



SACRAMENTO CITY UNIFIED SCHOOL DISTRICT BOARD OF EDUCATION

Agenda Item 9.1m

Meeting Date: July 16, 2015

Subject: Course of Study Approval: Medical Biology 1P, 2P

- Information Item Only
- Approval on Consent Agenda
- Conference (for discussion only)
- Conference/First Reading (Action Anticipated: _____)
- Conference/Action
- Action
- Public Hearing

Division: Academic Office/Curriculum & Instruction

Recommendation: Approve the Course of Study for Medical Biology 1P, 2P

Background/Rationale: “Medical Biology” is an introductory course covering biological concepts important for a general understanding and background for the health professions. Emphasis is on the scientific method and basic processes common to all forms of life. Topics will include ecology, evolution, cells structure and function, genetics, DNA processes, and key anatomy/physiology concepts. Medical Biology is part of the Health and Science Pipeline Initiative. It is designed to fill the role of regular high school Biology and to prepare students for a four-year college. It helps tie important Biological concepts to the health care field. After completing Medical Biology students will advance to Medical Chemistry.

Financial Considerations: None

LCAP Goal(s): College and Career Ready Students

Documents Attached:

1. Course of Study for Medical Biology1P, 2P

Estimated Time of Presentation: NA

Submitted by: Olivine Roberts, Chief Academic Officer and Iris Taylor, Assistant Superintendent for Curriculum & Instruction

Approved by: José Banda, Superintendent



COURSE OF STUDY

FOR

Medical Biology1P, 2P
QBS171, QBS172

Segment	High School
Length of Course	One Year
Developed by	<i>Jennifer Bilka</i>
First Edition	2013

SACRAMENTO CITY UNIFIED SCHOOL DISTRICT

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SECTION TWO — COURSE UNITS

Unit I Scientific Method
Unit II Basic Biochemistry
Unit III Cells
Unit IV Cell Energy
Unit V Molecular
Genetics
Unit VI Hereditary Genetics
Unit VII Evolution
Unit VIII Ecology
Unit IX Physiology

Medical Biology

SECTION ONE — GENERAL INFORMATION

COURSE DESCRIPTION

Medical Biology is an introductory course covering biological concepts important for a general understanding and background for the health professions. Emphasis is on the scientific method and basic processes common to all forms of life. Topics will include ecology, evolution, cells structure and function, genetics, DNA processes, and key anatomy/physiology concepts.

RATIONALE

Medical Biology is part of the Health and Science Pipeline Initiative. It is designed to fill the role of regular high school Biology and to prepare students for a four-year college. It helps tie important Biological concepts to the health care field. After completing Medical Biology students will advance to Medical Chemistry.

COURSE GOALS

Upon completion of this course, students will be able to:

Explain:

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.
2. Mutation and sexual reproduction lead to genetic variation in a population.
3. A multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization
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
5. The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells
6. Stability in an ecosystem is a balance between competing effects.
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
8. Evolution is the result of genetic changes that occur in constantly changing environments.
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.
10. Organisms have a variety of mechanisms to combat disease.
11. 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.

HPHS Outcomes for Medical Biology

Powerfully Prepared for College and Career (by)

Developing a Biology portfolio that will supplement their school career portfolio

Demonstrating proficiency in all Biology topics throughout the year

Turning in high quality, legible, and completed work, with first and last name

Using complete sentences when answering questions

Responsible Citizen (by)

Turning in all assignments on time

Maintaining organization of Biology handouts and assignments

Advocating for themselves in a mature and appropriate manner

Coming prepared to class with all of the necessary items and ready to learn

Independent Critical Thinker (by)

Generating and answer complex questions that require multiple steps (through experimentation and research)

Incorporate varying viewpoints to arrive at scientific conclusion

Successfully use guidelines to organize and accurately evaluate the task(s) presented to you

Determined Life Long Learner (by)

Being intrinsically motivated to answer science questions that are not necessarily within the given curriculum

Staying motivated to achieve proficiency in topics that challenge

Excellent Communicator

Creating lab reports that are complete and thorough

Acting and speaking professionally in the classroom

Demonstrating knowledge of correct English and scientific terms when writing

Using various media and computer programs to enhance presentations and discussions

