# Biology I

# Curriculum Guide

# Anchorage School District

**Working Version**
**2006- 2007**

# Introduction

- **ASD adopted textbooks for Biology I (school chooses either…):**

  Biology: The Dynamics of Life "Whale" book,
  Publisher: Glencoe, McGraw-Hill
  © 2000 ISBN: 0-02-828243-4

OR

  Modern Biology "Owl" book
  Publisher: Holt, Rinehart, Winston
  © 2002 ISBN: 0-03-056542-1

- **Notes for usage:**

  - These frameworks do not need to be taught in numerical order, but all should be taught at some point in a school year.
  - Pacing is a suggestion, based on ASD teacher experience.
  - Suggested pacing indicates relative emphasis on framework.
  - For Framework B3 – GLEs 9 2.3, 10 2.3, & 11 2.3 should be covered more heavily for any students who have not completed IS9.

  - **Explanation of columns:**

    -*ASD Framework and Pacing Guide* – the main concept the student should learn. Pacing guide is a suggested time frame based on ASD teacher experience and relative emphasis to be given to each concept/framework.

    -*National Science Standard* – the National Science Education Content Standards that ASD Frameworks addressed by the framework.
    To access complete document: http://books.nap.edu/readingroom/books/nses/

    -*Alaska State Science Content Standard* – Alaska Science Content Standards addressed by the framework.
    To access complete document: http://www.eed.state.ak.us/ContentStandards/

    -*Grade Level Expectations* – Alaska Science Grade Level Expectations (GLEs) that are addressed by the framework.
    To access complete document: http://www.eed.state.ak.us/tls/assessment/GLEHome.html

    -*Objectives (Bloom's)* – each objective is a goal for student learning. Bloom's level of taxonomy is given for each objective. Objectives are not necessarily listed in order of instruction. Link to useful verbs,question stems and potential activites and products:
    http://www.teachers.ash.org.au/researchskills/dalton.htm

    -*Representative Activities* – activities which have been shared by ASD Biology teachers. These are accessible on the ASD Intranet – Public Folders…fix this language as needed.

    -*Assessments/Evaluations* – assessment/evaluation activities shared by ASD Biology teachers. . These are accessible on the ASD Intranet – Public Folders…fix this language as needed.

    -*References* – Textbook, media and internet resources related to Framework. Link to ASD Media catalog: http://media.asd.k12.ak.us/

**The Science Curriculum Committee recommends science pedagogical practices be consistent with national recommendations.**

1. Hands-on activities that include:
   - students identifying their own real questions about natural phenomena
   - observation activity, often designed by students, aimed at real discovery, employing a wide range of process skills
   - students hypothesizing to explain data
   - information provided to explain data only after students have engaged in investigation process
   - students' reflection to realize concepts and processes learned
   - application, either to social issues or further scientific questions

2. Focus on underlying concepts about how natural phenomena are explained

3. Questioning, thinking, and problem solving, especially:
   - being skeptical, willing to question common beliefs
   - accepting ambiguity when data isn't decisive
   - willing to modify explanations, open to changing one's opinion
   - using logic, planning inquiry, hypothesizing, inferring

4. Active application of science learning to contemporary technological, social, and wellness issues

5. In-depth study of a few important thematic topics developing basic underlying principles of the discipline

6. Curiosity about nature and positive attitudes toward science for all students, including females and members of minority groups

7. Integration of reading, writing, and math in science units

8. Collaborative small-group work, with training to ensure it is efficient and includes learning for all group members

9. Teacher facilitating students' investigative steps

10. Evaluation that focuses on scientific concepts, processes, and attitudes

11. Educational technologies that enhance learning processes and expand skills and capabilities of all students including:
   - the scientific process
   - conducting research that includes data gathering, analysis, synthesis, and communication of findings
   - application of thinking skills such as sequencing, inference and deduction, and the transfer of such skills into daily use

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| ASD Science Curriculum Code | ASD Framework and Pacing Guide | National Science Standard | Alaska State Science Content Standard | Grade Level Expectations |
|---|---|---|---|---|
| **B1** | A living cell is primarily composed of a small number of chemical elements: hydrogen, oxygen, carbon, nitrogen, phosphorus and sulfur. Carbon, because of its small size and four available electrons, can join other atoms in chains and rings to form larger and more complex molecules.<br><br>*2 weeks* | **Life Science Content Standard C: grades 9-12: Matter, Energy and Organization in Living Systems**<br><br>All matter tends toward more disorganized states. Living systems require a continuous input of energy to maintain their chemical and physical organizations. With death, and the cessation of energy input, living systems rapidly disintegrate.<br><br>The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong(covalent) chemical bonds between the atoms of carbon-containing(organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars and fats). In addition, the energy stored in bonds between the atoms(chemical energy) can be used as sources of energy for life processes.<br><br>The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in phosphate bonds of a small high-energy compounds called ATP. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC2** Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms. | The student develops an understanding of the processes of science by:<br><br>*10 SA1.1* asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring and communicating.<br><br>*9 SA1.2* hypothesizing, designing a controlled experiment, making qualitative and quantitative observations, interpreting data, and using this information to communicate conclusions.<br><br>The student demonstrates an understanding of the structure and properties of matter by:<br><br>*10 SB1.1* using the periodic table to describe atoms in terms of their base components (i.e., protons, neutrons, electrons).<br><br>The student demonstrates an understanding of the interactions between matter and energy and the effects of these interactions on systems by:<br><br>*10 SB3.1* describing the behavior of electrons in chemical bonding. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Analyze the matter-energy relationships of living and non-living things. (analysis)<br><br>• Differentiate between ionic and covalent bonding. (analysis)<br><br>• Determine the atomic structure of C, H, N, O, P, S. (application)<br><br>• Distinguish the differences between an acid and a base (analysis)<br><br>• Describe the properties of water (polarity/adhesion/cohesion/ capillarity/temperature moderation) (comprehension)<br><br>• Distinguish between organic and inorganic compounds. (analysis)<br><br>• Explain why carbon atoms have so many different bonds (single, double, and triple bonds). (comprehension)<br><br>• Define functional groups and explain their roles. (comprehension)<br><br>• Compare a condensation reaction with hydrolysis. (analysis)<br><br>• Examine the hydrolysis of ATP. Generate discussion on the significance of harnessing energy for cellular use. (analysis) Cross reference to: | Blend fast-food meal (hamburger, fries, soda) and analyze for carbohydrates, fats, proteins, using appropriate biochemical tests.<br><br>Select an enzyme-substrate system (catalyze/hydrogen peroxide, amylase/starch, protease/gelatin) and investigate factors that affect the rate of enzyme-catalyzed reactions (temperature, pH, enzyme-substrate concentration).<br><br>Demonstrate the properties of water: Celery-sticks in colored water to display adhesion/ water forming a meniscus/ the rubber-rod on silk bends running water/ capillary tube in water.<br><br>Diagram the carbon atom.<br><br>Read the article on "The structure of insulin". Appreciate F. Sanger's work and his receipt of Nobel prize in chemistry. Tie in the two disciplines through this example.<br><br>Use clay models to demonstrate the enzyme-substrate interaction and its significance.<br><br>Compare water molecule to an enzyme molecule on Chime or RasMol/RasMac. (Another good site is Carbon is 4ever.) | Investigate the need for maintaining a narrow pH and temperature range in the human body.<br><br>Account for the difference in behavior between starch and cellulose.<br><br>Review Critical Thinking questions at the end of Chapter. | From Chapter 2 Chemistry<br>pg. 31-45 ( 4-5 days)<br><br>Biochemistry<br>pg. 48-65 (8-14 days)<br><br>Modern Biology pg. 60<br><br>Add RasMol, etc references |

