



LAB-AIDS Correlations for
NEXT GENERATION SCIENCE STANDARDS
HIGH SCHOOL LEVEL, LIFE SCIENCE¹

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This document is intended to show how our SEPUP curriculum products align with the *Next Generation Science Standards*² and Common Core documents. SEPUP project staff provided information that was very helpful in our production of this document, but LAB-AIDS takes sole responsibility for its content and final appearance.

ABOUT OUR PROGRAMS

LAB-AIDS Core Science Programs are developed to support current knowledge on the teaching and learning of science. All materials support an inquiry-driven pedagogy, with support for literacy skill development and with assessment programs that clearly show what students know and are able to do from using the programs. All programs have extensive support for technology in the school science classrooms, and feature comprehensive teacher support. For more information please visit www.lab-aids.com and navigate to the program of interest.

SEPUP

Materials from the Science Education for Public Understanding Program (SEPUP) are developed at the Lawrence Hall of Science, at the University of California, Berkeley, and distributed nationally by LAB-AIDS, Inc. Development of SEPUP materials is supported by grants from the National Science Foundation. SEPUP programs are available as full year courses, or separately, as units, each taking 3-9 weeks to complete, as listed below.

HIGH SCHOOL Level, Grades 9-12

Science in Global Issues Biology Unit Title	Student Book Pages	Issue Focus
Sustainability	1-46	Aspects of sustainability from a personal, community and global

¹ This document was first posted January, 2015

² <http://www.nextgenscience.org/next-generation-science-standards>

		perspective
Ecology: Living on Earth	43-154	<p>Sustainability from an ecosystems perspective, with a focus on humans' impacts on ecosystems</p> <p>Making decisions regarding fisheries management</p>
Cell Biology: World Health	155-258	<p>Disparities between developing and developed countries in terms of diseases' impacts on life</p> <p>Making decisions about priorities for diseases that limit social, economic, and environmental progress</p>
Genetics: Feeding the World	259-412	<p>Comparison of selective breeding and genetic modification</p> <p>Use of genetically modified organisms, particularly in the production of agricultural crops</p>
Evolution: Maintaining Diversity	413-512	<p>Conserving genetic, species and ecosystem diversity</p> <p>Ecosystems services and intrinsic value models for conservation</p>

ABOUT THE NEXT GENERATION SCIENCE STANDARDS

The National Academy of Sciences, Achieve, the American Association for the Advancement of Science, and the National Science Teachers Association have collaborated over several years to develop the *Next Generation Science Standards* (NGSS). The first step of the process was led by The National Academies of Science, a non-governmental organization commissioned in 1863 to advise the nation on scientific and engineering issues. On July 19, 2011, the National Research Council (NRC), the functional staffing arm of the National Academy of Sciences, released the *Framework for K-12 Science Education*.

The *Framework* was a critical first step because it is grounded in the most current research on science and science learning and it identifies the science all K–12 students should know. The second step in the process was the development of standards grounded in the NRC Framework. A group of 26 lead states and writers, in a process managed by Achieve, has been working since the release of the Framework to develop K-12 *Next Generation Science Standards*. The *Standards* have undergone numerous lead states and all state reviews as well as two public comment periods, the most recent of these in January, 2013. The final release of the Standards coincided with the National Conference of the National Science Teachers Association Annual Conference in San Antonio, TX, the week of April 8, 2013.

The *Next Generation Science Standards* (NGSS) provide an important opportunity to improve not only science education but also student achievement. Based on the *Framework for K–12 Science Education*, the NGSS are intended to reflect a new vision for American science education. *The Next Generation Science Standards* are student performance expectations – NOT curriculum. Even though within each performance expectation Science and Engineering Practices (SEP) are partnered with a particular Disciplinary Core Idea (DCI) and Crosscutting Concept (CC) in the NGSS, these intersections do not predetermine how the three are linked in curriculum, units, or lessons. Performance expectations simply clarify the expectations of what students will know and be able to do by the end of the grade or grade band.

As the reader knows, the *Standards* represent content from several domains: (1) science and engineering practices; (2) cross-cutting concepts; (3) the disciplines of life, earth, and physical science, as set forth in the *Next Generation Science Framework* (NRC, 2012). The Standards themselves are written as performance indicators, and content from the Common Core (<http://www.corestandards.org/>) is included. The following middle level standard from the life sciences is used to show the basic structure. Standards, as performance indicators, are in the white box on top, and the relevant Practices, Disciplinary Core Ideas, and Crosscutting Concepts are listed below in the blue, orange, and green boxes, respectively. Clarification Statements, in red, list assessment boundaries or further describe the standard; statements marked with an asterisk (*) denote integration of engineering content.

