

Biology I Curriculum Guide

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Introduction



Introduction

Biology is a course designed to introduce the student to a variety of core concepts demonstrating the complexity and diversity of life. Students will engage in a wide variety of experiences including traditional laboratory activities, Internet research, on-line virtual laboratory activities, on-line tutorials with self-assessment quizzes, and cooperative learning activities. The purpose of this curriculum guide is to provide a framework for the scope, order and pacing of these core concepts.

For the purpose of this document, the following abbreviations are used. The letters TE refer to the Teacher's Edition of the textbook, LM signifies the Laboratory Manual, Mini represents the BioLab and MiniLab Workbook and TP stands for the Tech Prep Applications workbook.

A separate section that lists web addresses follows the Curriculum Maps. Please note that these web sites are grouped according to the six major Gateway topics.

Philosophy

The Biology curriculum is designed to promote the thought processes and problem solving competencies of each student. The course work is designed to include laboratory experiences that emphasize problem solving, information gathering, and decision-making. Students are encouraged to apply the principles of biology and science to societal issues past and present.

Rationale

The course is designed to strengthen the cognitive abilities of students and help them meet the state gateway objectives. In each unit of study, students are asked to synthesize information in order to solve problems. Evaluation includes objective tests, open-ended essay tests, oral presentations, and demonstration of performance. Units of study focus on the six topics: Interactions, Cells, Photosynthesis, Genetics, Diversity, and Evolution.

Modifications for IEP

The students within Shelby County Schools who require modifications due to their Individualized Education Program (IEP) are legally entitled to curriculum adjustment. An IEP is a legal document which must be followed in accordance with the laws set forth by the federal government, state statutes and Shelby County Schools' policy.

All educators must examine the student's IEP to determine exactly what modifications are necessary to meet the student's educational needs. For example, many IEPs require extended time for student reading, writing, test taking, and other assignments. However, it is not a question of whether the IEP should be followed, rather, it is a question of how best to effectively implement the required modifications of the IEP to benefit the student. Educators should read each student's IEP and review curriculum plans. Interviewing the students individually provides an excellent means of finding techniques to maximize the student's educational progress. School resource departments are also invaluable resources.

Below are a few examples of modifications that can be used not only for science, but also across the curriculum:

Assignment Sheets

Refer to figure 1.2 for an example of an assignment sheet. An assignment sheet is an extremely effective modification tool. It allows students to take responsibility for their assignments. The assignment number is placed on each appropriate assignment. This modification is also effective and important for non-resource students.

Testing Modifications

Testing modifications requires the educator to alter testing procedures to fit specific individual needs. This modification does not have to be a major reformatting of the testing procedure. One example is to utilize a matching or visual answer format. Some IEPs require reducing items or reducing the number of choices on multiple-choice questions. Changing a testing format does not necessarily suggest that an essay test be transformed into a multiple-choice test. Providing a list of concepts with the question is one type of modification. Students can choose from a list and explain it in their own words. Giving an individual more information to assist guiding the train of thought is also helpful. Adding a few matching or visual items to the questions can accomplish this. The number of questions do not necessarily need to vary. The modified tests can virtually be the same in content,

Figure 1.2: Example copy of an assignment sheet
Assignment Sheet: Biology

Name: Period:

Assign. #	Assignment Title	Date Assigned/Date Due
1	The Plant Cell	08/07/03 / 08/12/03
2	The Animal Cell	08/10/03 / 08/17/03
3		

Possible Modifications for IEPs

Regular Program Participation

Classroom Accommodations/Modifications:

- Preferential seating
- Provide copies of material to be copied from book or board
- Provide copies of notes (from another student)
- Peer tutoring
- Behavior/performance contracting
- Acknowledge effort put forth
- Allow limited movement within classroom
- Other: _____

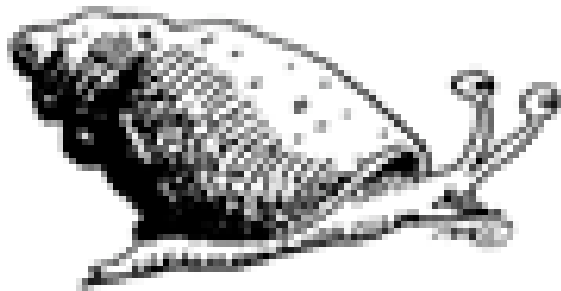
Assignment Accommodations/Modifications:

- Assignment book
- Abbreviated assignments or reduced number of assignments
- Study guide
- Cursive/manuscript handwriting
- Extra grade opportunities (Redo items missed, extra credit)
- Compacting
- Grade on effort/individual ability in addition to test scores
- Extended time
- Other: _____

Classroom Testing Accommodations/Modifications:

- Extended time
- Directions/test to be read for the student
- Use of calculator
- Word processor
- Modify grading scale
- Oral testing
- Modify test format
- Abbreviated concepts tested
- Reduce test items per page
- Allow tests to be taken in special education setting
- Other: _____

Tennessee State Standards



Standards

Course Description

Biology I is a course that introduces students to the world of living things. The students explore the following:

- basic life processes at the molecular, cellular, systemic, organismal, and ecological levels of organization within the biosphere;
- interdependence and interactions within the environment to include relationships, behavior, and population dynamics;
- cultural and historical scientific contributions of men and women;
- evidence that supports biological evolution; and
- current and emerging technologies.

It is expected that students will experience the content of Biology I through an inquiry approach. Using available technology, students will investigate the world around them. Biology I will provide the student with knowledge, prerequisite skills, and habits of mind needed for daily living and ethical decision making. This course provides a foundation for advanced biological studies and personal career choices.

Standard Number: 1.0 Cells

Standard: The student will investigate the structures and functions of the cell membrane, cellular organelles, and component biomolecules related to the major cell processes.

Learning Expectations:

The student will:

- 1.1 compare and contrast the chemistry of biomolecules and investigate their roles in cell structure and metabolism.
- 1.2 explore and compare the organelles of different cell types.
- 1.3 probe the composition of the cell membrane and its significance to homeostasis.
- 1.4 analyze the various cell processes.

Performance Indicators State:

As documented through state assessment,

at Level 1, the student is able to

- identify major cell organelles, given a diagram.
- distinguish between plant and animal cells, given diagrams or scenarios.
- predict the movement of water molecules across the cell membrane, given solutions of different concentrations.
- sequence a series of diagrams depicting the movement of chromosomes during mitosis.
- compare and contrast the cell cycle in plant and animal cells, given a diagram or description.

at level 2, the student is able to

- distinguish among proteins, carbohydrates, lipids, and nucleic acids, given structural diagrams (formulas).
- identify a positive test for carbohydrates and lipids when given an experimental procedure, data, and results.
- distinguish between active and passive transport, given examples of different molecules.
- evaluate the role of meiosis in maintaining genetic variability and continuity, given a scenario.
- determine the number of chromosomes following mitosis or meiosis, given the number of chromosomes in the original cell.
- recognize the significance of homeostasis to the viability of human and other organisms, given the definition of homeostasis.

at level 3, the student is able to

identify the biomolecules responsible for communicating, responding, regulating, and reproducing in the cell.