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| **B2** | Complex carbon-based molecules, including proteins, lipids, carbohydrates, and nucleic acids, comprise the primary building blocks of all living things.<br><br>*3 weeks* | **Life Science Content Standard C: grades 9-12: Matter, Energy and Organization in Living Systems**<br><br>The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC2** Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms. | The student demonstrates an understanding of the structure and properties of matter by:<br><br>*10 SB1.1* using the periodic table to describe atoms in terms of their base components (i.e., protons, neutrons, electrons).<br><br>The student develops an understanding of the processes of science by:<br><br>*10 SA1.1* asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring and communicating.<br><br>*9 SA1.2* hypothesizing, designing a controlled experiment, making qualitative and quantitative observations, interpreting data, and using this information to communicate conclusions. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Define the structure and discuss the significance of monosaccharides, disaccharides and polysaccharides. (knowledge)<br><br>• Examine the structure of carbohydrates and lipids as energy storing molecules. (application)<br><br>• Emphasize the building blocks of proteins, carbohydrates, lipids and functional groups. (knowledge)<br><br>• Recognize and understand the significance of fatty acids. (comprehension)<br><br>• Identify the two types of nucleic acids. (knowledge)<br><br>• Describe the structure and function of enzymes and explain their importance in biological systems. (knowledge)<br><br>• Discuss the effects of pH and temperature on enzymes. (application) | Build models of monomers and polymers given either the structural formula or from diagrams.<br><br>Heat and cool gelatin in the "Virtual Vomit" recipe or fry an egg to investigate protein conformational change. Explain making and breaking bonds and the relevant energy released<br><br>Students design an experiment to test for the presence of enzymes. Make gelatin and add fresh pineapples to half the gelatin and canned pineapples to the other half. Investigate the presence of proteases in both.<br><br>Identify enzymes in the digestive tract.<br><br>Students design an experiment to test for the presences of various macromolecules in a given solution.<br><br>Add Micah's trans-fat activity<br><br>Pizza pizza web site activity<br>http://12.156.197.18/pizza/<br><br>Jane's Potato lab: testing for buffers… | Generate discussion on fast foods/ HDL/LDL/Cholesterol/Heart Disease<br><br>Hypothesize the presence of bromelin in canned vs fresh pineapples.<br><br>?Make a concept map for macromolecules.?<br><br>Debate the existence of life without water or carbon.<br><br>Explain the need for arctic animals to have a greater number of triglycerides that are oils. | From Chapter 2 Chemistry: pp. 31-45 ( 4-5 days)<br>Biochemistry: pg.48-65 (8-14 days)<br><br>Molecular Modeling Kits<br>(from Boreal-Vani will get info)<br><br>www.sumanasinc.com (animations)<br>www.biology.arizona.edu/biochemistry/problem_sets<br>www.york.ac.uk/org/macromol/<br>http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/P/Proteins.html<br><br>http://www.imb-jena.de/IMAGE.htm<br>www.biologie.uni-hamburg.de/b-online/e17/17.htm<br>http://ga.water.usgs.gov/edu/waterproperties.html<br><br>http://www.oceansonline.com/water_props.htm<br><br>http://dev.nsta.org/ssc/pdf/v4-1047s.pdf<br><br>http://dev.nsta.org/ssc/pdf/v4-0969s.pdf<br><br>*Super-Size Me* Video or DVD (Note: many HS Health/PE teachers use this as part of **their** curriculum – please coordinate the use of this educational tool with the Health/PE dept. folks in your building.) |

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| **B3** | All living things are made of cells. Within each cell are specialized parts for the transport of materials, energy capture and release, protein building, waste disposal, information feedback, and movement. In addition to these basic cellular functions common to all cells, most cells in multicellular organisms perform some special functions that others do not.<br><br>*1 week ?* | **Life Science Content Standard C: grades 9-12: The Cell**<br>Cells have particular structures that underlie their functions. Every cell is surrounded by a membrane that separates it from the outside world. Inside the cell is a concentrated mixture of thousands of different molecules which form a variety of specialized structures that carry out such cell functions as energy production, transport of molecules, waste disposal, synthesis of new molecules, and the storage of genetic material. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC2** Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms. | The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by:<br><br>9 SC2.3 stating the function of major physiological systems (i.e., circulatory, excretory, digestive, respiratory, reproductive, nervous, immune, endocrine, musculoskeletal, and integumentary).<br><br>*10 SC2.2* explaining that cells have specialized structures in which chemical reactions occur.<br><br>10 SC2.3 explaining the functions of organs of major systems (i.e., respiratory, digestive, circulatory, reproductive, nervous, musculoskeletal and excretory).<br><br>*11 SC2.1* describing the structure-function relationship.<br><br>11 SC2.3 describing the functions and interdependencies of the organs within the immune system and within the endocrine system. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Compare and contrast cell structure from different representative eukaryotes (plants and animals). (analysis)<br><br>• Relate cell organelles to their specific cell function. (knowledge)<br><br>• Compare and contrast prokaryote and eukaryote cells. (analysis)<br><br>• Distinguish between tissues, organs, and organ systems. (analysis) | Create generic models representative of plants, animals and microorganisms for direct observation or use other resources to illustrate the difference between cells from the representative kingdoms.<br><br>Look at pg 87 in Owl book for other representative activities. | Create generic models representative of plant, animal and microorganisms for direct observation or other resources, to illustrate the difference between cells from the representative kingdoms.<br><br>What advantage does having a nucleus have? When you take an antibiotic, how come it doesn't kill all of your cells?<br><br>Go over Critical Thinking questions from the Chapter Review. | Interactive CD for Modern Biology |

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| **B4** | Photosynthesis is an anaerobic, energy-capturing and storing process, which uses carbon dioxide as a carbon source and light as an energy source to assemble complex organic molecules like glucose.<br><br>Glycolysis is an anaerobic, energy-releasing process, which partially breaks down a molecule of glucose, producing a few molecules of ATP and releasing two molecules of pyruvate.<br><br>Respiration is an aerobic, energy-releasing process, which breaks down small organic molecules like pyruvate, producing much more ATP than glycolysis and releasing carbon dioxide as a waste product. | **Life Science Content Standard C: grades 9-12: Matter, Energy and Organization in Living Systems**<br><br>The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes.<br><br>The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in phosphate bonds of a small high-energy compound called ATP.<br>The complexity and organization of organisms accommodates the need for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain the organism. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC2** Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms. | The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by:<br><br>*10 SC2.2* explaining that cells have specialized structures in which chemical reactions occur. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Compare and contrast photosynthesis and respiration as a means for cells to harness and release energy to perform cellular functions. *(analysis)*<br><br>• Describe the energy sources for each of the processes: glycolysis, respiration, photosynthesis. (comprehension)<br><br>• Explain the value of fermentation to eukaryotic cells (alcohol and lactic acid). (application)<br><br>• Explain the value of pigments to photosynthesis and identify the colors of light used by photosynthetic organisms of different colors (e.g. brown, purple, red, and green bacteria). (analysis)<br><br>• Identify ATP Synthase within a drawing of a membrane and know the importance of a proton gradient to its function. (comprehension)<br><br>• Define, "biochemical pathway."<br><br>•Compare and contrast C3, C4 and CAM plants. (Cross-reference with B 22.) | Lab: Photosynthesis & Respiration lab.<br><br>Lab: Test resting & exercising respiration rates by filling a garbage bag with breath.<br><br>Demonstrate the importance of light for photosynthesis and relate the differing results of subsequent iodine tests for carbohydrates to the plant's growth environment.<br><br>Make Root beer through fermentation.<br><br>Plant and snail lab. (See access excellence website.)<br><br>Diagram the input and output chemicals for each of the processes, accounting for every atom of carbon.<br><br>Hypothesize about the locations within a eukaryotic cell where each of the processes takes place and design an experiment to test their hypotheses.<br><br>• Hypothesize about the energy requirements of different cell types in the human body and design an experiment to test their hypotheses.<br><br>(Note: still need to review those in red.)<br>Associate processes with the kingdoms of organisms that carry out those processes.<br><br>• hypothesize about earlier processes of energy storage and release in the organisms on Earth and design an experiment to test their hypotheses.<br>(Cross ref w/ endosymbiosis)<br><br>As an introduction to the study of photosynthesis, students design a solar- | | www.pbs.org/wgbh/nova/sciencenow<br>Find and show the clip on fuel cells.<br><br>http://library.thinkquest.org/15215/Resources/carbon.html<br>(Ps & Respiration lab)<br><br>http://highered.mcgraw-hill.com/olc/dl/120071/bio11.swf<br>An animation on aerobic respiration.<br><br>http://highered.mcgraw-hill.com/olc/dl/120072/bio12.swf<br>An animation on cyclic and noncyclic photophosphorylation.<br>Understanding this helps students to understand that plants<br>(or algae, or cyanobacteria) were not the first photosynthesizers on Earth.<br>This animation also focuses on energy levels.<br><br>http://highered.mcgraw-hill.com/olc/dl/120072/bio13.swf<br>An excellent animation on the electron transport chain in chloroplasts.<br><br>http://www.sumanasinc.com/webcontent/anisamples/nonmajorsbiology/organelles.html<br>An animation on the evolution of chloroplasts and mitochondria.<br><br>Also in Modern Biology, there is a reading on Margulis' work and the<br>work of others on the topic. I don't have the page number (nor, as I recall, does the index).<br><br>http://www.sumanasinc.com/webcontent/anisamples/microbiology/winogradsky.html<br>Animation. The Winogradsky column shows different organisms, including<br>photosynthetic purple bacteria. Also it mentions respiration using sulfur instead of oxygen<br><br>http://www.sumanasinc.com/webcontent/anisamples/majorsbiology/harvestinglight.html<br>An animation on the electron transport chain. The animation shows the destruction<br>of water, the formation of free oxygen, the production of NADPH, and the formation<br>of a proton gradient (the animation does not show ATP synthesis). It focuses on electron<br>energy levels.<br><br>www.johnkyrk.com<br>Animations featuring the complexities of each of the processes.<br>The Krebs citric acid cycle is particularly pretty and complicated. |