COURSE STANDARDS

California Biology State Standards

INSTRUCTIONAL MATERIALS

- Various Lab Materials
- *Health and Science Pipeline Initiative* Curriculum
- Projector
- Computer

SUPPLEMENTARY MATERIALS:

SUGGESTED AVERAGE TIME FOR COVERING MAJOR UNITS

Unit I Scientific Method (*2 weeks*)

Unit II Basic Biochemistry (*2 weeks*)

Unit III Cells (*4 weeks*)

Unit IV Cell Energy (*4 weeks*)

Unit V Molecular Genetics (*4 weeks*)

Unit VI Hereditary Genetics (*4 weeks*)

Unit VII Evolution (*4 weeks*)

Unit VIII Ecology (*4 weeks*)

Unit IX Physiology (*4 weeks*)

TEACHER RESOURCES

HASPI

RECOMMENDED STUDENT RESOURCES

HASPI

SECTION TWO — COURSE UNITS

UNIT I: Scientific Method

This unit addresses key background information for laboratory science courses and sets the foundation for labs that will be explored throughout the year.

Standards Addressed/ Instructional Objectives

CA Science Standards:

Students will be able to

- 1a.** Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data.
- 1b.** Identify and communicate sources of unavoidable experimental error.
- 1c.** Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- 1d.** Formulate explanations by using logic and evidence.
- 1e.** Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.
- 1f.** Distinguish between hypothesis and theory as scientific terms.
- 1g.** Recognize the usefulness and limitations of models and theories as scientific representations of reality.
- 1h.** Read and interpret topographic and geologic maps.
- 1i.** 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).
- 1j.** Recognize the issues of statistical variability and the need for controlled tests.
- 1k.** Recognize the cumulative nature of scientific evidence.
- 1l.** Analyze situations and solve problems that require combining and applying concepts from more than one area of science.
- 1m.** 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.
- 1n.** Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent (e.g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets).

CCSS: Reading Standards

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.
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*.
5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
8. Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
10. By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Suggested Activities

Labs

Milk Madness Lab

Lab – What's in the Box?

Lab – Metrics, Microscopes, and Data
Collection

Lab – Scientific Method

Case Studies

A Recipe for Invention

AIDS and the Duesberg Phenomenon

Amandas Absence

An End to Ulcers

Cell Phone Use and Cancer

Childbed Fever

Lady Tasting Coffee

Life-The Final Frontier

Love Potion10

Nanobacteria

Suggested Assessment

Labs, quizzes, questions on readings, test

UNIT II: Basic Biochemistry

This unit addresses how Chemistry relates to Biology. It explains how metabolism refers to chemical reactions that occur within an organism. Atoms play a role in chemical reactions and are the fundamental units of matter. The body is composed of organic compounds and they are involved in chemical reactions that maintain homeostasis.

Standards Addressed/ Instructional Objectives

CA Standards Students will be able to

Cell Biology

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.

Function of specific human enzymes: amylase, catalase, lipase, etc.

Importance of maintaining a consistent pH within the human body – factors that may influence that pH.

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

Glucose as precursors to glycogen

Amino acids as precursors to complex proteins

Fatty acids and steroids

Nucleic acids relationship to DNA & RNA

Genetics

4e. Students know proteins can differ from one another in the number and sequence of amino acids.

Human proteins (images) to compare

4f.* Students know why proteins having different amino acid sequences typically have different shapes and chemical properties.

Human proteins (images) and explanation of their function and chemical properties.

