

## SCIENCE DEPARTMENT

## BIOLOGY CP: COURSE #423

### **Contact Information**

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### **The Department's Educational Philosophy**

We believe that students should be exposed to the process of scientific inquiry so they can acquire and interpret scientific knowledge, and begin to realize the wider applicability of scientific problem-solving methods. By making the laboratory the focal point of learning, we seek to foster students' appreciation for the experience of doing science.

### **Guiding Principles**

- Students must be able to collect and analyze data and formulate hypotheses.
- Inductive and deductive problem-solving skills are central to science education.
- An effective program in science addresses the limitations of data and conclusions.
- Students should be able to use or design a strategy for testing scientific concepts.
- A comprehensive science program will emphasize the delicate checks and balances in man's abiotic and biotic environments and the stresses upon these ecosystems, which could affect the destiny of the world.
- Science is integrally related to mathematics.
- An effective science program builds students' ability to communicate accurately and precisely.
- An effective science program stresses both cooperative and independent learning.

## **BIOLOGY CP: COURSE #423**

**Course Frequency:** Full-year course, five times per week; six times in a six-day cycle

**Credits Offered:** 5 credits

**Prerequisites:** By recommendation of the department

### **Background to the Curriculum**

Biology 423 (CP) is a college preparatory course designed to provide the students with a fundamental understanding of the major topics in biology. The following topics will be covered: ecology, biochemistry, cellular biology, genetics, natural selection, classification, a survey of major kingdoms and human biology.

### **Core Topics/Questions/Concepts/Skills**

<b>Core Topics</b>	<b>Questions</b>	<b>Concepts</b>
<b>I. Ecosystems</b>	<ul style="list-style-type: none"><li>• How do organisms in New England ecosystems and other ecosystems interact?</li><li>• How do matter and energy move through ecosystems?</li></ul>	Niches, habitats, biomes, biosphere, Ecological succession, competition, predator-prey, symbiosis, food web, energy pyramid
<b>II. Matter and Energy</b>	<ul style="list-style-type: none"><li>• How does life utilize energy?</li><li>• How does life utilize matter?</li></ul>	general chemistry, conservation of matter and energy, photosynthesis and cellular respiration, enzymes, ATP, macromolecules
<b>III. Cells</b>	<ul style="list-style-type: none"><li>• What are the basic structures of cells and their functions?</li><li>• How have complex cells evolved from simpler cells?</li></ul>	characteristics of life, cell structure and function, prokaryotes/eukaryotes, surface area/volume, proteins (channel, receptor, marker) diffusion, osmosis, active/ passive transport, mitosis, cancer, endosymbiotic theory
<b>IV. Heredity and Genetics</b>	<ul style="list-style-type: none"><li>• How is hereditary information housed in your cells?</li><li>• How is the hereditary information passed on from parent to offspring?</li><li>• How does variation in a species increase?</li><li>• What is the structure of DNA and where is it located?</li><li>• How are proteins made?</li></ul>	Mendel's experiments, inheritance, genotype vs. phenotype, probability, laws of segregation and independent assortment, pedigree, asexual and sexual reproduction, chromosomal theory of inheritance, meiosis, mutations, DNA and RNA structures