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| | powered factory that builds something (like goalposts for football fields) but due to competition from the factory down the street, it has to be the most efficient factory possible. It must run night and day, for instance, so students should figure out that they will need to charge batteries. Students should figure out that it should be staffed by robots rather than people. Afterward, teach photosynthesis and use their factory as an analogy for the process.<br><br>Have students act out an electron transport chain with each student playing the role of an enzyme or functional molecule (e.g. NADH, NADPH) and tennis balls representing electrons. A line of butcher paper can serve as the membrane in which the enzymes are bound.<br><br>Students write a recipe for an ignorant chloroplast, starting from basic ingredients like water, photons, and carbon dioxide. They can assume the chloroplast has a well-stocked "kitchen," but they have to tell it which enzymes to use and when. Describe it not as a test of memory, but a test of logic: if they need ATP for a certain step, the ATP must have already been made—therefore, they can set up an order of operations and fill in the gaps later. After 15-30 minutes, allow them to use textbooks as a resource. | | |

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| **B5** | Every cell is enclosed by a phospholipid membrane that controls what can enter and leave the cell. In all but quite primitive cells, a complex network of proteins provide organization, shape and movement.<br><br>*1-2 weeks* | **Life Science Content Standard C: grades 9-12: The Cell**<br>Cells have particular structures that underlie their functions. Every cell is surrounded by a membrane that separates it from the outside world. Inside the cell is a concentrated mixture of thousands of different molecules which form a variety of specialized structures that carry out such cell functions as energy production, transport of molecules, waste disposal, synthesis of new molecules, and the storage of genetic material. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC2** Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms. | The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by:<br><br>*11 SC2.1* describing the structure-function relationship |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Investigate the effect of concentration gradients on the movement of materials across cell membranes. (evaluation)<br><br>•Compare and contrast hypertonic, hypotonic, and isotonic situations. (analysis)<br><br>• Develop and construct an experiment through which they can explore hypertonic, hypotonic and isotonic situations. (evaluation)<br><br>• Compare and contrast hydrophobic, hydrophilic, and amphipathic (a molecule with both hydrophobic and hydrophilic) materials. (analysis) | Build a model of cell membranes using bubbles.<br><br>Egg demonstration (dissolve shell with vinegar then demonstrate osmosis with pancake syrup).<br><br>Plasmolyze elodea (a.ka. anacharis) cells with saline solution.<br><br>Construct cell models to investigate the relationship between cell size, surface to volume ratio and the rates of diffusion into and out of the cell (using agar cubes of differing sizes with NaOH). | Write a story detailing the (cellular) adventures of a fish in a brackish estuary. | Whale Bio Book – for Cell size & diffusion rates lab |

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| **B6** | The many body cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions. Different parts of the instructions are used in different types of cells, influenced by the cell's environment and past history.<br><br>*2 weeks* | **Life Science Content Standard C: grades 9-12: The Cell**<br>Cells can differentiate, and complex multicellular organisms are formed as a highly organized arrangement of differentiated cells. In the development of these multicellular organisms, the progeny from a single cell form an embryo in which the cells multiply and differentiate to form the many specialized cells, tissues and organs that comprise the final organism, this differentiation is regulated through the expression of different genes. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*10 SC1.3* examining issues related to genetics (L) |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
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| • Reconstruct the process by which cells divide using the stages of the cell cycle. (synthesis)<br><br>• Compare and contrast mitosis and meiosis. (analysis)<br><br>• Differentiate between the cell cycle and cell division. (analysis)<br><br>• Recognize that different types of cells with the same DNA are structurally and functionally different. (comprehension) | Conduct investigations to observe, quantify and describe the changes which take place in a plant seed as it develops into a mature plant and determine how development is affected by internal and external factors, e.g., auxins, nutrients, light<br><br>Construct models of cells undergoing mitosis and meiosis (Using beads and string).<br><br>Onion cell root tip microscope observations (using prepared slides).<br><br>Complete the online onion root tip mitosis investigation, in which students have to match microscopic images with the correct stages of the cell cycle, found at: http://www.biology.arizona.edu/cell_bio/activities/cell_cycle/cell_cycle.html | Given actual pictures of cells, students will identify the stages of meiosis and mitosis. | Project WISE (through Berkley)<br>http://wise.berkeley.edu<br>(Free registration) |

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| **B7** | The genetic information passed from parents to offspring is coded within DNA molecules.<br><br>*1 week* | **Life Science Content Standard C: Grades 9-12: Molecular Basis of Heredity**<br>In all organisms, the instruction for specifying the characteristics of the organism are carried in DNA, a large polymer formed form subunits of four kinds (A, G, C, and T). The chemical and structural properties of DNA explain how the genetic information that underlies heredity is both encoded in genes (as a string of molecular "letters") and replicated (by a templating mechanism). Each DNA molecule in a cell forms a single chromosome.<br><br>Most of the cells in a human contain two copies of each 22 different chromosomes. In addition, there is a pair of chromosomes that determines sex: a female contain two X chromosomes and a male contains one X and one Y chromosome. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. An egg and a sperm unit to form a new individual.. The fact that the human body is formed from cells that contain two copies of each chromosome – and therefore two copies of each gene – explains many features of human heredity, such as how variations that are hidden in one generation can be expressed in the next. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*9 SC1.1* recognizing that all organisms have chromosomes made of DNA and that DNA determines traits<br><br>The student demonstrates an understanding that solving problems involves different ways of thinking by:<br><br>*10 SE2.1* questioning, researching, modeling, simulating, and testing multiple solutions to a problem. (L)<br><br>Students demonstrate an understanding of the bases of the advancement of scientific knowledge by:<br><br>*10 SC2.1* using an account of an event to recognize the processes of science used by historically significant scientists (e.g., Goodall, Watson & Crick, Newton).<br><br>The student demonstrates an understanding that scientific knowledge is ongoing and subject to change by:<br><br>*10 SG3.1* using experimental or observational data to evaluate a hypothesis.<br><br>The student will demonstrate and understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base by:<br><br>*10 SG4.1* recognizing the role of these factors on scientific advancements. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
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| • Be able to identify the chemical building blocks that make up the DNA molecule. (knowledge)<br><br>• Produce or reconstruct a two or three-dimensional DNA model. (synthesis)<br><br>• Explain the contributions of individual scientists who discovered the double helix structure of DNA. (comprehension)<br><br>• Explain how the structure of DNA facilitates self-copying (replication). (comprehension) | Perform a DNA extraction from animal (i.e. Human cheek cells) or plant (i.e. Onion or wheat germ) sources.<br><br>Learn the DNA song or write their own song in order to learn the chemical building blocks that make up DNA.<br><br>Work with three-dimensional models of DNA or work on a two-dimensional color-coding exercise, such as those found in the *Biology Coloring Book.*<br><br>Watch and review parts or all of the movie *Race for the Double Helix.*<br><br>Read Rosalind Franklin's autobiography (cross reference to B 25) | Given blank cut out models of the four nucleic acids, phosphate, and nitrogenous bases, students should be able to assemble their model and label its parts correctly. | *The Dynamics of Life* – Ch 11<br><br>*Modern Biology* – Chapter 10<br><br>*Biology Coloring Book*<br>ISBN-10: 0064603075 ISBN-13: 978-0064603072<br><br>ASD Media:<br>• Double Helix (130078) IS 2004 DV<br>• Francis Crick: Beyond The Double Helix (206335) S 1990 VH<br>• Secret Of Photo 51 (208172) IS 2003 VH<br><br>DNA song:<br>http://whhs.guhsd.net/park/dnasong.html<br><br>Cell Biology Animations website:<br>http://www.johnkyrk.com<br><br>DNA Interactive website<br>www.dnai.org<br><br>Website with animations – find Puzzle for kids to cut and put together with facts:<br>http://www.dnai.org/timeline/index.html<br><br>Rosalind Franklin Biographies:<br>http://www.pbs.org/wgbh/aso/databank/entries/bofran.html<br><br>http://genome.wellcome.ac.uk/doc_WTD021052.html<br><br>http://www.mnsu.edu/emuseum/information/biography/fghij/franklin_rosalind.html<br><br>A two-hour lecture on the structure of DNA in five minutes. Good to give the link to students for study so they can review it many times, or go over it with them to show them what they will and won't be responsible for knowing:<br>http://www.sumanasinc.com/webcontent/anisamples/molecularbiology/DNA_structure.html |

