

# Norton City Schools Standards-Based Science Course of Study 2003

## HIGH SCHOOL ELECTIVE

### BOTANY (USED AS A SEMESTER, YEAR-LONG OR BLOCK SCHEDULED COURSE)

#### Life Sciences Standard (LS)

11-12 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 11-12 program, the student will:</p> <p><u>Life Sciences</u></p> <ul style="list-style-type: none"> <li>★ Explain how processes at the cellular level affect the functions and characteristics of an organism. (LS-A)</li> <li>★ Explain how humans are connected to and impact natural systems. (LS-B)</li> <li>★ Explain how the molecular basis of life and the principles of genetics determine inheritance. (LS-C)</li> <li>★ Explain the interconnectedness of the components of a natural system. (LS-E)</li> <li>★ Explain how human choices today will affect the quality and quantity of life on earth. (LS-F)</li> <li>★ Summarize the historical development of scientific theories and ideas within the</li> </ul>	<p>By the end of Eleventh/Twelfth Grades, the student will:</p> <p><u>Characteristics and Structure of Life</u></p> <ul style="list-style-type: none"> <li>★ Describe how the maintenance of a relatively stable internal environment is required for the continuation of life, and explain how stability is challenged by changing physical, chemical and environmental conditions as well as the presence of pathogens. (LS-11-1)</li> <li>★ Recognize that 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. Some of this energy is released as thermal energy. (LS-11-2)</li> <li>★ Relate how birth rates, fertility rates and death rates are affected by various environmental factors. (LS-11-3)</li> <li>★ Recognize that information stored in DNA provides the instructions for assembling protein molecules used by the cells that determine the characteristics of the organism. (LS-12-1)</li> <li>★ Explain why specialized cells/structures are useful to plants and animals (e.g., stoma, phloem, xylem, blood, nerve, muscle, egg and sperm). (LS-12-2)</li> <li>★ Explain that the sun is essentially the primary source of energy for life. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. (LS-12-3)</li> <li>★ Explain that carbon-containing molecules can be used to assemble larger molecules with biological activity (including proteins, DNA,</li> </ul>	

## Norton City Schools Standards-Based Science Course of Study 2003

<p>study of life sciences. (LS-G)</p>	<p>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. (LS-12-4)</p> <p><b><u>Diversity and Interdependence of Life</u></b></p> <ul style="list-style-type: none"> <li>★ Predict some possible impacts on an ecosystem with the introduction of a non-native species. (LS-11-6)</li> <li>★ Give examples of how human activity can accelerate rates of natural change and can have unforeseen consequences. (LS-11-9)</li> <li>★ Investigate issues of environmental quality at local, regional, national and global levels such as population growth, resource use, population distribution, over-consumption, the capacity of technology to solve problems, poverty, the role of economics, politics and different ways humans view the earth. (LS-11-11)</li> <li>★ Relate diversity and adaptation to structures and functions of living organisms at various levels of organization. (LS-12-7)</li> <li>★ Explain why and how living systems require a continuous input of energy to maintain their chemical and physical organization. Explain that with death and the cessation of energy input, living systems rapidly disintegrate toward more disorganized states. (LS-12-9)</li> </ul> <p><b><u>Evolutionary Theory</u></b></p> <ul style="list-style-type: none"> <li>★ Describe how the process of evolution has changed the physical world over geologic time. (LS-11-13)</li> </ul> <p><b><u>Historical Perspectives and Scientific Revolutions</u></b></p> <ul style="list-style-type: none"> <li>★ Trace the historical development of a biological theory or idea (e.g., genetics, cytology and germ theory). (LS-12-11)</li> <li>★ Describe advances in life sciences that have important, long-lasting effects on science and society (e.g., biotechnology). (LS-12-12)</li> </ul> <p><b><u>Sub-Objectives to Meet Indicators:</u></b></p> <p><b>Origin of Life</b></p> <ul style="list-style-type: none"> <li>• Describe the various theories pertaining to the development of life on Earth.</li> <li>• Explain the system of taxonomy classification.</li> <li>• Describe the major characteristics of viruses and viroids.</li> </ul>	
---------------------------------------	--	--

## Norton City Schools Standards-Based Science Course of Study 2003

- Compare and contrast prokaryotic and eukaryotic cell development.
- List the major characteristics of bacteria.
- Compare and contrast beneficial and pathogenic bacteria.
- Explain Cyanobacteria ecology and economics.
- Discuss variability and natural selection of species.
- Compare and contrast the works of Charles Darwin, Lamarck and Alfred Russell Wallace.
- Describe the rates of evolutionary change.
- Summarize kinds of natural selection, including the Peppered Moth Study.
- Explain speciation and biogeography.
- Evaluate the biological implications of continental drift.