MS-LS3 Heredity: Inheritance and Variation of Traits

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<p>Students who demonstrate understanding can:</p> <p>MS-LS3-1. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]</p> <p>MS-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]</p> <p>The performance expectations above were developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i>.</p>		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models</p> <p>Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.</p> <ul style="list-style-type: none"> Develop and use a model to describe phenomena. (MS-LS3-1),(MS-LS3-2) 	<p>LS1.B: Growth and Development of Organisms</p> <ul style="list-style-type: none"> Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS-LS3-2) <p>LS3.A: Inheritance of Traits</p> <ul style="list-style-type: none"> Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1) Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2) <p>LS3.B: Variation of Traits</p> <ul style="list-style-type: none"> In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2) In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1) 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2) <p>Structure and Function</p> <ul style="list-style-type: none"> Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1)
<p><i>Connections to other DCIs in this grade-band:</i> MS.LS1.A (MS-LS3-1); MS.LS4.A (MS-LS3-1)</p> <p><i>Articulation across grade-bands:</i> 3.LS3.A (MS-LS3-1),(MS-LS3-2); 3.LS3.B (MS-LS3-1),(MS-LS3-2); HS.LS1.A (MS-LS3-1); HS.LS1.B (MS-LS3-1),(MS-LS3-2); HS.LS3.A (MS-LS3-1),(MS-LS3-2); HS.LS3.B (MS-LS3-1),(MS-LS3-2)</p> <p><i>Common Core State Standards Connections:</i> ELA/Literacy –</p>		

Various other appendices describe other important elements of the Standards, such as DCI progressions, STS, nature of science, and more.

ABOUT THE LAB-AIDS CITATIONS

The following tables are presented in a Disciplinary Core Idea arrangement – Earth Space Science (ESS), Life Science (LS), Physical Science (PS) and Engineering, Technology and Applications of Science (ETS). This document is intended as a summary document to show the NGSS and Common Core ELA/Math alignment as of January 2015, and is based on input from the SEPUP staff. As of this writing, SEPUP has plans to post more details on their own internal NGSS review and alignment process on their project website (www.sepuplhs.org) later in 2015. In addition, not all SEPUP 6-8 units listed on pages 1-2 may appear here, as some may contain science content that falls outside NGSS specifications.

Citations included in the correlation document are as follows:

Unit title, Activity Number and Description:

Genetics: Feeding the World 6 MODELING : Breeding Corn for Two Traits

Students use Punnett squares to predict the outcome of a cross between corn plants for two traits.

Students create a plan to determine the genotype of a parent based on observing the results of crosses for two traits

NGSS Performance Expectations	HS-LS3-3
Science and Engineering Practices	Analyzing and Interpreting Data Developing and Using Models Using Mathematics and Computational Thinking
Crosscutting Concepts	Patterns Systems and System Models
Disciplinary Core Ideas	(ETS1.A)* ETS1.B ETS1.C
Common Core English-Language Arts	WHST.9-12.9
Common Core Mathematics	MP.2

*The use of parenthesis () indicates partial coverage.

SCIENCE & GLOBAL ISSUES: BIOLOGY

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Sustainability</i>					
1 INVESTIGATION: Our Global Community Students investigate the use of resources across regions of the world by manipulating indicator data.		Analyzing and Interpreting Data (Developing and Using Models) Using Mathematics and Computational Thinking	Patterns	(LS4.D) ETS1.A (ETS1.B) ETS1.C	RST.11-12.7 (WHST.9-12.1) MATH: MP.2 (HSS-IC.A.1) (HSS-IC.B.6)
2 INVESTIGATION: Life in Other Countries Students further investigate indicators of four countries and analyze the current sustainability challenges facing those communities.		Analyzing and Interpreting Data Using Mathematics and Computational Thinking	Patterns	ETS1.A ETS1.B ETS1.C	RST.11-12.7 MATH: MP.2 (HSS-IC.A.1) (HSS-IC.B.6)
3 READING: Sustainability Case Studies Students read about two communities that took steps to improve their resource use of energy, water, and land.		Constructing Explanations and Designing Solutions	Structure and Function	ETS1.A ETS1.B ETS1.C	(RST.11-12.1)
4 INVESTIGATION: Ecological Footprint Students complete an on-line survey that estimates their ecological footprint and then compares the results with averages for the United States, other countries, and the world.			Patterns	ETS1.A ETS1.B ETS1.C	(WHST.9-12.1)
5 LABORATORY : Jaffrey City's Problem Students act in the role of scientists testing for contaminants in the lake water of fictitious Jaffrey Lake.		Analyzing and Interpreting Data Engaging in Argument from Evidence (Obtaining, Evaluating,	Cause and Effect Systems and System Models	ETS1.A ETS1.C	WHST.9-12.1 (SL.11-12.4) MATH: (HSS-IC.B.6)

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Sustainability</i>					
		and Communicating Information) Planning and Carrying Out Investigations			
6 TALK IT OVER: Jaffrey City's Master Plan Students propose a master plan for dealing with the contamination of Jaffrey Lake in a way that is satisfactory to the stakeholders in the community.		Constructing Explanations and Designing Solutions Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information		ETS1.A ETS1.B ETS1.C	SL.11-12.4 (SL.11-12.5)

