**a-g Biology Syllabus**

**IEM Schools: Ocean Grove/South Sutter/Sky Mountain Charter Schools**

**Course Title** a-g Biology

**Department** Science

**Grade Level** 9-12 **Course Length** 2 semesters **Credits/Semester** 5

**Required for Graduation** No **Meets H.S. Grad Requirement Elective Credit** Yes

**Prerequisites** Algebra 1 with a grade C or better

**“a-g” Requirement** (d)

COURSE DESCRIPTION

**Overview:**

This one-year course is an in-depth study of Life Sciences. Through project based investigations, field exercises, demonstrations, research, and coursework students will develop an understanding of: Ecology, Cellular Biology (Prokaryotic and Eukaryotic), Genetics, Biological Diversity (and the History of), Botany, Invertebrate and Vertebrate Biology, and the Human Body Systems. Inquiry based laboratory and field exercises will help students develop critical thinking skills, perform collection and analysis of data proficiently, and understand proper laboratory procedures. The foundation of the class is based upon the standards developed by the California Board of Education.

 \*This course was written following, [Holt Biology](http://www.barnesandnoble.com/w/holt-biology-california-houghton-mifflin-harcourt/1119092993?ean=9780030993800), but can be followed using a variety of other textbooks and/or materials. (The books and activities are not limited to those listed.)

*NOTE TO PARENTS: This course was written to give you flexibility in constructing a course that meets the learning style of your child and your educational philosophy. In the spirit of our unique parent choice school structure, we value your participation in this process. You may find alternative books that you would like you child to read for a given unit, or you may think of a particular learning activity that would help your child learn the content covered in the unit. Please run these changes by your ES or SME. If the reading or learning activity is of high school rigor and it falls within the general theme covered in the unit, there is a high likelihood that it will be approved by the ES or SME.*

*Our school will have Amazon Kindle Unlimited service available for our students so that most of these books will not need to be purchased. A monthly subscription cost of only $10/month can be ordered with school funds and will provide unlimited access to over 600,000 digital books that can be read on any device. More details on this new service will be available very soon!*

**Biology Pacing Guides:**

[Biology 1A](https://docs.google.com/a/ieminc.org/document/d/1-dtEN4imxNshfJk703Fie8zx93d0BCvocPQ9QJNpQq8/edit?usp=sharing)

[Biology 1B](https://docs.google.com/a/ieminc.org/document/d/1nD3sh8QJP_In_bogDck0DPiTkc1pqg0RJt-f7kY11dk/edit?usp=sharing)

**Course Content**

**Semester 1-**

**Unit 1**: The Study of Life

Standards:

Investigation and Experimentation: 11b, 11c, 11d, 11f, 11g, 11k, 11l

PACING GUIDE: 4 WEEKS TO COMPLETE THIS UNIT

\*\*During this time Students (that will be choosing the final project option instead of a Final assessment) will choose a topic to work on for their final class project due in April.

Students will: Understand that all living things share the characteristics of life, define Biology as the study of life, identify the possible benefits of studying biology, and understand that all life forms depend on chemistry. Students will understand that scientific method is an inquiry based process. They will also study natural selection, along with evidence for evolution. Finally, students will explore the evolutionary record, along with a timeline of life. Students can meet unit objectives by completion of activities from one of the following suggested, but not required, resources.

1. **Students will read one of the following book(s):**
	1. Textbook reading
		1. [Holt Biology](http://www.hmhco.com/search?segment=All;mm=all;q=9780547586663)
			1. Read chapters 1 and 2
				1. answer all chapter questions
		2. [E. O. Wilsons Life on Earth-Unit 1](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888107968?mt=13)(free on iTunes)
			1. *read Chapter 1 (What is Life?), Chapter 2 (The Chemistry of Life)*
				1. *answer the end of chapter questions*
		3. Read pages 2-21 from [Glencoe 2012 Biology](https://www.mheonline.com/program/view/2/5/2217/0078945860/) and answer questions at the end of each section
			1. Introduction to Biology
			2. The Nature of Science
			3. Methods of Science
		4. [CK-12 Biology Free iBook](https://itunes.apple.com/us/book/ck-12-biology-interactive/id574071922?mt=13)
			1. Chapter 1: What is Biology?
				1. answer all chapter questions
		5. [Boundless Biology- The Science of Biology](https://www.boundless.com/biology/textbooks/boundless-biology-textbook/the-study-of-life-1/)
			1. Read section 1
				1. write a 1-2 page summary
2. **Students will watch all of the following videos:**
	1. [The Characteristics of Life Bozeman Science](https://www.youtube.com/watch?v=bILvTe2_FEE)
	2. [What is Science?](https://www.youtube.com/watch?v=hDQ8ggroeE4)
	3. [The Scientific Method- Education Portal](https://www.youtube.com/watch?v=Lv9-5avk4O8)
	4. [Taboos of Science](https://www.youtube.com/watch?v=3_dEsw1Ff1U&list=PLhWQfyIjGDq5guhBNmYeYjt3UEm1yZfYl) Crash Course
3. **Students will choose and complete complete four of the following activities:**
	1. [E. O. Wilsons Life on Earth-Unit 1](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888107968?mt=13)(free on iTunes)
		1. *read Chapter 1 (What is Life?), Chapter 2 (The Chemistry of Life), Chapter 3 (Evolutionary Mechanisms),*
			1. *complete the Project Based Activities (located at the end of the chapter).*
				1. *At Sea With Charles Darwin*
				2. *Yeast Rising*
	2. *Activity--*[Hands on Projects and Activities](http://serendip.brynmawr.edu/sci_edu/waldron/)
		1. Complete the Introduction to Biological Molecules Section
	3. Online learning:
		1. Section 1--Complete **one** webquest activity from each section, and write a 1-2 page summary **or** answer questions posed during the activity.
			1. [Biology Junction The Study of Life](http://www.biologyjunction.com/unit1_studyoflife.htm)
			2. [The Study of Life](http://www.nclark.net/LifeStudy)
			3. [Interactive Biology Section 1](http://www.interactive-biology.com/1065/what-is-biology/)
	4. Online Learning:
		1. Section 2 Complete these in order--Complete **one** webquest activity from each section, and write a 1-2 page summary **or** answer questions posed during the activity.
			1. [The Scientific Method interactive](http://sunshine.chpc.utah.edu/Labs/ScientificMethod/sci_method_main.html)
			2. [Scientific Inquiry- 4 Study Jams](http://www.scholastic.com/teachers/activity/scientific-inquiry-4-studyjams-interactive-science-activities)
			3. [Glencoe virtual Scientific Activity](http://www.glencoe.com/sites/common_assets/science/virtual_labs/E16/E16.html)
	5. Complete the activities in the interactive Glencoe text book
		* 1. [ConnectED login](http://connected.mcgraw-hill.com/connected/login.do) Chapter 1- The Study of Life
			2. Complete the following:
				1. Complete the Science Notebook (found in Resources)
				2. 2 interactive tables, and 2 videos
				3. Online self check quizzes for each section
				4. Online quiz for Chapter 1
	6. Read [The Characteristics of Life cK12 Foundation](http://www.ck12.org/biology/Characteristics-of-Life/lesson/Characteristics-of-Life-Advanced/r13/) and write a 1-2 page summary
	7. Read [How Science Really Works](http://undsci.berkeley.edu/article/howscienceworks_01) and write a 1-2 page summary

UNIT 2--Cells

Standards

Cell Biology: 1b, 1h

Ecology: 6a, 6b, 6c, 6d, 6e, 6f

Investigation and Experimentation: 11a, 11d, 11e, 11g, 11i, 11j, 11k, 11l

PACING GUIDE: 4 WEEKS TO COMPLETE THIS UNIT

Students will understand that the invention of the microscope led to the discovery of cells. Cell theory, and differentiation of basic plant and animal cells will be required. All cell structures and their functions will be described, and the structures diagrammed. Students will understand how cellular transport moves substances within the cell and moves substances out of the cell.

1. **Students will read one of the following book(s):**
	1. Textbook reading
		1. [Holt Biology](http://www.hmhco.com/search?segment=All;mm=all;q=9780547586663)
			1. Read chapters 3, 4 & 5
				1. answer all chapter questions
		2. [E. O. Wilson's Life on Earth - Unit 2/Guided Tour of the Living Cell](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888118327?mt=13) (free on iTunes)
			1. *Unit 2: Read chapter 5 (The Living Cell), Chapter 6 (Membranes, Transport and Signaling), Chapter 7 (Metabolism) Chapter 8 (Photosynthesis and Cellular Respiration), Chapter 9 (Cell Division).*
				1. *Answer the end of chapter questions.*
		3. Read Chapter 7, 8 & 9 from [Glencoe 2012 Biology](https://www.mheonline.com/program/view/2/5/2217/0078945860/) and answer questions at the end of each section
		4. [CK-12 Biology Free iBook](https://itunes.apple.com/us/book/ck-12-biology-interactive/id574071922?mt=13)
			1. Chapter 3 (Cellular Structure and function), Chapter 4 (Photosynthesis and Cellular Respiration), Chapter 5 (The Cell Cycle)
				1. answer all chapter questions

