

BERKELEY HEIGHTS PUBLIC SCHOOLS  
BERKELEY HEIGHTS, NEW JERSEY

**GOVERNOR LIVINGSTON HIGH SCHOOL  
SCIENCE DEPARTMENT**

**BIOLOGY**

**#0443**

**Curriculum Guide**

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This curriculum may be modified through varying techniques,  
strategies, and materials, as per an individual student's  
Individualized Educational Plan (IEP).

Approved by the Berkeley Heights Board of Education  
at the regular meeting held on \_\_\_\_\_.

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 <b>*New Jersey Core Curriculum Content Standards can also be viewed at     <a href="http://www.state.nj.us">www.state.nj.us</a></b>	

## **PHILOSOPHY/RATIONALE**

The philosophy of this biology program (#0443) is to develop biologically literate individuals who, through this course, will develop an understanding of:

Biological principles and major concepts of biology, the world and the living things in it, the scientific method in solving biological problems, reading, writing, and listening skills involved in science, and personal health, career selection, and general information on the organization and interactions of life on earth.

They should develop appropriate personal values regarding:

Scientific investigations, biodiversity, the impact of biology and biotechnology on society, and the importance of biology to the individual.

In addition, they should be able to:

Evaluate information, use technologies appropriately, make personal and ethical decisions related to biological issues, and apply knowledge to solve real world problems.

Topics included in the course are:

The structure and organization of life, the biological systems of man and other organisms, variety among living things, reproduction and development, genetics and heredity, evolution of living things, and living things and their environment.

Students enrolled in Biology will be expected to:

Complete lab exercises that stress independent thought and group interaction. These exercises will include: work with live and preserved specimens, reproduction of simple chemical interactions, and interpretation of data, making inferences, and forming conclusions.

Students will demonstrate the ability to communicate through:

Book reports/library study, oral presentations, class participation, note taking, homework, and lab reports (both oral and written).

Biology is intended for students in grades 9 or 10. Five (5.0) credits are earned upon successful completion of this full year course.

New Jersey Core Curriculum Content Standards in Science and New Jersey Core Curriculum Content Standards for Technological Literacy and Career Education have been integrated throughout the curriculum.

## **COURSE PROFICIENCIES**

### **COURSE OBJECTIVES**

1. To instill in our students an awareness of the interdependence of chemical and biological processes in the maintenance of living systems.
2. To introduce the concept of continuity of life.
3. To help students develop an understanding of the structure and function of living organisms.
4. To provide students with opportunities to practice the skills of the scientific research method.
5. To help students develop an appreciation for the complexity of living systems.
6. To provide for career orientation in the various aspects of biological activities, where appropriate.
7. To have students correctly use scientific instruments, apparatus, and technologies of biology and demonstrate the procedures of biology (preparation of wet mount slides, use of laboratory materials, and protective equipment) in a safe, prescribed manner.
8. To have students evaluate information about current biological issues.
9. To have students develop an understanding of, and appreciation for, the organization of the living world.

## **STUDENT PROFICIENCIES**

The biology student will be able to:

1. Demonstrate an adequate knowledge of major biological concepts and processes.  
(5.1/A1-4, B1,2, C1; 5.2/A1, B1-3; 5.3/A1, B1, C1, D1; 5.4/A1, B1, C1; 5.5/A1-4, B1,2, C1-3; 5.6/A1-8, B1,2; 5.7/A4-6, B1,2; 5.8/A1, B1, C1-3, D1; 5.9/D1,2; 5.10/A1, B1,2)
2. Assess a variety of biological information for practical purposes such as interpreting directions on medicine bottles and nutrition information on prepared food packages.  
(5.1/A1, C1; 9.2/A1)
3. Demonstrate the application of biological principles in their lives.  
(5.1/B1; 5.4/B1, C1; 5.10/B1,2)
4. Value the diversity of life and its relationship to human endeavors.  
(5.5/B1,2; 5.4/A1; 5.10/A1, B1,2; 9.2/A1, D4)
5. Recognize and accept individual responsibility for local human activities and their impact on the global environment.  
(5.1/A1-4; 5.4/A1, B1, C1; 5.10/A1, B2; 9.2/A1, B2, D4)
6. Think critically.  
(5.1/A1-3, B2; 5.3/C1; 5.4/C1; 5.10/B1,2; 9.2/A1)
7. Use appropriate procedural skills for scientific inquiry and problem solving.  
(5.1/B1,2, C1; 8.1/B5; 9.1/B3; 9.2/F1-5)
8. Solve problems cooperatively and creatively.  
(5.1/A1-3, B2; 5.4/C1; 5.10/B1,2; 9.2/C2)
9. Select and use appropriate instrumentation to design and conduct investigations.  
(5.1/B1; 9.1/B2; 9.2/F1-5)
10. Site examples of how science and technology have solved practical problems.  
(5.2/A1, B1-3; 5.4/A1; 8.2/A3; 9.2/A1)
11. Use computer spreadsheets and graphing programs to assist in quantitative analysis.  
(5.3/C1, D1; 8.1/A2; 9.1/B3)
12. Identify cell parts and explain the functions of each.  
(5.5/A1; 9.2/A3)

