














## 4. INTERDEPENDENCE OF ORGANISMS

**CORE CONTENT:** Topics should include, but not be limited to:










- consumers/decomposers
- ecosystems/relationships within
- biomes
- biological adaptations
- extinction of species
- symbiosis
  - commensalism
  - mutualism
  - parasitism
- human impact on the environment

### ASSESSMENT STRATEGIES:












-  Reconstruct a model skeleton of a rodent or bird using bones from the owl pellet.
-  Survey the school grounds to determine the consumers, decomposers and producers. What are the predator/prey relationships? Construct a food web of the organisms found in the schoolyard. 
-  Draw an ocean web cycle. Write an essay using the computer of how abiotic conditions vary in different parts of the classroom. Data will be graphed.   
-  Distinguish the major biomes of the earth on the basis of solar energy, rainfall, temperature and soil. Enter data in journal or lab book showing different results and do a comparative study – include drawings.  
-  Choose a biome and make a diorama using a shoebox, clay and recycled items.

## 4. INTERDEPENDENCE OF ORGANISMS (cont'd)

### ASSESSMENT STRATEGIES: (cont'd)















-  Prepare a research paper, which examines the following issue: Some cattle ranchers and farmers want to get rid of wolves and coyotes because they are predators that kill their livestock. What would happen if these animals were no longer in the community? What problems might occur? Would it seriously affect the community?  
-  Construct an explanation of a fossil record. Hypothesize about the effects of environmental change and catastrophic events on organisms and populations.  
-  Model an oil spill with a tub of water filled with rocks and sand contaminated with motor oil. Determine the best (least detrimental to the environment) way to cleanup the oil using cotton balls, paper towels, cotton swabs, baking soda, brushes and detergent. Lab reports will be prepared and results shared with the class.  

### INSTRUCTIONAL STRATEGIES:

-  Dissect an owl pellet; explain what owl pellets contain, where they are obtained and how they will be studied. 
-  Play the food web game. Show how an apple tree can be food and shelter for different organisms.
-  Collect data on various temperatures throughout the classroom. 
-  Research different types of soil and report their findings to the class.  
-  Choose an ecosystem and make a collage that shows the biotic and abiotic things that interact in it. Provide students with wildlife and nature magazines and large sheets of poster board.  

#### 4. INTERDEPENDENCE OF ORGANISMS (cont'd)

##### INSTRUCTIONAL STRATEGIES: (cont'd)











-  Introduce the various scientifically accurate fiction books of different biomes by author, Jean Craighead George. 
-  Provide sample fossil evidence and examine fossil records. 
-  Discuss what must happen to an organism for it to become a fossil. Explain why body parts, such as, shells, bones and teeth become fossilized more often than soft body parts, such as, skin, muscle, stems and leaves which usually decay before they are fossilized.
-  Create an index fossil record.   
-  Read excerpts from Rachael Carson's book, *Silent Spring*, Publisher: Signet Science Library. 
-  Show a video on the Exxon Valdez oil spill that happened in the late 80's in Prince Williams Sound, Alaska. Elicit students' reactions to the presentation of how the cleanup was approached.  

## 5. MATTER, ENERGY AND ORGANIZATION IN LIVING SYSTEMS

**CORE CONTENT:** Topics should include, but not be limited to:















- levels of organization (cell, tissue, organ, system)
- the systems: structure and function (introduction)
  - reproductive
  - circulatory
  - muscular
  - skeletal
  - endocrine
  - nervous
  - excretory
  - respiratory
- photosynthesis/metabolism (introduction)
- classification of kingdoms

### ASSESSMENT STRATEGIES:





-  Label all of the major bones and joints on a paper skeleton.
-  Diagram and explain what happens to their lunch from the first bite up to when it is ready to leave the body. 
-  Classify the muscles of the human body.
-  Describe a journey through a person's digestive system ending with the process of absorption. 
-  Diagram and label the heart and the major arteries and veins of the human body. Color and make a flow chart of systemic and pulmonary circulation. 
-  Write an advertisement to dissuade tobacco use. 