1. **Students will watch all of the following videos:**
	1. [Cells Alive](http://www.cellsalive.com/)--Explore this interactive site and view the Interactive Cell models and cell cycle.
	2. [UC Berkeley Lecture: Cells and Tissues](https://www.youtube.com/watch?v=pPu1ZdeIP5k&index=6&list=PL7D120055C712F646) (52 min)
	3. [Khan Video: Parts of a Cell](https://www.youtube.com/watch?v=Hmwvj9X4GNY) (21 min)
	4. [Plants and Plant Structure](https://www.youtube.com/watch?v=yxyHUv4zFgo) (41 min)
2. **Students will choose and complete complete four of the following activities:**
	1. [E. O. Wilson's Life on Earth - Unit 2/Guided Tour of the Living Cell](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888118327?mt=13) (free on iTunes)
		1. *Unit 2: Read chapter 5 (The Living Cell), Chapter 6 (Membranes, Transport and Signaling), Chapter 7 (Metabolism) Chapter 8 (Photosynthesis and Cellular Respiration), Chapter (Cell Division).*
			1. *complete the both Project Based Activities (located at the end of each chapter).*
				1. Chapter 5--Cell as a system
				2. Chapter 6--Under the Shell
				3. Chapter 7--Enhancing metabolism with enzymes
				4. Chapter 8--Up, up, and away
				5. Chapter 9--Cancer and the cell cycle
	2. Activity---How long does each phase of the cell cycle last?
		1. Use a microscope to identify cells in an onion root tip
		2. Identify the different stages of the cell cycle in onion cells
		3. Count the number of cells in each stage of the cell cycle
		4. Calculate the amount of time cells spend in each stage of the cell cycle
		5. Write a 2-3 page report on your findings including pictures or drawings.
		6. Resource--[Cells Alive](http://www.cellsalive.com/)
	3. [Hands on Projects and Activities](http://serendip.brynmawr.edu/sci_edu/waldron/) :
		1. Complete the Mitosis and Meiosis Activities (under Cell Division and Genetics.
	4. Activity--[Genome: Genes in Motion Mitosis Project](https://www.genome.gov/Pages/Education/DNADay/NewsAndFeatures/GenesinMotionLessonGuide.pdf)
		1. Complete the activities on Mitosis
	5. [Mitosis Meiosis Activities](http://www.nclark.net/MitosisMeiosis)
		1. Complete the activities in Meiosis
	6. Website review:
		1. View the following websites. Write a one paragraph review of each site rating their value on this subject matter.
			1. [PBS Learning Cellular Function](http://www.pbslearningmedia.org/resource/tdc02.sci.life.cell.lp_strufx/cellular-structure-and-function/)
			2. [What do cells do?](http://sepuplhs.org/high/sgi/teachers/cell_sim.html)
			3. [Bio Alive Inside a Cell](http://bio-alive.com/animations/cell-biology.htm)
			4. [The Living Cell Interactive](http://schoolmediainteractive.com/view/object/interactive/473F353293B156A0472E0561416301A1/FC628C7AAD3C3DF8C3257F73EBD9CDF4)
	7. Online learning--
		1. View the following interactive sites and write a 1-2 page summary of your findings.
			1. [Virtual Lab Cellular Reproduction](http://www.mhhe.com/biosci/genbio/virtual_labs/BL_23/BL_23.html)
			2. [PBS Learning Cell Division](http://www.pbslearningmedia.org/resource/lsps07.sci.life.stru.celldivision/cell-division/)
			3. [The Cell Cycle Game](http://www.rigb.org/education/games/human-body/the-cell-cycle)
	8. Activity--Using diagrams, demonstrate for each stage of the cancer cell cycle how it differs from that of a regular cell.

UNIT 3--Genetics

Standards:

Cell Biology: 1a, 1c, 1e, 1f, 1g, 1i, 1j

Genetics: 4d

Ecology: 6b, 6d

Investigation and Experimentation: 11d, 11j, 11k

PACING GUIDE: 4 WEEKS TO COMPLETE THIS UNIT

In this unit, students will understand and apply the knowledge of mutation and sexual reproduction in organisms leading to genetic variation including meiosis, fertilization, alleles and the probability of alleles, and how zygote’s gain their characteristics. Students will also understand and apply the knowledge of how a multicellular organism develops including genotype, phenotype, pedigrees, Mendelian genetics, and frequency of chromosomes as well as DNA sequencing including RNA, DNA, reproduction, replication, amino acids, genes, and current research on genetics and genetic technology. Students will apply unit 2 knowledge of cells and cell replication to DNA and mitosis. Students will predict genotypes and phenotypes using Mendelian genetics and Punnett squares. Students will diagram pedigrees and explain how traits are passed from a cellular allele level. Students will model transcription, translation, and replication of DNA and explain its importance in ensuring exact information. Students will apply genetic information to real world health issues as well as modern genetic technology and issues.

1. **Students will read one of the following book(s):**
	1. Textbook reading (select one option)
		1. [Holt Biology](http://www.hmhco.com/search?segment=All;mm=all;q=9780547586663)
			1. Read chapters 6, 7, 8 and 9
				1. answer all chapter questions
		2. [E O Wilsons Life on Earth-Unit 3, Genetics](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888132076?mt=13) (free on iTunes)
			1. *Unit 3: Read chapter 10 (The Nucleus and Gene Expression), Chapter 11 (Patterns of Inheritance), Chapter 12 (Meiosis and Sexual Reproduction) Chapter 13 (Gene Technology).*
				1. *Answer the end of chapter questions.*
		3. Read Chapter 9, 10, 11 and 12 from [Glencoe 2012 Biology](https://www.mheonline.com/program/view/2/5/2217/0078945860/) and answer questions at the end of each section
		4. [CK-12 Biology Free iBook](https://itunes.apple.com/us/book/ck-12-biology-interactive/id574071922?mt=13)
			1. Chapter 6 (Gregor Mendel and Genetics), Chapter 7 (Molecular Genetics), Chapter 8 (Human Genetics and Biotechnology)
				1. answer all chapter questions.
2. **Students will watch all of the following videos:**
	1. [From Grass to Maize](http://media.hhmi.org/biointeractive/films/PoppedSecret.html)  How are plants related? Can genetics help us find the relationship of plants to each other? A HHMI movie from Biointeractive Films.
	2. [Chemical Structure of DNA.](http://www.hhmi.org/biointeractive/chemical-structure-dna)
	3. [The components of DNA](http://bcove.me/8462rtsf) A short video showing each chemical in DNA
	4. [Damage to DNA causes mutations.](http://www.hhmi.org/biointeractive/damage-dna-leads-mutation)
	5. [Introduction to Heredity](https://www.youtube.com/watch?v=eEUvRrhmcxM) (17 min)
	6. [Punnett Square Fun](https://www.youtube.com/watch?v=eEUvRrhmcxM) (25 min)
	7. [Allele Frequency](https://www.youtube.com/watch?v=Bc9bhLk_AhI) (7 min)
	8. [Hardy Weinberg Equation](https://www.youtube.com/watch?v=oc9fJCAIRJs) (8 min)
	9. [Applying the Hardy Weinberg Equation](https://www.youtube.com/watch?v=oc9fJCAIRJs) (5 min)
	10. [Mendelian Genetics](https://www.youtube.com/watch?v=NWqgZUnJdAY) (16 min)
3. **Students will choose and complete complete five of the following activities:**
	1. [E O Wilsons Life on Earth-Unit 3, Genetics](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888132076?mt=13) (free on iTunes)
		1. *Unit 3: Read chapter 10 (The Nucleus and Gene Expression), Chapter 11 (Patterns of Inheritance), Chapter 12 (Meiosis and Sexual Reproduction) Chapter 13 (Gene Technology).*
			1. *complete the both Project Based Activities (located at the end of each chapter).*
				1. Chapter 10--It is a Spiral Staircase, not a Twisted Ladder
				2. Chapter 11--Ants in Mendel’s Garden
				3. Chapter 12--Meiosis, the Movie
				4. Chapter 13--The Business of Biotech
	2. Online Learning--Participate in the following Genetics activities. Write a 1-2 page summary of your discoveries. Include a page where you rate (describe the effectiveness of the lesson or activity) the following interactive websites.
		1. [Cells Alive Meiosis](http://www.cellsalive.com/meiosis.htm)
		2. [Genetics and Meiosis Bio Man](http://www.biomanbio.com/GamesandLabs/Genegames/genetics.html)
		3. [PBS Learning Mitosis vs Meiosis](http://www.pbslearningmedia.org/resource/tdc02.sci.life.gen.mitosis/how-cells-divide-mitosis-vs-meiosis/)
		4. [Mendelian Inheritance](http://geneed.nlm.nih.gov/topic_subtopic.php?tid=5&sid=6)
		5. [The Science Learning Center- Learn Genetics](http://learn.genetics.utah.edu/) (take a tour of basic genetics)
	3. Activity--
		1. Students will read The Double Helix and create a model of the DNA structure
	4. Activity--Gummi Bear Genetics:
		1. [Gummy Bear Activity](http://www.nclark.net/gummybeargenetics.pdf)--Complete this activity
		2. Write a 1-2 page summary on your findings
	5. [Dragon Genetics activity](http://www.nclark.net/DragonGeneticsProtocol.pdf)--Explore and complete this activity on Mendelian Genetics.
		1. Resource--[Dragon Genetics Teacher Notes](http://www.nclark.net/DragonGeneticsTeachPrep.pdf)
	6. Activity--[Genetic Traits in Harry Potter](http://www.nlm.nih.gov/exhibition/harrypottersworld/education/lessonplans/science.html)
		1. Complete this activity exploring the genetic traits of the Harry Potter characters. Report on your findings.
	7. Transcription and Translation Activity:
		1. [Transcription and Translation Activity](http://serendip.brynmawr.edu/sci_edu/waldron/pdf/TranscriptionTranslationProtocol.pdf)--Complete this activity and write a 1-2 page summary.
	8. [Hands on Projects and Activities](http://serendip.brynmawr.edu/sci_edu/waldron/) :
		1. Complete the following activities: Scroll down the page to find the following activities) Complete the following:
			1. Genetics
			2. Dragon Genetics
			3. Criminal Blood Activity
			4. DNA and Gene to Protein
		2. Write a 2-3 page summary of your findings.
	9. Activity--[DNA Forensics and Color Pigments](http://www.teachengineering.org/view_activity.php?url=collection/uoh_/activities/uoh_dna/uoh_dna_lesson02_activity1.xml)--Complete this activity exploring forensics!
	10. Pedigree/Phenotype/Genotype etc genetics activity:
		1. [Pedigree Activity](http://serendip.brynmawr.edu/sci_edu/waldron/pdf/GeneticsProtocol.pdf)--Complete this Pedigree activity.
	11. Complete a Webquest using the internet to find educational videos, interactive websites, worksheets, and/or educational games such as the following. (Please note the following resources may not meet all the above objectives and are meant to be used as examples of how they can be met using online resources.)
		1. [Learn Genetics](http://learn.genetics.utah.edu/)
		2. [DNA From the Beginning](http://www.dnaftb.org/#classical)
		3. [The Biology Corner](http://www.biologycorner.com/bio2/index2.html)
		4. Assignment--Write a 2-3 page summary of your Webquest including what information you learned about DNA.
	12. Activity--Extracting DNA from a fruit.
		1. Resource--[Extraction of DNA from strawberries.](http://genetics.thetech.org/online-exhibits/do-it-yourself-strawberry-dna)
		2. Write a 1-2 page report on your process of DNA extraction
	13. Key assignments (Choose 2 )
		1. Key Project: Using Punnett squares to record inheritance and coin flips prove statistically that the law of assortment is valid.
		2. Key Project: Students will research a genetic disease, such as Hemophilia, Huntington’s Chorea, Tay-Sachs, or Sickle Cell, and in a 1000 word paper, or 5-7 minute media presentation discuss the genetics of the disease, history, treatment, and progression and prognosis.
		3. Key Project: Research, and using family trees, explain the incidence of Hemophilia in European families of the 19th and 20th centuries.
		4. Key Project: Students will construct a timeline of the Human Genome Project.