## **STUDENT PROFICIENCIES (continued)**

13. Discuss scientific hypotheses concerning the origin of life and the various theories of evolution.  
(5.5/B1, C2; 5.8/C1-3, D1; 5.9/D2)
14. Understand the relationship of organisms to their environment.  
(5.1/A2; 5.2/A2; 5.5/A1, B1,2; 5.8/A1, B1, C1-3; 5.10/A1, B1,2; 9.2/A3)
15. Compare and contrast the general characteristics of specific organisms, especially with regard to the human body.  
(5.5/A1)
16. Understand the role of genetics in today's changing world.  
(5.5/A1, C1-3; 9.1/A2,5)
17. Understand how the various systems of the body interact with one another.  
(5.5/A1)
18. Use models to explain the structure and behavior of biological concepts.  
(5.4/C1; 5.5/A1, C1; 5.6/A1-8, B1,2; 5.7/B2; 9.2/A3)
19. Predict how human activity or natural phenomena may affect the balance of life on earth.  
(5.1/A1-3, B2; 5.4/A1, B1, C1; 5.5/C3; 5.8/A1, B1, C2; 5.10/A1, B1,2; 9.2/A1)
20. Identify career opportunities within the sphere of science.  
(5.1/A4; 9.1/A2,3,5)

## **METHODS OF EVALUATION**

Students will demonstrate skills and understanding through:

1. Tests.
2. Quizzes.
3. Laboratory reports.
4. Oral presentations/demonstrations.
5. Written homework assignments.
6. Proper use of specific tools, such as the microscope and the computer.
7. Quality of dissection/or production of models and identification of structures.
8. Mid-term and final exams.
9. Internet research.
10. Notebooks.
11. Cooperative learning activities.



		<p>II. Similarities Among Living Things (continued)</p> <p>6. Prepare a wet mount slide</p> <p>C. Nature of Matter</p> <ol style="list-style-type: none"> <li>1. Know the parts of an atom</li> <li>2. Understand the importance of models in biology</li> <li>3. Distinguish among covalent, ionic, and hydrogen bonds</li> <li>4. Recognize the significance of polar molecules and give an example</li> <li>5. Differentiate between acids and bases</li> <li>6. Use the pH scale to determine acidity and alkalinity of various substances</li> <li>7. Identify the reactants and products of a chemical equation</li> <li>8. Distinguish between the chemistry of living and nonliving things</li> <li>9. Name the main types of organic compounds in living cells</li> </ol> <p>D. Organic Chemistry</p> <ol style="list-style-type: none"> <li>1. Identify the generalized chemical structures of <ol style="list-style-type: none"> <li>a. carbohydrates</li> <li>b. lipids</li> <li>c. proteins</li> <li>d. nucleic acids</li> </ol> </li> <li>2. Explain how macromolecules can be formed using simple monomers</li> <li>3. Differentiate between hydrolysis and dehydration (condensation) synthesis</li> <li>4. Explain the importance of enzymes to living things</li> </ol>
<p>5.1</p> <p>5.2</p> <p>5.3</p> <p>5.5</p> <p>5.6</p> <p>5.7</p> <p>9.2</p>	<p>B1</p> <p>A1</p> <p>B1,2,3</p> <p>C1</p> <p>D1</p> <p>A1,2,3</p> <p>C1,2</p> <p>A1,3,4,6,7,8</p> <p>B1,2</p> <p>A4</p> <p>B1,2</p> <p>A3</p> <p>B2</p>	<p>III. Cells</p> <p>A. Cell Structure and Function</p> <ol style="list-style-type: none"> <li>1. Construct a timeline of cell discoveries and relate them to cell theory</li> <li>2. Identify cell organelles and describe their functions</li> <li>3. Distinguish between prokaryotic and eukaryotic cells</li> <li>4. Compare plant and animal cells</li> </ol> <p>B. Movement Through the Membrane</p> <ol style="list-style-type: none"> <li>1. Model the cell membrane</li> <li>2. Define and demonstrate diffusion/osmosis</li> <li>3. Create a diagram showing the concepts of isotonic, hypotonic, and hypertonic solutions</li> <li>4. Identify and explain the various forms of active transport</li> </ol>