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Ecology: Living on Earth</i>					
1 TALK IT OVER: Ecosystems and Change Students investigate case studies of ecosystem changes and the impacts on organisms.		Obtaining, Evaluating, and Communicating Information	Cause and Effect Energy and Matter Stability and Change	LS2.C	(WHST.9-12.5) WHST.9-12.9
2 LABORATORY : A Population of Duckweed Students monitor and analyze the growth of a population of duckweed plants for an eight-week period.		Analyzing and Interpreting Data (Asking Questions and Defining Problems) Obtaining, Evaluating, and Communicating Information (Planning and Carrying Out Investigations) Using Mathematics and Computational Thinking	Cause and Effect	LS2.A	(WHST.9-12.1) (WHST.9-12.2) MATH: MP.2; HSN-Q.A.1 HSS-ID.A.1
3 INVESTIGATION: Biomes Students investigate characteristics of biomes and types of organisms in biomes.		Analyzing and Interpreting Data (Engaging in Argument from Evidence) (Obtaining, Evaluating, and Communicating Information) Using Mathematics and Computational Thinking	Patterns		RST.11-12.7 (WHST.9-12.1) WHST.9-12.2 MATH: HSF-IF.C.7 HSN-Q.A.1 HSS-ID.A.1
4 INVESTIGATION: Invasive Species Students investigate characteristics that make it likely for a species to become an invasive and examine case studies of invasive species introductions		(Constructing Explanations and Designing Solutions) Engaging in Argument from Evidence	(Cause and Effect) Stability and Change	LS2.C (ETS1.A) (ETS1.B) ETS1.C	WHST.9-12.1 WHST.9-12.2 WHST.9-12.7 WHST.9-12.9 SL.11-12.4

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Ecology: Living on Earth</i>					
		Obtaining, Evaluating, and Communicating Information			
5 MODELING: The Tragedy of the Commons Students investigate how fishing limits impact the sustainability of a fishery.		(Constructing Explanations and Designing Solutions) Engaging in Argument from Evidence Developing and Using Models	Cause and Effect Scale, Proportion, and Quantity Systems and System Models	LS2.C (ETS1.A) (ETS1.B)	WHST.9-12.1 WHST.9-12.7
6 INVESTIGATION: Producers and Consumers Students observe plankton and investigate the link between plankton productivity and sustainable fisheries.		(Constructing Explanations and Designing Solutions) Planning and Carrying Out Investigations Using Mathematics and Computational Thinking	Cause and Effect (Energy and Matter) Scale, Proportion, and Quantity (Structure and Function)	LS2.B (PS3.D)	WHST.9-12.2 MATH: MP.2
7 INVESTIGATION: Energy Flow Through an Ecosystem Students explore the relationships that exist among organisms in a kelp forest and use a food web they construct to predict the impact of different events on the kelp forest ecosystem.		Constructing Explanations and Designing Solutions (Engaging in Argument from Evidence) Developing and Using Models	Energy and Matter (Stability and Change) Systems and System Models	LS2.B LS2.C (PS3.D) (ETS1.B)	WHST.9-12.1 WHST.9-12.2
8 INVESTIGATION: Carbon Cycle The class models the movement of carbon through the natural carbon cycle, and compares this to the impact of human activities on the movement of carbon in		Developing and Using Models	(Energy and Matter)	LS2.A LS2.B LS2.C (PS3.D)	(RST.11-12.9) WHST.9-12.2 WHST.9-12.9

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Ecology: Living on Earth</i>					
carbon cycle.					
9 INVESTIGATION: The Photosynthesis and Cellular Respiration Shuffle Students determine the cycle of photosynthesis and cellular respiration by organizing a series of statements into a sequence.	HS-LS1-5 HS-LS1-6 HS-LS1-7	Developing and Using Models	Energy and Matter Systems and System Models	LS1.C LS2.B PS3.D	WHST.9-12.2
10 LABORATORY : Respiring Beans Students investigate cellular respiration in beans. Students develop their own variable and test conditions.	(HS-LS1-5) HS-LS1-7	(Analyzing and Interpreting Data) Planning and Carrying Out Investigations	Cause and Effect	LS1.C LS2.B	WHST.9-12.2
11 LABORATORY : Respiration and Photosynthesis in Plants Students observe underwater plants in various conditions to determine if plants respire and photosynthesize. Students develop their own variable and test conditions.	HS-LS1-5 HS-LS1-6 HS-LS1-7	(Analyzing and Interpreting Data) (Constructing Explanations and Designing Solutions) (Engaging in Argument from Evidence) Planning and Carrying Out Investigations	Energy and Matter	LS1.C LS2.B PS3.D	WHST.9-12.1 WHST.9-12.2
12 INVESTIGATION: Too Much Life Students use yeast to model population dynamic, cellular respiration & eutrophication.		(Analyzing and Interpreting Data) Constructing Explanations and Designing Solutions	Energy and Matter Stability and Change Systems and System Models	(LS2.A)	WHST.9-12.2
13 INVESTIGATION: Symbiotic Relationships Students use descriptions of inter-species interactions to determine different symbiotic relationships.		Constructing Explanations and Designing Solutions (Developing and Using Models)	Systems and System Models		