CCSS:

ELA/Literacy –

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS3-1),(HS-LS3-2)

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-LS3-1)

WHST.9-12.1 Write arguments focused on discipline-specific content. (HS-LS3-2)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. (HS-LS1-1)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS1-3)

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.(HS-LS1-3)

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-4)

Mathematics – MP.2 Reason abstractly and quantitatively. (HS-LS3-2),(HS-LS3-3)

MP.4 Model with mathematics. (HS-LS1-4)

HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (HS- LS1-4)

HSF-BF.A.1 Write a function that describes a relationship between two quantities. (HS-LS1-4)

NGSS

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Suggested Activities

Labs

Quantifying Enzyme Activity with Amylase;

Wards

Activity – pH of the Body

Lab – Catalase

Lab – Enzyme Action on Starch

Lab – Enzymes on Germinating Seeds

Lab – Polymers

Case Studies

Acid pH and Buffers

Should Bill Buy Sammy

Why is Patrick Paralyzed

Suggested Assessment

Labs, quizzes, questions on readings, test

UNIT III: Cells

This unit addresses the relationships between structure and function at the cellular level and subcellular levels of an organism. It identifies common features of cells and the major differences between prokaryotes and eukaryotes and how cell structures maintain homeostasis. It describes how substances move in and out of a cell and how that is accomplished.

Standards Addressed/ Instructional Objectives

CA Students will be able to

Cell Biology

1a. Students know cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings.

- Disorders that disrupt the semi-permeable membrane*
- Process through which a virus invades the semi-permeable membrane*
- Prokaryotic capsid as protection against outside environment*
- Poisons that cause lysis of cell membrane*

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

- The process of viral infection in the human body cell.*

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

- Specific proteins produced and used in the body*

1j* Students know how eukaryotic cells are given shape and internal organization by a cytoskeleton or cell wall or both.

- Cytoskeleton disorders and affect*

CCSS

ELA/Literacy –

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS3-1),(HS-LS3-2)

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-LS3-1)

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HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Suggested Activities

Labs

Extracting DNA

Labs – Cells

Lab – Osmosis

Lab – Plant vs. Animal

Lab – Surface Area

Lab – Surface Area

Lab – Water Transport/Osmosis

Case Studies

A Typical Cold

Agony and Ecstasy- Diffusion & Osmosis

Between the Living and the Dead

But I'm Too Young

Little Mito

Osmosis is Serious Business

Sickle Cell Anemia

Take Two and Call Me in the Morning

Suggested Assessment

Labs, quizzes, questions on readings, test

UNIT IV: Cell Energy

This unit addresses how energy is made available to cells to power metabolism. It will explain how energy is captured and stored during photosynthesis in autotrophs, and how energy becomes useable to both autotrophs and heterotrophs through cellular respiration.

Standards Addressed/ Instructional Objectives

CA Students will be able to

Cell Biology

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

Importance of photosynthesis to the creation of sugar for energy that runs the human body

1g. 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.

Relationship between ATP energy content and a calorie.

Breakdown of fats and proteins to produce ATP in absence of adequate carbohydrates.

Effects of anorexia and bulimia on these processes.

1i.* Students know how chemi-osmotic gradients in the mitochondria and chloroplast store energy for ATP production.

Effects of protein alteration within the chemi-osmotic gradient

CCSS:

ELA/Literacy –

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS3-1),(HS-LS3-2)

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-LS3-1)

WHST.9-12.1 Write arguments focused on discipline-specific content. (HS-LS3-2)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. (HS-LS1-1)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS1-3)

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.(HS-LS1-3)

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-4)

Mathematics – MP.2 Reason abstractly and quantitatively. (HS-LS3-2),(HS-LS3-3)

MP.4 Model with mathematics. (HS-LS1-4)

HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (HS- LS1-4)

HSF-BF.A.1 Write a function that describes a relationship between two quantities. (HS-LS1-4)

NGSS

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

HS-LS2-3.

Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

Suggested Activities

Labs

Structure and Function of Mitochondria Lab

Lab – Cellular Metabolism

Lab – Chromatography

Lab – Fermentation

Lab – Photosynthesis

Lab – Yeast Respiration

Case Studies

A Can of Bull

A Rigorous Investigation

The Mystery of the Seven Deaths

Suggested Assessment

Labs, quizzes, questions on readings, test

UNIT V: Molecular Genetics

This unit addresses how genetic traits are passed from one generation to the next. It explains how genetic variation is fundamental to evolutionary change and how possible combinations of parental genes increase the probability that evolution will occur. It also addresses genetic mutations.