## 5. MATTER, ENERGY AND ORGANIZATION IN LIVING SYSTEMS (cont'd)

### ASSESSMENT STRATEGIES: (cont'd)

-  Explain the path of a nerve impulse when the phone rings. ▽
-  Prepare a flow chart of the structures of the excretory system. Discuss the collection of waste products and their removal from the body. ▽  
-  Write a paragraph explaining how their skin provides a tough, flexible, protective covering while helping to maintain a constant body temperature. 
-  Draw diagrams showing the relationship between photosynthesis and respiration. ▽
-  Research and prepare oral reports on the benefits of an aerobic exercise program.  ☺
-  Compare the function of the skin when a person is taking a walk on a freezing day with a walk on a 100-degree day. Brainstorm all of the ways that skin is important and prepare a list for the whole class.  ☺ 
-  Using audiovisual aids that they have made, students will make a presentation about the hazardous effects of smoking to their peers. ▽  ☺

### INSTRUCTIONAL STRATEGIES:

-  Examine beef bones and chicken bones from the supermarket. 
-  View The National Geographic video, "The Incredible Human Machine." Discuss function and parts of the skeletal system and the various joints using a full-size plastic model skeleton.  ☺








## 5. MATTER, ENERGY AND ORGANIZATION IN LIVING SYSTEMS (cont'd)

### INSTRUCTIONAL STRATEGIES: (cont'd)

- ✍️ Observe the action of their arm muscles. Observe the skeletal muscle tissue of a chicken leg and chicken wing. Make prepared slides of this muscle tissue for observation under the microscope. 📖
- ✍️ Discuss the three types of muscle in the human body: skeletal, smooth and cardiac. Discuss how muscles work in pairs.
- ✍️ Outline the body of one group member and then label the major muscles of each main body area. 📖
- ✍️ Investigate the parts and function of the digestive system using the CD-ROM or laser disc. 📖 📖 △
- ✍️ Learn how the heart works and the function of the blood vessels by using a flow chart. △
- ✍️ Keep a food log of your weekly diet. Students will compare their diet to the suggested choices on The Food Pyramid guide. 📖
- ✍️ Students will learn how the heart works and the function of the blood vessels by using a flow chart. △
- ✍️ Examine the circulation of blood (arteries, veins and capillaries) in the tail of a goldfish using the microscope. Goldfish are returned to the aquarium unharmed after this activity. 📖 📖 📖 ⚡
- ✍️ Investigate the structure and function of the lungs by inhaling and exhaling with a tape measure around their chests.
- ✍️ Make a model of the lungs and demonstrate how breathing takes place using balloons, a 2-liter soda bottle, rubber band, scissors and an 8-inch square of thin plastic bag. △
- ✍️ Discuss the three types of neurons and how they interact. Using reflex action, explore the CNS – Central Nervous System and the PNS – Peripheral Nervous System. 📖
- ✍️ Make a brain manipulative model to show how the nervous system regulates activities. △

## 5. MATTER, ENERGY AND ORGANIZATION IN LIVING SYSTEMS (cont'd)

### INSTRUCTIONAL STRATEGIES: (cont'd)


























-  Discuss the structure and function of the endocrine glands. Make clay models and label and explain the function of each structure. Discuss how negative feedback controls hormone levels. 📖 ⚠
-  Play the game of “Freeze” to show how the endocrine system regulates activities.
-  Show The National Geographic video, “The Miracle of Life.” 📺 ⚡
-  Explain how urine is produced in the kidneys. Discuss dialysis and its importance. 📖 😊
-  Measure the overall surface area (length and width) of the major body parts: head, neck, trunk, arms and leg to see that skin is the largest body organ.
-  Research the field of dermatology on the web. 📖
-  Conduct a photosynthesis experiment using an aquarium plant and appropriate materials. 😊