		<p>III. Cells (continued)</p> <p>C. Diversity</p> <ol style="list-style-type: none"> <li>1. Describe the levels of organization in living things</li> <li>2. Research how cells shape and structure influences its function (“form fits function”) using examples such as <ol style="list-style-type: none"> <li>a. red blood cells/white cells</li> <li>b. nerve cells</li> <li>c. amoeba</li> </ol> </li> </ol> <p>D. Photosynthesis</p> <ol style="list-style-type: none"> <li>1. Classify organisms as heterotrophs or autotrophs</li> <li>2. Model how ATP works</li> <li>3. Write the accepted equation for photosynthesis</li> <li>4. List the colors of the visible spectrum and explain the importance of red, blue, and green wavelengths with respect to absorption and reflection</li> <li>5. Illustrate a chloroplast identifying the structures related to photosynthesis</li> <li>6. Model the light reactions and the Calvin cycle</li> </ol> <p>E. Cellular Respiration</p> <ol style="list-style-type: none"> <li>1. Write the accepted equation for cell respiration</li> <li>2. Illustrate a mitochondrion identifying the structures related to respiration</li> <li>3. Name the three stages of cell respiration</li> <li>4. Briefly describe what happens during each stage</li> <li>5. Name the two main types of fermentation and identify several food products that result</li> <li>6. Compare ATP production in fermentation and cellular respiration</li> </ol> <p>F. Cell Growth and Division</p> <ol style="list-style-type: none"> <li>1. Explain the limitations of cell size</li> <li>2. Draw and label a metaphase chromosome</li> <li>3. Model the cell cycle and briefly explain what occurs at each stage</li> <li>4. Identify the stages and key structures of mitosis</li> </ol>
5.1	A1,2,3,4	<p>IV. Genetics and Heredity</p> <p>A. Mendelian Genetics</p> <ol style="list-style-type: none"> <li>1. Summarize principles of genetics</li> <li>2. Relate the mathematics of probability to genetics</li> <li>3. Predict the genotypes and phenotypes that may result from specific genetic crosses using Punnett Squares</li> <li>4. Provide several examples of non-Mendelian genetics</li> </ol>
5.2	B2	
5.3	A1	
5.4	B1,2,3	
5.5	C1	
	D1	
	A1,4	
	B1	
	C3	
	A1	