Performance Indicators Teacher:

As documented through teacher observation,

at Level 1, the student is able to:

- demonstrate appropriate use and care of compound microscopes.
- examine plant and animal cells using compound microscopes.
- create a 3D model of a typical cell.
- prepare wet mount slides.
- demonstrate molecular movement across a semi-permeable membrane.
- model or observe the movement of chromosomes during mitosis in plant and animal cells.
- model or observe the movement of chromosomes during meiosis in plant and animals cells.
- research careers related to the study of cells, such as, microscopist, cytologist, oncologist, medical technician, and biochemist.
- write a persuasive essay, supported by current scientific journals, relating certain lifestyle choices to a particular disease.
- create a time line that traces the development of microscopes and correlates this information to discoveries in cytology.

at Level 2, the student is able to

- construct a model of each of the biomolecules given a structural diagram.
- conduct an experiment to identify carbohydrates and lipids.
- prepare a slide using proper staining technique.
- record nutritional intake for one week, calculating daily caloric intake for each biomolecule, and evaluate the diet to develop an improvement plan.
- calculate the ratio of cell surface area to cell volume.

at Level 3, the student is able to

- design and conduct a controlled experiment to observe enzymatic actions and identify possible sources of experimental error.
- conduct a test to detect the presence of proteins.

Sample Task:

Egg Membrane Experiments: Decalcify eggs overnight by covering them with vinegar. The next morning, gently rub the eggs to loosen the shell. 1) Hypertonic solution experiment: dissolve two parts Karo syrup and one part water, place one egg in solution and store under refrigeration; maximum shriveling will occur in twelve hours. 2) Hypotonic solution experiment: fill a beaker with water; place one egg in the water and store at room temperature; the egg will demonstrate maximum stretching in ten hours. 3) Isotonic solution experiment: store two eggs in one part Karo syrup and two parts water solution. Minor adjustments in syrup and water may be necessary to maintain normal size. 4) Diffusion experiment: place an egg in isotonic solution; add 2 or 3 drops of blue food coloring to the solution, the dye will penetrate the egg within 30 minutes.

Integration/Linkages

microscope, homeostasis, chemistry, physical science, meiosis, heredity, mitosis, art, mathematics, lifetime wellness, nutrition, history, research and writing, careers

Standard Number: 2.0 Interactions

Standard: The student will investigate the interactions of organisms within their environment through different relationships, population dynamics, and patterns of behavior.

Learning Expectations:

The student will

- 2.1 compare and contrast the different types of symbiotic relationships.
- 2.2 distinguish between abiotic and biotic factors in an environment.
- 2.3 analyze the flow of energy in an ecosystem using energy and biomass pyramids.
- 2.4 analyze innate and learned behaviors and relate this to the survival of the organism.
- 2.5 investigate the roles of producers, consumers, and decomposers in an ecosystem.
- 2.6 examine the effects of human activity on ecosystems.

Performance Indicators State:

As documented through state assessment,

at Level 1, the student is able to

- identify commensalism, parasitism, and mutualism, given a scenario with examples.
- classify organisms as producers, consumers, or decomposers, given their behavior and environment.

at Level 2, the student is able to

- identify abiotic and biotic factors, given a description or an illustration of an ecosystem.
- make inferences about how environmental factors would affect population growth, given a scenario.
- examine the energy flow and loss through the trophic levels of an ecosystem, given an illustration of an energy pyramid.
- determine the effects of human activities on ecosystems, given a scenario.
- analyze and interpret population growth curves, given graphs.

at Level 3, the student is able to

- distinguish between a learned and an innate behavior, given a description of that behavior in a scenario.

Performance Indicator Teacher:

As documented through teacher observation,

at Level 1, the student is able to

- compare and contrast the three types of symbiotic relationships: parasitism, mutualism, and commensalism.
- recognize the general conditions necessary to maintain an ecosystem by constructing a model of an ecosystem.
- describe the niche and habitat of an organism in an ecosystem.
- recognize the kinds of organisms found at the base of a food chain.
- identify the producers, consumers, and decomposers in a food chain.
- observe an outdoor habitat, identifying the abiotic and biotic factors, types of populations, producers, consumers, and decomposers.
- research careers that relate to the environment, such as urban planner, forester, park ranger, environmental engineer, and environmental lawyer.

at Level 2, the student is able to

- use current publications to research examples where human influence has changed an ecosystem; communicate findings through written and/or oral presentation.
- investigate the impact of parasites on human population.
- investigate the effects of acid rain on the environment.
- maintain a model of an ecosystem.
- illustrate the flow of energy through an ecosystem.
- collect data, construct and interpret population graphs to determine if the population is stable, increasing, or declining.

at Level 3, the student is able to

- investigate the behaviors and adaptations of selected organisms, and relate these to the survival of the species.
- analyze human population graphs to infer the impact on global resources, as well as economic and political systems.
- investigate factors that influence Hardy-Weinberg equilibrium.
- research and evaluate the economic and political impact of recycling on nonrenewable resources.

Sample Task:

The students will choose an ecosystem that they would like to simulate. They will design a mini ecosystem that will support at least three types of plants and animals from that ecosystem. They will observe the ecosystem daily and add water as needed. The students will observe the ecosystem inhabitants and note their behavior and growth. The students will also look for interaction between organisms and for changes that may occur.

Integration/Linkages:

energy transfer, ecology, biogeochemical cycles, mathematics/graphing, health, evolution, mutations, adaptations, immunology, physical science, geography, populations, ecology, genetics, politics, economics, natural resources, recycling, careers, sociology, research and writing

Standard Number: 3.0 Photosynthesis and Respiration

Standard: The student will compare and contrast the biochemical processes involved in the transfer of energy during photosynthesis and respiration, and analyze the major biogeochemical cycles in the biosphere.

Learning Expectations:

The student will

- 3.1 compare and contrast the light dependent and light independent reactions of photosynthesis.
- 3.2 investigate the relationship between the processes of photosynthesis and respiration.
- 3.3 analyze the carbon, oxygen, nitrogen, and water cycles in the biosphere.
- 3.4 distinguish between aerobic and anaerobic respiration.

Performance Indicators State :

As documented through state assessment,

at Level 1, the student is able to

- identify the reactants and products of photosynthesis and respiration, given the equations.
- identify the cell organelle in which photosynthesis occurs, given a diagram of a plant.
- interpret a diagram of the oxygen-carbon dioxide cycle, given a diagram.

at Level 2, the student is able to

- distinguish between aerobic and anaerobic respiration in terms of the presence or absence of oxygen and ATP produced.
- relate the interdependence of the processes of photosynthesis and respiration to living organisms, given a diagram or a description.

at Level 3, the student is able to

- recognize the transfer of energy from respiration to cellular work, given an equation or diagram of the ATP cycle.