Standards Addressed/ Instructional Objectives

CA Students will be able to

Cell Biology

1d. 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.

- Importance of molecular biology for medical advancements for patient specific cancer therapies.*

Genetics

4a. Students know the general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA.

- RNA's role in neurological diseases*
- RNA viral infections - ebola*

4b. Students know how to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA.

- Effect of single codon errors – sickle cell, thalassemia*

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 an encoded protein.

- Single amino acid mutation in H1N1 caused pandemic in 2009 by dramatically increasing the viral replication and pathogenicity of H1N1.*

4d. Students know specialization of cells in multi-cellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves.

- Identify the role of stem cells.*
- Compare and contrast some common specialized cells of the human body – neurons, skin cells, muscle cells, blood cells, etc.*

4e. Students know proteins can differ from one another in the number and sequence of amino acids.

- Compare the protein structures of major human proteins – hemoglobin, myosin, insulin, etc.*
- Comparison of normal proteins to abnormal proteins.*

4f.* Students know why proteins having different amino acid sequences typically have different shapes and chemical properties.

- Compare the protein structures of major human proteins – hemoglobin, myosin, insulin, etc.*
- Comparison of normal proteins to abnormal proteins.*

5a. Students know the general structures and functions of DNA, RNA, and protein.

- Look at diseases or situations that could cause disruption of DNA, RNA, or protein structure – Ewing's Sarcoma, poisons, extreme temperatures, etc.*

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.

- Talk about different genetic disorders and how each step of the transcription process is integral to keep permanent mutations from occurring.*

CCSS

ELA/Literacy -

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-1),(HS-LS2-2),(HS-LS2-6),(HS-LS2-8)

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS2-1),(HS-LS2-2)

WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS4-6)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7),(HS-LS4-6)

Mathematics -

MP.2 Reason abstractly and quantitatively. (HS-LS2-1),(HS-LS2-2),(HS-LS2-6),(HS-LS2-7)

MP.4 Model with mathematics. (HS-LS2-1),(HS-LS2-2)

HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-7)

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-1),(HS-LS2-2),(HS-LS2-7)

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-1),(HS-LS2-2),(HS-LS2-7)

HSS-ID.A.1 Represent data with plots on the real number line. (HS-LS2-6)

HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (HS-LS2-6)

HSS-IC.B.6 Evaluate reports based on data. (HS-LS2-6)

NGSS

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scalesHS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

Suggested Activities

Labs

Lab – DNA Extraction

Lab – Mitosis

Case Studies

Baby Doe vs. Prenatal Clinic

Cross Dressing or Crossing-Over
 Make a Life to Save a Life
 The Case of the Dividing Cell
 The Case of the Druid Dracula

Suggested Assessment

Labs, quizzes, questions on readings, test

UNIT VI: Hereditary Genetics

This unit addresses DNA as the hereditary material that directs the development of a new generation of individuals patterned after parental generation, through meiosis. It will explore the concepts of DNA replication, transcription, and translation. In addition, it explains the how genes can be isolated for genetic engineering, identifying/ curing certain diseases, and altering farm animals to medically useful proteins.

Standards Addressed/ Instructional Objectives

CA Students will be able to

Genetics

- 2a.** 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.
- 2b.** Students know only certain cells in a multicellular organism undergo meiosis.
 Only sperm and eggs undergo meiosis within the testes and ovaries only.
- 2c.** Students know how random chromosome segregation explains the probability that a particular allele will be in a gamete.
- 2d.** Students know new combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization).
 Use human traits to demonstrate the random acquisition of traits from parents.
- 2e.** Students know why approximately half of an individual's DNA sequence comes from each parent.
- 2f.** Students know the role of chromosomes in determining an individual's sex.
- 2g.** Students know how to predict possible combinations of alleles in a zygote from the genetic makeup of the parents.
- 3a.** 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).
 Identify common genetic disorders resulting from different modes of inheritance – colorblindness, Huntington's disease, cystic fibrosis, Klinefelter's syndrome, etc.
- 3b.** Students know the genetic basis for Mendel's laws of segregation and independent assortment.
- 3c.*** Students know how to predict the probable mode of inheritance from a pedigree diagram showing phenotypes.
 Use pedigrees to predict whether individuals are susceptible to
- 3d.*** 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.
- 5c.** Students know how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.
- 5d.*** Students know how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation, and transformation) is used to construct recombinant DNA molecules.
 Go over the uses of recombinant DNA molecules in medicine – insertion and translation of various human proteins such as insulin.
- 5e.*** Students know how exogenous DNA can be inserted into bacterial cells to alter their genetic makeup and support expression of new protein products.
 Medical impacts of cloning, recombinant DNA, and gene therapy.