### **Genetics**

- Explain the importance of DNA replication.
- Illustrate and label a DNA nucleotide.
- List the nitrogen bases.
- Discuss the role of RNA in protein synthesis.
- Compare and contrast the processes of transcription and translation.
- Distinguish among the various mutagens and discuss the process of mutation.
- Describe genetic engineering in relation to recombinant DNA, cloning, and bioethics.
- Illustrate and label the stages of mitosis and meiosis.
- Solve problems that apply Mendelian genetics.
- Explain the chromosome theory.
- Apply the Hardy-Weinberg Law to genetic combinations.
- Discuss lethal genes in population and the gene pool concept.
- Explain how genetics is applied in animal breeding.

### **Cytology**

- Describe the properties of the water molecule.
- Compare and contrast the various types of carbohydrates.
- Identify the major forms of lipids.
- Explain the importance of proteins in relation to amino acids, polypeptides, and enzymes.
- Compare and contrast plant and animal cell structures.

## Norton City Schools Standards-Based Science Course of Study 2003

	<ul style="list-style-type: none"><li>• Identify organelles of eukaryotic cells.</li><li>• Compare and contrast active transport with passive transport.</li><li>• Trace water, gas, and material movement through selectively permeable membranes.</li><li>• Compare and contrast hypotonic, isotonic and hypertonic solutions.</li><li>• Explain the processes of plasmolysis and cytolysis.</li></ul> <p><b>Energy Conversions</b></p> <ul style="list-style-type: none"><li>• Trace the steps of the process of photosynthesis.</li><li>• Explain the importance of photosynthesis to life on earth.</li><li>• Identify and discuss the photosynthetic pigments such as chlorophyll.</li><li>• Summarize the light reactions of photosynthesis, including photolysis and photophosphorylation.</li><li>• Summarize the dark reactions of photosynthesis.</li><li>• Illustrate the ecological aspects of carbon fixation.</li><li>• Describe respiration and its efficiency as a process.</li><li>• Describe mitochondrion in relation to structure and function.</li><li>• Explain and discuss the importance of the process of glycolysis.</li><li>• Summarize the Krebs Cycle.</li><li>• Trace the electron transport system.</li><li>• Explain the process of fermentation.</li></ul> <p><b>Plant Anatomy and Physiology</b></p> <ul style="list-style-type: none"><li>• Recognize relationships among the major classifications of plants.</li><li>• Compare and contrast gymnosperms and angiosperms.</li><li>• Compare and contrast monocots and dicots.</li><li>• Illustrate and label internal and external leaf structures.</li><li>• Describe the physiology of leaves.</li><li>• Compare and contrast herbaceous and woody stems.</li><li>• Identify examples of hardwood and softwood.</li><li>• Illustrate the anatomy and describe the physiology of stems.</li><li>• Illustrate and label external stem structures.</li><li>• Identify external and internal root structures.</li><li>• Discuss the physiological functions of roots.</li><li>• Compare and contrast natural vegetative propagation with artificial vegetative propagation.</li></ul>	
--	--	--

## Norton City Schools Standards-Based Science Course of Study 2003

	<ul style="list-style-type: none"><li>• Identify the floral structures and discuss the importance of flowers.</li><li>• Describe ovule and pollen formation.</li><li>• Explain the process of pollination and fertilization.</li><li>• Compare and contrast types of roots.</li><li>• Identify the major types of fruits.</li><li>• Illustrate and label the structures of a variety of seeds.</li><li>• Compare and contrast monocot and dicot seeds.</li><li>• Explain the importance of dormancy.</li><li>• Recognize relationships of seed germination to oxygen, temperature, and light.</li><li>• Research internal factors affecting plant growth such as auxins, gibberellins, and other hormones.</li><li>• Describe relationships among light, moisture, temperature, and salts to plant growth.</li><li>• Describe plant movements (i.e., phototropism, thigmotropism, hydrotropism, and nastic movements).</li></ul>	
--	--	--