplasm.</td>
</tr>
<tr>
<td>e. Students know the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins.</td>
</tr>
<tr>
<td>f. Students know usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide.</td>
</tr>
<tr>
<td>g. Students know the role of the mitochondria in making stored chemical-bond energy available to cells by completing the breakdown of glucose to carbon dioxide.</td>
</tr>
<tr>
<td>h. Students know most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.</td>
</tr>
<tr>
<td>i.* Students know how chemiosmotic gradients in the mitochondria and chloroplast store energy for ATP production.</td>
</tr>
<tr>
<td>j.* Students know how eukaryotic cells are given shape and internal organization by a cytoskeleton or cell wall or both.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard Set 2: Sexual Reproduction and Meiosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Mutation and sexual reproduction lead to genetic variation in a population. As a basis for understanding this concept:</td>
</tr>
<tr>
<td>a. Students know meiosis is an early step in sexual reproduction in which the pairs of chromosomes separate and segregate randomly during cell division to produce gametes containing one chromosome of each type.</td>
</tr>
<tr>
<td>b. Students know only certain cells in a multicellular organism undergo meiosis.</td>
</tr>
<tr>
<td>c. Students know how random chromosome segregation explains the probability that a particular allele will be in a gamete.</td>
</tr>
<tr>
<td>d. Students know new combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization).</td>
</tr>
<tr>
<td>e. Students know why approximately half of an individual’s DNA sequence comes from each parent.</td>
</tr>
<tr>
<td>f. Students know the role of chromosomes in determining an individual’s sex.</td>
</tr>
<tr>
<td>g. Students know how to predict possible combinations of alleles in a zygote from the genetic makeup of the parents.</td>
</tr>
</tbody>
</table>
### Standard Set 3: Mendelian and Modern Genetics

3. A multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization. As a basis for understanding this concept:

| a. Students know how to predict the probable outcome of phenotypes in a genetic cross from the genotypes of the parents and mode of inheritance (autosomal or X-linked, dominant or recessive). |
| b. Students know the genetic basis for Mendel’s laws of segregation and independent assortment. |
| c. Students know how to predict the probable mode of inheritance from a pedigree diagram showing phenotypes. |
| d. Students know how to use data on frequency of recombination at meiosis to estimate genetic distances between loci and to interpret genetic maps of chromosomes. |

### Standard Set 4: Molecular Genetics

4. Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:

| a. Students know the general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA. |
| b. Students know how to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA. |
| c. Students know how mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in an encoded protein. |
| d. Students know specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves. |
| e. Students know proteins can differ from one another in the number and sequence of amino acids. |
| f. Students know why proteins having different amino acid sequences typically have different shapes and chemical properties. |

### Standard Set 5: Biotechnology/Genetic Engineering

5. The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept:

| a. Students know the general structures and functions of DNA, RNA, and protein. |
| b. Students know how to apply base-pairing rules to explain precise copying of DNA during semiconservative replication and transcription of information from DNA into mRNA. |
| c. Students know how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products. |
| d. Students know how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation, and transformation) is used to construct recombinant DNA molecules. |
| e. Students know how exogenous DNA can be inserted into bacterial cells to alter their genetic makeup and support expression of new protein products. |

### Standard Set 6: Ecology

6. Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:

| a. Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats. |
| b. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size. |
| c. Students know how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death. |
| d. Students know how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration. |
| e. Students know a vital part of an ecosystem is the stability of its producers and decomposers. |
f. *Students know* at each link in a food web some energy is stored in newly made structures but much energy is dissipated into the environment as heat. This dissipation may be represented in an energy pyramid.

g.* *Students know* how to distinguish between the accommodation of an individual organism to its environment and the gradual adaptation of a lineage of organisms through genetic change.