## 6. BEHAVIOR OF ORGANISMS

**CORE CONTENT:** Topics should include, but not be limited to:



- relationships among populations
- harmony in nature
- natural adaptations to survival
- learned behavior
- innate (instinctive) behavior
- behavioral responses to stimuli

### ASSESSMENT STRATEGIES:


















-  Direct students to make a chart of the three types of symbiotic relationships and identify examples organisms that are involved in each type.   
-  Draw and color diagram illustrating how flower and butterfly benefit each other. 
-  Research and write a report on how orchids benefit from living in trees.   
-  Using computers, type a report on the whales and their relationship with barnacles.  
-  Count and list how many characteristics separate humans from other species.
-  Write a report on documentaries of one of the naturalists.  
-  Bring in pictures of various types of behavior in animal or plant life. Give oral presentation. 
-  Using the Internet, investigate migrations of certain species of waterfowl.  
-  Write a report on movie, “Fly Away.”  

## 6. BEHAVIOR OF ORGANISMS (cont'd)

### ASSESSMENT STRATEGIES: (cont'd)




















-  List at least two activities today that show you have innate behavior. ☺
-  Keep a study of your own body rhythms, activities and feelings. Determine if they are in a regular pattern. ☺ ▽

### INSTRUCTIONAL STRATEGIES:

-  A comparison and contrast will be investigated among organisms regarding the three major kinds of symbiotic relationships. ☹
-  The relationship between clownfish and sea anemone will be studied through the use of the Internet.  
-  Create a model showing some form of relationship. Create your own organism. Label your model. ☺  ▽
-  Human beings and bacteria E. coli have a mutually beneficial relationship. Explain the importance of this relationship. List the foods that encourage good intestinal functioning.  ☺
-  The buffalo and cattle egret have a beneficial relationship; explain the importance of this relationship. How does it benefit all of nature? In the sea, barnacles survive while being attached to whales. Use laser disc that features various forms of sea life especially the habitat. ☺  
-  Choose one animal from the desert, rainforest or ocean and explain its environment and adaptations to its surroundings.
-  Make chart with different categories of behavior and reasons for them. ▽ ☺
-  Invite a veterinarian or obedience trainer to class to discuss basic animal behavior characteristics. ☺ 
-  Show documentary on the life and work of famous naturalist, such as, Jane Goodall, Dain Fossey, and Marley Mowat.  ☺

## 6. BEHAVIOR OF ORGANISMS (cont'd)

### INSTRUCTIONAL STRATEGIES: (cont'd)

-  Show video/laser disc on bird migration. Invite a guest speaker from Audubon Society or Fish and Wildlife Agency to discuss bird migration. 
-  In the spring, construct a Monarch butterfly nest and keep a log on development of the larva.   
-  Explain how ants produce an alarm chemical anytime danger is encountered.  
-  Research the hibernation of bears.   
-  Investigate how a mammals' ear changes sound waves to nerve impulses.  
-  Investigate movement of paramecium on slide. 
-  Label a drawing of a mammal's ear and explain function of major parts.

# *Life Science*

## *Secondary Level*

### **NSES:** Life Science, Content Standard C

As a result of their activities in grades 9 – 12, all students should develop an understanding of:

- the cell
- molecular basis of heredity
- biological evolution
- interdependence of organisms
- matter, energy, and organization in living systems
- behavior of organisms

### **NJCCCS:**

Standard 5.6

- All students will gain an understanding of the structure, characteristics, and basic needs of organisms.
- Standard 5.7
- All students will investigate the diversity of life.

### **DIOCESAN STANDARDS:**

- Students will demonstrate an understanding and an appreciation of the diversity and sacredness of life.
- Students will gain an understanding of the interrelationship and interdependence among species and ecosystems.