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| **B8** | The genetic information in DNA provides instructions for assembling protein molecules for all life forms.<br><br>*1 week* | **Life Science Content Standard C; grades 9-12: Molecular Basis of Heredity**<br>In all organisms, the instruction for specifying the characteristics of the organism are carried in DNA, a large polymer formed form subunits of four kinds (A,G,C, and T). The chemical and structural properties of DNA explain how the genetic information that underlies heredity is both encoded in genes (as a string of molecular "letters") and replicated (by a templating mechanism). Each DNA molecule in a cell forms a single chromosome. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by:<br><br>*10 SC2.1* describing the structure-function relationship (i.e., joints, lungs).<br><br>The student demonstrates an understanding that solving problems involves different ways of thinking by:<br><br>*10 SE2.1* questioning, researching, modeling, simulating, and testing multiple solutions to a problem. (L) |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Compare and contrast the DNA molecule and the mRNA molecule. (analysis)<br><br>• Identify the different types of RNA molecules and their roles in assembling proteins. (knowledge)<br><br>• Reconstruct the step-by-step sequence of how a strand of DNA codes for a protein (transcription and translation). (synthesis) | Using cut out models of DNA, mRNA, tRNA, ribosomes, and amino acids reconstruct the steps of transcription and translation.<br><br>Have student groups of four or five act out protein synthesis in a game of charades, prizes to the most convincing group.<br><br>Students in groups of 3 given DNA sequence on 3x5 cards – go from place to place in room finding amino acids code. Amino acid codes for a word (64 scattered about) – students use to build a sentence.<br><br>Lab from Modern Biology Owl Book (Title ?) | Students should be able to draw or describe in a complete paragraph (from memory) how a section of DNA gets turned into a protein. | *The Dynamics of Life* – Ch11<br><br>*Modern Biology* – Chapter 10<br><br>Protein Synthesis kit can be purchased through Boreal or Fischer:<br>http://boreal.com/category.asp_Q_c_E_561312<br>http://boreal.com/category.asp_Q_c_E_675595<br>https://www1.fishersci.com/Coupon?cid=1341&gid=2799353&details=Y<br><br>Following a protein through its formation:<br>http://www.sumanasinc.com/webcontent/anisamples/majorsbiology/pulsechase/pulsechase.html<br><br>*Understanding DNA* - DVD |

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| **B9** | The study of DNA has contributed to the fields of medicine, genetic engineering, and evolutionary biology.<br><br>*A few days to one week* | **Life Science Content Standard C; grades 9-12: Molecular Basis of Heredity**<br>In all organisms, the instructions for specifying the characteristics of the organism are carried in DNA, a large polymer formed from subunits of four kinds (A, G, C, and T). The chemical and structural properties of DNA explain how the genetic information that underlies heredity is both encoded in genes (as a string of molecular "letters") and replicated (by a templating mechanism). Each DNA molecule in a cell forms a single chromosome. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*11 SC1.1* relating the structure of DNA to characteristics of an organism |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Examine the various uses for DNA fingerprinting technology. (analysis)<br><br>• Describe the Human Genome Project and its potential uses. (analysis) Note – from Modern Biology, page 243, third objective. | Use a class "who done it" simulation to apply DNA fingerprinting technology. This can be done with paper cut-outs see http://www.accessexcellence.org/AE/AEPC/WWC/1994/dna_fingerprinting.html for an excellent example) or done using actual electrophoresis equipment (see http://www.accessexcellence.org/AE/AEC/AEF/1996/conley_dna.html for a sample lab)<br><br>Building *You* From *Moo*: Proteins from Plants to You by Way of a Moo!http://www.accessexcellence.org/AE/AEPC/WWC/1994/building.html)<br><br>Research the government's human genome web page (http://www.genome.gov/) as well as others related to human genomic research and participate in a class debate or discussion justifying the projects budgetary expenses.<br><br>Watch the NOVA film *Murder, Rape, and DNA.* | Given a description of a crime scene, witness statements, and various suspects DNA fingerprints (RFLP's) students will be able to use the available evidence to identify the correct suspect for prosecution. | *The Dynamics of Life* – Chapter 13<br><br>*Modern Biology* – Chapter 13 |

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| **B10** | The sorting and recombination of genes during sexual reproduction results in countless possible gene combinations for offspring.<br><br>*2 weeks* | **Life Science Content Standard C: grades 9-12: Molecular Basis of Heredity**<br>Most of the cells in a human contain two copies of each 22 different chromosomes. In addition, there is a pair of chromosomes that determines sex: a female contain two X chromosomes and a male contains one X and one Y chromosome. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. An egg and a sperm unit to form a new individual.. The fact that the human body is formed from cells that contain two copies of each chromosome – and therefore two copies of each gene – explains many features of human heredity, such as how variations that are hidden in one generation can be expressed in the next. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*9 SC1.2* using probabilities to recognize patterns of inheritance (e.g. Punnett Squares) |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Compare and contrast mitosis and meiosis with respect to chromosomal outcomes. (analysis)<br><br>• Calculate the probabilities of monohybrid and dihybrid crossings using Punnett squares. (comprehension) | Solve various collections of punnett square problems, including examples of monohybrid, dihybrid, sex linked, co and incomplete dominance, and multiple allele problems. See www.dnaftb.org for an excellent interactive student tutorial.<br><br>Use models of plants and animal cell meiosis to describe the major events that occur during the reduction division process that forms gametes. Discuss why the number of chromosomes in gametes is one half the chromosome number in body cells.<br><br>Use models of plants and animal cell meiosis to describe the major events that occur during the reduction division process that forms gametes. Discuss why the number of chromosomes in gametes is one half the chromosome number in body cells.<br><br>Sesame Street Genetics activity http://www.nsta.org/main/news/pdf/ss0102_12.pdf | Use the "genetics of parenthood lab" to determine if students are able to identify the correct number of chromosomes found in human body and gamete cells, as well as how these chromosomes can be combined into different patterns creating very different appearances in offspring. (see http://www.accessexcellence.org/AE/AEPC/WWC/1994/parenthood.html) | *The Dynamics of Life* – Chapter 10<br><br>*Modern Biology* – Chapter 9<br><br>Two animations: mitosis and meiosis. Good for compare/contrast: http://www.sumanasinc.com/webcontent/anisamples/majorsbiology/mitosis.html http://www.sumanasinc.com/webcontent/anisamples/majorsbiology/meiosis.html |

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| **B11** | Genes are segments of DNA molecules. Inserting, deleting, or substituting DNA segments can result in genetic mutations**.**<br><br>*1-2 weeks* | **Life Science Content Standard C: grades 9-12: Molecular Basis of Heredity**<br><br>Changes in DNA (mutations) occur spontaneously at low rates. Some of these changes make no difference to the organisms, whereas others can change cells and organisms. Only mutations in germ cells can create the variation that changes an organism's offspring. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*9 SC1.1* recognizing that all organisms have chromosomes made of DNA and that DNA determines traits.<br><br>*11 SC1.1* relating the structure of DNA to characteristics of an organism |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Identify and illustrate how changes in DNA can cause mutations. (analysis)<br><br>• Evaluate the significance of different types of changes in DNA. (evaluation)<br><br>• Relate the structural change of a protein and its effects to a change in DNA sequence. (synthesis)<br><br>• Explain the role of gene insertion in modern genetic engineering. (comprehension) | Identify several causes of mutations and distinguish between beneficial, harmful, and neutral mutations. Explain why exposures to mutagens such as UV light and X-rays should be limited to prevent gene mutation.<br><br>Use models of DNA, RNA, amino acids, etc., to demonstrate how mutations affect the structure of proteins, Relate the structural change in the protein to the alteration of a trait; for example, sickle-cell disease is caused by a single DNA base substitution that affects the structural configuration of hemoglobin molecules found in red blood cells.<br><br>Investigate a significant genetic disorder and describe the type of mutation that causes the disorder.<br><br>Examine the role of gene insertion and genetic engineering in modern medicine and industry, using examples such as the production of human insulin though bacteria. | Develop and present to the class a written paper or oral presentation on a genetic disorder of your choice<br><br>Develop and present to the class a written paper or oral presentation on a recent advancement in genetic engineering. | *The Dynamics of Life* – Chapter 12<br><br>*Modern Biology* – Chapter 12 |