Performance Indicators Teacher:

As documented through teacher observation,

at Level 1, the student is able to

- identify and explore the chloroplasts in a leaf such as *Elodea*.
- construct a model or a diagram of the oxygen-carbon dioxide cycle.
- model or illustrate the paths of water, oxygen, nitrogen, and carbon dioxide through a plant.
- research careers that relate to photosynthesis and respiration, such as horticulturist, brewer,

environmentalist, paper manufacturer, and agricultural extension agent.

at Level 2, the student is able to

- construct charts comparing reactants, products, and energy transfer during photosynthesis and respiration.
- demonstrate that oxygen is released during photosynthesis through a laboratory investigation.
- sequence the major events of cellular respiration and anaerobic respiration.
- investigate the importance of fermentation to the pharmaceutical, agricultural, and food and beverage industries.

at Level 3, the student is able to

- produce concept maps of the major events occurring in the light dependent and light independent reactions.
- compare the efficiency of aerobic and anaerobic respiration.

Sample Task:

Oxygen Production in Photosynthesis: Prepare three test tubes, one of each of the following: well aerated water, boiled and cooled water, and boiled and cooled water with 2 cc of a .25% sodium bicarbonate solution. Place a 3-inch twig of *Elodea*, cut end up, in each test tube. Tie the *Elodea* to a glass rod to keep it in place. Expose the tubes to full light intensity and allow to stand for several minutes. Count the bubbles released in each test tube for five minutes. Record results. Repeat the procedure, but place the tubes in darkness or cover with aluminum foil. The rate of the carbohydrates made depends on factors such as temperature, light intensity, carbon dioxide, and water concentration. The rate of photosynthesis can be determined by noting the materials entering the reaction and determining an end product, such as oxygen.

Integration/Linkages:

interaction of organisms, physical science/equations and hydrolysis, ecology, diversity, adaptations, C3, C4, CAM, microscopes, graphs, mathematics, research and writing, chemistry, careers, physical science, concept maps

Standard Number: 4.0 Genetics and Biotechnology

Standard: The student will investigate the concepts of genetics and heredity, different methods of reproduction, patterns of inheritance, and genetic disorders; as well as, explore and evaluate DNA technologies from both a scientific and ethical perspective.

Learning Expectations:

The student will

- 4.1 investigate the structure and molecular composition of DNA and RNA.
- 4.2 relate the structure of DNA and RNA to the processes of replication and protein synthesis.
- 4.3 compare and contrast the asexual and sexual reproductive strategies used by organisms.
- 4.4 apply the principles of Mendelian inheritance to make predictions for offspring.
- 4.5 examine modes of inheritance involving sex linkage, co-dominance, incomplete dominance, multiple alleles, and polygenic traits.
- 4.6 investigate the causes and effects of mutations.
- 4.7 identify the causes and effects of genetic diseases in plants and animals.
- 4.8 investigate the scientific and ethical ramifications of genetic engineering, recombinant DNA, selective breeding, hybridization, cell and tissue culture, transgenic animals, and DNA fingerprinting.

Performance Indicators State:

As documented through state assessment,

at Level 1, the student is able to

- distinguish between asexual and sexual methods of reproduction, using a scenario.
- identify the dominant trait, given the results of a monohybrid cross in a scenario.

- determine the genotype and phenotype of a monohybrid cross, given a Punnet square.
- relate changes in the DNA instructions to cause mutations, given diagrams.

at Level 2, the student is able to

- recognize the two major functions of DNA as replication and protein synthesis, given diagrams showing strands of bases with a complimentary strand.
- identify the sex chromosomes in humans and recognize inheritance patterns that are sex-linked, using a pedigree.
- analyze modes of inheritance including co-dominance, incomplete dominance, polygenic, and multiple alleles using genetic problems or Punnet Squares.
- describe and analyze DNA fingerprinting using an illustration of DNA bands.
- analyze a series of DNA bases to determine the sequence which demonstrates a mutation.
- determine the probability of having a child with cystic fibrosis, sickle cell anemia, or Tay Sachs if both parents are carriers, given the scenario or genetic problem.

at Level 3, the student is able to

- differentiate the processes of transcription and translation, given diagrams.
- analyze a dihybrid cross, given a completed Punnet square to determine the probability of a particular trait.

Performance Indicators Teacher:

As documented through teacher observation,

at Level 1, the student is able to:

- construct a model of DNA.
- construct a monohybrid cross, given a genetic problem.
- distinguish between dominant and recessive traits, given the results of a monohybrid cross.
- research careers in genetics, such as, lab technician, forensic pathologist, livestock breeder, medical doctor, and reproductive endocrinologist

at Level 2, the student is able to

- identify a DNA molecule when given a choice of several representations.
- construct a chart comparing DNA with RNA for shape, functions, and molecular make-up.
- model the processes of replication, transcription, and translation.
- construct a dihybrid cross to predict genotypic and phenotypic ratios.
- use a microscope or hand lens to diagram and label different types of reproductive cells.
- participate in a classroom debate regarding the scientific and ethical issues surrounding current emerging DNA technologies and/or the Human Genome Project.
- model the process of recombinant DNA.

at Level 3, the student is able to

- manipulate a model of DNA to show different types of mutations.
- analyze/construct a karotype and identify abnormalities for chromosome number, deletions, and translocations.
- research a position paper defending views of the ethics of a chosen group of DNA technologies.
- apply an ethical model to evaluate current and future DNA technologies.

Sample Task:

DNA Gumdrop Lab: Students will prepare a model of a segment of DNA using large and small marshmallows, gumdrops of four different colors, and toothpicks. Give each student a specific base triplet sequence to model. Students will connect the large marshmallows (representing sugar molecules) alternately with the small marshmallows (representing phosphate groups) to represents the "sides" of the DNA. The marshmallows are connected with toothpicks (representing bonds). Assign each of the four bases a color. For example, cytosine might be red and guanine might be yellow. Connect the bases (in the order given in their base triplet sequence) to the sugar groups of one side.

Connect the complementary base to the initial bases with toothpicks and then connect them to the sugar on the opposite side. The DNA model may be twisted if the students are careful. Students may exchange models and write the sequences. After studying RNA, students may use their model, divide and then model RNA using a color for uracil.

Integration/Linkages:

biological evolution, mitosis, meiosis, cell, math, probability, statistics, Hardy-Weinberg, microscope, art, research and writing, chemistry, careers, debate, adult living, lifetime wellness, physical science, communication

Standard Number: 5.0 Diversity

Standard:

The student will investigate the diversity of organisms by analyzing taxonomic systems, exploring diverse environments, and comparing life cycles.