<b>V. Natural Selection</b>	<ul style="list-style-type: none"> <li>• How do species evolve over time?</li> <li>• How does variation in a species relate to evolution?</li> <li>• Can an organism adapt?</li> </ul>	Darwin vs. Lamarck, variation, reproduction, Environmental influence, adaptation, homologous/analogous structures, adaptive radiation
<b>VI. Earth History</b>	<ul style="list-style-type: none"> <li>• How did life evolve from inorganic matter?</li> <li>• What is the timeline of the history of life on Earth?</li> </ul>	Miller – Urey experiment, endosymbiotic theory, protenoid microsphere, cyanobacteria, properties of RNA, mass extinction
<b>VII. Classification</b>	<ul style="list-style-type: none"> <li>• How do scientists categorize the diversity of life?</li> <li>• How are organisms classified based on evolutionary relationships?</li> </ul>	biodiversity, taxonomy phylogeny, convergent and divergent evolution, patterns of evolution
<b>VIII. Bacteria and Viruses</b>	<ul style="list-style-type: none"> <li>• What is the structural diversity of bacteria?</li> <li>• What roles do bacteria play in ecosystems?</li> <li>• How are bacteria classified?</li> <li>• What are the general characteristics of viruses?</li> </ul>	bacteria (distribution, structure, diversity, nutrition, pathogens, antibiotic resistance), viruses ( structure, reproduction, pathogens, HIV), vaccines
<b>IX. Protists</b>	<ul style="list-style-type: none"> <li>• What is the structural diversity of protists?</li> <li>• What roles do protists play in ecosystems?</li> <li>• How are protists classified?</li> </ul>	protists (characteristics, diversity, pathogens), reproduction, examples
<b>X. Fungi</b>	<ul style="list-style-type: none"> <li>• What is the structural diversity of fungi?</li> <li>• What roles do fungi play in ecosystems?</li> <li>• How are fungi classified?</li> </ul>	fungi (characteristics, diversity, reproduction, examples, symbiosis, lichens, mycorrhizae)
<b>XI. Plants and Photosynthesis</b>	<ul style="list-style-type: none"> <li>• What is the structural diversity of plants?</li> <li>• What roles do plants play in ecosystems?</li> <li>• How are plants classified?</li> <li>• What were the survival strategies that plants evolved and what evidence supports this?</li> <li>• How do plants convert abiotic energy to biotic energy?</li> </ul>	Evolution, biodiversity, reproduction, plant structure/function, photosynthesis
<b>XII. Animals</b>	<ul style="list-style-type: none"> <li>• What is the structural diversity of animals?</li> <li>• What roles do animals play in ecosystems?</li> <li>• How are animals classified?</li> <li>• What were the survival strategies that animals evolved and what evidence supports this?</li> <li>• What were the major changes in body plan that evolved?</li> </ul>	evolution, structure, development, body plan, phyla characteristics

<b>XIII. Human Body Systems</b> (Nervous, Skeletal, Muscular, Endocrine, Circulatory, Respiratory, Digestive, Excretory, and Immune Systems)	<ul style="list-style-type: none"> <li>• How do structure and function relate in the human body systems?</li> <li>• What is homeostasis and how is it disrupted in each of the human body systems?</li> </ul>	structure versus function, major bones, bone formation, types of muscle, movement, cellular respiration, microscopic anatomy, nerve impulse, neuron structure, synapse, hormones, glands, cardiovascular, pulmonary and systemic circuits, immune response, disease
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### Course-End Learning Objectives

<u>Learning objectives</u>	<u>Corresponding state standards, where applicable</u>
<p><b><u>Ecosystems</u></b></p> <ol style="list-style-type: none"> <li>1] Explain how organisms in New England ecosystems and other ecosystems interact.</li> <li>2] Describe how matter and energy move through ecosystems.</li> </ol> <p><b><u>Matter and Energy</u></b></p> <ol style="list-style-type: none"> <li>1] Describe how living organisms utilize energy.</li> <li>2] Explain the composition and functions of the different molecules within living organism.</li> </ol> <p><b><u>Cells:</u></b></p> <ol style="list-style-type: none"> <li>1] Describe the basic structures of cells and their functions.</li> <li>2] Explain how complex cells have evolved from simpler cells.</li> </ol> <p><b><u>Heredity and Genetics:</u></b></p> <ol style="list-style-type: none"> <li>1] Identify how and where hereditary information is housed in cells.</li> <li>2] Explain how hereditary information is passed from parent to offspring.</li> <li>3] Identify how variation in a species increase over time.</li> <li>4] Describe the structure of DNA and where it is located.</li> <li>5] Describe how are proteins made.</li> </ol>	<p>Biology 6.2, 6.3, 6.4, 6.5  Biology 6.3, 6.4, 2.5</p> <p>Biology 1.2, 2.1, 2.4, 2.5  Biology 1.1, 1.2, 1.3</p> <p>Biology 2.1, 2.2, 2.3  Biology 2.2, 2.3, 5.1</p> <p>Biology 2.1, 2.2, 3.1  Biology 2.7, 3.3, 3.4, 3.5, 3.6  Biology 3.3, 5.3  Biology 3.1, 2.1  Biology 3.2, 3.3</p>