UNIT 4--Evolution

Standards:

Genetics: 2a, 2b, 2c, 2d, 2e, 2f, 2g, 3a, 3b, 3c

Investigation and Experimentation: 11d, 11g, 11j, 11k

PACING GUIDE: 4 WEEKS TO COMPLETE THIS UNIT--(Final Unit of Biology A)

*\*\*Outline/First draft for final project due (if student is choose the end of course final project option) -- 20% of first semester’s grade*

*(At the end of the course Students will either complete a comprehensive final examination or a substantive, culminating project.)*

Students will understand that Charles Darwin developed an evidence based theory of evolution based on natural selection. They will explain how the idea of artificial selection contributed to Darwin’s ideas on natural selection and identify and provide examples of the four principles of natural selection. Wallace’s contribution of to the theory of evolution will also be examined. Students will understand how multiple lines of evidence support the theory of evolution

and describe how fossils and biochemistry provide evidence of evolution. They will also explain what natural selection predicts about mimicry, camouflage, homologous structures, and vestigial structures. Students will compare the morphological evidence and the biochemical evidence supporting evolution and understand that the theory of evolution continues to be refined as scientists learn new information. Finally they will identify the conditions of the Hardy-Weinberg principle and discuss factors that lead to speciation.

1. **Students will read one of the following book(s):**
	1. Textbook reading (select one option)
		1. [Holt Biology](http://www.hmhco.com/search?segment=All;mm=all;q=9780547586663)
			1. Read chapters 10, 11 and 12
				1. answer all chapter questions
		2. [E. O. Wilsons Life on Earth-Unit 1](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888107968?mt=13)(free on iTunes)
			1. *read Chapter 3 (Evolutionary Mechanisms), Chapter 4 (The History of Life on Earth)*
				1. *answer the end of chapter questions*
		3. Read Chapter 14, 15 and 16 from [Glencoe 2012 Biology](https://www.mheonline.com/program/view/2/5/2217/0078945860/) and answer questions at the end of each section
		4. [CK-12 Biology Free iBook](https://itunes.apple.com/us/book/ck-12-biology-interactive/id574071922?mt=13)
			1. Chapter 9 (Life: From the First Organism Onward) and 10 (The Theory of Evolution)
				1. answer all chapter questions
2. **Students will watch all of the following videos:**
	1. [**Evolution: What Darwin Never Knew--NOVA/PBS Documentary**](https://www.youtube.com/watch?v=AYBRbCLI4zU) **(1.5 hrs)**
	2. [**Evolution of Humans Documentary**](https://www.youtube.com/watch?v=MsHEAnPX59Y) **(45 min)**
	3. [What is the Evidence of Evolution?](https://www.youtube.com/watch?v=lIEoO5KdPvg) (11 min)
	4. [How Evolution Works](https://www.youtube.com/watch?v=hOfRN0KihOU) (11 min)
	5. [Natural Selection--(Crash Course)](https://www.youtube.com/watch?v=aTftyFboC_M) (12 min)
	6. [The Making of a Theory: Darwin, Wallace and Natural Selection](https://www.youtube.com/watch?v=XOiUZ3ycZwU) (30 min)
	7. [The Making of the Fittest: Natural Selection and Adaption](https://www.youtube.com/watch?v=AMtT5_AQmLg) (9 min)
3. **Students will choose and complete complete four of the following activities:**
	1. [E. O. Wilsons Life on Earth-Unit 1](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888107968?mt=13)(free on iTunes)
		1. *read Chapter 3 (Evolutionary Mechanisms), Chapter 4 (The History of Life on Earth)*
			1. *complete the Project Based Activities (located at the end of the chapter).*
				1. *Sickle Cell Selection and Malaria*
				2. *Evolution Illustrated*
	2. Key Project: Go to [Howard Hughes Medical Institute Virtual Lizard Evolution Lab](http://www.hhmi.org/biointeractive/lizard-evolution-virtual-lab) and run the virtual lizard evolution lab. Complete the 6 pages of worksheets that accompany this lab.
	3. Activity--[The Co-Evolution of Diet and Salivary Amylase](http://www.hhmi.org/biointeractive/diet-and-evolution-salivary-amylase). This is a real world application of change in a population. Read the handouts and complete the activity, then complete the worksheets on this site.
	4. Hardy-Weinberg Activity--
		1. [H.W. Goldfish Activity](http://evolution.about.com/od/teaching/a/Hardy-Weinberg-Goldfish-Lab.htm)--Complete this activity and summarize your findings.
	5. [The Co-Evolution of Diet and Salivary Amylase](http://www.hhmi.org/biointeractive/diet-and-evolution-salivary-amylase). This is a real world application of change in a population. Read the handouts and complete the activity, then complete the worksheets on this site.
	6. Key Project: Students will choose one species that has shown evidence of evolution, and list the changes in the species, and reasons why these changes occurred.
	7. [Hands on Projects and Activities](http://serendip.brynmawr.edu/sci_edu/waldron/)--Complete the Natural Selection Activity and document your findings in a 1-2 page summary.
	8. [Peppered Moth Natural Selection Activity](http://www.biologycorner.com/worksheets/pepperedmoth.html)--Complete this activity and answer the questions provided.

**SECOND SEMESTER**

UNIT 5--Ecology

Standards:

Cell Biology

1d

Genetics

4a, 4b, 4c, 4d, 4e, 4f

5a, 5b, 5c, 5d, 5e

Investigation and Experimentation

11a, 11d, 11e, 11j, 11k, 11l, 11n

PACING GUIDE: 3 WEEKS TO COMPLETE THIS UNIT

Students will: Understand that Ecology is the study of relationships among living organisms and their interaction with the environment, define biotic and abiotic factors and understand their interactions in complex ways in communities and ecosystems, understand the flow of energy in an ecosystem, know that autotrophs capture sun energy, making it available for all members of a food web, be able to understand and diagram models of energy flow, explain that essential nutrients are cycled through biogeochemical processes, and be able to understand and diagram the water, carbon and oxygen, nitrogen, and phosphorus cycles as well as understand the Biosphere and human impact on Ecosystems.