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| **B12** | Radiation and chemicals can cause gene mutations. When they occur in sex cells, mutations can be passed on to offspring; if they occur in other cells, they can be passed on to descendant cells only. The experiences an organism has during its lifetime can affect its offspring only if the genes in its own sex cells are changed by the experience.<br><br>*1 week* | **Life Science Content Standard C: grades 9-12: Molecular Basis of Heredity**<br>Changes in DNA (mutations) occur spontaneously at low rates. Some of these changes make no difference to the organisms, whereas others can change cells and organisms. Only mutations in germ cells can create the variation that changes an organism's offspring. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*10 SC1.2* explaining how the processes of natural selection can cause speciation and extinction.<br><br>*11 SC1.2* relating the structure of DNA to characteristics of an organism. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Investigate a significant human genetic disorder and identify the source of the mutation. (analysis)<br><br>• Construct/ produce a pedigree that shows the passage of a disease or trait through several generations. (synthesis)<br><br>• Identify the gender of a human karyotype and analyze it for potential chromosomal abnormalities. (analysis)<br>*Cross reference with B5.*<br><br>• Relate environmental mutagens to human diseases. (application) | Use the interactive online karyotyping activity found at http://www.biology.arizona.edu/human_bio/activities/karyotyping/karyotyping.html<br><br>Work with various pedigrees of various diseases, such as hemophilia, or Huntington's disease.<br><br>Watch sections of the movie "Erin Brockovich" and participate in a class debate/ discussion on the ethics of toxic waste disposal.<br><br>Watch the movie "Lorenzo's Oil" and discuss/debate the discrepancies in medical funding for various genetic and infectious diseases | Watch and discuss the movie GATTACA. Write a five paragraph essay describing three reasons why it is or is not ethical, as the technology becomes available, to remove diseased or damaged genes from embryos still in their mother's womb.<br><br>Given the names of the family from Lake Maricaibo, Venezuela studied by Nancy Wexler, create a pedigree for five generations of the family, indicating who had the disease and who was a carrier.<br><br>Have students solve the "ultimate pedigree challenge" – creating a pedigree based on the folk song "I am my own grampa" by Dwight Latham and Moe Jaffe, 1947 | *The Dynamics of Life* – Ch 12, 13<br><br>*Modern Biology* – Chapter 12, 13 |

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| **B13** | The historical connections between the work of Gregor Mendel and Charles Darwin form the base for connections between genetics and evolution.<br><br>*1 week* | **Life Science Content Standard C: grades 9-12: Molecular Basis of Heredity**<br>Most of the cells in a human contain two copies of each 22 different chromosomes. In addition, there is a pair of chromosomes that determines sex: a female contain two X chromosomes and a male contains one X and one Y chromosome. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. An egg and a sperm unite to form a new individual. The fact that the human body is formed from cells that contain two copies of each chromosome – and therefore two copies of each gene – explains many features of human heredity, such as how variations that are hidden in one generation can be expressed in the next. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*9 SC1.2* using probabilities to recognize patterns of inheritance (e.g. Punnett Squares)<br><br>*11 SC1.1* relating the structure of DNA to characteristics of an organism<br><br>The student demonstrates an understanding that scientific knowledge is ongoing and subject to change by:<br><br>*10 SG3.1* using experimental or observational data to evaluate a hypothesis.<br><br>*11 SG3.1* investigating instances when scientists' observations were not in accord with prevailing ideas of the time. (L) |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Distinguish between dominant and recessive genes. (application)<br><br>• Identify the phenotypic and genotypic outcomes for various traits. (knowledge)<br><br>• Apply Mendel's Laws on Inheritance to a real-life situation. (application)<br><br>• Explain how Mendel's laws (independent assortment and segregation) lead to species diversity. | Solve a paternity case using only the blood types of child, mother, and potential fathers.<br><br>Use the "Genetics of Parenthood lab" to determine if students are able to identify the correct number of chromosomes found in human body and gamete cells, as well as how these chromosomes can be combined into different patterns creating very different appearances in offspring.<br><br>Calculate potential ABO blood types for various parental outcomes. | Describe the difference between the probability of any one outcome and actual outcome results of plant breeding experiments.<br><br>Read a chapter from Matt Ridley's book Genome. Describe how work on the human genome project is modifying Mendelian genetics. | *The Dynamics of Life* – Chapter 10<br><br>*Modern Biology* – Chapter 9<br><br>The Biology Project – Blood Types http://www.biology.arizona.edu/human_bio/problem_sets/blood_types/Intro.html<br><br>Genetics of Parenthood lab http://www.accessexcellence.org/AE/AEPC/WWC/1994/parenthood.html |

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| **B14** | Life on earth began about 4 billion years ago, as single-celled organisms, and has since diversified into a variety of organisms both single-celled and multi-celled.<br><br>*5 days*<br>*(six weeks for all 8 goals in The Diversity of Life section)* | **Life Science Content Standard C, grades 9-12: Biological Evolution**<br>The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms.<br><br>The millions of different species of plants, animals, and microorganisms that live on earth today are related by descent from common ancestors. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>10 SC1.2 explaining how the processes of natural selection can cause speciation and extinction.<br><br>11 SC1.2 researching how the processes of natural selection cause changes in species over time. (L)<br><br>9 SC1.3 inferring evolutionary pathways from evidence (e.g., fossils, geologic samples, recorded history). |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Relate the early conditions believed to have existed on Earth to the building blocks of life. (application)<br><br>• Describe the theoretical explanation for the development of early prokaryotic life. (comprehension)<br><br>• Using relevant evidence, explain the progression from prokaryotic to eukaryotic life (endosymbiosis). (analysis) | Create a timeline of Earth's history.<br><br>Coacervates lab.<br><br>Urey Miller demonstration/discussion<br><br>Explain the theory of the oxygen holocaust. | Students create a poem/song/rap that goes through and explains the timeline of Earth's history | *Modern Biology* Chapter 14<br><br>Video: *Evolution* by Nova<br><br>Creating Coacervates lab http://www.indiana.edu/~ensiweb/lessons/coacerv.html |

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| **B15** | Present day species developed from earlier, distinctly different species. This common ancestry is explained by evolutionary theory.<br><br>*Six weeks for all 8 goals in The Diversity of Life section:*<br>*3 Weeks for the first 4 goals or approximately 3/4 class per each of the first four goals in this section* | **Life Science Content Standard C, grades 9-12: Biological Evolution**<br>Species evolve over time. Evolution is the consequence of the interactions of (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection by the environment of those offspring better able to survive and leave offspring.<br><br>Natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life forms, as well as for the striking molecular similarities observed among the diverse species of living organisms.<br><br>The millions of different species of plants, animals, and microorganisms that live on earth today are related by descent from common ancestors. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*9 SC1.3* inferring evolutionary pathways from evidence (e.g., fossils, geologic samples, recorded history).<br><br>*10 SC1.2* explaining how the processes of natural selection can cause speciation and extinction.<br><br>*11 SC1.2* researching how the processes of natural selection cause changes in species over time. (L) |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Investigate the laws of superposition and its significance to evolutionary theory. (analysis)<br><br>• Compare and contrast radiometric dating and relative dating as tools to determine age. (synthesis)<br><br>• Demonstrate how early scientists inferred a succession of life forms from the fossil record(s). (application)<br><br>• Explain how geographic isolation (e.g., Darwin's finches) has led to biodiversity among species. *(comprehension)*<br><br>• Determine the significance(s) of Darwin's two major theories (descent with modification and modification with natural selection). (evaluation) | Sort a collection of fossils and develop a dichotomous key that would allow you to differentiate the fossil (plant or animal.)<br><br>Research others throughout history that made important contributions to this area of science. (i.e. Alfred Wallace) Rank order those found and explain your ranking.<br><br>Dinosaurs (timeline, dinosaurs to birds)<br><br>Reconstruct a model showing the succession of life forms cited.<br><br>Hominid skull Lab (online) Analysis based on measurements and observation comparisons. | Conceive a model that could explain what is happening if you were too find identical examples of fossilized organisms in multiple adjacent geological strata.<br><br>Given the geological history of the Earth develop a symbolic format that would help you understand that history. (pg. 280 – text)<br><br>Develop a new species and then criticize its possibility of existence. | *The Dynamics of Life*<br>Section 15-1 "The Fossil Record" (pg. 279-282)<br><br>Online reference for Hominid Skull Lab: www.indiana.edu/~ensiweb/lessons/hom.cran.html<br><br>http://evolution.berkeley.edu/evosite/evo101/index.shtml<br><br>Lots of links to various sites about human evolution: http://www.mrs.umn.edu/academic/anthropology/chollett/anth2101/physical.html<br><br>Yahoo! Site for Human Evolution web links: http://dir.yahoo.com/Science/Biology/Evolution/Human_Evolution<br><br>Human Origins Program, Smithsonian Institution: http://www.mnh.si.edu/anthro/humanorigins/<br><br>Human Origins and Evolution/Human Origins and Evolution in Africa http://www.talkorigins.org/faqs/homs/<br><br>Fossil Hominids FAQ: http://www.talkorigins.org/faqs/homs |