Learning Expectations:

The student will

5.1 establish criteria for designing a system of classification and compare historically relevant systems of classification used in Biology.

5.2 infer the types of organisms native to specific major biomes.

5.3 integrate a comparative study of plant and animal anatomical structures so as to recognize relationships among organisms related to structural components, symmetry, metamorphosis, and alternation of generations.

Performance Indicators State:

As documented through state assessment,

at Level 1, the student is able to

- infer animals or plants indigenous to an environment, given pictures or diagrams of the organisms and a description of the environment.
- infer the biome in which an animal or plant lives, given a description of the organism and pictures of various biomes.
- infer the relatedness of different organisms using the Linnean system of classification, given pictures of a variety of different plants or animals and a key to classification of organisms.

at Level 2, the student is able to

- determine the genus and species of an organism, given a dichotomous key containing descriptions of the characteristics of each classification level.
- determine whether an insect undergoes complete or incomplete metamorphosis, given pictures or diagrams of the insect in its stages of development.
- infer the body symmetry of an organism, given a diagram or picture of the organism.
- predict the function of a system or organ, given structural descriptions, whether in the earthworm, crayfish, frog, or human.

at Level 3, the student is able to

- predict the function of an organ, given a description of its component tissues.
- compare and contrast life cycles of various organisms to include alternation of generations, given pictorial representations.

Performance Indicators Teacher:

As documented through teacher observation,

at Level 1, the student is able to

- develop a rationale for a system of classification, given a group of objects to classify.
- examine plant and animal specimens and compare and contrast their structure, symmetry, and life cycles.

- illustrate or construct a biome for specific plant and animal species by determining the needs of the organisms.
- predict the types of plants and animals indigenous to a biome by determining the characteristics of the biome.
- research careers that relate to diversity, such as farmer, zookeeper, pest control consultant, entomologist, taxonomist, lab technician, naturalist, and botanist.

at Level 2, the student is able to

- relate the advantages and disadvantages of various classification systems, including the Aristotelian, Linnean, and DNA sequencing systems.
- model or observe the stages of complete and incomplete metamorphosis.
- model or observe body plans with asymmetry, radial, and bilateral symmetry.
- observe or illustrate the alternation of generations in a plant or animal species.
- predict the function of a system or organs given the characteristics of the organs contained within that system.
- classify a group of organisms given a dichotomous key with characteristics of the organisms.

at Level 3, the student is able to

- perform comparisons using DNA sequencing to determine relatedness of different organisms.
- compare and contrast the organs and organ system of various species of plants and animals as related to their structural components and the functions of the organs and systems.

Sample Task:

16 Bean Soup Classification: After discussing the characteristics used to determine different groups, such as age, grade level, first letter of the alphabet, etc., explain to students that classification is an arbitrary method of grouping things. At your local grocer obtain a bag of 16-bean soup mix with a variety of 16 different types of beans included. Divide your students into groups of three or four, and give each group about 1 cup of beans of different kinds. Instruct the groups to design their own system of classifying the objects you have given them. They must write out qualifications for each of their units of classification. Have each group report their system to the class, and then allow the class to adapt a system of classification for the beans. Discuss the rationale used in systems of classification (i.e. color, shapes, numbers of parts, symmetry, etc.). Relate this to the methods used by Aristotle, Linneus, and the DNA base sequencing method of determining relatedness of different organisms. Students may be evaluated by looking for some of these rationales: 1) method of grouping defined (shapes, colors, size, etc), 2) provide explanation for groupings, 3) develop a key to the groupings.

Integration/Linkages:

tessellating in mathematics, evolutionary trends in plants and animals, Fibonacci sequences in mathematics, genetics, geography, research and writing, careers, ecology, entomology, anatomy and physiology, history

Standard Number: 6.0 Biological Evolution

Standard: The student will investigate the process of natural selection and examine the evidence for biological evolution.

Learning Expectations:

The student will

- 6.1 interpret and evaluate the evidence for biological evolution in the fossil record.
- 6.2 investigate how natural selection, mutation, and adaptation impact a species.
- 6.3 recognize the contributions of scientists, including Darwin, to the concept of evolution.
- 6.4 apply current knowledge of DNA and comparative anatomy to provide evidence for biological evolution.

Performance Indicators State:

As documented through state assessment,

at Level 1, the student is able to

- differentiate between the relative age of various fossils in sedimentary rock, given a diagram of rock strata.
- predict how environmental changes will encourage or discourage the formation of a new species or extinction of an existing species, given a written scenario.

at Level 2, the student is able to

- transfer knowledge of divergent evolution, as in Darwin's finches, to determine why species with a common ancestor have adapted differently, given a diagram of the various species.
- compare homologous structures in species to determine the relatedness of certain species, given diagrams or pictures of each.
- differentiate between natural selection and selective breeding, given a scenario.

at Level 3, the student is able to

- recognize the relatedness of species using DNA strands.

Performance Indicators Teacher:

As documented through teacher observation,

at Level 1, the student is able to

- compare and contrast the processes of fossil formation.
- construct mock fossils using casts and molds.
- collect and/or observe various fossils and relate them to biogeographical changes.
- research careers that relate to biological evolution, such as farmers, field biologist, geologist, archeologist, epidemiologist, and anthropologist.

at Level 2, the student is able to

- calculate the approximate age of a fossil, given the amount of Carbon-14 atoms found in the fossil and the half-life of Carbon-14.
- compare and contrast the homologous and analogous structures of organisms to demonstrate relatedness.
- analyze a graph of population distribution of peppered moths as their environment changed.
- predict the role of mutation in population change.

at Level 3, the student is able to

- develop a diorama or time line that depicts change of organisms through time.
- collect data from local or regional records regarding population counts of a specific species found in the area and hypothesize what events might affect populations.

Sample Task:

Given a specific biome of the world, select a natural event that might affect the organisms living in the biome. With this knowledge, predict what adaptations would become more important than they seemed in the past. Design a "new" organism that might appear because of the adaptations that might be necessary. Draw the organism and give it a name. Present your organism to the class and explain why you think it might have formed and what traits are evident.