<table>
<thead>
<tr>
<th>Standard Set 7: Evolution [Variation in the Gene Pool]</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time. As a basis for understanding this concept:</td>
</tr>
<tr>
<td>a. <em>Students know</em> why natural selection acts on the phenotype rather than the genotype of an organism.</td>
</tr>
<tr>
<td>b. <em>Students know</em> why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool.</td>
</tr>
<tr>
<td>c. <em>Students know</em> new mutations are constantly being generated in a gene pool.</td>
</tr>
<tr>
<td>d. <em>Students know</em> variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.</td>
</tr>
<tr>
<td>e.* <em>Students know</em> the conditions for Hardy-Weinberg equilibrium in a population and why these conditions are not likely to appear in nature.</td>
</tr>
<tr>
<td>f.* <em>Students know</em> how to solve the Hardy-Weinberg equation to predict the frequency of genotypes in a population, given the frequency of phenotypes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard Set 8: Evolution [Natural Selection and Speciation, Evidences]</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept:</td>
</tr>
<tr>
<td>a. <em>Students know</em> how natural selection determines the differential survival of groups of organisms.</td>
</tr>
<tr>
<td>b. <em>Students know</em> a great diversity of species increases the chance that at least some organisms survive major changes in the environment.</td>
</tr>
<tr>
<td>c. <em>Students know</em> the effects of genetic drift on the diversity of organisms in a population.</td>
</tr>
<tr>
<td>d. <em>Students know</em> reproductive or geographic isolation affects speciation.</td>
</tr>
<tr>
<td>e. <em>Students know</em> how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.</td>
</tr>
<tr>
<td>f.* <em>Students know</em> how to use comparative embryology, DNA or protein sequence comparisons, and other independent sources of data to create a branching diagram (cladogram) that shows probable evolutionary relationships.</td>
</tr>
<tr>
<td>g.* <em>Students know</em> how several independent molecular clocks, calibrated against each other and combined with evidence from the fossil record, can help to estimate how long ago various groups of organisms diverged evolutionarily from one another.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard Set 9: Physiology [Homeostatic Controls]</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment. As a basis for understanding this concept:</td>
</tr>
<tr>
<td>a. <em>Students know</em> how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.</td>
</tr>
<tr>
<td>b. <em>Students know</em> how the nervous system mediates communication between different parts of the body and the body’s interactions with the environment.</td>
</tr>
<tr>
<td>c. <em>Students know</em> how feedback loops in the nervous and endocrine systems regulate conditions in the body.</td>
</tr>
<tr>
<td>d. <em>Students know</em> the functions of the nervous system and the role of neurons in transmitting electrochemical impulses.</td>
</tr>
<tr>
<td>e. <em>Students know</em> the roles of sensory neurons, interneurons, and motor neurons in sensation, thought, and response.</td>
</tr>
</tbody>
</table>
### Standard Set 10: Physiology [Immune System]

10. Organisms have a variety of mechanisms to combat disease. As a basis for understanding the human immune response:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td><strong>Students know</strong> the role of the skin in providing nonspecific defenses against infection.</td>
</tr>
<tr>
<td>b.</td>
<td><strong>Students know</strong> the role of antibodies in the body’s response to infection.</td>
</tr>
<tr>
<td>c.</td>
<td><strong>Students know</strong> how vaccination protects an individual from infectious diseases.</td>
</tr>
<tr>
<td>d.</td>
<td><strong>Students know</strong> there are important differences between bacteria and viruses with respect to their requirements for growth and replication, the body’s primary defenses against bacterial and viral infections, and effective treatments of these infections.</td>
</tr>
<tr>
<td>e.</td>
<td><strong>Students know</strong> why an individual with a compromised immune system (for example, a person with AIDS) may be unable to fight off and survive infections by microorganisms that are usually benign.</td>
</tr>
<tr>
<td>f.*</td>
<td><strong>Students know</strong> the roles of phagocytes, B-lymphocytes, and T-lymphocytes in the immune system.</td>
</tr>
</tbody>
</table>

### Standard Set 11: Investigation and Experimentation

1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.</td>
</tr>
<tr>
<td>b.</td>
<td>Identify and communicate sources of unavoidable experimental error.</td>
</tr>
<tr>
<td>c.</td>
<td>Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.</td>
</tr>
<tr>
<td>d.</td>
<td>Formulate explanations by using logic and evidence.</td>
</tr>
<tr>
<td>e.</td>
<td>Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.</td>
</tr>
<tr>
<td>f.</td>
<td>Distinguish between hypothesis and theory as scientific terms.</td>
</tr>
<tr>
<td>g.</td>
<td>Recognize the usefulness and limitations of models and theories as scientific representations of reality.</td>
</tr>
<tr>
<td>i.</td>
<td>Analyze the locations, sequences, or time intervals that are characteristic of natural phenomena (e.g., relative ages of rocks, locations of planets over time, and succession of species in an ecosystem).</td>
</tr>
<tr>
<td>j.</td>
<td>Recognize the issues of statistical variability and the need for controlled tests.</td>
</tr>
<tr>
<td>k.</td>
<td>Recognize the cumulative nature of scientific evidence.</td>
</tr>
<tr>
<td>l.</td>
<td>Analyze situations and solve problems that require combining and applying concepts from more than one area of science.</td>
</tr>
<tr>
<td>m.</td>
<td>Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California.</td>
</tr>
</tbody>
</table>

### Target Common Core Standards (ELA)

**Reading**

1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Writing: 1. Write arguments focused on discipline-specific content.