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Ecology: Living on Earth</i>					
14 INVESTIGATION: Investigating Population Growth Rates An online simulation is used to investigate the effect of birth rate and carrying capacity on the growth rate of a population.		Analyzing and Interpreting Data Constructing Explanations and Designing Solutions (Developing and Using Models) (Using Mathematics and Computational Thinking)	(Stability and Change) Systems and System Models	LS2.A LS2.C (ETS1.B)	WHST.9-12.2 MATH: (MP.4)
15 MODELING: Changes Due to Population Growth Students examine the effect of a salmon farm on wild salmon population growth.		Analyzing and Interpreting Data (Developing and Using Models) Obtaining, Evaluating, and Communicating Information Using Mathematics and Computational Thinking	Cause and Effect Stability and Change Systems and System Models	LS2.C (ETS1.A) (ETS1.B) ETS1.C	MATH: (MP.4); HSS-ID.A.1
16 INVESTIGATION: Ecosystems Out of Balance Students examine graphs of different populations effected by fisheries and try to determine what the whole ecosystem effect has been.		Analyzing and Interpreting Data (Constructing Explanations and Designing Solutions) (Developing and Using Models) Obtaining, Evaluating, and Communicating Information	Cause and Effect Stability and Change Systems and System Models	(LS2.A) LS2.C (ETS1.A) (ETS1.B)	WHST.9-12.2 MATH: HSS-ID.A.1

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Ecology: Living on Earth</i>					
		Using Mathematics and Computational Thinking			
17 READING: Ecosystem Change and Resiliency Students read about primary and secondary succession and how that is affected by ecosystem resiliency.		(Constructing Explanations and Designing Solutions)	Stability and Change	LS2.C	WHST.9-12.2
18 TALK IT OVER : Fishery Case Studies Students analyze case studies and predict how fishery management strategies might impact the sustainability of Bayside and the Purple-spotted Flatfish fishery.		(Analyzing and Interpreting Data) Constructing Explanations and Designing Solutions	Stability and Change	LS2.C ETS1.A ETS1.B ETS1.C	(WHST.9-12.2)
19 INVESTIGATION: Making Sustainable Fishery Decisions Students analyze indicator data to determine the impact of a fishery management strategy on the sustainability of Bayside and the Purple-spotted Flatfish fishery.		(Analyzing and Interpreting Data) Constructing Explanations and Designing Solutions (Using Mathematics and Computational Thinking)	Stability and Change	ETS1.A ETS1.B	(RST.11-12.7) (WHST.9-12.2) MATH: MP.2

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Cell Biology: World Health</i>					
1 TALK IT OVER : World Health and Sustainability Students look at world health data and examine factors of sustainability tied to disease	HS-LS3-1	Analyzing and Interpreting Data Asking Questions and Defining Problems Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information Using Mathematics and Computational Thinking	Patterns	ETS1.A ETS1.B ETS1.C	SL.11-12.4 MATH: MP.2; (MP.4) HSN-Q.A.2 (HSS-IC.A.1)
2 LABORATORY : Cells and Disease Students observe normal red blood cells, sickled red blood cells, and blood infected with Plasmodium in order to determine the cause of two patients' symptoms. Students begin to think about cell structure and function.	HS-LS3-1	Engaging in Argument from Evidence (Planning and Carrying Out Investigations)	(Structure and Function)	(LS1.A) (ETS1.A) (ETS1.B)	RST.11-12.7 (RST.11-12.8) (WHST.9-12.2) WHST.9-12.9
3 LABORATORY: What is a Cell? Students prepare a drawing of a cell as a formative assessment and write their ideas about cells. Then they examine using a light microscope the similarities and differences in various types of living cells and fixed cells.	HS-LS1-2 HS-LS3-1	(Planning and Carrying Out Investigations)	(Scale, Proportion, and Quantity) (Structure and Function)	LS1.A (ETS1.A)	(RST.11-12.7) WHST.9-12.1 WHST.9-12.9
4 INVESTIGATION: What Do Cells Do? Students learn about common cells structures and functions.	HS-LS1-2	(Constructing Explanations and Designing Solutions) Developing and Using Models	(Patterns) Structure and Function (Systems and System Models)	LS1.A	RST.11-12.9 (WHST.9-12.2)