<p>5.10 9.1 9.2</p>	<p>C1,2,3 B2 A3,5 B1 A3 D2,4</p>	<p>IV. Genetics and Heredity (continued)</p> <p>B. Meiosis</p> <ol style="list-style-type: none"> <li>1. Identify the stages of meiosis</li> <li>2. Compare meiosis and mitosis</li> <li>3. Relate meiosis to Mendelian Genetics</li> </ol> <p>C. DNA and RNA</p> <ol style="list-style-type: none"> <li>1. Model DNA</li> <li>2. Develop a timeline of experiments that contributed to an understanding of DNA</li> <li>3. Summarize the events of DNA replication, compare DNA and RNA</li> <li>4. Briefly describe the role of each type of RNA in protein synthesis       <ol style="list-style-type: none"> <li>a. messenger RNA</li> <li>b. ribosomal RNA</li> <li>c. transfer RNA</li> </ol> </li> <li>5. Briefly summarize the events of transcription and translation</li> <li>6. Define mutation and provide several examples</li> </ol> <p>D. Genetic Engineering</p> <ol style="list-style-type: none"> <li>1. List several examples of genetic engineering</li> <li>2. Explore the pros and cons of genetic variation</li> <li>3. Convey your feelings about genetically engineered products and public awareness</li> <li>4. Summarize the main steps in cloning</li> <li>5. Explain the term transgenic and list practical applications for each of the following       <ol style="list-style-type: none"> <li>a. transgenic bacteria</li> <li>b. transgenic animals</li> <li>c. transgenic plants</li> </ol> </li> </ol> <p>E. Human Genome</p> <ol style="list-style-type: none"> <li>1. Understand how karyotypes and pedigrees are used to interpret human genetics</li> <li>2. Research one genetic disorder in humans providing information about cause, frequency, symptoms, treatment, etc.</li> <li>3. Suggest several careers in human molecular genetics</li> <li>4. List several ethical issues associated with human genetic research</li> </ol>
<p>5.1 5.2 5.5 5.8</p>	<p>A1,3,4 A1 B1,2,3 B1,2 A1 C1,3 D1</p>	<p>V. Evolution of Living Things</p> <p>A. Evidence of Evolution</p> <ol style="list-style-type: none"> <li>1. Recognize the problems involved in determining the age of the earth and its fossils</li> <li>2. Recognize the problems involved in formulating theories for the origin of life</li> </ol>

<p>5.9 9.2</p>	<p>D2 A3</p>	<p>V. Evolution of Living Things (continued)</p> <ol style="list-style-type: none"> <li>3. Identify observations that support evolution</li> </ol> <p>B. Theories of Evolution</p> <ol style="list-style-type: none"> <li>1. Contrast the theories of evolution of Darwin and Lamarck</li> <li>2. Explain modern theories of evolution that have grown out of new research</li> <li>3. Understand how plate tectonics functions in the building of mountains</li> <li>4. Explain how topography, fossils, rock stratification, ice cores, and/or radiometric data provide evidence for changes on earth</li> <li>5. Develop questions about the mechanisms of evolution</li> <li>6. Define and model speciation</li> </ol>
<p>5.1 5.5  5.10 8.1 9.2</p>	<p>A1,2,3 A1,2,3,4 B2 C1,2 B1,2 B5 A1,3</p>	<p>VI. Diversity</p> <p>A. Classification</p> <ol style="list-style-type: none"> <li>1. Explain the Linnaean System of Classification</li> <li>2. Identify characteristics used for classifying</li> <li>3. Identify unknown species using a taxonomic key</li> </ol> <p>B. Prokaryotes</p> <ol style="list-style-type: none"> <li>1. Model bacteria</li> <li>2. Recognize the three distinct shapes of bacteria</li> <li>3. Illustrate the effects of bacteria on the ecology and development of disease</li> <li>4. Show how humans use bacteria</li> </ol> <p>C. Viruses</p> <ol style="list-style-type: none"> <li>1. Know the parts of a virus</li> <li>2. Interpret the lysogenic and lytic life cycles</li> <li>3. Describe the impact of viruses on organisms</li> </ol> <p>D. Overview of Eukaryotes</p> <ol style="list-style-type: none"> <li>1. Characterize a eukaryote</li> <li>2. Outline the classification of eukaryotes</li> <li>3. Identify the major characteristics for each major phylum</li> <li>4. For plants:       <ol style="list-style-type: none"> <li>a. understand the structure and function of roots, stems, and leaves</li> <li>b. discuss the importance of plants in photosynthesis</li> <li>c. compare vascular and nonvascular plants</li> </ol> </li> <li>5. For animals:       <ol style="list-style-type: none"> <li>a. understand the differences between vertebrates and invertebrates</li> <li>b. research one animal and discover the mechanism for           <ol style="list-style-type: none"> <li>1. feeding and digestion</li> </ol> </li> </ol> </li> </ol>