Integration/Linkages:

genetics/inheritance of traits, diversity of life, mathematics/calculations, graphing and time lines, microscopy, physical science, geology, populations, history, genetics, geography, earth science, bacteria, disease

Course Outline



First Nine Weeks

- I. Introduction and review
 - A. Lab safety
 - B. Scientific method
 - C. Metric measurements
 - D. Properties of life
 - E. Microscope
- II. Interactions
 - A. Symbiosis
 - B. Organisms as producers, consumers and decomposers
 - C. Abiotic and biotic factors
 - D. Population growth curves
 - E. Energy flow through trophic levels
 - F. Effects of human activity on an ecosystem
 - G. Innate and learned behaviors
- III. Cells
 - A. Cell organelles
 - B. Plant vs. animal cells

Second Nine Weeks

- I. Cells
 - A. Active / Passive transport
 - B. Permeability of the cell membrane
 - C. Homeostasis
 - D. Mitosis and cell cycle
 - E. Meiosis and genetic variability
 - F. Chromosome number in mitosis and meiosis
 - G. Biomolecules
- II. Photosynthesis / Respiration
 - A. Reactants and products photosynthesis and respiration
 - B. Cellular organelles
 - C. Aerobic / anaerobic reactions
 - D. Interdependence of photosynthesis and

respiration

- E. Transfer of energy from respiration to cellular work
- F. Carbon and oxygen cycles

Third Nine Weeks

- I. Genetics and Biotechnology
 - A. Reproduction: sexual / asexual
 - B. DNA structure
 - C. DNA replication and protein synthesis
 - D. Dominant and recessive genes
 - E. Monohybrid and dihybrid crosses
 - F. Mutations
 - G. Genetic diseases
 - H. Genetic engineering / gel electrophoresis
- II. Evolution:
 - A. Analyze DNA bases for mutations
 - B. DNA fingerprints

Fourth Nine Weeks

- I. Evolution:
 - A. Speciation
 - B. Divergent evolution
 - C. Homologous and analogous structures
 - D. Natural and artificial selection
 - E. Biochemical comparison
- II. Diversity:
 - A. Biomes
 - B. Taxonomy
 - C. Dichotomous key
 - D. Life cycles
 - E. Symmetry
 - F. Organ structure and function
- III. Infectious Diseases
 - A. AIDS
 - B. Vectors
 - C. Vaccines

Biology Curriculum Objectives

It is essential that each teacher review and contemplate the objectives in the Gateway Standards. The following objectives are representative of the essential performances that the student accomplishes.

I. Introduction and Review

- A. Read, review and return a copy of the lab safety contract with their signature and parental signature.
- B. Identify lab safety procedures before entering the lab.
- C. Compare and contrast activities that promote safe lab practices.
- D. Relate the scientific method to studying and solving current biological problems.
- E. Demonstrate proficiency in making measurements and graphing data.
- F. List and describe the properties common to living organisms.
- G. Describe the correct way to carry, store, and clean a microscope.
- H. Demonstrate the ability to prepare a wet mount slide and focus a microscope.

II. Interactions

- A. Identify commensalisms, parasitism, and mutualism, given a scenario.
- B. Classify organisms as producers, consumers, or decomposers given their behaviors and environment.
- C. Identify abiotic and biotic factors, given a description or illustration of an ecosystem.
- D. Make inferences about how environmental factors would affect population growth.
- E. Examine the energy flow and loss through the trophic levels of an ecosystem, given an illustration of an energy pyramid.
- F. Determine the effects of human activities on ecosystems, given a scenario.
- G. Analyze and interpret population growth curves, given a graph.
- H. Distinguish between a learned and innate behavior given a description of that behavior in a scenario.

III. Cell

- A. Identify major cell organelles, given a diagram.
- B. Distinguish between plant and animal cells given diagrams or scenarios.
- C. Predict the movement of water molecules across a cell membrane, given solutions of different concentrations.
- D. Sequence a series of diagrams depicting the movement of chromosomes in meiosis.
- E. Compare and contrast the cell cycle in plant and animal cells, with a diagram.
- F. Distinguish proteins, carbohydrates, lipids, and nucleic acids, given structural diagrams.
- G. Identify a positive test for carbohydrates and lipids when given an experimental procedure, data, and results.
- H. Distinguish between active and passive transport, given examples of different molecules.
- I. Evaluate the role of meiosis in maintaining genetic variability and continuity, given a scenario.
- J. Determine the number of chromosomes following mitosis or meiosis, given the number of chromosomes in the original cell.
- K. Relate the significance of homeostasis to the viability of humans and other organisms, given the definition of homeostasis.

IV. Photosynthesis

- A. Identify the reactants and products of photosynthesis and respiration, given the equations.
- B. Identify the cell organelle in which photosynthesis occurs, given a diagram of a plant cell.
- C. Interpret a diagram of the oxygen-carbon dioxide cycle, given a diagram.

- D. Distinguish between aerobic and anaerobic respiration in terms of the presence or absence of oxygen and ATP produced.
- E. Relate the interdependence of the process of photosynthesis and respiration to living organisms, given a diagram or a description.

V. Genetics and Biotechnology

- A. Distinguish between asexual and sexual methods of reproduction, using a scenario.
- B. Identify the dominant trait, given the results of a monohybrid cross.
- C. Determine the genotype and phenotype of a monohybrid cross, given a Punnett Square.
- D. Relate changes in the DNA instructions to cause mutations, given diagrams.
- E. Recognize the two major functions of DNA as replication and protein synthesis, given a diagram.
- F. Identify the sex chromosomes in humans and recognize inheritance patterns that are sex-linked using a pedigree.
- G. Analyze modes of inheritance including co-dominance, incomplete dominance, polygenic, and multiple alleles using genetic problems of Punnett Squares.
- H. Analyze a series of DNA bases to determine the sequence with a mutation.
- I. Describe and analyze DNA fingerprints using an illustration of DNA bands.
- J. Determine the probability of having a child with cystic fibrosis, sickle cell anemia, or Tay-Sachs if both parents are carriers, given a scenario.

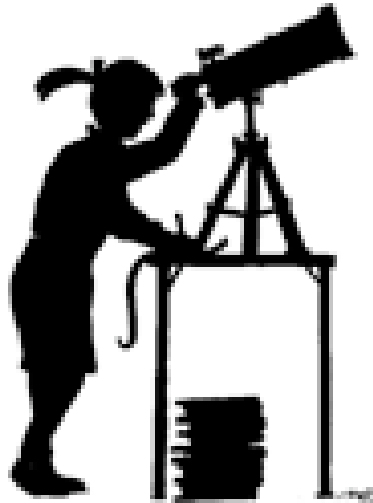
VI. Diversity

- A. Infer animals or plants indigenous to an environment, given pictures or diagrams of the organisms and a description of the environment.
- B. Infer the biome in which an animal or plant lives, given a description of the organism and pictures of various biomes.
- C. Infer the relatedness of different organisms using the Linnean system of classification, given pictures of a variety of different plants or animals and a classification key of organisms.
- D. Determine the genus and species of an organism, given a dichotomous key containing descriptions of the characteristics of each classification level.
- E. Determine whether an insect undergoes complete or incomplete metamorphosis, given pictures or diagrams of the insect in its stages of development.
- F. Infer the body symmetry of an organism.
- G. Predict the function of a system or organ given structural descriptions, whether earthworm, crayfish, frog, or human.