1. **Students will read one of the following book(s):**
	1. Textbook reading (select one option)
		1. [Holt Biology](http://www.hmhco.com/search?segment=All;mm=all;q=9780547586663) ($93.55)
			1. Read chapters 13, 14, 15 & 16
				1. answer all chapter questions
		2. [E. O. Wilson's Life on Earth--Unit 7/Guided Tour of Ecosystems](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888491533?mt=13) (free on iTunes)
			1. *Unit 7 - read the chapters 37 (Introduction to Ecology, 38(Behavior and Ecology), 39 (Population Ecology), 40 Ecosystems, 41 (Conservation and restoration Ecology)*
				1. *Answer the end of chapter questions*
		3. [Glencoe 2012 Biology](https://www.mheonline.com/program/view/2/5/2217/0078945860/)--
			1. Read chapter 2, 3 & 4
			2. Answer the chapter questions
		4. [CK-12 Biology Free iBook](https://itunes.apple.com/us/book/ck-12-biology-interactive/id574071922?mt=13)
			1. Chapter 11 (The Principles of Ecology) & 12 (Communities and Populations)
				1. answer all chapter questions
2. **Students will watch all of the following videos:**
	1. [Crash Course Ecology #1](https://www.youtube.com/watch?v=sjE-Pkjp3u4)
	2. [Biodiversity in a Wetland Ecosystem](http://education.nationalgeographic.com/education/activity/biodiversity-in-wetland-ecosystem/?ar_a=1)
	3. [Exploring Ecosystems](http://education.nationalgeographic.com/education/activity/exploring-ecosystems-using-gis/?ar_a=1)
	4. [Mapping our Human Footprint](http://education.nationalgeographic.com/education/activity/mapping-our-human-footprint/?ar_a=1)
	5. [Population Density](http://education.nationalgeographic.com/education/activity/introduction-population-density/?ar_a=1)
	6. [Calculating Population Density](http://education.nationalgeographic.com/education/activity/calculating-population-density/?ar_a=1)
	7. [Global Warming and Plant Productivity](https://www.youtube.com/watch?v=Er3iD5PIR00) (3 min)
	8. [Global Ecology](https://www.youtube.com/watch?v=UERX_2er950&list=PLdYnPVzNyMELg2kadvnHfl4sfyUpNv5Wz) (49 min)
	9. [Species, Communities and Ecosystems](https://www.youtube.com/watch?v=_V_gjIE3LGo) (9 min)
	10. [Ecosystems and Biomes](https://www.youtube.com/watch?v=NYb2EhcPchA) (47min)
3. **Students will choose and complete complete four of the following activities:**
	1. [Life on Earth--Unit 7/Guided Tour of Ecosystems](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888491533?mt=13) (free on iTunes)
		1. *Read Unit 7 - read the chapters 37 (Introduction to Ecology, 38(Behavior and Ecology), 39 (Population Ecology), 40 Ecosystems, 41 (Conservation and restoration Ecology)*
			1. *complete the Project Based Activities (located at the end of each chapter).*
				1. *Chapter 37--Plant Wars*
				2. *Chapter 38--Field Observation*
				3. *Chapter 39--Ecological Surveys*
				4. *Chapter 40--Polyculture Farm*
				5. *Chapter 41--Fishing out an Ecosystem*
	2. [Invasion Ecology](http://www.nsta.org/store/product_detail.aspx?id=10.25.5/9780873552110)
		1. Complete pages 3 to 91, including Protocols 1, 2 and 3
	3. Invasive Species Ecology Activity
		1. Students will visit and compare and evaluate two nurseries and two local parks (in their area) to gather information on exotic and native plants. Students will also research/analyze growing conditions required for native vs. nonnative plants. In the process students will gain a better understanding of native plants, local growing requirements, and environmental risks associated with non-native and exotic plants. Students will write a lab report including their observations, information collected, sources of information, pictures, tables, graphs and date etc. The report will be approximately 3-5 pages.
	4. Eco-Column activity
		1. Students will develop and maintain a miniature ecosystem (including terrestrial and aquatic plants, fishes, insects, earthworms) to evaluate species interaction and learn the techniques of soil and water testing. Each student will keep an observation journal to record their findings and have the opportunity to compare and contrast individual data to other ecosystem projects in the lab? Journal length will vary, depending on the format used by the student. Resource: [Making a Mini Ecosystem 1](https://www.youtube.com/watch?v=VCH5Egcaxv4), [Making a mini Ecosystem 2](https://www.youtube.com/watch?v=gM8yxVNu-co), [Making a mini Ecosystem 3](https://www.youtube.com/watch?v=mTkXzumP64Q)
	5. Biomes study
		1. Students will describe, compare and contrast the major ecosystems of the world including desert, grasslands, and forests, freshwater and marine. Presentation can include a PowerPoint/slide show, video, or poster. Resources: [What is a Biome (National Geographic)](http://education.nationalgeographic.com/education/encyclopedia/biome/?ar_a=1), [Biome Lesson (Discovery Education)](http://www.discoveryeducation.com/teachers/free-lesson-plans/elements-of-biology-biomes.cfm)(Students are welcome to complete this lesson or use this link as a reference)
	6. Online Learning:
		1. [Learner.org/Envrionmental Science Courses--The Habitable Planet](http://www.learner.org/courses/envsci/)
			1. Complete all reading, interactive labs, and videos in Unit 4 (Ecosystems)
			2. (Many Planets, One Earth; Atmosphere).
	7. Activity/Project: Construct a timeline of the extinction of one organism, such as the Carrier Pigeon. The timeline should contain graphics, and fully explain the environmental and human factors which led to the extinction. If these factors are unproven probable causes may be substituted. A trend line of population over time should also be included.
	8. [Hands on Projects and Activities](http://serendip.brynmawr.edu/sci_edu/waldron/) : Complete the Infectious Diseases and Population Growth activities.

UNIT 6--Classification and Diversity

Standards:

Ecology

6g

Evolution

7a, 7b, 7c, 7d, 7e ,7f

8c, 8d, 8e, 8f, 8g

Investigation and Experimentation

11a, 11d, 11i,11j, 11k

PACING GUIDE: 3 WEEKS TO COMPLETE THIS UNIT

Students will use a system of classification to organize information about the diversity of living things, explain why a biological classification system is important, and summarize the rules for using binomial nomenclature. Students will review the history of classification, describe methods of determining species, phylogeny, and organize animal in ascending complexity.

In addition, Students will understand that Prokaryotes are diverse organisms that live in nearly all environments, diagram a bacterium, understand that Prokaryotes belong to two domains, that bacteria can cause disease and some can be beneficial to humans. Students will describe how viruses and prions can alter cell functions, draw and diagram a virus and label the parts,and describe virus replication. Furthermore, Students will understand that protists form a diverse group of organisms that are subdivided based on their method of obtaining nutrition, describe theories of the origin of protists, understand that protozoans are animal-like, heterotrophic protists, and compare the methods of feeding, locomotion, and reproduction of three groups of protozoa. Finally, Students will understand that fungi are unicellular or multicellular eukaryotic heterotrophs that are decomposers, name the major characteristics of Kingdom Fungi, state the different methods by which fungi obtain food, and describe the ways fungi reproduce both asexually and sexually.

Students will understand that fungi exhibit a broad range of diversity and are classified into four major phyla, identify the characteristics of each of the four major phyla of fungi, explain the life cycles of the major phyla of fungi, understand the lichens and mycorrhizae demonstrate important symbiotic relationships between fungi and other organisms, identify the characteristics of the mutualistic relationship between fungi and algae.

1. **Students will read one of the following book(s):**
	1. Textbook reading (select one option)
		1. [Holt Biology](http://www.hmhco.com/search?segment=All;mm=all;q=9780547586663) ($93.55)
			1. Read chapters 17, 18, and 19
				1. answer all chapter questions
		2. [E. O. Wilson's Life on Earth--Guided Tour of Biodiversity, Unit 6](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888419779?mt=13) (free on iTunes)
			1. *Unit 6 - read chapters 25 (Bacteria and Archaea), 26 (Viruses), 27 (Protists), 28 (fungi), 29 (Plant Diversity)*
				1. *Answer the end of chapter questions*
		3. [Glencoe 2012 Biology](https://www.mheonline.com/program/view/2/5/2217/0078945860/)--
			1. Read chapter 15, 16, 17, and 18
			2. Answer the chapter questions
		4. [CK-12 Biology Free iBook](https://itunes.apple.com/us/book/ck-12-biology-interactive/id574071922?mt=13)
			1. Chapter 13, 14, 15 and 17
				1. answer all chapter questions
2. **Students will watch all of the following videos:**
	1. [Bacterial Sensing](http://www.hhmi.org/biointeractive/eavesdropping-tiny-conspiracies)
	2. [Plant Diversity](https://www.youtube.com/watch?v=X4L3r_XJW0I) (8 min)
	3. [Fungi](https://www.youtube.com/watch?v=dj9m7Oc36wM) (9 min)
	4. [Protists](https://www.youtube.com/watch?v=8deF3Rw4ti4) (5 min)
	5. [Archaea](https://www.youtube.com/watch?v=W25nI9kpxtU) (7min)
	6. [Bacteria](https://www.youtube.com/watch?v=h-z9-9OOWC4) (11min)
	7. [Overview of Archaea, Protista, Bacteria](https://www.youtube.com/watch?v=cN5jQ7sQMn0) (7min)
	8. [Kingdom Protista](https://www.youtube.com/watch?v=mNsFk2OZi3Q) (22 min)
	9. [Killer Algae](https://www.youtube.com/watch?v=3_iPnFVMRek) (43 min)
3. **Students will choose and complete complete four of the following activities:**
	1. [E. O. Wilson's Life on Earth--Guided Tour of Biodiversity, Unit 6](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888419779?mt=13) (free on iTunes)
		1. *Unit 6 - read chapters 25 (Bacteria and Archaea), 26 (Viruses), 27 (Protists), 28 (fungi), 29 (Plant Diversity)*
			1. *complete the Project Based Activities (located at the end of each chapter).*
				1. *Chapter 25--Innate Immunity*
				2. *Chapter 26--Who Started It?*
				3. *Chapter 27--The Next Population*
				4. *Chapter 28--The Fungus Within*
				5. *Chapter 29--Going Native*
	2. Classification Activity--At this web site [NOVA Classifying Life](http://www.pbs.org/wgbh/nova/nature/classifying-life.html) you can sort animals by taxonomy.
		1. Classify 10 different animals
		2. Write a 2-3 page report on your experience include your work on classifying the 10 animals.
	3. Tree of Life Activity--
		1. Explore [The Tree of Life](http://tolweb.org/tree/phylogeny.html) website (this website gives the information on thousands of plants and animals.)
		2. Use this information to create a visual representation of the classification system biologists use as well as writing a 1-2 page report explaining why there is a trunk and branches.
	4. Activity--[Sorting-seashells](http://www.hhmi.org/biointeractive/sorting-seashells) can show how morphology help to classify individuals animals. Go to the website and sort the 20 shells and classify them. When you have completed the project, write at least 500 words about what you have discovered.
	5. Activity--Bacterium and Virus
		1. Draw a bacterium and label all of the parts of it.
		2. Draw a virus and label the parts. Describe its replication.
		3. Compare the bacterium with the virus and write a 2-3 page compare and contrast essay.
	6. Online Activity:
		1. Watch the following video about [Bacterial Sensing.](http://www.hhmi.org/biointeractive/eavesdropping-tiny-conspiracies) (How to develop a new type of antibiotic by learning more about the sensing of bacteria and how bacteria interact.)
		2. Write a 500 word essay about the sensing of bacteria and how we can make that work in our favor inside of our bodies and maybe on plants and foods.
	7. Activity---Diagram a protist and label the parts and write a 1-2 page report describing a protist including your diagram.
	8. Spore Activity-- Create a print of Spores.
		1. This can be done with a fern leaf that has spores on the back or it can be done with the top of a mushroom. Place the Fern leaf or mushroom cap without the stem overnight on a piece of white paper. In the morning lift up the mushroom and you will see the pattern of the spores that have dropped onto the paper.
	9. Fungi Project:
		1. Choose 3 articles by Paul Stamets [from Fungi Perfecti](http://www.fungi.com/blog-archive/tag/Articles%2Bby%2BPaul%2BStamets.html).
		2. Describe the relationship between humans and fungi. Write about how fungi can be of benefit to humans in a variety of ways and why we need them as part of our environment. Create a 2-3 page written report.