# *Life Science Key Areas and Content Topics*

## *Secondary Level (cont'd)*

### **3. Evolution:**

- evidence of evolution
- Darwinian theory
  - how organisms adapt (natural selection)
- evolution as an on-going process:
  - modern day examples
- how genetics applies to evolution
- controversial issues surrounding evolution:
  - origin of life – age of the earth

### **4. Interdependence of Organisms:**

- interactions within a community:
  - food webs, predator/prey
  - adaptations
  - symbiosis
- population growth analysis
- ecological issues which impact interdependence of organisms:
  - acid rain,
  - global warming
  - ozone depletion
- energy flow in ecosystems

# *Life Science Key Areas and Content Topics*

## *Secondary Level (cont'd)*

### **5. Matter, Energy and Organization in Living Systems:**





- chemical nature of photosynthesis
- chemical nature of cellular respiration
- relationship between energy and matter in photosynthesis
- importance of the ATP molecule
- matter and energy as limiting factors in distribution and numbers of organisms
- laws of conservation as matter and energy travel through organisms

### **6. Behavior of Organisms:**

- how messages are sent throughout an organism  
brain – chemical/physiology
- how organisms respond to external stimuli and internal changes
- how behavioral responses evolved through natural selection

## 1. THE CELL (cont'd)

### INSTRUCTIONAL STRATEGIES:



-  Conduct a discussion on whether one organelle in the cell is more important than another. Relate cell parts to genetic disorders, (e. g., Lysosomes to Tay-Sachs Disease). 😊
-  Use the Addison Wesley Internet site to have students become familiar with mitosis and the follow-up computer lab on identification of the stages of mitosis. (Search “biosurf” and find Addison Wesley site and search for “mitosis”.) 📖
-  Use videodisk presentations or other sources to show how the 3-D shape of protein determines function and how enzymes are specific to their jobs based on structure. 📖
-  Have students use different power microscopes to study cells or microorganisms to experience how the type of technology can affect their conclusions. Arrangements might be made to take students to visit a place with an electron microscope or students could study pictures of cells or microorganisms taken with electron microscopes to draw conclusions. 📖

## 2. REPRODUCTION AND HEREDITY

**CORE CONTENT:** Topics should include, but not be limited to:












- meiosis (comparative study with mitosis)
- chemical nature of nucleic acids (DNA and RNA)
- relationship of structure to function of nucleic acids
- protein synthesis:
  - transcription
  - translation
- Mendelian genetics:
  - terminology
  - analyze, predict and incorporate probability of various crosses.
- human inheritance:
  - types, disorders and mutations
- genetic engineering:
  - human genome
  - moral and ethical issues

### ASSESSMENT STRATEGIES:












-  Use DNA model kits to demonstrate the similarities and differences between mitosis and meiosis.
-  Construct “Reebops” (imaginary creatures), which simulate meiosis, fertilization and resulting genotypes and phenotypes. Construct their creature from the information. (See “Science Teacher”, Nov.92, P. Soderberg ) 😊

## 2. REPRODUCTION AND HEREDITY (cont'd)

### ASSESSMENT STRATEGIES: (cont'd)



-  Demonstrate how DNA stores information and how the code is deciphered. (See activity “Science Teacher, Dec. 97, M. Warren) 
-  Using the Internet, produce a report on the International significance of the Human Genome Project. The project’s current status and benefits already derived from the project could also be addressed in the report, as well as any controversial issues.  
-  Given a complex family marriage history, construct a pedigree chart demonstrating how various types of genetic disorders are passed from generation to generation. (Good activity in “Cranial Creations” by J. Weston Walch.)  
-  Conduct a debate on the pros and cons of various topics dealing with genetic engineering, cloning or other related genetic issues.  

### INSTRUCTIONAL STRATEGIES:

-  Use the Internet to help students obtain the latest advances made on various human genetic disorders.  
-  Use a videodisk presentation to help explain the process of protein synthesis.  
-  Provide students with the opportunity to work in groups to predict, solve and analyze punnett square problems. 
-  Help students understand relationships between various genetic terminologies by having them construct a concept map using the terms studied.  