		<p>VI. Diversity (continued)</p> <ol style="list-style-type: none"> <li>2. circulation</li> <li>3. respiration</li> <li>4. excretion</li> <li>5. response</li> <li>6. movement</li> <li>7. reproduction</li> </ol> <p>c. understand the importance of “form fits function” in the animal kingdom by showing how one animal has adapted to its lifestyle</p>
<p>5.1 5.2 5.3 5.5 5.7 5.8 5.10 8.1 9.2</p>	<p>A1,2,3,4 A1 B3 C1 D1 B1,2 B1,2 A1 B1 C2 A1 B1,2 B5 A3 D4,5</p>	<p>VII. Ecology</p> <p>A. Organization of the Environment</p> <ol style="list-style-type: none"> <li>1. Define ecology</li> <li>2. Trace the flow of energy through living systems identifying producers, consumers, and feeding relationships</li> <li>3. Evaluate the efficiency of energy transfer among organisms through the various trophic levels and ecological pyramids</li> <li>4. Describe how matter cycles among the living and nonliving parts of an ecosystem</li> <li>5. Model one of the following <ol style="list-style-type: none"> <li>a. water cycle</li> <li>b. carbon cycle</li> <li>c. nitrogen cycle</li> <li>d. phosphorus cycle</li> </ol> </li> </ol> <p>B. Biomes</p> <ol style="list-style-type: none"> <li>1. Provide examples of biotic and abiotic factors for the biomes</li> <li>2. Identify different community interactions such as <ol style="list-style-type: none"> <li>a. competition</li> <li>b. predation</li> <li>c. symbiosis</li> </ol> </li> <li>3. Model ecological succession in a biome</li> </ol> <p>C. Populations</p> <ol style="list-style-type: none"> <li>1. Identify factors that affect population size</li> <li>2. Infer how changes in nutrient levels can limit population growth</li> <li>3. Draw and interpret population growth curves</li> <li>4. Analyze why population growth rates differ throughout the world</li> <li>5. Predict the consequences of unchecked population growth</li> </ol> <p>D. Human Ecology</p> <ol style="list-style-type: none"> <li>1. List human activities that can affect the biosphere</li> </ol>

		<p>VII. Human Ecology (continued)</p> <ol style="list-style-type: none"> <li>2. Research one type of human activity that has changed the biosphere emphasizing environmental costs and benefits</li> <li>3. Identify one renewable and one non-renewable resource for a biome and predict how the loss of each might affect that biome</li> <li>4. Define biodiversity</li> <li>5. Evaluate the importance of biodiversity</li> <li>6. Research a specific threatened or endangered species and evaluate the impact of both its loss and conservation</li> <li>7. Develop a personal mission statement addressing the effect of human activities on the biosphere</li> </ol>
<p>5.1 5.5 5.6 9.2</p>	<p>A1 B1 C1,2 A1,4 C1,2 B1 A3 C2 F4</p>	<p><i>If time permits, topics will be selected from the following:</i></p> <p>VIII. Human Biology</p> <p>A. Nutrition</p> <ol style="list-style-type: none"> <li>1. Identify and describe the roles of the nutrients needed to sustain life</li> <li>2. Recognize the need for a balanced diet</li> <li>3. Test different food samples to identify which nutrients they contain</li> <li>4. Discuss how vitamins are important for the body</li> <li>5. Discuss the necessity of food for energy and body development</li> <li>6. List the food groups and discuss the contents and values of each</li> </ol> <p>B. Digestion</p> <ol style="list-style-type: none"> <li>1. List the phases of digestion and the events that occur in each</li> <li>2. Discuss the process of absorption in the small intestine</li> <li>3. Discuss the function of enzymes and their actions in digestion</li> <li>4. List and describe the organs of the digestive system</li> <li>5. Identify the functions of several digestive structures of vertebrates using computer simulations, illustrations, and/or dissections</li> <li>6. Compare these structures to those found in humans</li> </ol> <p>C. Transport</p> <ol style="list-style-type: none"> <li>1. List and discuss the structure and functions of parts of a heart</li> <li>2. Discuss the main blood vessels and describe their functions in the transport of materials through the body</li> </ol>