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Cell Biology: World Health</i>					
5 INVESTIGATION: What Do Specialized Cells Do? Students investigate the different numbers and types of organelles required for specialized plant and animal cells.	HS-LS3-1	Developing and Using Models	Cause and Effect Structure and Function (Systems and System Models)	LS1.A	RST.11-12.9
6 READING: Cell Structure and Function Students read about the history of the development of the cell principle, and cell structures and functions.		(Constructing Explanations and Designing Solutions) Obtaining, Evaluating, and Communicating Information	Structure and Function	LS1.A	(RST.11-12.1) (WHST.9-12.9)
7 MODELING: A Model Membrane Students investigate several models of the cell membrane in order to observe properties of the cell membrane.		(Analyzing and Interpreting Data) Developing and Using Models (Planning and Carrying Out Investigations)	(Cause and Effect) Structure and Function Systems and System Models	(ETS1.A)	(WHST.9-12.2) (WHST.9-12.9)
8 LABORATORY: The Cell Membrane and Diffusion Students investigate the properties of the cell membrane and osmosis and diffusion by using dialysis tubing models using water, glucose, starch and iodine.		(Analyzing and Interpreting Data) Developing and Using Models (Engaging in Argument from Evidence) (Planning and Carrying Out Investigations)	(Cause and Effect) Structure and Function Systems and System Models	(ETS1.A) (ETS1.B)	(WHST.9-12.1)
9 READING: Cell Membrane Structure and Function Students read about the cell membrane's functions and the fluid mosaic model.	HS-LS1-2	Constructing Explanations and Designing Solutions	(Stability and Change) Structure and Function	LS1.A	(WHST.9-12.1) (WHST.9-12.2) WHST.9-12.9

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
Cell Biology: World Health					
10 RESEARCH PROJECT AND PRESENTATION: Functions of Proteins in Cells Students research one type of protein and present the information to the class in order to learn the diverse functions of proteins in cells.	HS-LS1-1 HS-LS3-1	Obtaining, Evaluating, and Communicating Information	Structure and Function	LS1.A	RST.11-12.9 WHST.9-12.7 WHST.9-12.8 WHST.9-12.9 SL.11-12.4 SL.11-12.5
11 LABORATORY : Investigating Enzyme Function Students design an experiment to test the effects of pH and temperature on the function of an enzyme.	HS-LS3-1	(Analyzing and Interpreting Data) Constructing Explanations and Designing Solutions Planning and Carrying Out Investigations	Stability and Change		(RST.11-12.8) WHST.9-12.2 (WHST.9-12.9) MATH: (MP.2)
12 READING: Photosynthesis and Cellular Respiration Students complete a computer simulation of the processes of photosynthesis and cellular respiration and then complete a reading about the two processes	HS-LS1-2 HS-LS1-5 HS-LS1-6 HS-LS1-7	(Constructing Explanations and Designing Solutions) Developing and Using Models	Energy and Matter (Patterns) Structure and Function Systems and System Models	LS1.A LS1.C LS2.B PS3.D	(RST.11-12.7) RST.11-12.9 (WHST.9-12.9)
13 INVESTIGATION: The Cell Cycle Students investigate the cell cycle including mitosis and cytokinesis	HS-LS1-4 (HS-LS3-2)	Constructing Explanations and Designing Solutions Developing and Using Models (Engaging in Argument from Evidence)	Stability and Change Structure and Function Systems and System Models	(LS1.A) LS1.B (LS3.B) (ETS1.A) (ETS1.B)	(RST.9-10.8) RST.11-12.9 (WHST.9-12.1) (WHST.9-12.9)
14 INVESTIGATION: Stem Cell Differentiation Students use a set of colored chips to investigate the steps in which embryonic	HS-LS1-1 HS-LS1-2	Constructing Explanations and Designing Solutions	(Stability and Change)	LS1.A LS1.B	RST.11-12.9 WHST.9-12.2

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
Cell Biology: World Health					
stem cells become specialized cells.	HS-LS1-4 HS-LS3-1	Developing and Using Models	Structure and Function Systems and System Models		
15 TALK IT OVER : Stem Cell Research Students discuss a set of questions surrounding the stem cell research debate, and examine why it is not useful for addressing infectious diseases.	HS-LS1-2 HS-LS1-4 HS-LS3-1	(Asking Questions and Defining Problems)	(Structure and Function)	LS1.A ETS1.A (ETS1.B)	(RST.11-12.9) (WHST.9-12.9)
16 INVESTIGATION: HIV/AIDS Infection and Cell Organelles Students investigate how HIV uses the endomembrane system during infection of a human cell.	HS-LS3-1	Constructing Explanations and Designing Solutions Developing and Using Models	(Scale, Proportion, and Quantity) (Stability and Change) Structure and Function Systems and System Models	(ETS1.A)	(RST.9-10.8) (RST.11-12.7) (WHST.9-12.9)
17 TALK IT OVER : Disease Interventions Students summarize the disease mechanism for six diseases, examine various interventions for the six diseases and their trade-offs		(Constructing Explanations and Designing Solutions) Developing and Using Models Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information	(Cause and Effect) (Stability and Change) Structure and Function Systems and System Models	(ETS1.A)	(RST.11-12.7) RST.11-12.9 (WHST.9-12.7) WHST.9-12.8 SL.11-12.4 SL.11-12.5
18 TALK IT OVER : World Health Proposal Students write a world health proposal to		Constructing Explanations and Designing Solutions	(Stability and Change)	(ETS1.B) ETS1.C	RST.11-12.9 WHST.9-12.1

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Cell Biology: World Health</i>					
address the problems of disease and vote on which to fund when funding is limited.		Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information	(Systems and System Models)		WHST.9-12.2 (WHST.9-12.8) SL.11-12.4 SL.11-12.5