CCSS

ELA/Literacy -

- RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)
- RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-1),(HS-LS2-2),(HS-LS2-6),(HS-LS2-8)
- RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)
- RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)
- WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. (HS-LS2-1),(HS-LS2-2)

WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS4-6)
WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7),(HS-LS4-6)

Mathematics -

MP.2 Reason abstractly and quantitatively. (HS-LS2-1),(HS-LS2-2),(HS-LS2-6),(HS-LS2-7)

MP.4 Model with mathematics. (HS-LS2-1),(HS-LS2-2)

HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-7)

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-1),(HS-LS2-2),(HS-LS2-7)

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-1),(HS-LS2-2),(HS-LS2-7)

HSS-ID.A.1 Represent data with plots on the real number line. (HS-LS2-6)

HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (HS-LS2-6)

HSS-IC.B.6 Evaluate reports based on data. (HS-LS2-6)

NGSS

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Suggested Activities

Labs

Lab – Transfusions

Lab – Karyotyping

Lab – Genetic Disorders

Lab – Electrophoresis

Preparation of Human Chromosome Spread

Analyzing Chromosomes Through Karyotyping

Linking Blood Donors and Recipients

Activity – Heredity

Case Studies

A Right to Her Genes

A Sickeningly Sweet Baby Boy

Bringing Back Baby Jason

Can a Genetic Disease be Cured

Genetic Testing and Breast Cancer

In Sickness and in Health- Genetic Counseling

Living With Her Genes

More Than Meets the Eye

SNPs and Snails and Puppy Dog Tails

Salamander Superman

Saving Superman

Selecting the Perfect Baby

Sometimes it is All in the Genes

The Case of Eric – Lou Gehrig's disease

The Death of Baby Pierre

The Raelians

Those Old Kentucky Blues

Two Peas in a Pod

Wolfman- Chromosomal Basis of Heredity

Suggested Assessment

Labs, quizzes, questions on readings, test

UNIT VII: Evolution

This unit addresses a basic understanding of evolution and natural selection. It will explore the elements of the theory and the examples of changes in natural populations. It explains the how scientists estimate the age of the earth and life complexity increased from its first form.

Standards Addressed/ Instructional Objectives

CA Students will be able to

Evolution

7a. Students know why natural selection acts on the phenotype rather than the genotype of an organism.

The natural selection and mutation of bacteria and viruses occurs rapidly allowing them to quickly evolve and evade our natural and unnatural defenses.

7b. Students know why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool.

Discuss the concept of carriers for a disorder.

Discuss interaction between sickle cell anemia traits and malaria.

7c. Students know new mutations are constantly being generated in a gene pool.

The mutation of bacteria and viruses to quickly adapt to our defenses.

7d. Students know variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.

Ability of some humans to be resistant to certain diseases increasing their likelihood of survival.

7e.* Students know the conditions for Hardy-Weinberg equilibrium in a population and why these conditions are not likely to appear in nature.

Application of Hardy-Weinberg to the human population with HIV.

7f.* Students know how to solve the Hardy-Weinberg equation to predict the frequency of genotypes in a population, given the frequency of phenotypes.

Application of Hardy-Weinberg to the human population with HIV.

8a. Students know how natural selection determines the differential survival of groups of organisms.

Discuss how bacteria and viruses continue to adapt to survive in their environment.

8b. Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment.

Ability of some humans to be resistant to certain diseases increasing their likelihood of survival.