		<p>VIII. Human Biology (continued)</p> <ol style="list-style-type: none"> <li>3. List the components of blood and describe the functions of each</li> <li>4. Discuss blood related diseases and their consequences</li> <li>5. Illustrate the path of blood through the body</li> <li>6. Associate the heartbeat rate with exercise</li> <li>7. Explain the relationship of the pulse to blood moving through the body</li> <li>8. Know the various blood types and safe transfusions</li> <li>9. Understand the difference between passive and active immunity</li> </ol> <p>D. Respiration</p> <ol style="list-style-type: none"> <li>1. Discuss respiration as a life process common to all living things</li> <li>2. Define “breathing” as a mechanical process in which oxygen enters the body and waste gases leave the body</li> <li>3. List and describe the structure and functions of the organs of the respiratory system</li> <li>4. Discuss the transport of oxygen to the cells of the body</li> <li>5. Describe the increased rate of breathing as related to body activity</li> <li>6. State the effects of smoking on normal lung tissue</li> <li>7. Discuss various respiratory diseases</li> </ol> <p>E. Excretion</p> <ol style="list-style-type: none"> <li>1. Define excretion as the removal of liquid waste products from the body</li> <li>2. List and describe the structure, functions, and process of the organs involved in the excretion of liquids</li> <li>3. List and discuss the important functions of the liver</li> <li>4. Label and indicate the process of excretion using a model or diagram</li> </ol> <p>F. Regulation</p> <ol style="list-style-type: none"> <li>1. Describe the brain and list and discuss its regions</li> <li>2. List and describe the parts of the central nervous system</li> <li>3. Discuss and illustrate the actions of nerve impulses</li> <li>4. Distinguish between voluntary and involuntary activities of nerves</li> <li>5. Explain the effects of drugs on the nervous system</li> <li>6. List and describe the sense organs in man</li> <li>7. Discuss how senses influence learning</li> <li>8. Complete an experiment illustrating how the tongue tastes good and how the nose helps identify food</li> <li>9. Define the purpose of the endocrine system</li> </ol>
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		<p>VIII. Human Biology (continued)</p> <ol style="list-style-type: none"> <li>10. Define hormones as secretions involved in the regulation of growth and development</li> <li>11. List the major endocrine glands and hormone secreted by each</li> </ol> <p>G. Locomotion</p> <ol style="list-style-type: none"> <li>1. Discuss the structure and function of the skeletal system</li> <li>2. Discuss the structure and function of the muscular system</li> <li>3. Associate movement with muscles and bones working together</li> <li>4. Complete an experiment illustrating how muscles make the body move</li> <li>5. Discuss the role of muscles and bones in protecting other body parts</li> <li>6. Illustrate the mechanism of a simple reflex</li> </ol> <p>H. Asexual Reproduction</p> <ol style="list-style-type: none"> <li>1. Define reproduction and relate the process of reproduction and development to species survival</li> <li>2. Describe the stages of mitosis and the events occurring in each phase</li> <li>3. Understand the process of meiosis in the formation of sex cells</li> <li>4. Describe various forms of asexual reproduction in plants and animals</li> </ol> <p>I. Sexual Reproduction</p> <ol style="list-style-type: none"> <li>1. Identify the major structures and processes involved in animal and plant sexual reproduction</li> <li>2. Discuss the differences between external and internal fertilization</li> <li>3. Describe the process of pollination and fertilization</li> <li>4. Discuss the role of insects in pollination</li> <li>5. Discuss and illustrate the anatomy of a flower</li> </ol>
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\*New Jersey Core Curriculum Content Standards can be viewed at [www.state.nj.us](http://www.state.nj.us)

## **SUGGESTED AUDIO VISUAL/COMPUTER AIDS**

1. LCD Projector.
2. Microsoft PowerPoint Software.
3. Microsoft Word Software.
4. Microsoft Internet Explorer Software.
5. Teacher Online Access Pack with iText.
6. Prentice Hall Presentation Pro.

## **SUGGESTED MATERIALS**

### **Resources for Students**

Text:

Kenneth R. Miller and Joseph Levine  
*Prentice Hall Biology*  
Prentice Hall  
2002

### **Resources for Teachers**

Text:

Kenneth R. Miller and Joseph Levine  
*Prentice Hall Biology*  
Prentice Hall  
2002

Supplemental Materials:

Core Teaching Resources  
Prentice Hall  
2002

Resource Presentation Pro  
Prentice Hall Biology  
Pearson Education, Inc.  
2002

Teacher Online Access Pack with iText  
Pearson Education, Inc.  
2003

## **SUGGESTED TARGETS**

### **Agreed upon targets for coverage of content by the end of the first semester:**

- I. Introduction to Biology
- II. Similarities Among Living Things
- III. Cells
- IV. Genetics Part A

### **Agreed upon targets for coverage of content by the end of the second semester:**

- IV. Genetics Parts B - G
- V. Evolution
- VI. Diversity
- VII. Ecology

### **If time permits,**

- VIII. Human Biology