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Genetics: Feeding the World</i>					
1 INVESTIGATION: A Genetically Modified Solution? Students consider the use of Genetically Modified Organisms by looking at it from the perspective of a country trying to decide if they should grow Bt corn.		(Constructing Explanations and Designing Solutions) Asking Questions and Defining Problems Engaging in Argument from Evidence	(Structure and Function)	(ETS1.A) ETS1.B ETS1.C	RST.9-10.8 WHST.9-12.1 SL.11-12.4
2 LABORATORY : Creating Genetically Modified Bacteria Students investigate the conditions necessary for genetically modified bacteria to express an inserted gene.	HS-LS1-1	Planning and Carrying Out Investigations	(Structure and Function)	(LS1.A) (ETS1.A) (ETS1.B)	WHST.9-12.2
3 MODELING: Mitosis and Asexual Reproduction Students view online computer animations and construct a narrated sketch of the phases of meiosis. Students show how a gene inserted into a genetically modified organism can be passed on to a daughter cell through the process of asexual reproduction.	(HS-LS1-1)	Constructing Explanations and Designing Solutions Developing and Using Models	Scale, Proportion, and Quantity Structure and Function Systems and System Models	LS1.A LS1.B	
4 INVESTIGATION: Breeding Corn Students observe the phenotypes of several ears of corn and use their observations and Punnett squares to determine the genotypes of the parents used to produce the resulting corn ears.	HS-LS3-3	Analyzing and Interpreting Data (Constructing Explanations and Designing Solutions) Developing and Using Models Obtaining, Evaluating, and Communicating Information	Patterns Systems and System Models		WHST.9-12.2 MATH: MP.2

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Genetics: Feeding the World</i>					
		Using Mathematics and Computational Thinking			
5 READING: Genes and Traits Students read about basic genetics concepts as they relate to the heredity of traits.	(HS-LS1-1) HS-LS3-3	(Engaging in Argument from Evidence)	Patterns		WHST.9-12.1 MATH: MP.2
6 MODELING : Breeding Corn for Two Traits Students use Punnett squares to predict the outcome of a cross between corn plants for two traits. Students create a plan to determine the genotype of a parent based on observing the results of crosses for two traits.	HS-LS3-3	Analyzing and Interpreting Data Developing and Using Models Using Mathematics and Computational Thinking	Patterns Systems and System Models	(ETS1.A) ETS1.B ETS1.C	WHST.9-12.9 MATH: MP.2
7 MODELING: Breeding Better Rice Students use Allele Cards to apply their knowledge of genetics to the breeding of a desirable strain of rice.	HS-LS3-3	Analyzing and Interpreting Data Developing and Using Models Obtaining, Evaluating, and Communicating Information Using Mathematics and Computational Thinking	Patterns Systems and System Models		WHST.9-12.9 MATH: MP.2
8 INVESTIGATION: Interpreting Pedigrees Students trace traits in pedigrees to determine their mechanism of inheritance.		Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Developing and Using Models	Patterns Systems and System Models		(RST.11-12.7) WHST.9-12.1

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<i>Genetics: Feeding the World</i>					
		Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information			
9 LABORATORY : DNA Isolation Students compare DN A isolated from spinach to DN A from various other samples to investigate the universal structure of DNA.		Planning and Carrying Out Investigations	Patterns	LS1.A LS3.A	
10 MODELING: Modeling DNA Structure Students work with several different representations and a model of DN A to learn about its molecular structure.	HS-LS1-1	Developing and Using Models	Patterns Structure and Function Systems and System Models	LS1.A LS3.A	
11 READING: Genomics Students read about the history of genomics and how the science is developing.	HS-LS1-1	(Constructing Explanations and Designing Solutions)	(Patterns)	LS3.A (LS4.A)	(RST.11-12.1)
12 INVESTIGATION: DNA Replication Students use online simulation & DNA model to gather evidence to support one of three hypothesis of DN A replication—conservative, semi-conservative, or dispersive-- in a historical exploration of the DNA replication experiments conducted by Meselson and Stahl.	HS-LS3-2 HS-LS3-3	Constructing Explanations and Designing Solutions Developing and Using Models	Systems and System Models	LS3.A	
13 MODELING: Meiosis and Sexual Reproduction Students view computer simulations to investigate how chromosomes divide during meiosis. Students use their understanding of	HS-LS3-2	Constructing Explanations and Designing Solutions Developing and Using Models	Systems and System Models	LS3.B (ETS1.A)	