8c. Students know the effects of genetic drift on the diversity of organisms in a population.

Epidemics and pandemics of diseases like H1N1, HIV, etc.

8d. Students know reproductive or geographic isolation affects speciation.

The "Blue People" of Kentucky are isolated and a large percentage of the population have methemoglobinemia.

8e. Students know how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.

8f.* Students know 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.

8g.* Students know 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

CCSS

ELA/Literacy -

RST-11.12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS4-1),(HS-LS4-2),(HS-LS4-3),(HS-LS4-4)

RST-11.12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS4-5)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. (HS-LS4-1),(HS-LS4-2),(HS-LS4-3),(HS-LS4-4)

WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS4-1),(HS-LS4-2),(HS-LS4-3),(HS-LS4-4),(HS-LS4-5)

SL.11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (HS-LS4-1),(HS-LS4-2)

Mathematics -

MP.2 Reason abstractly and quantitatively. (HS-LS4-1),(HS-LS4-2),(HS-LS4-3),(HS-LS4-4),(HS-LS4-5)

MP.4 Model with mathematics. (HS-LS4-2)

NGSS

HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment

HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Suggested Activities

Labs

Lab – Bacteria & Antibiotics

Antibiotic Resistance

Activity – Hardy Weinberg and HIV

Case Studies

A Tale of Three Lice

An Antipodal Mystery

Case of Desiree's Baby – Evolution of Skin Color

Chimp Droppings Lead to Evolution Discovery

Cross Dressing Salmon

My Brother's Keeper

The Dating Game- Human Evolution

Trouble in Paradise

Why Sex is Good

Suggested Assessment

Labs, quizzes, questions on readings, test

UNIT VIII: Ecology

This unit addresses how a population grows and changes, how organisms interact within their environment, how matter and energy are moved within an ecosystem, and how symbiotic interactions affect organisms.

Standards Addressed/ Instructional Objectives

Students will be able to

Ecology

CA Students will be able to

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

Effect of biodiversity on human population and effect of human population on biodiversity

Use of plant and/or animal species in pharmaceuticals and herbal supplements.

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.

Analyze how climate change, population size, nonnative species, and pollution can effect human health.

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

Look at current human population rate and compare overall health in areas of high vs. low population density.

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.

Causes and effect of imbalance in any of the biogeochemical cycles.

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

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.

Nutritional value comparison of producers, consumers, and decomposers.

6g.* 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.

CCSS

ELA/Literacy -

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS1-6),(HS-LS2-3)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS1-6),(HS-LS2-3)

WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS1-6),(HS-LS2-3)

WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS1-6)

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-5),(HS-LS1-7)

Mathematics -

MP.2 Reason abstractly and quantitatively. (HS-LS2-4)

MP.4 Model with mathematics. (HS-LS2-4)

HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-4)

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-4)

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-4)

NGSS

HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

Suggested Activities

Labs

Lab – Body Ecosystems

Lab – The Oral Environment

Lab – Disease Transmission

Lab – Outbreak!

Lab – Epidemics

Lab – Bioaccumulation

Effects of Toxic Chemicals on Cells

Activity – Ecology & Evolution

Activity – Food webs

Lab – Chlorophyll Fluorescence

Lab – Effect of pH on growth

Lab – Growth rate

Lab – Transpiration

Case Studies

A Case of a Tropical Disease and its Treatment

AH-CHOO Climate Change and Allergies

Bad Fish Bad Bird

Banana Split-To Eat or Not to Eat

Cancer Cure or Conservation

Eating PCBs from Lake Ontario

Fecal Coliform in Antarctica

Fishing for Answers in Gulf of Mexico's Dead Zone

Improving on Nature

PCBs in the Last Frontier

The Mystery of the Blue Death

To Spray or Not to Spray

Tuna for Lunch

What's in Your Water Bottle

You Poured it Where?

Suggested Assessment

Labs, quizzes, questions on readings, test

UNIT IX: Physiology

This unit addresses internal organization of important body systems. It explores the skeletal, muscular, cardiovascular, respiratory, digestive, excretory, nervous, endocrine, lymphatic, integumentary, and reproductive systems with regards to functions and structures.