- a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.

- b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.

- c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

- d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

- e. Provide a concluding statement or section that follows from or supports the argument presented.

Note: Standards marked with [*] are not assessed in SASA.

### 6.0 Suggested Instructional Strategies and Alternative Assessment Options

<table>
<thead>
<tr>
<th>Instructional Strategies</th>
<th>Assessment Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer assisted learning</td>
<td>Assignments/Homework</td>
</tr>
<tr>
<td>Cooperative Learning Groups</td>
<td>Class participation</td>
</tr>
<tr>
<td>Debates</td>
<td>Graded discussion</td>
</tr>
<tr>
<td>Demonstrations</td>
<td>In-class essays</td>
</tr>
<tr>
<td>Discussion</td>
<td>In-class participation</td>
</tr>
<tr>
<td>Explicit Direct Instruction</td>
<td>Interactive notebooks</td>
</tr>
<tr>
<td>Field trips</td>
<td>District Assessments [SASA]</td>
</tr>
<tr>
<td>Graphic organizers</td>
<td>Laboratory Reports</td>
</tr>
<tr>
<td>Guest speakers</td>
<td>Oral presentations</td>
</tr>
<tr>
<td>Independent practice</td>
<td>Peer Evaluation</td>
</tr>
<tr>
<td>Individual and or group projects</td>
<td>Projects</td>
</tr>
<tr>
<td>Interactive media [e.g. Videoconferencing]</td>
<td>Publications</td>
</tr>
<tr>
<td>Internet activities</td>
<td>Research papers</td>
</tr>
<tr>
<td>Jigsaw activities</td>
<td>Self-evaluation</td>
</tr>
<tr>
<td>Laboratory Investigations</td>
<td>Posters/Scientific Poster Papers</td>
</tr>
<tr>
<td>Manipulative activities</td>
<td>Student publications and newspapers</td>
</tr>
<tr>
<td>Modeling</td>
<td>Web-based tests and quizzes</td>
</tr>
<tr>
<td>Oral presentation</td>
<td></td>
</tr>
<tr>
<td>Pair-share activities</td>
<td></td>
</tr>
<tr>
<td>Peer teaching</td>
<td></td>
</tr>
<tr>
<td>Posters/displays</td>
<td></td>
</tr>
<tr>
<td>Projects</td>
<td></td>
</tr>
<tr>
<td>Reciprocal teaching</td>
<td></td>
</tr>
<tr>
<td>Research projects</td>
<td></td>
</tr>
<tr>
<td>Role playing and dramatization</td>
<td></td>
</tr>
<tr>
<td>Whole Group Instruction and discussion</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** A list of varied formative assessments with descriptions and examples can be found in the Appendix Section.
## 2013-2014 BIOLOGY PACING GUIDE & ASSESSMENT CALENDAR

| M | T | W | Th | F | M | T | W | Th | F | M | T | W | Th | F | M | T | W | Th | F | Total Days |
|---|---|---|----|---|---|---|---|----|---|---|---|---|----|---|---|---|----|---|---|---|---|---|---|---|

### August

- **August 26** - **September 5**
  - Unit 1: Introduction to Biology and Cell Biology

- **September 2** - **September 5**
  - Unit 1: Introduction to Biology and Cell Biology

### September

- **September 2** - **September 5**
  - Unit 1: Introduction to Biology and Cell Biology

### October

- **October 1** - **October 31**
  - Unit 2: Molecular Genetics
  - Unit 3: Genetics of Inheritance

### November

- **November 1** - **November 30**
  - Unit 3: Genetics of Inheritance
  - Thanksgiving Break

### December

- **December 2** - **December 31**
  - Unit 3: Genetics of Inheritance
  - Winter Break

### January

- **January 2** - **January 31**
  - Winter Break
  - Unit 4: Evolution

### February

- **February 3** - **February 28**
  - Unit 4: Evolution
  - Presidents' Week
  - Unit 5: Anatomy and Physiology