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| **B16** | Evolution by natural selection provides the scientific explanation for the history of life on earth as depicted in the fossil record and in the similarities evident within the diversity of existing organisms.<br><br>Six weeks for all 8 goals in The Diversity of Life section:<br>(3 Weeks for the first 4 goals or approximately 3/4 class per each of the first four goals in this section. | **Life Science: Content Standard C, grades 9-12: Biological Evolution**<br>Natural Selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life forms, as well as for the striking molecular similarities observed among the diverse species of living organisms.<br><br>The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms.<br><br>The millions of different species of plants, animals, and microorganisms that live on earth today are related by descent from common ancestors. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*9 SC1.3* inferring evolutionary pathways from evidence (e.g., fossils, geologic samples, recorded history).<br><br>*10 SC1.2* explaining how the processes of natural selection can cause speciation and extinction.<br><br>*11 SC1.2* researching how the proceses of natural selection cause changes in species over time. (L) |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Compare and contrast stabilizing, directional, and disruptive selection of a species. (analysis)<br><br>• Provide evidence used by Darwin to develop his idea of how species might change over time. (knowledge)<br><br>• Investigate how environmental or selective pressures result in phenotypic changes in populations over time. (analysis)<br><br>• Compare Darwin's and Lamarck's theories of evolution. (analysis) | Simplify the Hardy-Weinberg genetic equilibrium so that your seat neighbor could understand the five violations of conditions necessary to cause evolution to occur (pg. 302) Concern that this is ambiguous – implies 5 violations must occur for evolution to occur. Only 1 is necessary.<br><br>"Why sex?" from Evolution series (4 disc series)<br><br>Compare and contrast stabilizing, directional and disruptive selection<br><br>What is the significance of The Origin of Species? Is the publication any significance in the 21st century?<br><br>Fabricate an example in future history of how modification by natural selection will occur.<br><br>Read Beak of the Finch and investigate the importance of the finches to the writing of Darwin's theory/ies.<br><br>Explain the significance of Darwin's work as a naturalist on the HMS Beagle.<br><br>Trace the voyage of the HMS Beagle and research what was found at different stops on their voyage around the world. | Compare the works of Lamarck (1744-1829) to the work of Darwin (1809-1882.)<br><br>Create beaks that could be developed for "Darwin's Galapagos finches and explain the existence and possibility of survival.<br><br>Determine the importance of Darwin's two theories. | *The Dynamics of Life* Section 15-2: "Theories of Evolution"<br><br>Why Sex? DVD |

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| **B17** | Variation within a population increases the likelihood that at least some members of the population will survive under changed environmental conditions<br><br>*3 to 4 days*<br>*(six weeks for all 8 goals in The Diversity of Life section)* | **Life Science Content Standard C, grades 9-12: Biological Evolution**<br>Species evolve over time. Evolution is the consequence of the interactions of (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of resources required for life, and (4) the ensuing offspring of those better able to survive and leave offspring.<br><br>**Life Science Content Standard C, grades 9-12: The Interdependence of Organisms**<br><br>Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*10 SC1.2* explaining how the processes of natural selection can cause speciation and extinction.<br><br>*10 SC1.3* examining issues related to genetics. (L)<br><br>*11 SC1.2* researching how the processes of natural selection cause changes in species over time. (L) |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Identify favorable traits that would benefit a species. (application)<br><br>Predict the survival of variations within a species under changing environmental conditions. (evaluation) | Circle Bug Lab<br><br>Guppy activity<br><br>Best Beaks activity<br><br>Modeling Selection lab in Modern Biology p 296-297<br><br>Origami Bird lab | Given a list of organisms, students will research natural history and population distribution. Based on this information, students will rank organisms according to what population(s) have the best chance of survival and justify their choices. | *Modern Biology* by Holt Chapter 15-2 and chapter 16<br><br>Video: *Evolution* part 1<br><br>www.pbs.org/wgbh/evolution/educators/lessons/lesson4/act2notes.html<br><br>An article on Evolutionary Baggage: good for students to go through as part of a day in the computer lab: http://evolution.berkeley.edu/evolibrary/article/0_0_0/mantisshrimp_01<br><br>Animation on antibiotic resistance framed as a basic evolutionary response to a selective pressure: http://www.sumanasinc.com/scienceinfocus/sif_antibiotics.html |

# Biology I

| ASD Science Curriculum Code | ASD Framework and Pacing Guide | National Science Standard | Alaska State Science Content Standard | Grade Level Expectations |
|---|---|---|---|---|
| **B18** | Similarities between different organisms' DNA sequences show relatedness of these organisms.<br><br>*3 days*<br>*(six weeks for all 8 goals in The Diversity of Life section)* | **Life Science Content Standard C, grades 9-12: Biological Evolution**<br>Natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life forms, as well as for the striking molecular similarities observed among the diverse species of living organisms.<br><br>The millions of different species of plants, animals, and microorganisms that live on earth today are related be descent from common ancestors.<br><br>**Life Science Content Standard C, grades 9-12:The Molecular Basis of Heredity**<br><br>Changes in DNA (mutations) occur spontaneously at low rates. Some of these changes make no difference to the organism, whereas others can change cells and organisms. Only mutations in germ cells can create the variation that changes an organism's offspring. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*9 SC1.1* recognizing that all organisms have chromosomes made of DNA and that DNA determines traits.<br><br>*11 SC1.1* relating the structure of DNA to characteristics of an organism.<br><br>*10 SC1.2* explaining how the processes of natural selection can cause speciation and extinction.<br><br>*11 SC1.2* researching how the processes of natural selection cause changes in species over time. (L)<br><br>*9 SC1.3* inferring evolutionary pathways from evidence (e.g. fossils, geologic samples, recorded history).<br><br>*10 SC1.3* examining issues related to genetics. (L) |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Determine which organisms came from a recent common ancestor. (evaluation)<br><br>• Classify the relatedness of organisms based on evidence provided (cladogram). (analysis) | *Modern Biology* Lab C19: Analyzing Amino Acid Sequences to Determine Evolutionary Relationships<br><br>Lab: Molecular Sequences and Primate Evolution http://www.indiana.edu/~ensiweb/evol.fs.html | Students design a cladogram from DNA sequences to show relatedness | *Modern Biology* by Holt Chapter 15-3<br><br>Video: *Journey of Man*<br><br>http://www.indiana.edu/~ensiweb/lessons/mclad.html |

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| ASD Science Curriculum Code | ASD Framework and Pacing Guide | National Science Standard | Alaska State Science Content Standard | Grade Level Expectations |
|---|---|---|---|---|
| **B19** | Organisms are classified into taxonomic groups and subgroups based on biochemical and structural similarities as well as evolutionary relationships.<br><br>*5 days*<br>*(six weeks for all 8 goals in The Diversity of Life section)* | **Life Science Content Standard C, grades 9-12: Biological Evolution**<br>Biological classifications are based on how organisms are related. Organisms are classified into a hierarchy of groups and subgroups based on similarities, which reflect their evolutionary relationships. Species is the most fundamental unit of classification. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution.<br><br>**SC2** Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection and biological evolution by:<br><br>*10 SC1.2* explaining how the processes of natural selection can cause speciation and extinction.<br><br>*11 SC1.1* relating the structure of DNA to characteristics of an organism.<br><br>*9 SC1.3* inferring evolutionary pathways from evidence (e.g., fossils, geologic samples, recorded history).<br><br>The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by:<br><br>*9 SC2.1* describing and comparing the characteristics of phyla/divisions from each kingdom. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Determine different criteria (homologous forms, proteins, mitochondrial DNA) that are used to categorize organisms. (analysis)<br><br>• Create a classification system for a variety of items. (synthesis)<br><br>• Use current classification systems to place organisms in the appropriate kingdom (analysis) | Using a large list of television shows, students determine what criteria they will use to classify the shows.<br><br>Using common objects, students design a classification system and build a dichotomous key.<br><br>• Design a classification system for a variety of things. Students must justify their groupings (evaluation)<br><br>• Students will build and use a dichotomous key (synthesis)<br><br>Cytochrome C activity – Owl book | Use the current classification system to place organisms in the appropriate kingdom. | *Modern Biology* by Holt Chapter 18<br><br>Video: *Classification of Living Things*<br><br>http://www.indiana.edu/~ensiweb/lessons/mol.biol.html |