UNIT 7--Plants

Standards:

Cell Biology

1d

Genetics

2a, 2b

Ecology

6e

Physiology

10d

Investigation and Experimentation

11d, 11k, 11m

PACING GUIDE: 4 WEEKS TO COMPLETE THIS UNIT

Students will understand that plants have adaptations for environments on Earth, explain why scientist hypothesize that green algae and plants share a common ancestor, name the plant divisions and which are nonvascular, vascular seedless, and vascular seed plants. S students will summarize the characteristics of nonvascular plants. Students will list the characteristics of seedless plant groups, compare the sporophyte and gametophyte generations of vascular and nonvascular plants. Students describe the advantages of plants that produce seeds, compare and contrast a gymnosperm and angiosperm, distinguish between male and female cones of gymnosperms, differentiate between monocot and eudicot, and compare and contrast three types of anthophyte life spans.

Plant Structure and Function--

Students will recognize and identify different types of plant cells make up plant tissues, compare, and contrast the types of plant cells and tissues related to its function. Students will identify the location and function of different types of plant tissues, compare and contrast xylem and phloem, summarize the function of the root cap, cortex, and endodermis, describe the functions and modifications of the roots, stems, and leaves. Students will understand how hormones can affect a plant’s response to its environment, identify plant hormones and classify them according to the effects they have on a plant, describe tropisms and compare and contrast tropisms and nastic responses.

 Reproduction in Plants--

Students will describe the stages of alternation of generations of mosses, ferns, and conifers include alternation of generations, identify advantages of vegetative reproduction, explain how the fern sporophyte is dependent upon the gametophyte. Students will compare and contrast the life cycles of mosses and conifers. Students will understand that flowers are the reproductive structure of anthophytes, compare and contrast the function of each of the four organs of a typical flower, describe traits of a typical monocot flower and a typical eudicot flower, compare and contrast complete and incomplete flowers. Students will understand that in anthophytes, seeds and fruits can develop from flowers after fertilization and explain the steps of flowering-plant life cycles.

1. **Students will read one of the following book(s):**
	1. Textbook reading (select one option)
		1. [Holt Biology](http://www.hmhco.com/search?segment=All;mm=all;q=9780547586663) ($93.55)
			1. Read chapters 20, 21, and 22
				1. answer all chapter questions
		2. [Life on Earth -Unit 5/ Plant Physiology Unit](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888382630?mt=13) *(free on iPad or Mac computers)*
			1. *Unit 5: read Chapter 22 (Plant Structure and Function), 23 (Plant Reproduction) and 24 (Plant Responses)*
				1. *Answer the end of chapter questions*
		3. [Glencoe 2012 Biology](https://www.mheonline.com/program/view/2/5/2217/0078945860/)--
			1. Read chapter 19, 20, and 21
				1. Answer the chapter questions
		4. [CK-12 Biology Free iBook](https://itunes.apple.com/us/book/ck-12-biology-interactive/id574071922?mt=13)
			1. Chapter 15 and 16
				1. answer all chapter questions
	2. Supplemental Texts
		1. [Botany Adventure!](https://www.rainbowresource.com/product/Botany%2BAdventure%2B2ED/001506) (includes labs and text)
2. **Students will watch all of the following videos:**
	1. [BBC Life: Plants](https://www.youtube.com/watch?v=0MdBdTemZdw) (1hr 13min)
	2. [BBC How Plants Communicate and Think](https://www.youtube.com/watch?v=Q-4w5xYLwiU) (52 min)
	3. [Khan Video: Parts of a Cell](https://www.youtube.com/watch?v=Hmwvj9X4GNY) (21 min)
	4. [Plants and Plant Structure](https://www.youtube.com/watch?v=yxyHUv4zFgo) (41 min)
	5. BBC video: [Botany, A Blooming History - Photosynthesis](https://www.youtube.com/watch?v=fPRSlWzQc04&list=PLvfMTRnEQbt2hJs0lGdFC__PB6n7Yd7bI) (1 hour)
	6. [Photosynthesis](https://www.youtube.com/watch?v=g78utcLQrJ4) (12 min)
	7. [**Photosynthesis process**](https://www.youtube.com/watch?v=sQK3Yr4Sc_k) **(14 min)**
	8. [Photosynthesis, Transforming Light to Life](https://www.youtube.com/watch?v=KLVjz_cPI_4&index=4&list=PLvfMTRnEQbt2hJs0lGdFC__PB6n7Yd7bI) (3min)
	9. [Plant Genetics and the Environment](https://www.youtube.com/watch?v=fghFaDlgc-E) (29 min)
	10. [Gymnosperms and Angiosperms](https://www.youtube.com/watch?v=2B3mEHwh6PU) (8 min)
	11. [The Difference between Gymnosperms and Angiosperms](https://www.youtube.com/watch?v=Uwke9czlFo4) (10 min)
	12. [Plant Physiology of Seed plants](https://www.youtube.com/watch?v=vJsKEAlOasw) (1:07)
3. **Students will choose and complete complete four of the following activities:**
	1. [Life on Earth -Unit 5/ Plant Physiology Unit](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888382630?mt=13) *(free on iPad or Mac computers)*
		1. *Unit 5: read Chapter 22 (Plant Structure and Function), 23 (Plant Reproduction) and 24 (Plant Responses),*
			1. *complete the Project Based Activities (located at the end of each chapter).*
				1. *Chapter 23--Water Running Uphill*
				2. *Chapter 24--Cloning for the Future*
				3. *Chapter 25--”Mouths” on Leaves*
	2. Prepare and collect plant specimens
		1. Order a [Plant Press](https://wardsci.com/store/catalog/product.jsp?catalog_number=100800) ($65) or build your own by watching YouTube videos
		2. [Video instructions](https://www.youtube.com/watch?v=iVT6RXlwIyQ) on how to press plants
		3. [Build a portfolio](http://herbarium.usu.edu/k-12/collecting/specimens.htm) of pressed plant specimens that have been labeled and identified
			1. Students will provide written reasoning for their classification of each of the plants
			2. *You may do this activity progressively and build your portfolio. Take day-trips to various destinations to get some great diversity.*
	3. Seed Project:
		1. Gather seeds of various types and classify them according to what you have studied about seed variety.
		2. Make a chart and presentation about your classification system.
	4. [Glencoe Virtual Photosynthesis Lab](http://www.glencoe.com/sites/common_assets/science/virtual_labs/LS12/LS12.html)--Complete this activity and write a 1-2 page report on your findings.
	5. [Botany Adventure!](https://www.rainbowresource.com/product/Botany%2BAdventure%2B2ED/001506)*--*
		1. *Complete 6 activities of your choice*
		2. *write a 1-2 page description of each activity and your findings*
	6. Online Learning 1: View these animations and write a summary of your learning
		1. [Bio Alive--Plants](http://purchon.com/biology/?page_id=82)--(Follow directions for the animations, answer the key questions given, draw and label a section of a leaf)
	7. [Cells Alive](http://www.cellsalive.com/)**--**(explore the interactive cell models for plants and animals and the cell cycle. Write a summary of the cell cycle)
	8. Online Learning 2: [Bio Alive--Harvesting Light](http://www.sumanasinc.com/webcontent/animations/content/harvestinglight.html), [Bio Alive--Photosynthesis](http://www.johnkyrk.com/photosynthesis.html), [Bio Alive--Photosynthesis animation](http://www.stolaf.edu/people/giannini/flashanimat/metabolism/photosynthesis.swf), [Photophosphorylation](http://highered.mheducation.com/sites/0072437316/student_view0/chapter10/animations.html) (watch the animations then write a 1 page report describing photosynthesis. Include drawings)
	 [Photosynthesis and Respiration](http://www.nclark.net/PhotoRespiration) (complete the activities and work the labs)
	9. [Garden Genetics](http://www.nsta.org/store/product_detail.aspx?id=10.2505/9780873552646) 1--
		1. Complete Activity/lab 1--Edible Punnett’s Squares you can eat: Segregation ratios you can taste.
		2. Complete Activity/lab 2--Proteins, Codons and Mutations
		3. Complete Activity/lab 3--Insect predation and plant genes
	10. [Garden Genetics](http://www.nsta.org/store/product_detail.aspx?id=10.2505/9780873552646) 2--

*i. Complete Activity/lab 8-Where does it come from? Biomes and Food plants and Centres of origin and Food plants.*

 *ii. Complete Activity/lab 9--Mapping Tomato Color*

* + 1. Complete Activity/lab 7--Sweet Seeds (Sweet genes in Corn)

UNIT 8--Animals

Standards:

Cell Biology

1c, 1f

Genetics

2a, 2b, 2d

Ecology

6f, 6g

Evolution

8f

Physiology

9a, 9b, 9c, 9d

Investigation and Experimentation

11d, 11k, 11l, 11m

PACING GUIDE: 4 WEEKS TO COMPLETE THIS UNIT

Students will understand that animals are multicellular, eukaryotic heterotrophs that have adapted to live in many different habitats, animal cells do not have cell walls, and most have cells that are organized into tissues. Students will describe how most animal undergo sexual reproduction, and how during embryonic development, animal cells become tissue layers, which become organs and systems. Students understand that animal phylogeny can be determined, in part, by body plans and the ways animals develop, and how body symmetry is related to the phylogeny of animals. Students will name the features of the theory marking the main branching points on the evolutionary tree of animals and how body cavities distinguish branches of developments of animals with bilateral symmetry. Students will compare and contrast deuterostome and protostome development, describe the differences between the body plans of sponges and cnidarians, explain why cnidarians and sponges are important to the ecology of their habitats and to humans.