### March

- **March 3** - **March 31**
  - Unit 5: Anatomy and Physiology
  - Spring Recess
  - Unit 6: Ecology

### April

- **April 1** - **April 30**
  - Unit 5: Anat and Phys
  - Spring Recess
  - Unit 6: Ecology

### May

- **May 1** - **May 31**
  - Unit 6: CST Week
  - Unit 6: Ecology

### June

- **June 2** - **June 30**
  - Unit 6: Ecology

### End of Semester:

- **Semester 1**
  - 20-Dec

- **Semester 2**
  - 27-Jun

### September PD Days

- **20-Sep**
  - Foothill
  - Rio Linda

- **27-Sep**
  - Grant/Del Paso
  - North Highlands

### Vacation Days/Holidays

- **Thanksgiving**
  - November 25-29

- **Winter Break**
  - Dec 23 - Jan 3

- **Presidents' Week**
  - February 17-21

- **Spring Recess**
  - April 14-21

---

**Ends of Semesters**

- **Semester 1**
  - 20-Dec

- **Semester 2**
  - 27-Jun

---

**Total Days**

- **176**
### BIOLOGY PACING GUIDE
#### 2013-2014

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>Standards</th>
<th># of Weeks</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>Introduction to Biology and Cell Biology</td>
<td>Standard Set 1</td>
<td>6 weeks</td>
<td>August 15 – September 27&lt;br&gt;<strong>Testing Window:</strong> September 23-27</td>
</tr>
<tr>
<td>U2</td>
<td>Molecular Genetics</td>
<td>Standard Set 4 Standard Set 5</td>
<td>5 weeks</td>
<td>September 30 – Oct 31&lt;br&gt;<strong>Testing Window:</strong> October 28-31</td>
</tr>
<tr>
<td>U3</td>
<td>Genetics of Inheritance</td>
<td>Standard Set 2 Standard Set 3</td>
<td>6 weeks</td>
<td>November 1 – Dec 20&lt;br&gt;<strong>Testing Window:</strong> December 16-20</td>
</tr>
<tr>
<td>U4</td>
<td>Evolution</td>
<td>Standard Set 7 Standard Set 8</td>
<td>6 weeks</td>
<td>January 6 – Feb 14&lt;br&gt;<strong>Testing Window:</strong> Feb 10-14</td>
</tr>
<tr>
<td>U5</td>
<td>Anatomy and Physiology</td>
<td>Standard Set 9 Standard Set 10</td>
<td>7 weeks</td>
<td>February 24 – April 11&lt;br&gt;<strong>Testing Window:</strong> April 7-11</td>
</tr>
<tr>
<td>U6</td>
<td>Ecology</td>
<td>Standard Set 6</td>
<td>7 weeks</td>
<td>April 22 – June 12&lt;br&gt;<strong>Testing Window:</strong> June 9-12</td>
</tr>
</tbody>
</table>

* I and E standards will be addressed throughout the year and will be assessed at the end of the year.
1a. Students know cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings.

1b. Students know enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings.

1c. Students know how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure.

1d. Students know the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins.

1e. Students know usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide.

1f. Students know the role of the mitochondria in making stored chemical-bond energy available to cells by completing the breakdown of glucose to carbon dioxide.

1g. Students know how macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.

2a. Students can explain what catalysts [and enzymes] are and discuss their mechanism of action.

2b. Students can identify the different factors that affect enzymatic rate of action.

2c. Students can analyze a graph describing enzymatic rate of action, identifying different parts of the curve [activation energy, for e.g.].

2d. Students can discuss how denaturation alters an enzyme's shape as well as its function.

2e. Students can differentiate between rough and smooth endoplasmic reticulum.

2f. Students can trace the path of proteins from manufacture to transport to modification to packaging to secretion.

2g. Students can explain the general equation of photosynthesis and identify the reactants and products.

3a. Students can discuss the important events that happen during the light reactions and Calvin-Benson Cycle.

3b. Students can describe the internal structure of the chloroplast.

3c. Students can discuss a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

3d. Students can analyze a graph describing enzymatic rate of action.

3e. Students can identify why a virus is considered non-living and describe its basic structure.

3f. Students can compare and contrast the different classes of biomolecules in terms of composition, structure, and cellular function/s.

3g. Students can compare and contrast between plant and animal cells.

3h. Students can describe the structure of the endoplasmic reticulum and Golgi apparatus.