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<i>Genetics: Feeding the World</i>					
meiosis to explore the question, “What is the chance an inserted gene will be passed onto a daughter cell through the process of sexual reproduction?”					
14 READING: Genes and Chromosomes Students read about the passing of chromosomes from the parents to offspring during the process of sexual and asexual reproduction.	(HS-LS1-1) HS-LS3-2	Constructing Explanations and Designing Solutions	Structure and Function	LS1.A (LS1.B) LS3.B	WHST.9-12.2
15 PROJECT : Evaluating Genetically Modified Organisms Student produce informational posters that highlight the development of and issues related to a genetically modified organism. Information gained through a poster session is used to develop criteria to evaluate GM organisms that will be used in the final activity.		Asking Questions and Defining Problems Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information	(Stability and Change)	ETS1.A ETS1.B ETS1.C	(RST.11-12.9) WHST.9-12.1 WHST.9-12.7 (WHST.9-12.8) WHST.9-12.9 SL.11-12.4 SL.11-12.5
16 MODELING: Protein Synthesis: Transcription and Translation Students work through the stages of protein synthesis. Then they work through a model to show the steps involved at each stage.	HS-LS1-1 HS-LS3-2	Analyzing and Interpreting Data Developing and Using Models (Engaging in Argument from Evidence) (Obtaining, Evaluating, and Communicating Information)	Patterns (Stability and Change) Structure and Function Systems and System Models	LS1.A LS3.B (ETS1.A)	RST.11-12.9
17 INVESTIGATION AND MODELING: Cell Differentiation and Gene Expression Students explore gene expression	(HS-LS1-1) HS-LS1-4	Constructing Explanations and Designing Solutions	(Cause and Effect) Patterns	LS1.A LS1.B LS3.A	(RST.11-12.7) RST.11-12.9

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Genetics: Feeding the World</i>					
combinations and explore the impact of gene expression and repression on cell phenotype.		Developing and Using Models (Obtaining, Evaluating, and Communicating Information)	Structure and Function Systems and System Models	LS3.B	
18 LABORATORY: Which Corn is Genetically Modified? Students run and interpret a DNA electrophoresis gel to determine which corn samples contain genetically modified corn.		Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Engaging in Argument from Evidence Planning and Carrying Out Investigations	(Patterns)	ETS1.A ETS1.C	(RST.11-12.9) WHST.9-12.1
19 READING: Biopharming Edible Vaccines Students read about the engineering of plants that are genetically modified to produce proteins that induce a vaccine response in humans.	(HS-LS1-1)	Constructing Explanations and Designing Solutions (Developing and Using Models)	(Structure and Function) Systems and System Models	(LS1.A) ETS1.A ETS1.C	(RST.11-12.7) RST.11-12.9
20 TALK IT OVER: Are GMOs the Solution? Students use information gathered from different research studies to determine if they want to use a genetically modified crop to help solve a sustainability challenge.		Analyzing and Interpreting Data (Constructing Explanations and Designing Solutions) Engaging in Argument from Evidence (Obtaining, Evaluating, and Communicating Information)	(Cause and Effect) (Patterns)	ETS1.A ETS1.B ETS1.C	RST.9-10.8 RST.11-12.1 (RST.11-12.7) WHST.9-12.1 MATH: (HSS-IC.A.1) (HSS-IC.B.6)

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<i>Genetics: Feeding the World</i>					
		(Using Mathematics and Computational Thinking)			

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Evolution: Maintaining Diversity</i>					
1 TALK IT OVER : Biodiversity and Sustainability Students play a game in which they manage one ecosystem on an island to learn about how biodiversity and sustainability are connected.		(Analyzing and Interpreting Data) (Constructing Explanations and Designing Solutions) Developing and Using Models	Cause and Effect (Patterns) Stability and Change (Systems and System Models)	LS2.C LS4.D (ETS1.A)	(RST.11-12.9)
2 TALK IT OVER : Human Activities and Biodiversity Students read scenarios that describe various human activities that affect the diversity of ecosystems, species, and populations.		Constructing Explanations and Designing Solutions	Cause and Effect (Stability and Change)	LS2.C LS4.D (ETS1.A) (ETS1.C)	
3 MODELING: Geologic Time Students convert geologic time to the scale of a football field and place key events along the timeline.	HS-LS4-5	Constructing Explanations and Designing Solutions Developing and Using Models Using Mathematics and Computational Thinking		(LS4.C) (LS4.D)	WHST.9-12.2 MATH: MP.2; MP.4 HSN-Q.A.2
4 READING: Darwin and the Development of a Theory Students read about Charles Darwin and how his ideas were emerging from others' and led to the theory of evolution by natural selection.	HS-LS4-1 HS-LS4-2 HS-LS4-4 HS-LS4-5	Constructing Explanations and Designing Solutions	Cause and Effect (Patterns) Stability and Change	LS4.B LS4.C	WHST.9-12.2
5 INVESTIGATION: Using Fossil Evidence to Investigate Whale Evolution Students examine illustrations of whale fossils and stratigraphic representations to	HS-LS4-1 HS-LS4-4	Constructing Explanations and Designing Solutions (Developing and Using	Patterns (Structure and Function)		WHST.9-12.1 WHST.9-12.2