Mammals--

Students will understand that mammals have distinct characteristics explain how mammals maintain a constant body temperature, and are successful in a wide variety of habitats. Summarize how the respiratory, circulatory, and nervous systems have complex adaptations that enable mammals to have the extra energy they need to maintain homeostasis. Students understand that mammals have internal fertilization and, in most mammals, offspring develop within the female uterus, the three division of the class Mammalia, and the function of a placenta.

 Animal Behavior--

Students will understand that animal behaviors can be innate or learned, and they evolve through natural selection, explain the difference between internal stimulus and an external stimulus and give examples of each, compare and contrast innate and learned behavior, understand that behavior can be influenced by both genes and experience, and that successful behaviors give individuals an advantage for survival and reproduction.

1. **Students will read one of the following book(s):**
	1. Textbook reading (select one option)
		1. [Holt Biology](http://www.hmhco.com/search?segment=All;mm=all;q=9780547586663) ($93.55)
			1. Read chapters 23, 24, 25, 26 and 27
				1. answer all chapter questions
		2. E.O Wilson’s Life on Earth Series:
			1. [E. O. Wilson's Life on Earth--Guided Tour of Biodiversity, Unit 6](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888419779?mt=13) (free on iTunes)
				1. *Unit 6 - read chapters 30 (Sponges and Cnidarians), 31 (Flatworms, Segmented Worms and Mollusks), 32 (Arthropods and Roundworms), 33 (Echinoderms and Invertebrates), 34 (Fish and Amphibians), 35 (Reptiles and Birds), 36 (Mammals)*
				2. *Answer the end of chapter questions*
			2. [*E. O. Wilson's Life On Earth/Unit 4--Animal Physiology*](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888140952?mt=13)
				1. *Read chapters 14 (Animal Bodies)*
		3. [Glencoe 2012 Biology](https://www.mheonline.com/program/view/2/5/2217/0078945860/)--
			1. Read chapter 22, 23, and 24
				1. Answer the chapter questions
		4. [CK-12 Biology Free eBook](https://itunes.apple.com/us/book/ck-12-biology-interactive/id574071922?mt=13)
			1. Chapter 17, 18, 19, and 20
				1. answer all chapter questions
2. **Students will watch all of the following videos:**
	1. [Sponges and Cnidarians](https://www.youtube.com/playlist?list=PLX8ALUM5ARx32t_sA7YJ2QCzN0sXap5pi) (45 min)
	2. [Animal Kingdom: Invertebrates, Minor Phyla Part 1](https://www.youtube.com/watch?v=yCJjbFA7ysA) (2 min)
	3. [Animal Kingdom: Invertebrates, Minor Phyla Part 2](https://www.youtube.com/watch?v=G0VTRDZzixI) (2 min)
	4. [Fish and Amphibians](https://www.youtube.com/watch?v=qE84uflfCPM) (13 min)
	5. [Fish, Reptiles and Amphibians](https://www.youtube.com/playlist?list=PLknbi03vIG9PK_DX893_kbIucH8ejZ7Nx) (1hrs)
	6. [Reptiles and Birds](https://www.youtube.com/playlist?list=PLWF8_CZIgo1O4gFH2v_FF9bCB4pjbYksf) (choose 5)
	7. [Mammals--BBC documentary](https://www.youtube.com/watch?v=KgjJtzfcXnM) (1 hr)
3. **Students will choose and complete complete four of the following activities:**
	1. [E. O. Wilson's Life on Earth--Guided Tour of Biodiversity, Unit 6](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888419779?mt=13) (free on iTunes)
		1. *Unit 6 - read chapters 30 (Sponges and Cnidarians), 31 (Flatworms, Segmented Worms and Mollusks), 32 (Arthropods and Roundworms), 33 (Echinoderms and Invertebrates), 34 (Fish and Amphibians), 35 (Reptiles and Birds), 36 (Mammals)*
		2. *complete the Project Based Activities (located at the end of each chapter).*
			1. *Chapter 30--Reverse Engineering a Choanocyte*
			2. *Chapter 31--Mollusks in the Market*
			3. *Chapter 32--Insect Bioblitz*
			4. *Chapter 33--Sea Urchin Development*
			5. *Chapter 34--Gill Ventilation*
			6. *Chapter 35--Bird Count*
			7. *Chapter 36--Friendly Fur*
	2. **Animal Diversity Project--**
		1. Using ladybug beetles, students will design an activity to identify visible diversity in traits. Students will record the different characteristics that can be recorded to demonstrate diversity (colors, spots, size, etc…). Students will create a table to record the number of beetles exhibiting the chosen characteristics. Students will discuss how this diversity can be advantageous to beetles based on their environment, and also use critical thinking skills to deduce other characteristics that they may have that can’t be seen (resistance to disease, ability to obtain nutrients from a new food source, etc..)
	3. [Hands on Projects and Activities](http://serendip.brynmawr.edu/sci_edu/waldron/) :
		1. Complete the Invertebrate Diversity Activity
		2. Write a 1-2 page report on your process and findings
	4. Phyla Project: Create a collage that has pictures of many varieties of animals from various phyla, show if they have symmetry, and which type they have.
	5. Frog dissection Activity--
		1. Students will learn about the anatomy of the frog
		2. Students will examine the external and internal structures of the frog
		3. Students will note similar features to human anatomy
		4. Identify and diagram organs and organ systems
		5. Label external anatomy, oral cavity, major muscles, and internal organs
	6. How do ANIMALS Learn?
		1. write a 3-5 page report on: How Animals Learn. Include a discussion about the following: learned behaviors include habituation, conditioning, and imprinting, and that cognitive behavior involves thinking, reasoning, and problem solving.

UNIT 9--Human Biology

Standards:

Cell Biology

1d

Genetics

4a, 4b, 4c, 4d, 4e, 4f

5a, 5b, 5c, 5d, 5e

Investigation and Experimentation

11a, 11d, 11e, 11j, 11k, 11l, 11n

PACING GUIDE: 4 WEEKS TO COMPLETE THIS UNIT

In this unit students will understand and apply the knowledge of human body systems including Integumentary, Skeletal, Muscular, Nervous, Circulatory, Respiratory, Excretory, Digestive, Endocrine, Immune and Reproductive Systems. This includes but is not limited to their importance, characteristics, the structures and organs that compose the system as well as their functions, how they lead to human survival, and the interaction between the systems. Students will identify interactions between systems and model various body systems. Students will learn to apply observations from their own bodies as well as mammal dissections to their knowledge of human body systems. Students will interpret data about various systems and body output and formulate hypotheses based on that data.