3i. Students can describe the internal structure of the mitochondrion [cristae].

3j. Students can identify the different stages involved in cellular respiration.

Reading
1. Write arguments focused on discipline-specific content. (See unit 3)

2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Writing
1. Write arguments focused on discipline-specific content. (See unit 3)
5a. Students know the chemical structure of DNA, RNA, and protein.

5b. Students know how to apply base-pairing rules to explain precise copying of DNA during semi-conservative replication and transcription of information from DNA into mRNA.

5c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

5d. Students know the general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA.

4a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.

4b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.

4c. Students know how mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in the encoded protein.

4d. Students can differentiate between DNA transcription in prokaryotes and eukaryotes [In prokaryotes, an mRNA chain is transcribed as a continuous chain while in eukaryotes, non-coding sequences called introns – as opposed to exons – exist]. Before translation, the mRNA transcript is processed to remove all introns.

4e. Students know how mutations can occur [insertion or deletion of a base in DNA or when bases are incorrectly matched].

4f. Students can give examples of the results of mutations [cancers or such diseases as Tay-Sachs, sickle cell anemia, and Duchenne muscular dystrophy].

1. Students discuss the structure of a DNA molecule, which consists of two strands. The strands are held together by hydrogen bonds between the bases A-T and G-C.


3. Students can describe the structure of RNA as a single-stranded molecule consisting of the same A, G, C, & T nucleotides but with Uracil instead of Thymine.

4. Students can explain why DNA replication is described as “semi-conservative.”

5. Students can identify the two different types of RNA [mRNA and tRNA] and describe their functions.

6. Students can describe the initial step in DNA replication as involving “unzipping” of the DNA to form two separate strands.

7. Students can explain how a polypeptide chain is transcribed as a continuous chain.

8. Students can give examples of the results of mutations [cancers or such diseases as muscular dystrophy].

9. Students can describe how mutations occur in somatic cells [often undetected] or in gametes.

10. Students can describe how mutations affect the expression of the gene or the sequence of amino acids in the encoded protein.

11. Students can differentiate between DNA transcription in prokaryotes and eukaryotes [In prokaryotes, an mRNA chain is transcribed as a continuous chain while in eukaryotes, non-coding sequences called introns – as opposed to exons – exist]. Before translation, the mRNA transcript is processed to remove all introns.

12. Students can give examples of the results of mutations [cancers or such diseases as Tay-Sachs, sickle cell anemia, and Duchenne muscular dystrophy].

Writing: Write arguments focused on discipline-specific content.

- Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
- Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
- Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- Provide a concluding statement or section that follows from or supports the argument presented.
Unit 3 Map of Key and Unpacked Standards

Mendelian and Modern Genetics
# of Days of Instruction = 6 weeks

Students will discuss the role of meiosis, segregation, and independent assortment of chromosomes within gametes during sexual reproduction and how this leads to genetic variation in populations. [CCS 2a, 2b, 2c, 3b].

1. Students should be able to create a flow chart identifying and describing the different stages of meiosis.
2. Students should be able to apply the laws of segregation and independent assortment to the steps in meiosis and explain the reduction in chromosome number.
3. Students should be able to explain how sexual reproduction results in genetic variation.

Students will explain how genotype influences phenotype and predict probable outcomes of crosses involving various modes of inheritance using Punnett Squares and pedigree charts. [CCS 2g, 3a, 3c].

1. Students will differentiate genotype from phenotype and give examples using common traits.
2. Students will predict the genotypic and phenotypic outcomes [F1 and F2] of monohybrid and dihybrid crosses using Punnett squares [in various modes of inheritance: autosomal dominance, sex-linked, etc].
3. Students will create [and analyze] pedigree charts that describe inheritance of certain traits [or diseases such as PKU, Tay-Sachs].

Students will explain how the union of gametes during fertilization generates a zygote that can develop into a multi-cellular organism. [CCS 2d, 2e].

1. Students can create a diagram [or analyze one] describing the event of fertilization.
2. Students can discuss how a zygote derives half of its DNA from each parent.
3. Students can explain how all the specialized cells in a multi-cellular organism originated from the zygote.

Students know the role of chromosomes in determining an individual's sex. [CCS 2f].

1. Students can identify the two kinds of chromosomes present in human somatic cells [homologous and sex chromosomes].
2. Students can describe that human somatic cells in females carry the XX pair while males carry the XY pair.