VII. Biological Evolution

- A. Differentiate between the relative ages of various fossils in sedimentary rock, given a diagram of rock strata.
- B. Predict how environmental changes will encourage or discourage the formation of a new species or extinction of an existing species, given a written scenario.
- C. Transfer knowledge of divergent evolution, as in Darwin's finches, to determine why species with a common ancestor have adapted differently, given a diagram of the various species.
- D. Compare homologous structures in species to determine the relatedness of certain species, given diagrams or pictures of each.
- E. Differentiate between natural selection and selective breeding, given a scenario.

Scope & Sequence for



Nine Weeks: First

Unit	Chapter Topics	Gateway Activities	Lab Activities	Demonstrations
Introduction	Lab Safety Appdx D p7 Scientific Method Ch 1 Metrics Ch 1 Properties of Life Ch 1 Microscope Ch 7		LM p. xvii LMp.1 TP p. 1 LM p. 5	Model use & safety of science tools LM p. xiv
		Field of view M-5 Making Slides M-7	LM p. 47 Mini p. 31	Model use of microscope TE p. 174
Interactions	Symbiosis Ch 2	Symbiosis Step Book S2-19 (L 1, Std. 2.1) Viewing Lichens S 2-20 (L 1, 2, Std.2.1)	Mini p. 13	TE Quick Demo p.45 Lichens
	Organisms as producers, consumers, and decomposers Ch 2/3	Dessert Food Web S2-24 (L 2, Std. 2.5)	Mini p. 11 LM p. 19	
	Abiotic/ Biotic factors Ch 2	Abiotic vs. Biotic Factors S2-42 (L 1, 2, Std. 2.2)		TE Quick Demo p. 40 Fish Demo
	Environmental effects on population growth curves. Ch 4	Mimicry S2-22 (L 1)	Mini p. 19 LM p. 23	TE Quick Demo p. 101 Density Factors
	Energy flow through trophic levels. Ch 2	Energy Pyramid S2-28 (L1, 2, Std. 2.3)		
	Human activities on ecosystems. Ch 5	A Grave Mistake S2-37 (L 1, 2, 3, Std.2.6)	LM p. 35	

Cells	Analyze and interpret population growth curves. Ch 4		Mini p. 17 Mini p. 18 LM p. 27	TE Demo p. 94 Population Size
	Innate and learned behaviors. Ch 33	Learned and Innate Behaviors S2-16 (L 1, 2, 3, Std. 2.4)	LM p. 243 Mini p. 147	TE Quick Demo p. 891 Blink Response TE Quick Demo p. 901 Shoe tying
	Identify organelles Ch 4	Comparing a Cell to a City S1-14 (L1, Std. 1.2)	Mini p. 32	TE Quick Demo p. 191 Cell Model
	Plant and animal cells Ch 4	Viewing a Cork Cell S1-19 (L1, Std.1.2) Observing Animal Cells S1-20 (L 1, Std. 1.2)	Mini p. 33	

Nine Weeks: Second

Unit	Chapter Topics	Gateway Activities	Lab Activities	Demonstrations
Cells	Active & Passive Transport Ch 9	Egg Membrane S1-23(L1, Std. 1.3)	Mini p. 35	TE Quick Demo p. 229 Energy Potato
	Movement of water Ch 8	Permeability Model S1-21 (L1, Std. 1.3)		
	Homeostasis Ch 8	Osmosis and concentration S1-26 (L 1, Std. 1.3)		TE Demo p. 200 Raisin Osmosis
	Mitosis / cell cycle Ch 8	Red Rover Molecules S1-28 (L1, Std. 1.3)	TE p. 209 Mini p. 36	TE Quick Demo p. 208 Chromatids TE Lab p. 209 Surface Area TE p. 212 Mitosis Models
		The Cell Cycle: interphase, mitosis and cytokinesis. S1-30 (L1, Std. 1.4)		
	Meiosis and Genetic Variability Ch 10	(L2, Std.1.4)	LM p. 69	
	Chromosome number in mitosis and meiosis	(L1, 2 Std. 1.4)		TE p. 271 Pipe Cleaner Chromosomes
Biomolecules Ch 6	(L2, 3 Std. 1.1)	LM p. 39 LM p. 43		
Respiration/ Photosynthesis	Products and Reactants Ch 9	Reactants and Products S3-17 (L1, Std,3.2)	Mini p. 41	TE Quick Demo p. 146 Elements
	Organelle of photosynthesis	Hammering Chloroplasts S3-23		

	Carbon/Oxygen Cycle	(L1, Std. 3.1) Oxygen – Carbon dioxide Cycle and Drawing S3-37 (L1, Std.)	LM p. 11	
	Aerobic and Anaerobic Respiration	The Killer Bee Story S3-43 (L2, Std.3.4)	Mini p. 40	
	Interdependence of Photosynthesis and Respiration	Where is My Team? S3-19 (L1, Std.3.2)	LM p. 61 LM p. 65	TE Quick Demo p. 238 Fermentation
	Recognize transfer of energy from respiration to cellular work	The Effects of Fatigue on Muscles S3-41 (L2, Std.3.4)	TE p. 228	

Nine Weeks: Third

Unit	Chapter Topics	Gateway Activities	Lab Activities	Demonstrations
Genetics and Biotechnology	Reproduction (Asexual /Sexual) Ch 10	Reproduction Round Robin S4 44-48 (Level 1, Std. 4.1)	LM p. 69 Mini p. 109	
	DNA Structure Ch 11	Marshmallow DNA S4-21 (Level 1, Std. 4.1)	Mini p. 55	TE Quick Demo p. 288 Zipper DNA
	Replication and Protein Synthesis Ch 11	Writing Sentences S4-20 (Level 1, Std. 4.1) Protein Synthesis Sentences II S4-10f (Level 3, Std. 4.11)	Mini p. 49 Mini p. 53 LM p. 79 Mini p. 49 Mini p. 51	TE Quick Demo p. 291 Zipper DNA
	Mutations Ch 11			
	Dominant and Recessive genes Ch 10	Dominant Traits S4-29 (Level 1, Std. 4.1)	LM p. 83	TE Quick Demo p. 265 Bean Genotype
	Monohybrid and Dihybrid Crosses Ch 10	Genotypes and Phenotypes of Monohybrid Crosses S4-32 (Level 2 Std. 4.3) Monohybrid Cross Scenarios S4-35f (Level 1, 2 Std. 4.2)	LM p. 91	
		Sex-Linked Inheritance II S4-20f (Level 2, Std. 4.6)	LM p. 71	
	Genetic Diseases Ch 12/13	Dihybrid Cross II s4-29,30 (Level 3, Std. 4.12)	Mini p. 57	

Evolution		Disease Inheritance II S4-27, 28 (Level 2, Std. 4.10)	LM p. 87	
	Genetic Engineering/Gel Electrophoresis Ch 13	Human Karyotype Lab II S4-33-46 (Level 2, 3 Std. 4.6, 4.10, 4.11)	LM p. 95	
	DNA Changes Related to Mutations Ch 13	Paper Clip Mutations S4-25 (L2,3 Std 4.6)	LM p. 79	
	Analyze DNA Bases for Mutations Ch 13	Sentence Mutations S4-23 (L2,3 Std 4.6)	LM p. 95	
	DNA Fingerprinting Ch 13	(L2 Std 4.8)		