1. **Students will read one of the following book(s):**
	1. Textbook reading (select one option)
		1. [Holt Biology](http://www.hmhco.com/search?segment=All;mm=all;q=9780547586663) ($93.55)
			1. Read chapters 28, 29, 30, 31, 32, 33, and 34
				1. answer all chapter questions
		2. E.O Wilson’s Life on Earth Series:
			1. [*E. O. Wilson's Life On Earth/Unit 4--Animal Physiology*](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888140952?mt=13) (free on iTunes)
				1. *Unit 4 - read chapters 15 (Nervous System), 16 (Skeleton and Muscle, 17 (Respiration and Circulation), 18 (Nutrition and Excretion), 19 (Endocrine Systems), 20 (Immunity), 21 (Reproduction and Development),*
				2. *Answer the end of chapter questions*
		3. [Glencoe 2012 Biology](https://www.mheonline.com/program/view/2/5/2217/0078945860/)--
			1. Read chapter 25, 26, 27, 28, 29, and 30
				1. Answer the chapter questions
		4. [CK-12 Biology Free iBook](https://itunes.apple.com/us/book/ck-12-biology-interactive/id574071922?mt=13)
			1. Chapters 20-25
				1. answer all chapter questions
2. **Students will watch all of the following videos:**
	1. [Inside The Human Body](https://www.youtube.com/watch?v=HBIYwiktPsQ) (1.5 hrs)
	2. [The Digestive System--Crashcourse](https://www.youtube.com/watch?v=s06XzaKqELk) (13 min)
	3. [The Nervous System--Crashcourse](https://www.youtube.com/watch?v=x4PPZCLnVkA) (12 min)
	4. [Human Biology](https://www.youtube.com/watch?v=0QP6AFhNOzI) (50 min)
	5. [Human Anatomy and Medicine](https://www.youtube.com/watch?v=9V-Ts9rFX2Q) (42 min)
3. **Students will choose and complete complete four of the following activities:**
	1. [*E. O. Wilson's Life On Earth/Unit 4--Animal Physiology*](https://itunes.apple.com/us/book/e.-o.-wilsons-life-on-earth/id888140952?mt=13) (free on iTunes)
		1. *Unit 4 - read chapters 15 (Nervous System), 16 (Skeleton and Muscle, 17 (Respiration and Circulation), 18 (Nutrition and Excretion), 19 (Endocrine Systems), 20 (Immunity), 21 (Reproduction and Development),*
		2. *complete the Project Based Activities (located at the end of each chapter).*
			1. *Chapter 15--Reflexive Memory*
			2. *Chapter 16--Mechanical Advantage*
			3. *Chapter 17--Exercise Physiology*
			4. *Chapter 18--How Sweet it is*
			5. *Chapter 19--The Time of Our Lives*
			6. *Chapter 20--Diagnose and Decode*
			7. *Chapter 21--Parthenogenesis*
	2. Skelton Project:
		1. Create a model of an internal moving skeleton simulating a land creature. Include the various types of joints, appendages, and protective features. Label and describe each type, compare it to other existing creatures and why this is an advantage for your creature.
	3. Bone Project--
		1. Bones not only support the body structurally, they also produce blood cells for the body. Bone can also repair itself.
		2. Write a 1-2 page report or 3 2-3 min video describing the functions of bones above that of just support for a structure and Tell how the bones perform these various functions.
	4. Elasticity Project:
		1. Using elastic or similar material create a pair of antagonistic muscles.
		2. Attach them to two bone type structures and demonstrate their use.
	5. Skin Activity--
		1. Create a model of the skin, 2D or 3D. Model burns to the skin, infections, cuts, and explain how they heal.
	6. Nervous System Activity--
		1. Chiropractors use the central nervous system that extends from the spine to correct possible problems Review a chiropractor's chart about the nervous system and then create your own model of how nerves extent over your body and give you feedback through your senses and control your bodily functions.
	7. Key Project: Research a drug and how it affects the body through the nervous system.
		1. Create a presentation on the benefits and detriments of this drug. Include side effects, possible good and bad outcomes of use of this drug.
	8. Human waste Project: Waste removal is important to the human body.
		1. Create a model of the human body waste removal system. This can be a working model in three dimensions, a computer simulation, a movie, or another presentation modality. Identify each area of the three system you have studied.
	9. Feedback System Activity:
		1. Create a of Model a feedback system for blood sugar, and indicate the organs of the body that are involved in this feedback system.
		2. Create a model of a disease that would show one part of the system does not work, and how that could be corrected.
	10. Digestion project:
		1. Create a Diagram/model of digestion, include the key components of digestion, the enzymes, hormones, proteins, carbohydrates,vitamins, and more that are involved in the process.
	11. Key Project: Research a disease and find the vectors or causes of contagion, the symptoms and outcomes of the disease, and possible ways of preventing the disease. Present your findings in the form of a written report, video, Power point presentation or other form of your choice.

***Course Requirements and Final Grade Calculation****:*

**Activities and Assignments (60% of semester grade)**

Average grade earned on assignments and lab activities completed from the selection of assignments listed for each unit.

**Projects or Final Assessment (20% of final grade)**

**Final Assessment (End of course final exam or project)-**-Students will take a Cumulative written final assessment or complete an approved Project (see below) or both.

**Final Project** — Students will choose and complete one final project (First Draft Due in December and Final Project Due in April). The objective of this project is to have students study Biology in the field or lab and examine an aspect that truly interests them. This project will involve components of the scientific process: making critical observations, recognizing patterns, asking questions and formulating hypotheses, testing hypotheses, then explaining one’s findings. This project will be ongoing throughout the life of the course.

1. Some ideas include but are not limited to the following:
	1. Choose a research topic and write a 5 page report (for example: Compare and contrast food chains in various parts of ocean such as mid or deep ocean areas or research what characteristics deep ocean creatures have that distinguish them from other forms of marine life).
	2. Complete a video complete with narration and a written document (For example: Film a documentary local marine sanctuaries or film and research whale migration)
	3. A scrap-book including written summaries, pictures, diagrams, etc.. of the main topics or topics of interest in each Unit.

**Labs-- (20% of final grade)** Participation in a a-g Lab class (an a-g certified lab) is a requirement for a-g Biology.

Students will complete wet labs which will entail 20% of the course time as well as 20% of the final grade. Although labs are encouraged in the home for learning, 20% must be done in a certified/approved lab location. Each lab activity, students will complete a pre-lab write up consisting of reading the lab beforehand, potentially completing a safety pre-lab worksheet, noting any safety concerns and identifying possible hazards. During each lab, students will follow written procedures, develop a hypothesis, maintain a lab notebook where all data is written for each lab, work with lab partners to solve problems, and use critical thinking skills to complete the lab objectives. Students will complete a post-lab report where they will answer procedural questions, write their results and conclusions for each lab, determine any areas of possible error, and complete a written analysis. Follow the directions and rubric linked here for all lab reports even when the lab comes with a worksheet:

[Lab Report Directions and Rubric](https://drive.google.com/a/ieminc.org/file/d/0B0gZxuKw6F1XVERFR1RMWjhFNUU/view?usp=sharing)

**a-g Recommended/Suggested Labs-**-Below are recommended a-g Labs. Labs must be taken with a qualified a-g vendor. These labs are used along with the QSL (Quality Science Lab Kit) from [QSL Biology](http://www.qualitysciencelabs.com/biology-labs/).

1. Introduction to the Laboratory

· Identify laboratory equipment and learn the proper uses, handling, and care of equipment

· Identify Safety symbols used in the laboratory and learn the hazards, precautions, disposal of, and examples of each

· Understand proper eye safety, clothing protection, and hand washing techniques

· Learn how to write a laboratory report including: Title, Hypothesis, Materials, Procedure, Data Collection, Results, and Conclusions

2. Observe the Characteristics of Life

· Observe objects and classify as living or nonliving

· Make a prediction of each object, compare to the characteristics of life, and write the evidence for choice based on the characteristics

3. Examine an Ecosystem

· Students will observe pond water in a jar

· Students will observe the condition of the water, and note any organisms that can be seen, · check for order or coloration

· Students will test the water (depending on what kits available: pH, water test kit, microscope or stereoscope)

· Students will use a pond identification guide to identify any organisms found

4. How can you show a population trend?

· Culture bacterial colonies to track population growth

· Graph population data, choosing appropriate scales and titles

· Compare and contrast populations and the factors that affect growth

5. Construct a Food Web

· Understand how energy is passed from organism to organism in an ecosystem

· Diagram a food chain showing the path for energy flow in an ecosystem

· Understand that the overlapping relationships between food chains are shown in a food web

· Use local ecosystem as an example and observe in nature a food chain and food web

6. How do we measure biodiversity?

· Analyze data from four test sites

· Infer trends in biodiversity

· Predict which environmental factors impact biodiversity

7. Animal Diversity

· Using ladybug beetles, students will design and activity to identify visible diversity in traits. Students will record the different characteristics that can be recorded to demonstrate diversity (colors, spots, size, etc…). Students will create a table to record the number of beetles exhibiting the chosen characteristics. Students will discuss how this diversity can be advantageous to beetles based on their environment, and also use critical thinking skills to deduce other characteristics that they may have that can’t be seen (resistance to disease, ability to obtain nutrients from a new food source, etc..) Students will understand how interbreeding populations increase the chances of individuals to survive during changing environmental conditions.

8. What substances or solutions act as buffers?

· Form a hypothesis about the success of certain materials as buffers

· Design an experiment to test the hypothesis

· Control variables in the experiment

· Draw conclusions about the success of animal and plant solutions as buffers in biological systems

9. Using a Compound Microscope

· Students will familiarize themselves with the basic parts of a microscope and label a worksheet correctly, learn the proper use, handling, and storage of a microscope and slides

· Students will practice using the microscope by preparing a wet mount of the letter “e”

· Students will observe prepared slides of animal cells and plant cells, and label the parts of the cells identified

· Students will also complete a take-home assignment where they create a model of plant and animal cells

10. What can affect the rate of photosynthesis?

· Formulate a hypothesis about the connection between light intensity or water temperature and oxygen production in photosynthesis

· Design an experiment to test this hypothesis

· Control variables, and use a control during experiment (varying light intensity or temp. of water)

· Draw conclusions about the rate of photosynthesis

11. How long does each phase of the cell cycle last?

· Use a microscope to identify cells in an onion root tip

· Identify the different stages of the cell cycle in onion cells

· Count the number of cells in each stage of the cell cycle

· Calculate the amount of time cells spend in each stage of the cell cycle

12. Analyzing Meiosis and Fertilization to understand Genetics

· Students complete hands on activities to model meiosis and compare and contrast with mitosis

· Students complete hands on activities to understand how combinations of alleles can occur in the zygotes produced by fertilization of an egg and sperm cell

· Students will can learn how mutations can affect the number of chromosomes in the zygote and result in abnormalities

· Students will use Punnett Squares to predict genotypes and phenotypes

13. Pedigrees (What are the chances?)

· Construct a pedigree for a family

· Determine the probability of a couple having a child with a genetic disorder

14. What is DNA?

· Extract DNA from organic sources

· Compare the amount of DNA yielded from different sources

· Create a model of the DNA structure to understand that structure

15. Who did it?

· Use models to represent DNA fingerprints

· Infer why DNA patterns differ between individuals

· Draw conclusions about which “suspect” was present at a crime scene through identifying a pattern, and using DNA evidence