Target Common Core Standards (ELA)

Reading
1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Writing: 1. Write arguments focused on discipline-specific content.
   a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
   b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
   c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
   d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
   e. Provide a concluding statement or section that follows from or supports the argument presented.

NOTE: Target Common Core Standards (ELA) are the same for all units.
Unit 4 Map of Key and Unpacked Standards

Target Common Core Standards (ELA)

Reading
1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Writing
1. Write arguments focused on discipline-specific content.
   a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
   b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
   c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
   d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
   e. Provide a concluding statement or section that follows from or supports the argument presented.

Evolution and Natural Selection

- Standard Sets 7 & 8-

7a. Students know why natural selection acts on the phenotype rather than the genotype of an organism.
7b. Students know why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus, maintained in the gene pool.
7c. Students know new mutations are constantly being generated in a gene pool.
7d. Students know that variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.
8a/8b. Students know how natural selection determines the differential survival of groups of organisms. Great diversity increases the chance that some organisms survive major changes in the environment.
8c. Students know the effects of genetic drift on the diversity of organisms in a population.
8d. Students know how reproductive isolation affects speciation.
8e. Students know how to analyze fossil evidence with regard to biological diversity, episodic speciation and mass extinction.
8f. Students can explain how harmful mutations or totally eliminate breeding cannot survive under conditions in the living world.
8g. Students can discuss how variation is produced via mutation or genetic recombination.
8h. Students can explain how some traits enable organisms to adapt more successfully to their environment.
8i. Students can explain why reproductive isolation of the same species can cause new species to appear.
9a. Students can explain why polyploidy has different effects in the reproductive capacities of plants and animals.
9b. Students can explain why allopolyploidy has different effects in the reproductive capacities of plants and animals.
9c. Students know what lethal mutations occur by recalling the processes of additions, deletions, and substitutions of nucleotides during DNA/chromosome replication.
9d. Students can distinguish between mutations that are beneficial and those that are harmful.
9e. Students can explain how lethal alleles can remain in a population, “hidden” by heterozygous individuals or carriers.
9f. Students can define what recombination is produced via mutation or genetic recombination.
9g. Students can discuss how selective breeding cannot totally eliminate harmful mutations or undesirable traits because the trait will constantly reappear from new mutations.
9h. Students can explain how natural selection favors the organisms that are better adapted to their environment.
9i. Students can recognize that environments change and thus, adaptive traits are constantly being realigned with the change.
9j. Students can explain how natural selection favors the organisms that are better adapted to their environment.
9k. Students can explain why polyploidy has different effects in the reproductive capacities of plants and animals.
Unit 5 Map of Key and Unpacked Standards

**Standard Set 9: Physiology, Part 1 - Homeostasis, Nervous and Endocrine Systems**

9a. Students know how the complementary activity of major body systems provide cells with nutrients and oxygen and removes toxic waste products such as CO₂.

9b. Students develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.

9c. Students know how the nervous system mediates communication between different parts of the body and the body’s interaction with the environment [NERVOUS SYSTEM and ENDOCRINE SYSTEM].

9d. Students know the functions of the nervous system [NS] and the role of neurons in transmitting electrical impulses.

9e. Students know the roles of sensory neurons, interneurons, and motor neurons in sensation, thought, and response.

1. DIGESTIVE SYSTEM: Students can identify the different organs of the digestive system and their functions.

2. DIGESTIVE SYSTEM: Students can explain how the concentration of sugar in the blood is monitored and controlled through the production and breakdown of glycogen in the liver and muscles.

3. EXCRETORY SYSTEM: Students can describe the structure of the kidneys and describe its function, especially in the production of harmless area from toxic ammonia.

4. RESPIRATORY SYSTEM: Students can identify the different organs of the respiratory system and describe their structure and function.

5. RESPIRATORY SYSTEM: Students can describe how gas exchange occurs in the capillaries of the alveoli.

6. CIRCULATORY SYSTEM: Students can explain how the circulatory system delivers O₂ and nutrients to each cell of the body via blood and vessels and also facilitate the removal of wastes.

1. Students can identify the different organs of the digestive system and their functions.

2. Students can explain how the concentration of sugar in the blood is monitored and controlled through the production and breakdown of glycogen in the liver and muscles.