Nine Weeks: Fourth

Unit	Chapter Topics	Gateway Activities	Lab Activities	Demonstrations
Evolution	Fossils Ch 14	Relative Age of Fossils S6-20 (L1 Std 6.1)	Mini p. 72	
		Types of Fossils S6-22 (L1 Std 6.1, 6.3)	Mini p. 69	
		Centonium Half-life S6-27 (L2 Std 6.1)		
	Speciation Ch 15	Variation in a Species S6-46 (L1 Std 6.2,6.4)	Mini p. 72	
	Divergent Evolution Ch 15	Models of Evolution S6-38 (L1,2 Std 6.2,6.3)	Mini p. 76	
	Homologous Structures Ch 15	Homologous Structures S6-43 (L2, Std 6.4)	Mini p. 77	
	Natural and Artificial Selection Ch 15	What Bird Lives Here? S6-40(L1 Std 6.2,6.3)	Mini p. 73 Mini p. 76	
Biochemical Comparison Ch 13	Comparing DNA S6-48 (L3, Std 6.4)			
Diversity	Biomes Ch 3		Mini p. 15	TE Quick Demo p. 82 Cutin TE Quick Demo p. 85 Rainfall
	Classification Ch 17	(L1, Std. 5.2)	LM p. 121	TE Quick Demo p. 454 Classification TE Quick Demo p. 468 Drawings
	Dichotomous Key Ch 17	Pasta Dichotomous Key S5-16 (L1,2, Std. 5.1)	Mini p. 81 Mini p. 83 LM p. 117	TE Demo p. 474 Dichotomous Key
	Life Cycles Ch 28/30	Insect Dichotomous Key S5-18 (L1,2, Std. 5.1, 5.3)	LM p. 203 Mini p. 126	

Infectious Diseases	Symmetry Ch 25	Life Cycle Information S5-22 (L2,3, Std.5.3)	Mini p. 135 LM p. 183	TE Quick Demo p. 701 Symmetry
	Organ Structure and Functions Ch 27-38	Anatomy Information S5-23 (L1,2,3, Std. 5.3)		
	Immunity Ch 39	Pickle Autopsy S5-24 (L1,2,3, Std. 5.3) (L 2,3, Std. 5.3)	LM p. 219 Mini p. 123 Mini p. 125 LM p. 199 LM p. 213	TE p. 762 Crayfish Characteristics TE Quick Demo p. 829 Frog Behavior
			LM p. 285 LM p. 289 Mini p. 173 Mini p. 175	TE Quick Demo p. 1056 Bacterial Growth TE Quick Demo p. 1064 White Blood Cells

Curriculum Map



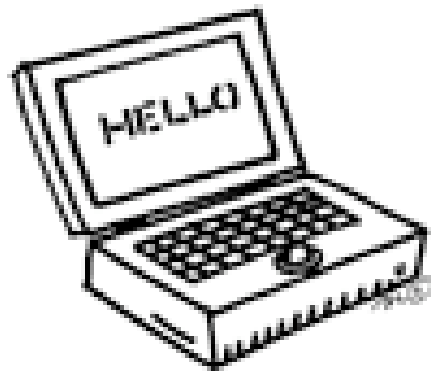
Organizing Concepts	August	September	October
<p>Interactions Standard 2.0</p>	<p>-Introduction to Biology -Discuss lab safety -Review scientific method, metrics, and life properties -Interpret and analyze graphs. -Demonstrate appropriate use of the microscope.</p>	<p>L1 Identify symbiotic relationships. L1 Classify organisms according to their niche. L2 Identify abiotic and biotic factors. L2 Discuss effects of environmental factors on population growth curves. L2 Examine energy flow through the ecosystem. L2 Examine the impact of human activities on ecosystems. L3 Distinguish between learned and innate behavior.</p>	
<p>Cells Standard 1.0</p>			<p>L1 Identify cell organelles. L1 Distinguish between plant and animal cell organelles and cell cycles. L2 Identify the biomolecules using lab activities and structural diagrams.</p>

Organizing Concepts	November	December
Cells Standard 1.0	<p>L1,2 Distinguish between active and passive transport. L2 Determine the significance of homeostasis for life.</p> <p>L1 Sequence chromosomal movement and indicate chromosomal number in mitosis and meiosis. L2 Evaluate the role of meiosis in genetic variability.</p>	
Photosynthesis / Respiration Standard 3.0		<p>L1,2 Using the formulas for photosynthesis and respiration , compare the products and reactants and discuss the interdependence of both processes. L1 Identify the cell organelle for photosynthesis. L1 Interpret O₂ and CO₂ cycle. L2,3 Distinguish between aerobic and anaerobic respiration in terms of ATP production and the availability of oxygen.</p>

Organizing Concepts	January	February	March
Genetics Standard 4.0	<p>L1 Compare sexual and asexual reproduction.</p> <p>L1,3 Distinguish between dominant and recessive traits, phenotype and genotype in a monybrid and dihybrid cross.</p> <p>L2 Analyze models of inheritance and calculate probability for sex-linked incomplete dominance, and multiple alleles.</p> <p>L2 Describe replication and protein synthesis.</p>	<p>L1,2 Identify the structure and function of DNA and relate changes in DNA sequences that cause mutations.</p> <p>L3 Differentiate between transcription and translation.</p> <p>L2 Describe and analyze DNA</p>	
Evolution Standard 6.0			<p>L1 Identify the relative age of fossils in sedimentary rock.</p> <p>L1 Predict the effect of the environment on speciation.</p> <p>L2 Describe divergent evolution, natural selection and selective breeding.</p> <p>L2 Recognize homologous structures to compare the relatedness of organisms.</p> <p>L3 Using DNA, indicate the relationship between organisms.</p>

Organizing Concepts	April	May
Diversity Standard 5.0	<p>L1 Indicate plants and animals indigenous to an environment.</p> <p>L1,2 Describe the relationship between organisms using the Linnean system of classification and a dichotomous key.</p> <p>L2,3 Describe the life cycle of various organisms including complete and incomplete metamorphosis.</p>	<p>L2 Define body symmetry using examples.</p> <p>L2,3 Predict the function of an organ or system from a description.</p> <p>Discuss AIDS.</p>

Technology Resources



Videos

Interactions

08621 – Essentials of Biology Series: Web of Life: Producer to Predator
Discusses terms: community, homeostasis, biome, niche, 23 minutes

08665 – Beneath the South Pacific
Examines a coral reef ecosystem, 23 minutes

03878 – Cycles of Life: Exploring Biology: Part 25: Ecosystems and the Biosphere
Examines a balance of interactions in an ecosystem, 30 minutes