# Biology I

| ASD Science Curriculum Code | ASD Framework and Pacing Guide | National Science Standard | Alaska State Science Content Standard | Grade Level Expectations |
|---|---|---|---|---|
| **B20** | The amount of life any environment can support is limited by the available energy, water, oxygen, and minerals, and by the ability of ecosystems to recycle dead organisms.<br><br>*2 – 3 days* | **Life Science Content Standard C, grades 9-12: Interdependence of Organisms**<br>The atoms and molecules on the earth cycle among the living and nonliving components of the biosphere.<br><br>**Life Science Content Standard C, grades 9-12: Matter, Energy & Organization in Living Systems**<br>The distribution and abundance of organisms and populations in ecosystems are limited by the availability of matter and energy and the ability of the ecosystem to recycle materials. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC3** Students develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy. | The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by:<br><br>*9 SC3.1* describing the carbon and nitrogen cycle within an ecosystem and how the continual input of energy from sunlight keeps the process going. (L)<br><br>*9 SC3.3* identifying dynamic factors (e.g. carrying capacity, limiting factors, biodiversity, and productivity) that affect population size.<br><br>*10 SC3.2* exploring ecological relationships (e.g., competition, niche, feeding relationships, symbiosis). (L) |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Determine the individual contribution of a species in an ecosystem with respect to energy transfer and recycling of nutrients. (synthesis)<br><br>• Describe pathways through a given ecosystem through which carbon, nitrogen, and phosphorus are cycled. (comprehension)<br><br>• Describe biotic and abiotic factors that limit productivity, including the ability of decomposers to recycle organic and inorganic nutrients, in various ecosystems. (comprehension)<br><br>• Evaluate limiting factors affecting the growth rate of a population to determine their effect on population size. (analysis) | Diagram energy flow through an ecosystem.<br><br>Diagram or construct a flow chart of the carbon, nitrogen, and phosphorus cycles.<br><br>Investigate a nearby aquatic or terrestrial ecosystem and identify the flow of energy and cycling of materials.<br><br>Establish permanent plots in a natural area near the school early in the spring, and monitor changes in biomass and biodiversity by collecting data each week.<br><br>Students read "The Darkening Sea: What carbon emissions are doing to the ocean." By Elizabeth Kolbert from the New Yorker, November 20, 2006. | Given an ecosystem diagram, identify the flow of energy, showing possible transfers and losses.<br><br>Write an essay describing changes in an ecosystem that occur after the decline or removal of a single factor that can limit overall productivity. | *The Dynamics of Life* Chapter 2.2<br><br>*Modern Biology* Chapters 19.1, 21 & 22<br><br>"The Darkening Sea" http://www.newyorker.com/fact/content/articles/061120fa_fact3<br><br>See following table: |

| Title | Edition | Publisher | Copyright | Location |
|---|---|---|---|---|
| Intimate Strangers Unseen Life on Earth: Keepers of the Biosphere | | A & E Home Video | 1996 | |
| Explorations: Biology with TI-83 Plus | | Texas Instruments Inc. | 2001 | education.ti.com |
| Ecology: Projects for Young Scientists | | Martin J. Gutnik | 1984 | |
| Global Environmental Change: Biodiversity | | National Science Teachers Association | 1997 | www.nsta.org |
| Biology is Outdoors: A Comprehensive Resource for Studying School Environments | | J. Weston Walch | 1991 | www.walch.com |
| Ecology and Evolution: Islands of Change | | National Science Teachers Association | 2000 | www.nsta.org |
| Alaska Trees and Shrubs | | University of Alaska Press | 1972 | |
| Insects and Diseases of Alaskan Forests (Alaska Region Report Number 181) | Revised | USDA Forest Service | 1985 | |
| Wild Edible and Poisonous Plants of Alaska | Revised | Cooperative Extension Service, University of Alaska Fairbanks | 1981 | |
| Discovering Wild Plants: Alaska, Western Canada, the Northwest | | Alaska Northwest Books | 1989 | |
| Medicinal Flora of the Alaska Natives | | Alaska Natural Heritage Program | 1999 | |
| Issues in Ecology | | Ecological Society of America | 2001 | www.esa.org/sbi/sbi_issues/ |
| 2000 Summer Biology Institute: Biodiversity | | The Woodrow Wilson Foundation Leadership Program for Teachers | | www.woodrow.org/teachers/biology/ |

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| ASD Science Curriculum Code | ASD Framework and Pacing Guide | National Science Standard | Alaska State Science Content Standard | Grade Level Expectations |
|---|---|---|---|---|
| **B21** | The chemical elements that make up the molecules of living things and are combined and recombined in different ways as they pass through food webs. At each link in a food web, some energy is stored in newly made structures, but much is dissipated into the environment as heat. Continual input of energy from sunlight keeps the process going.<br><br>*2 – 3 days* | **Life Science Content Standard C, grades 9-12: Interdependence of Organisms**<br>Energy flows through ecosystems in one direction, from photosynthetic organisms to herbivores to carnivores and decomposers.<br><br>**Life Science Content Standard C, grades 9-12: Matter, Energy & Organization in Living Systems**<br>All matter tends toward more disorganized states. Living systems require a continuous input of energy to maintain their chemical and physical organizations. With death, and the cessation of energy input, living systems rapidly disintegrate.<br><br>The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes.<br><br>As matter and energy flows through different levels of organization of living systems--cells, organs, organisms, communities--and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC3** Students develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy | The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by:<br><br>*9 SC3.1* describing the carbon and nitrogen cycle within an ecosystem and how the continual input of energy from sunlight keeps the process going. (L)<br><br>*10 & 11 SC3.1* relating the carbon cycle to global climate change. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Determine how chemosynthesis and photosynthesis are used to create the building blocks of life throughout the various trophic levels. (analysis)<br><br>• Assess the utilization of energy input in an ecosystem, and identify where in the food web energy is stored and where it is dissipated as heat. (evaluation)<br><br>• Identify the original source of energy in a given ecosystem, and the transformations that result in energy flowing throughout the system. (analysis) | Create food web diagrams for a local ecosystem.<br><br>Create a "bottle biology" habitat for plants and animals, identify the biotic and abiotic factors in the habitat and explain their interactions.<br><br>Need good activity to pull these together!!<br><br>From Moo to You (remind students of this activity). | Quantify and record observations in a science journal. Present your findings to the class.<br><br>Given 25 organisms, organize them into a realistic energy web. Label energy flow. | *The Dynamics of Life* Chapter 2<br><br>*Modern Biology* Chapters 19, 21 & 22<br><br>Project Wild<br><br>Stream Team<br><br>Alaska's Ecology (Alaska Wildlife Curriculum Teacher's Guide) from Alaska Dept. of Fish & Game |

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|---|---|---|---|---|
| **B22** | At times, environmental conditions are such that an area's biomass becomes unavailable for decomposers to recycle into the environment. Layers of energy-rich organic material have been gradually turned into great coal beds and oil deposits by the pressure of the overlying earth. By burning these fossil fuels, stored energy is passed back into the environment as heat, releasing large amounts of carbon dioxide.<br><br>*1 - 2 days* | **Life Science Content Standard C: grades 9-12: Matter, Energy & Organization in Living Systems**<br>As matter and energy flows through different levels of organization of living systems - cells, organs, organisms, communities – and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC3** Students develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy. | The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by:<br><br>*9 SC3.1* describing the carbon and nitrogen cycle within an ecosystem and how the continual input of energy from sunlight keeps the process going. (L)<br><br>*10 & 11 SC3.1* relating the carbon cycle to global climate change. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Identify various carbon sinks in the biosphere, past or present, and their impact on environmental stability. (analysis)<br><br>• Determine the result of the eventual release of carbon from carbon sinks back into the environment. (evaluation) | Identify a commonly used resource. Research the methods used to obtain the resource, and the impact the removal of the resource has o the biogeochemical cycles of an ecosystem.<br><br>Research ways scientists study global warming trends including techniques used to measure how, where, and in what form carbon is stored in the biosphere, and ways it is released into the atmosphere.<br><br>Greenhouse effect | Produce a report or a poster on various issues of global warming. For example: causes, governmental policies or laws, dilemmas associated with economic hardship, human influence vs. natural causes, and reliability of studies and statistics. | *The Dynamics of Life* Chapter 2.2<br><br>*Modern Biology* Chapter 22, 23<br><br>"The Darkening Sea: What carbon emissions are doing to the ocean." By Elizabeth Kolbert, New Yorker, November 20, 2006. http://www.newyorker.com/fact/content/articles/061120fa_fact3 |