16. How do species compare?

· Examine a table of amino acid data

· Interpret the table and find relationships

· Draw conclusions about how closely related species are

· Understand that scientists have studied protein sequences and have found evidence to support the idea of a common ancestor

17. Create a Fossil

· Through the hands on activity of creating a fossil, the student will be able to list conditions necessary for fossilization

· State where fossils are usually found

· Define four types of fossils (Trace, Molds and Casts, Carbonization, Petrification)

18. Could you beat Natural Selection?

· Locate organisms (represented by chips) in the natural environment of the classroom

· Make a prediction about survivability of two sets of organisms

· Simulate predator/prey relationships

· Complete data tables

· Graph results

19. What is a taxonomic key?

· Examine the method to make a taxonomic key

· Create a taxonomic key for the order Artiodactyla

· Use a key to identify a group of organisms

20. Compare Bacteria

· Investigate different features of bacteria by viewing prepared bacteria slides under the microscope

· Create a data table to compare the shapes and features of bacteria

· Design a classification system for the bacteria observed based on the collected data

21. Investigate Protists

· Investigate different features of protists by viewing prepared slides under the microscope

· Create a data table to record observations

· Sketch, label, and describe each specimen

22. Microscopic organisms in action

· Prepare a slide using pond water (or hay infusion)

· Identify protozoans located in the sample through using textbook and notes from the previous investigative lab

· Sketch, label, and describe each specimen and compare/contrast the live specimens to the prepared slides already viewed

23. Examine Yeast Growth

· Investigate the behavior of unicellular fungi, yeast

· Understand the asexual reproduction of yeast

· Identify the relationship between yeast reproduction and availability of food

24. Investigate mold growth

· Students will design their own activity to test for the most optimal mold growth conditions (choose three conditions to compare)

· After mold growth has occurred, students will prepare a stained slide of the specimen

· Observe, sketch, label, and describe observations under 40x and 100x magnification

· Identify structures as spores or hyphae

· Records data and compare results of the three conditions

· Graph and chart data to conclude under which conditions the mold grew best

25. How do ferns, mosses, and conifers reproduce?

· Examine samples of ferns, mosses, and conifers

· Compare characteristics of seeds, spores, and pollen in each

· Infer how these characteristics have made survival of each plant possible

26. How does a flower grow?

· Dissect flowers to examine female and male parts

· Measure and describe characteristics of flowers

· Draw and label flower diagrams

· Draw conclusions about reproduction in plants

27. Field Exercise- “Plant Walk” (take home assignment)

· Students will use their local environment to identify and classify plants and understand the diversity of plants

· Students will take samples of each plant, label, and identify the plant as vascular, non-vascular, seedless, seed plant, and further into each division (liverworts, mosses, hornwort, ferns, horsetails, club mosses, anthophytes, conifers, gnetophytes, cycads, ginkoes)

· Students will need to identify each of the major categories (non vascular (at least one), seedless vascular (at least one), vascular seed plant (at least 2)

· Students will provide written reasoning for their classification of each of the plants

28. Phototropism

· Over a month period, students will be able to observe the effects of phototropism in plants

· Students will grow bean seeds in a maze created in a cardboard box with one hole at one end where light enters.

· Students will observe the seedlings and growth of the plant.

· Students will record their findings and analyze their data, and write a summary of what caused the plants to grow the way they did

29. Is that symmetrical?

· Identify lines of symmetry in animal samples

· Model symmetry in the human face

· Infer relationships between body structure and survival

30. Frog dissection

· Students will learn about the anatomy of the frog

· Students will examine the external and internal structures of the frog

· Students will note similar features to human anatomy

· Identify and diagram organs and organ systems

· Label external anatomy, oral cavity, major muscles, and internal organs

· Answer questions focusing on anatomy and questions

31. How do we learn?

· Design and conduct an experiment to answer questions about human learning

· Make predictions about learning and performance

· Communicate findings in an appropriate manner

32. Reflexology lab

· Students will complete activities to understand that the entire nervous system can be considered a system of innumerable reflex arcs

· Students will complete activities to investigate the following reflexes: Patellar, Biceps, Achilles, Triceps, Uvular, Cilio-spinal, Sneezing, Pupillary, Corneal, Accommodation

· Student will also learn about reaction time between the application of a stimulus and the beginning of a response through completing an activity

· Student will conclude how the reflexes explored could provide advantages to the animal

· Student will answer questions about each reflex and also describe possible abnormal reflex results could be due to damaged or diseased motor areas in the Central Nervous System, degeneration of nerves, and other factors

33. Breathing Balloons/How big is your breath?

· Develop hypotheses about what students know about the Respiratory System

· Analyze and interpret data

· Use reference material to help students understand data

· Use evidence to support or reject their hypotheses

· Recognize the organ functions of the respiratory system

· Identify the organs of the respiratory system

· Explain gas exchange

34. How do you digest protein?

· Design an experiment

· Compare conditions for the function of pepsin in the digestive process

· Collect and interpret data, and draw conclusions about the conditions within the stomach

35. Regulation of the human heart rate

· Students will learn how to measure heart rate accurately

· Design an experiment to test how a stimulus or activity affects heart rate

· Analyze data

· Create a poster describing the experiment (explain hypothesis, basic procedures used, main results summarized in graph and/or table, conclusions)

36. How does a body grow?

· Compare the average height of humans within the average length of body parts during various stages of human development

· Graph the average height of humans

· Analyze rates of human development, male or female, based on the data assembled and graphed

37. Who needs a banana peel? (Continuous over one school week)

· Prepare and observe bananas over a period of five days

· Model the skin’s defense against disease using banana peels

· Conduct an experiment controlling variables

· Form a conclusion about the necessity of washing and cleaning cuts to prevent disease

38. Fetal pig dissection (2 class periods)

· Students will observe mammalian organs and structures and compare them to human anatomy

· Students will examine the external features of the pig

· Students will remove a portion of the umbilical cord and cut a cross section to observe the arteries and vein

· Student will identify and label organs in the abdominal and thoracic cavities

· Use photographs to identify the sex and identify structures of the excretory and reproductive systems

**Resources:**

1. [Principles of Ecology activity](http://www.nclark.net/Ecology)
2. [Interactive Biology principles of Ecology](http://www.interactive-biology.com/1096/organisms-of-environment-principles-of-ecology/)
3. [Principles of Ecology videos and handouts](http://www.interactive-biology.com/1106/principles-of-ecology-powerpoint-slides-chapter-2/)
4. [Interactive Ecology Labs](https://www.learner.org/courses/envsci/interactives/ecology/)
5. [NOVA Population Ecology](http://www.pbs.org/wgbh/nova/nature/population-ecology.html)
6. [Virtual Ecology Lab](http://faculty.etsu.edu/jonestc/virtualecology.htm)
7. [Bioman Biology Games, Videos, Quizzes](http://www.biomanbio.com/GamesandLabs/LifeChemgames/lifechem.html)
8. [BioInteractive](http://www.hhmi.org/biointeractive)
9. [Interactive Biology- The Chemistry of Life](http://www.interactive-biology.com/1358/life-substances-the-chemistry-of-life/)
10. [PBS Project](http://www.pbs.org/wgbh/nova/nature/population-ecology.html)
11. [Ecology as a Profession](http://www.esa.org/esa/education-and-diversity/info-for-high-school-students/)
12. [NGSS Ecology and Conservation Projects](http://www.ngsslifescience.com/biology_lesson_plans_ecology_lab.html)
13. [Cellular Respiration Animation](http://www.sumanasinc.com/webcontent/animations/content/cellularrespiration.html)
14. [Pearson Cellular Respiration](http://www.phschool.com/science/biology_place/biocoach/cellresp/intro.html)
15. [Energy in a Cell Glencoe](http://glencoe.mheducation.com/sites/dl/free/0078802849/383932/BL_25.html)
16. [Interactive Biology Cellular Respiration](http://www.interactive-biology.com/326/bio-1-section-9-3-cellular-respiration/)
17. [Genetics activities and labs](http://www.nclark.net/Genetics#Labs)
18. [PBS Project](http://www.pbs.org/wgbh/nova/nature/population-ecology.html)
19. [Ecology as a Profession](http://www.esa.org/esa/education-and-diversity/info-for-high-school-students/)
20. [NGSS Ecology and Conservation Projects](http://www.ngsslifescience.com/biology_lesson_plans_ecology_lab.html)
21. [Notes, Coloring Pages, Quizzes](http://www.biologycorner.com/anatomy/)
22. [Science Fair Type Project Ideas](http://www.education.com/science-fair/anatomy/)
23. [Artful Biology Projects](http://www.nsta.org/publications/news/story.aspx?id=50078)
24. [NTSA Argument Driven Biology](http://www.nsta.org/publications/press/extras/adi-bio.aspx)
25. [NTSA 30 Biology activities](http://www.nsta.org/store/product_detail.aspx?id=10.2505/9781936137275)
26. Biology Apps for iTunes
27. [Biology for Education](https://itunes.apple.com/us/app/biology-for-education/id965099573?mt=8)
28. [Biology Today Magazine Subscription](https://itunes.apple.com/us/app/biology-today/id583702070?mt=8)
29. [Biology Core](https://itunes.apple.com/us/app/biologycore/id357423231?mt=8)

**Field Trip Resources:**

1. [California Science Teacher Association Field Trips](http://www.cascience.org/csta/res_fieldTrips.asp)
2. [Oak Canyon Nature Center, Anaheim](http://www.anaheim.net/title/Community%2BServices/Oak%2BCanyon%2BNature%2BCenter/#PE)
3. [Lawrence Hall of Science- Berkeley](http://www.lawrencehallofscience.org/kidsite/)
4. [Chino Hills State Park](http://www.parks.ca.gov/?page_id=648)