08829 – Life Science / Ecosystem Series – Succession
Process of transforming a sand pit into a forest, 24 minutes

03988 or 09360 (DVD) – Simply Science Series – Water Through the Ecosystem
How water affects vegetation and climate and the role of water in moving molecules through the cell membrane, 27 minutes

Cells

05381 – Cell Series: Mitosis and Genetics
Demonstrates mitosis, 16 minutes

08620 – Essentials of Biology Series: Cells: Building Blocks of Life
Illustrates major organelles, diffusion and active transport, 23 minutes

03994 – Simple Science Series: Maintaining Equilibrium
Investigates equilibrium and homeostasis, 27 minutes

03862 – Cycles of Life! Exploring Biology Series: Part 9 Proteins – Building Blocks Of Life
Examines structure of proteins, discusses sickle cell anemia, 30 minutes

Photosynthesis

03858 – Cycles of Life: Exploring Biology Series: Part 5 Energy In & Energy Out
Photosynthesis and aerobic respiration, 30 minutes

06257 – Photosynthesis Series: Absorbing The Light
Computer animation explores the stages of photosynthesis, 10 minutes

06258 – Photosynthesis Series – C3 and C4 plants
Demonstrates concept of C3 and C4 with computer animation, 10 minutes

06262 – Photosynthesis Series – Seeing The Light
Historical discoveries of Priestley, Ingenhousz, and Senebier, 10 minutes

06259 – Photosynthesis Series – The Dark Reaction
Step by step developments in the dark reactions, production of glucose and starch
10 minutes

Genetics and Biotechnology

08622 – Essential of Biology Series Genetics and Heredity: Blueprint of Life-Structure of DNA, How traits are passed on to offspring, 23 minutes

08667 – Meiosis and Mitosis – Fertilization and Sexual Reproduction
Microphotography and animated graphics illustrate both processes, 23 minutes

Protein Synthesis Series:

06191 – DNA Replication: The Repeating Formula
Synthesis of DNA, 10 minutes

06190 – DNA: The Molecule of Heredity
Discusses structure and role of DNA, 10 minutes

06192 – Protein: The Stuff of Life
Structure of Proteins, 10 minutes

06193 – Ribosomal RNA – The Protein Maker
Translation, 10 minutes

06194 – RNA Synthesis – The Genetic Messenger
Transcription, 10 minutes

Diversity

08623 – Essentials of biology Series: World's Biomes: Desert to Rainforest
Physical factors determine the climate of a biome, 23 minutes

04713 – Amphibians
Metamorphosis, 14 minutes

06518 – Insects: Reproduction and Metamorphosis
Beetle, Butterfly, and other life cycles, 19 minutes

05748 – Crustaceans
Structures and function, habitats of various Crustaceans, 14 minutes

05793 – Vascular Plants: Ferns, Specialized structures, 17 minutes

Evolution

07508 – Evolution: The Heart Series: New Ecosystems: Volume 3

Describes the Big Bang Theory – life moving from the primeval swamp to dry land, 27 minutes

03863 – Cycles of Life: Exploring Biology Series: Part 10:Microevolution

Examine Darwin's Theory – Natural Selection, Divergent Evolution, 30 minutes

04832 – Life on Earth Series: Beginning of Life

DNA, mutations and evolution and prokaryotes, 30minutes

04828 – Life on Earth Series: Flowers and Insects

Interdependent evolution: Insect development, 30 minutes

04840 – Life of Earth Series: Infinite Variety

Questions of evolution, adaptation and natural selection discussed. 30 minutes

Websites

Teachers must review these sites to make sure they are currently active and meet current standards set by the Shelby County School Board. The authors are not responsible for any links within these sites.

General Interest

<http://www.accessexcellence.org>

<http://www.woodrow.org/teachers/bi>

www.scidu/hrw

www.scilink.org

<http://www.biology.arizona.edu>

<http://www.tc.cornell.edu:80/Services/Edu/MathSciGateway/biology.sp>

<http://www.pbs.org/teachersource>

<http://achievement.org>

Cells

<http://cellbio.utmb.edu/cellbio/cilia.htm>

<http://www.und.nodak.edu/dept/jcarmich/102lab/mitosis9/ans.html>

<http://cellbio.utmb.edu/cellbio/membrane.htm#menu>

<http://www.cellsalive.com>

<http://www.iacr.bbsrc.ac.uk/notebook/courses/guide/cell.htm>

Interactions

<http://www.neosoft.com/~inflo/eco.htm>

<http://www.gwu.edu/~greenu/index2.html>

<http://www.enn.com>

<http://www.bio2.edu/this.htm>

<http://eelink.net>

Photosynthesis

<http://www.jonmaber.demon.co.uk/glyintro/>

<http://photoscience.la.asu.edu/photosyn/education/experiments/virtual.html>

<http://www.sp.uconn.edu/~terry/images/anim/ETS.html>

<http://www.nyu.edu/pages/mathmol/library/photo/>

<http://www.life.uiuc.edu/cgi-bin/gov/gov.cgi>

Genetics and Biotechnology

<http://www.nhgri.nih.gov/index.html>

<http://gslc.genetics.utah.edu>

<http://www.kumc.edu/gec/>

<http://biotech.icmb.utexas.edu/>

<http://vector.cshl.org>

Diversity

<http://phylogeny.arizona.edu/tree/phylogeny.html>

<http://www.utm.edu/~rirwin/b120lab.htm>

<http://www.cdc.gov>

<http://teach.virginia.edu/go/frog>

<http://www.innerbody.com>

Evolution

www.ucmp.berkeley.edu/history

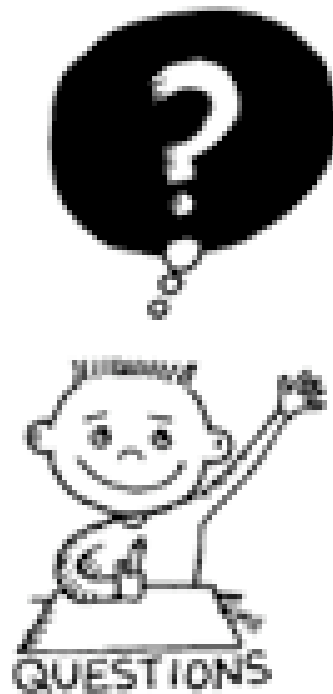
www.talkorigins.org

<http://www.indiana.edu/~ensiweb>

<http://www.nap.edu/readingroom/books/evolution98/>

Credits: Graphics from Discoveryschool.com

Themes & Essential Questions



Themes

What is the nature of living things that allows them to live and adapt in their environment?

Essential Questions

How does the external structure of an organism relate to its survival in its environment?

What are the patterns and products of change?

How do living systems interact with their environment?

How do living organisms maintain their organization and homeostasis?