3. Students can differentiate between stimuli and response and can describe the nature of the reflex arc.

4. Students know how such hormones as insulin and the growth hormone act to regulate bodily responses and functions.

Target Common Core Standards (ELA)

**Reading**

1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

**Writing**

1. Write arguments focused on discipline-specific content.

   a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.

   b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.

   c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

   d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

   e. Provide a concluding statement or section that follows from or supports the argument presented.
10a. Students know the role of the skin in providing non-specific defenses against infection.

1. Students can differentiate between the specific and non-specific defenses of the immune system against infections.
2. Students can describe how the skin offers non-specific defenses against infections by primarily functioning as a defensive barrier.

10b. Students know the role of antibodies in the body’s response against infection.

1. Students can explain what antibodies are, and how they exhibit specificity for antigens.
2. Students can describe how and why antibodies are produced.
3. Students can explain how antibodies can inactivate pathogens directly and indirectly.

10c. Students know how vaccination protects an individual from infectious diseases.

1. Students can explain how vaccination works by providing the body with an early “warning” as to how a pathogen may “look”.
2. Students can identify the components of a vaccine and the immune responses that follow a vaccination.
3. Students can explain how vaccinations can inactivate pathogens directly and indirectly.

10d. Students know there are important differences between bacteria and viruses, with respect to their requirements for growth and replication, the body’s 1st defenses vs. bacterial and viral infections, and effective treatments of these infections.

1. Students can explain the similarities and differences between viruses and bacteria in terms of the way they grow and replicate.
2. Students can explain why treatment options for bacteria and viruses are different and why viruses should not be treated with antibiotics.
3. Students are aware that some protists can also cause infections in humans.
4. Students can explain the dangers of overusing antibiotics in the generation of drug-resistant bacteria.

10e. Students know why an individual with a compromised immune system may be unable to fight off and survive infections by microorganisms that are usually benign.

1. Students know the different ways by which the immune system may be compromised [Example: HIV].
2. Students can explain how a compromised immune system is rendered incapable of fighting off infections.
3. Students can give examples of how usually harmless organisms can be fatal in individuals with compromised immune systems.

Target Common Core Standards (ELA)

Reading
1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Writing
1. Write arguments focused on discipline-specific content.
   a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
   b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
   c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
   d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
   e. Provide a concluding statement or section that follows from or supports the argument presented.

NOTE: Target Common Core Standards (ELA) are the same for all units.
Unit 6 Map of Key and Unpacked Standards

6a. Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.

- A. Students can explain the meaning of biodiversity and discuss its importance in terms of an ecosystem's stability and resiliency.
- B. Students can compare ecosystems in terms of their biodiversity.
- C. Students can identify the different factors that influence the biodiversity of a habitat.

6b. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.

- A. Students can pinpoint the different factors that can cause changes in an ecosystem over time.
- B. Students can identify examples of how certain human activities have impacted living communities.
- C. Students can explain how the introduction of a non-native species can adversely affect an ecosystem and give examples.
- D. Students can analyze ecosystem changes and hypothesize on possible causes.

6c. Students know how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.

- A. Students can enumerate the various factors that can affect population growth.
- B. Students can draw, explain, and analyze different population growth [curve] models.
- C. Students can explain the concept of carrying capacity and the different factors that affect its size.
- D. Students can differentiate between immigration and emigration.

6d. Students know how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.

- A. Students can analyze any of the biogeochemical pathways and trace the flow of nutrients from one form to another.
- B. Students can identify the different processes that convert an element [C, N] from one form to another.
- C. Students can identify the various reservoirs of Carbon, Nitrogen, and Water in an ecosystem.
- D. Students can explain how matter is recycled [with the input of energy] and why

6e. Students know a vital part of an ecosystem is the stability of its producers and decomposers.

- A. Students can draw/analyze a food chain and identify the different organisms that occupy each trophic level.
- B. Students can explain the important role/s of decomposers and producers in a food chain/web.
- C. Students can pinpoint the Sun as the ultimate source of energy that supports all food chains.

6f. Students know at each link in a food web some energy is stored in newly made structures but much energy is dissipated into the environment as heat. This dissipation may be represented in an energy pyramid.

- A. Students can discuss the efficiency of energy transfer [10%] from one trophic level to the next.
- B. Students can explain how energy is "lost" from one level to another.
- C. Students can analyze a food web, and identify the roles [producer, consumer, decomposer] each organism plays in the web.

Target Common Core Standards (ELA)

Reading

1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Writing

1. Write arguments focused on discipline-specific content.
   a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
   b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
   c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
   d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
   e. Provide a concluding statement or section that follows from or supports the argument presented.