## 2. REPRODUCTION AND HEREDITY (cont'd)

### INSTRUCTIONAL STRATEGIES: (cont'd)

-  Show variations among human traits by having students measure and graph various body parts, e.g., *length of arms, fingers*. Have this lead into a discussion of multiple alleles and multiple genes. The results can also be used to study evolution and adaptation. ▽
-  Provide Case Studies or have students investigate examples of times when some scientists did not follow ethical procedures regarding genetic issues and the societal consequences of such actions. ☹️ 😊

*Teacher Comments:*

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### 3. EVOLUTION

**CORE CONTENT:** Topics should include but not be limited to:












- evidence of evolution
- Darwinian theory:
- how organisms adapt (natural selection)
- evolution as an on-going process:
  - modern day examples
- how genetics applies to evolution
- controversial issues surrounding evolution
  - origin of life - age of the earth

#### ASSESSMENT STRATEGIES:

- ☀️ Provide groups of students with a variety of fossils representing each of the four major eras in the history of life. Have each group develop a chronological time line of the fossils and reasons for their choices. Hold follow up presentations and comparative discussions of each group's time line. ☺️ 📎
- ☀️ Research examples of modern evolution. (e.g.; antibiotic resistant bacteria) Relate to genetic principles and that evolution is an on-going process. ☺️ 📎
- ☀️ Using skeletons of various animals, do a comparative forelimb study. Relate structure to function and the evidence of homologous structures. 📎
- ☀️ Students can research and report on an historical scientific study and the social context in which the studies were conducted. One example is the text Voyage of the Beagle. Questions such as: "How did the investigation eventually influence society?" and "Were there any ethical issues that had to be addressed?" could be answered in the report. 📎 📎

### 3. EVOLUTION (cont'd)

#### INSTRUCTIONAL STRATEGIES:

-  Do a pre-unit survey on student concepts of evolution. ☺
-  Hold discussions on the connection between genetic manipulation and evolution. (Oil consuming bacteria, drought resistant plants.) What are possible consequences? ☺  
-  Have students' research controversial issues surrounding the origin of life.   
-  Briefly review Catholic Church documents regarding Evolution (see Introduction).  

#### *Teacher Comments:*

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## 4. INTERDEPENDENCE OF ORGANISMS

**CORE CONTENT:** Topics should include but not be limited to:



- interactions within a community:  
food webs, predator/prey  
adaptations
- symbiosis
- population growth analysis
- ecological issues which impact interdependence of organisms:  
acid rain,  
global warming  
ozone depletion
- energy flow in ecosystems

### ASSESSMENT STRATEGIES:






- ☀️ Assign students a particular biome and have them construct a typical food web found in that biome and show the consequences of biomagnification when a toxin is introduced into the system. 😊 📄
- ☀️ Construct pyramids to show the flow of energy and biomass through a food chain. Given a certain amount of productivity in an area, predict how many humans with different types of consumption patterns the area can support (e.g. vegetarians vs. diets high in meat.) 😊 ▽

#### 4. INTERDEPENDENCE OF ORGANISMS (cont'd)

##### ASSESSMENT STRATEGIES: (cont'd)

-  Investigate and produce graphs of the population trends of various animals in various State Park Areas. Compare these graphs to the graph of human populations in the last 200 years. Discuss the limiting factors in both cases. ☺ △ ♪
-  Using an environmental chamber design an experiment to show the effects of increased carbon dioxide on temperature. Present the findings to class. 📖