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|---|---|---|---|---|
| **B23** | Ecosystems can be reasonably stable over hundreds or thousands of years. If a disturbance occurs, the affected ecosystem is likely to recover in stages that eventually result in a system similar to the original one.<br><br>*3 – 4 days* | **Science and Technology Content Standard E: grades 9-12: Population Growth**<br>Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. This fundamental tension has profound effects on the interactions between organisms.<br><br>**Science and Technology Content Standard E: grades 9-12: Population Growth**<br>Populations can reach limits to growth. Carrying capacity is the maximum number of individuals that can be supported in a given environment. The limitation is not the availability of space, but the number of people in relation to resources and the capacity of earth systems to support human beings. Changes in technology can cause significant changes, either positive or negative, in carrying capacity. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC3** Students develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy. | The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by:<br><br>*9 SC3.3* identifying dynamic factors (e.g. carrying capacity, limiting factors, biodiversity, and productivity) that affect population size.<br><br>*10 SC3.2* exploring ecological relationships (e.g., competition, niche, feeding relationships, symbiosis). (L)<br><br>*11 SC3.2* analyzing the potential impacts of changes (e.g., climate change, habitat loss/gain, cataclysms, human activities) within an ecosystem. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Examine specific examples of both intra-specific and inter-specific competition in populations and within communities, and analyze the effect these interactions have on population densities. (synthesis)<br><br>• Assess the result of natural and human-induced disturbances on a given ecosystem, and evaluate the ability of the system to reconstruct itself through succession. (evaluation)<br><br>• Understand that population equilibrium is dependent upon dynamic changes that occur in an ecosystem. (comprehension) | Research the history of one of Alaska's glaciers (such as Portage Glacier) and describe succession processes that have occurred as the glacier retreated, and how scientists use this information to document historical glacial activity.<br><br>Predict the population growth curve over time assuming no hunting pressure or predation of moose in Alaska by using a theoretical model.<br><br>Graph a predator/prey population model using graphing calculators. | Identify evidence of intra- and interspecies interactions among plants and animals (e.g., competition, predation, parasitism, symbiosis, social behavior) in an environment. | *The Dynamics of Life* Chapter 3.1<br><br>*Modern Biology* Chapter 20, 21.1 |

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|---|---|---|---|---|
| **B24** | Human beings are part of the Earth's ecosystems. Human activities, deliberately or inadvertently, alter ecosystems.<br><br>*3 – 4 days* | **Life Science Content Standard C: grades 9-12: Interdependence of Organisms**<br>Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.<br>Science and Technology Content Standard E: grades 9-12: Natural Resources<br>The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.<br><br>**Science and Technology Content Standard E: grades 9-12: Environmental Quality**<br>Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.<br><br>**Science and Technology Content Standard E: grades 9-12:**<br>**Natural & Human-induced Hazards**<br>Human activities can enhance potential for hazards. Acquisition of resources, urban growth, and waste disposal can accelerate rates of natural change.<br><br>**Science and Technology Content Standard E: grades 9-12: Science & Technology in Local, National, and Global Challenges**<br>Humans have a major effect on other species. For example, the influence of humans on other organisms occurs through land use--which decreases space available to other species--and pollution-- which changes the chemical composition of air, soil, and water. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC3** Students develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy.<br><br>**SE3** Students develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures. | The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by:<br><br>*9 SC3.3* identifying dynamic factors (e.g. carrying capacity, limiting factors, biodiversity, and productivity) that affect population size.<br><br>*10 SC3.2* exploring ecological relationships (e.g., competition, niche, feeding relationships, symbiosis). (L)<br><br>*11 SC3.2* analyzing the potential impacts of changes (e.g., climate change, habitat loss/gain, cataclysms, human activities) within an ecosystem.<br><br>The student demonstrates an understanding that solving problems involves different ways of thinking by:<br><br>*10 SE2.1* questioning, researching, modeling, simulating, and testing multiple solutions to a problem.<br>The student demonstrates an understanding of how scientific discoveries and technological innovations affect our lives and society by:<br><br>*10 & 11 SE 3.1* researching a current problem, identifying possible solutions, and evaluating the impact of each solution. (L)<br><br>The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives by:<br><br>*9 SF1.1-SF1.3* describing the scientific principles involved in a subsistence activity (e.g., hunting, fishing, gardening). (L)<br><br>The student demonstrates an understanding of changes in historical perspectives of science by:<br><br>*10 SG1.1* describing how those perspectives (i.e., cultural, political, religious, philosophical) have impacted the advancement of science. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Determine the environmental consequences of various human activities such as habitat loss, ozone depletion, climate change, and loss of species diversity. (evaluation)<br><br>• Critique human efforts to positively alter or stabilize threatened ecosystems and habitats, such as bioremediation and wetlands restoration. (evaluation) | Investigate a local habitat and identify human impact on the structure and stability of the ecosystem.<br><br>Identify sensitive habitats and rank them according to need for their preservation and/or restoration.<br><br>Assess the effectiveness of attempts to control pollution in various parts of the world.<br><br>Study the urban ecology of our city and compare its biodiversity to that of other cities.<br><br>Use computer simulation software to design an environment and test the effects of biotic and abiotic factors, analyze successes and failures on terms of population ecology and ecosystem dynamics.<br><br>Study the issue of subsistence resources in Alaska. Choose a subsistence species (plant or animal) and write a report addressing life history, use, regulation, and importance.<br><br>Vani – algal bloom activity (Owl exploration book) | Create a power point presentation on a issues that effect a local ecosystem. | *The Dynamics of Life* Chapter 4.2, Chapter 5<br><br>*Modern Biology* Chapters 22 & 23<br><br>DVD: "An Inconvenient Truth" |

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| **B25** | Introduce current issues related to the science of biology (e.g., bioethics, drugs, alcohol, HIV, smoking, cloning).<br><br>*1 week* | **Life Science Content Standard C: grades 9-12: Molecular Basis of Heredity**<br>Most of the cells in a human contain two copies of each 22 different chromosomes. In addition, there is a pair of chromosomes that determines sex: a female contain two X chromosomes and a male contains one X and one Y chromosome. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. An egg and a sperm unite to form a new individual. The fact that the human body is formed from cells that contain two copies of each chromosome – and therefore two copies of each gene – explains many features of human heredity, such as how variations that are hidden in one generation can be expressed in the next. | **SC** Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.<br><br>**SC1** Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution. | The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:<br><br>*9 SC1.2* using probabilities to recognize patterns of inheritance (e.g. Punnett Squares).<br><br>*10 SC1.2* explaining how the processes of natural selection can cause speciation and extinction.<br><br>*11 SC1.1* relating the structure of DNA to characteristics of an organism. |

| Objectives (Bloom's) – Students will be able to: | Representative Activities | Assessments/Evaluations | References |
|---|---|---|---|
| • Discuss the ethics of hot topics from a personal and social perspective in science. (synthesis)<br><br>• Analyze the global impacts of hot topics in science. (synthesis)<br><br>• Develop scientific perspectives on current issues. (evaluate) | Simulate the spread of a communicable disease and determine the original source of the disease.<br><br>Criticize the fairness of adjusted insurance rates for smokers versus<br><br>Investigate the economic and ecological impacts of such topics as spruce bark beetle infestation, bottom fishing, endangered species, etc….<br><br>Use models or lab procedures to understand the process of inserting DNA form one organism into the genetic makeup of another organism. Discuss the application of recombinant DNA technology and the economic implications of allowing organisms created by biotechnology (e.g., genetically engineered frost-resistance plants, human growth hormone and insulin) to be patented.<br><br>Justify a position regarding the use of genetic counseling information for family planning.<br><br>*Examine a DNA profile, produced by gel electrophoresis, or participate in a simulation activity to identify and compare DNA "fingerprint" in different samples of DNA. Discuss how DNA fingerprinting is used in criminal trials, cases of disputed parentage, and genetic screening for disease.* | Debate an ethical question relating to a hot topic.<br><br>Prepare a poster or Powerpoint presentation to increase public awareness and understanding of an issue. | Rare-T: ASD Health/PE Curriculum<br><br>Movie: *Surviving AIDS*; NOVA WGBH Ed. Foundation: 1999<br><br>Movie: *And the Band Played On*<br><br>Periodical: Science World<br><br>*Science and Civics: Sustaining Wildlife*. A Project Wild curriculum.<br><br>life cycle of HIV: http://www.sumanasinc.com/webcontent/anisamples/microbiology/hiv.html<br>How a common type of infection testing—including an HIV test—works: http://www.sumanasinc.com/webcontent/anisamples/molecularbiology/ELISA.html<br>Another type of infection test, the Southern Blot: http://highered.mcgraw-hill.com/olc/dl/120078/bio_g.swf<br>Using basic genetics and DNA information to establish paternity: http://www.sumanasinc.com/webcontent/anisamples/dynamicillustrations/paternitytesting.html<br>How to collect and reuse stem cells: http://www.sumanasinc.com/scienceinfocus/sif_stemcells.html (Note also the Nova ScienceNOW clips on stem cells, below.)<br>IVF: http://www.sumanasinc.com/webcontent/anisamples/nonmajorsbiology/invitrofertilization.html (Keep in mind this may describe the genesis of one or more of your students!)<br>Go to www.pbs.org/wgbh/nova/sciencenow and look in the archive of past episodes. Each of the following is a good choice for this framework: RNAi, Mirror Neurons, Obesity (also, Frontline: Fat), Aging, Stem Cells and Stem Cells Update, 1918 Flu, Artificial Life. |