Standards Addressed/ Instructional Objectives

CA: Students will be able to

Physiology

- 9a.** Students know how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.
- 9b.** Students know how the nervous system mediates communication between different parts of the body and the body's interaction with the environment.
- 9c.** Students know how feedback loops in the nervous and endocrine systems regulate conditions in the body.
- 9d.** Students know the functions of the nervous system and the role of neurons in transmitting electrochemical impulses.
- 9e.** Students know the roles of sensory neurons, interneurons, and motor neurons in sensation, thought, and response.
- 9f.*** Students know the individual functions and sites of secretion of digestive enzymes (amylases, proteases, nucleases, lipases), stomach acid, and bile salts.
- 9g.*** Students know the homeostatic role of the kidneys in the removal of nitrogenous wastes and the role of the liver in blood detoxification and glucose balance.
- 9h.*** Students know the cellular and molecular basis of muscle contraction, including the roles of actin, myosin, Ca^{+2} , and ATP.
- 9i.*** Students know how hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms for homeostasis at the cellular level and in whole organisms.
- 10a.** Students know the role of the skin in providing nonspecific defenses against infection.
- 10b.** Students know the role of antibodies in the body's response to infection.
- 10c.** Students know how vaccination protects an individual from infectious diseases.
- 10d.** Students know 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.
- 10e.** Students know 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.
- 10f.*** Students know the roles of phagocytes, B-lymphocytes, and T-lymphocytes in the immune system.

CCSS

ELA/Literacy –

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS3-1),(HS-LS3-2)

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-LS3-1)

WHST.9-12.1 Write arguments focused on discipline-specific content. (HS-LS3-2)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. (HS-LS1-1)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS1-3)

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.(HS-LS1-3)

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-4)

Mathematics – MP.2 Reason abstractly and quantitatively. (HS-LS3-2),(HS-LS3-3)

MP.4 Model with mathematics. (HS-LS1-4)

HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (HS-LS1-4)

HSF-BF.A.1 Write a function that describes a relationship between two quantities. (HS-LS1-4)

NGSS

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Suggested Activities

Labs

BonE Voyage to Marsa

Lab – Bones

Lab – Reflexes

ATP Muscle Kit

Lab – How Muscles Work

Lab – Muscles

Lab – Blood Types & Transfusions

Lab – Blood Typing Investigating Human

Respiration Lab

Lab – Lung Capacity

Lab – Digestion

Lab – Calorimetry

Lab – Enzyme Invertase

Lab – Lactose Digestion

Lab – Nutrient Identification

Lab – Protease Enzymes

Dem Bones

Lab – Testing Food for Nutrients

Lab – Urinalysis

Urinalysis and Disease Identification

Lab – Effects of Substances

Lab – Nerve Maps

Lab – Reflexes & Memory

Lab – Senses

Lab – Diabetes

Lab – HIV Transmission

Lab – Bacterial Colonies

Pathogen Webquest

Lab – Transdermal Patches

Lab – HIV Transmission ELISA: HIV/AIDS

Test

Case Studies

Ellen's Choice

Osteoporosis
A Perfect Storm in the Operating Room
A Rigorous Investigation
Anyone Who Had a Heart
Keeping up with the Jones's
Wake-Up Call
Coffee and Cigarettes
Driving Can be Dangerous to Your Health
Woe to That Child
Atkins or Fadkins
Energy Up Weight Down
The Case of the Crying Baby
It's Like Pulling Teeth
Taking It on the Chin
Andrea – The Death of a Diabetic

Chemical Eric
It's Just Stress Right
Anthrax Attack
Closing the Gap – Antiretroviral Therapy
Dr. Collins and the Case of Mysterious Infection
I Don't Need a Flu Shot
Influenza and the Influenza Vaccine
The Unfortunate Nurse
To Vaccinate or Not to Vaccinate
Not Just Another Day at the Beach
Not an Old Person's Disease
Amber's Secret
Giving Birth to Someone Else's Child
Uretero What?

Suggested Assessment

Labs, quizzes, questions on readings, test