##### INSTRUCTIONAL STRATEGIES:

-  Discuss the potential environmental impact of technology on the biochemical cycles. ☺
-  Have students use the Internet to investigate such problems as: endangered species legislation, present ozone depletion status or global warming trends. 📖 ♪
-  Discuss several examples of introduced species and their impact on an ecosystem. (e.g. gypsy moths, medfly, killer bees.) ☺
-  Students can conduct experiments on the effects of over-population using mealworm or cricket species.
-  Investigate sea levels of various coastal areas and determine the first places that would be affected by rising sea levels due to global warming. ☺

## 5. MATTER, ENERGY AND ORGANIZATION IN LIVING SYSTEMS














**CORE CONTENT:** Topics should include, but not be limited to:

- chemical nature of photosynthesis
- chemical nature of cellular respiration
- relationship between of energy and matter in photosynthesis and respiration
- importance of the ATP molecule
- matter and energy as limiting factors in distribution and number of organisms
- laws of conservation as matter and energy travel through organisms

### ASSESSMENT STRATEGIES:

- ☀️ Given the basic formula for photosynthesis, name the source of each molecule involved in the process.
- ☀️ Explain why certain plants such as spider plants and philodendrons can reduce the amount of some pollutants like carbon monoxide (CO) or formaldehyde (CH<sub>2</sub>O). ☺️
- ☀️ Draw diagrams showing the relationships between photosynthesis and cellular respiration. △
- ☀️ Design experiments to show the effects of environmental factors (e.g. humidity, temperature, light levels) on the rates of photosynthesis. ☺️

## INSTRUCTIONAL STRATEGIES:










- ✍ When teaching photosynthesis and cellular respiration have the students keep the “big picture” in mind. Work from the general to the specific.  
- ✍ Have students find out more information about photosynthesis and cellular respiration by exploring the following internet address: <http://basis-of-life.biosurf.com>  
- ✍ Explain the ATP cycle with the aid of videodisc slides and videoclips.  
- ✍ Using a prism, review the fact that white light is made up of various colors of the spectrum. Continue discussion on why we see things as different colors (reflected light). Relate this to the green color of chlorophyll. Also explain the presence of other pigments and their appearance in the colors of fall leaves.   
- ✍ Using the microscope, have students observe the structure of stomates from several different types of leaves. A fresh cut leaf can be placed in water for about 30 minutes to show the formation of oxygen bubbles coming from the stomates. 
- ✍ Differentiate between the amount of energy produced by cellular respiration and by fermentation. Have students compare the complexity of the end products. Where is most of the energy in products produced by fermentation?   

## 6. BEHAVIOR OF ORGANISMS






**CORE CONTENT:** Topics should include, but not be limited to:

- how messages are sent throughout an organism.  
brain – chemical/physiology
- how organisms respond to external stimuli and internal changes.
- how behavioral responses evolved through natural selection.

### ASSESSMENT STRATEGIES:

-  Conduct research on some of the specific material that was learned during the “Decade of the Brain”. 
-  Investigate the differences between right brain and left-brain individuals.
-  Investigate and report on courtship behavior or examples of territoriality and aggressive behavior in animals. Students should speculate on why these behaviors evolved.  
-  Research the relationship of new information that has been learned about the workings of the brain and changes that are occurring in the field of education.  

### INSTRUCTIONAL STRATEGIES:

-  Use both microscope slides and videodisc selections to study the structure and workings of a neuron. 
-  Distinguish between innate behavior and learned behavior and have student give several examples of each. Use videodisc selections and have students identify the type of behavior.  



# *Additional Topics for Enrichment or Honor Programs*

## *Secondary Level*

### **1. The Cell**

- microscopy (advanced) e.g. oil immersion

### **2. Heredity and Genetics:**

- biotechnology: DNA fingerprinting, tools (electrophoresis), human genome

### **3. Taxonomy:**

- classifying invertebrates
- plants

### **4. Comparative anatomy-plants:**

- monocots, dicots
- structure of leaves, stems roots
- reproduction (seed structure)

### **5. Microbiology:**

- classifying bacteria
- viruses
- culturing