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Evolution: Maintaining Diversity</i>					
trace the evolution of whales.	HS-LS4-5	Models) Engaging in Argument from Evidence	(Systems and System Models)		
6 READING: Evidence from the Fossil Record Students read about how scientists interpret evidence from the fossil record, including the use of stratigraphy and radiometric dating to determine the age of fossils.	HS-LS4-1 HS-LS4-4 HS-LS4-5	Constructing Explanations and Designing Solutions Engaging in Argument from Evidence	Patterns Stability and Change (Structure and Function)		(RST.11-12.8) WHST.9-12.1 WHST.9-12.2
7 INVESTIGATION: The Phylogeny of Vertebrates Students use a matrix of shared derived characters to create an evolutionary tree for a group of vertebrates, and use additional evidence to support a tree hypothesis.	HS-LS4-1 HS-LS4-4 HS-LS4-5	Constructing Explanations and Designing Solutions Engaging in Argument from Evidence	(Patterns) (Structure and Function)		WHST.9-12.1
8 INVESTIGATION: Studying Hominids Students examine fossil and molecular data to hypothesize the evolutionary relationships between apes, and extinct and modern humans.	HS-LS4-1 HS-LS4-4 HS-LS4-5	Constructing Explanations and Designing Solutions (Developing and Using Models) Engaging in Argument from Evidence (Planning and Carrying Out Investigations) (Using Mathematics and Computational Thinking)	(Patterns)	LS4.A	RST.11-12.7 (RST.11-12.9) WHST.9-12.1 MATH: MP.2
9 INVESTIGATION: Studying Lineages for Conservation Students read about Madagascar and	HS-LS4-1 HS-LS4-6	Constructing Explanations and Designing Solutions	(Cause and Effect) (Patterns)	LS2.C LS4.A LS4.D	WHST.9-12.1

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Evolution: Maintaining Diversity</i>					
investigate an evolutionary tree of lemurs in order to rank four areas on the island for conservation priority		(Engaging in Argument from Evidence)		ETS1.A (ETS1.B) ETS1.C	
10 INVESTIGATION: What is a Species? Students use the biological species concept as one piece of information about where new species are in the process of separation from existing species. Students also investigate the factors that lead to reproductive isolation of species.	HS-LS4-1 HS-LS4-5	Constructing Explanations and Designing Solutions Obtaining, Evaluating, and Communicating Information Engaging in Argument from Evidence	Cause and Effect	LS4.A	WHST.9-12.1 WHST.9-12.2 (WHST.9-12.9)
11 MODELING: Natural Selection Students work with a computer simulation to investigate the processes of adaptive radiation and extinction.	HS-LS4-1 HS-LS4-2 HS-LS4-3 HS-LS4-4 HS-LS4-5 HS-LS4-6	(Analyzing and Interpreting Data) Constructing Explanations and Designing Solutions Developing and Using Models Engaging in Argument from Evidence Using Mathematics and Computational Thinking	Cause and Effect (Patterns) Stability and Change Systems and System Models	LS4.B LS4.C LS4.D	(RST.11-12.9) WHST.9-12.1 WHST.9-12.2 MATH: (MP.4)
12 MODELING: The Genetic Basis of Adaptation Students use a model to investigate changes in gene frequency in a population of mice after an environmental change occurs.	HS-LS4-2 HS-LS4-3 HS-LS4-4 HS-LS4-5	(Analyzing and Interpreting Data) Constructing Explanations and Designing Solutions Developing and Using Models	Cause and Effect (Stability and Change) Systems and System Models	LS4.B LS4.C	WHST.9-12.1 WHST.9-12.2 MATH: (MP.4)

SEPUP Unit: Activity	Performance Expectation	Practices	Crosscutting Concepts	Disciplinary Core Ideas	Common Core ELA/Mathematics
<i>Evolution: Maintaining Diversity</i>					
	HS-LS4-6	Engaging in Argument from Evidence Using Mathematics and Computational Thinking			
13 READING: The Processes and Outcomes of Evolution Students read about the concepts of microevolution, adaptation, speciation, macroevolution, and extinction.	HS-LS4-1 HS-LS4-2 HS-LS4-4 HS-LS4-5	Constructing Explanations and Designing Solutions Engaging in Argument from Evidence	(Cause and Effect) (Patterns) (Stability and Change)	LS4.B LS4.C LS4.D	WHST.9-12.1 WHST.9-12.2
14 TALK IT OVER : Ideas About Evolution Students reexamine the thinking they have done in the unit about the statements describing scientific concepts related to evolution.	HS-LS4-1 HS-LS4-5	Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information			WHST.9-12.1 WHST.9-12.9
15 TALK IT OVER : Conservation on an Island Biodiversity Hotspot Students read about four forest areas being considered for conservation on a fictitious island, and use phylogenetic data and other evidence to make their recommendation.	HS-LS4-6	Constructing Explanations and Designing Solutions Obtaining, Evaluating, and Communicating Information Engaging in Argument from Evidence	Cause and Effect (Patterns) Stability and Change	(LS4.A) LS4.D ETS1.A ETS1.B ETS1.C	RST.11-12.7 (RST.11-12.9) WHST.9-12.1 WHST.9-12.2 WHST.9-12.9