<p><b><u>Natural Selection</u></b></p> <ol style="list-style-type: none"> <li>1] Explain how do species evolve over time.</li> <li>2] Describe the role that variation plays in the evolution of a species.</li> <li>3] Explain what is meant by the term adaptation as it relates to natural selection.</li> </ol> <p><b><u>Earth History</u></b></p> <ol style="list-style-type: none"> <li>1] Describe how life evolved from inorganic matter.</li> <li>2] Explain the timeline of the history of life on Earth.</li> </ol> <p><b><u>Classification</u></b></p> <ol style="list-style-type: none"> <li>1] Explain how scientists categorize the diversity of life.</li> <li>2] Describe the impact that the evolutionary relationships of organisms plays in classification.</li> </ol> <p><b><u>Bacteria and Viruses</u></b></p> <ol style="list-style-type: none"> <li>1] Describe the structural diversity of bacteria.</li> <li>2] Explain the diverse roles bacteria play in ecosystems.</li> <li>3] Explain how bacteria are classified</li> <li>4] Describe the general characteristics of viruses</li> </ol> <p><b><u>Protists</u></b></p> <ol style="list-style-type: none"> <li>1] Describe the structural diversity of protists.</li> <li>2] Explain the diverse roles protists play in ecosystems.</li> <li>3] Explain how protists are classified.</li> </ol> <p><b><u>Fungi</u></b></p> <ol style="list-style-type: none"> <li>1] Describe the structural diversity of fungi.</li> <li>2] Explain the diverse roles fungi play in ecosystems.</li> <li>3] Explain how fungi are classified.</li> </ol> <p><b><u>Plants and Photosynthesis</u></b></p> <ol style="list-style-type: none"> <li>1] Describe the structural diversity of plants.</li> <li>2] Explain the role plants play in ecosystems.</li> <li>3] Explain how plants are classified</li> <li>4] Describe the survival strategies that plants evolved and the evidence that supports this.</li> <li>5] Discuss how plants convert abiotic energy to biotic energy.</li> </ol>	<p>Biology 5.1, 5.3 Biology 5.3 Biology 5.3, 6.2</p> <p>Biology 5.1 Biology 5.1</p> <p>Biology 5.1, 5.2, 5.3 Biology 5.1, 5.2, 5.3</p> <p>Biology 2.1, 2.2, 2.3 Biology 6.2, 6.3 Biology 5.2 Biology 2.8</p> <p>Biology 2.1, 2.2, 2.3, 5.2 Biology 6.2, 6.3 Biology 5.2, 5.3</p> <p>Biology 2.1, 2.2, 2.3, 5.2 Biology 6.2, 6.3 Biology 5.2, 5.3</p> <p>Biology 2.1, 2.2, 2.3, 5.2 Biology 6.2, 6.3 Biology 5.2, 5.3</p>
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<p><b><u>Animals</u></b></p> <ol style="list-style-type: none"> <li>1] Describe the structural diversity of animals.</li> <li>2] Explain the diverse roles plants play in ecosystems.</li> <li>3] Explain how animals are classified.</li> <li>4] Describe the survival strategies that animals evolved and the evidence supports this.</li> <li>5] Discuss the major changes in body plan that evolved in the animal kingdom.</li> </ol> <p><b><u>Human Body Systems</u></b></p> <ol style="list-style-type: none"> <li>1] Explain the structures and functions of the organ systems in the human body.</li> <li>2] Describe how homeostasis is maintained and how it can be disrupted in each of the human body systems</li> </ol>	<p>Biology 2.1, 2.2, 2.3, 5.2  Biology 6.2, 6.3  Biology 5.2, 5.3  Biology 5.1, 5.2, 5.3, 6.3  Biology 5.1, 5.2, 5.3</p> <p>Biology 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7  Biology 4.8</p>
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**Assessment**

- Tests: written based on curriculum covered; focus on terms and concepts and application of these.
- Quizzes: vocabulary in matching format; identify and label.
- Laboratory activities and reports: some formal typed with hypotheses, procedure, materials, data, discussion and conclusion; some informal with questions.
- Projects: often in cooperative groups, presented to the class
- Homework: questions from the chapter review, vocabulary work, and work sheets.

### **Technology and Health Learning Objectives Addressed in This Course**

**(This section is for faculty and administrative reference; students and parents may disregard.)**

<b><u>Course activity: skills &amp;/or topics taught</u></b>	<b><u>Standard(s) addressed through this activity</u></b>
<p>1] Word processing, power point presentations, internet-based activities, internet research, computer probes, databases, spread sheets, computer simulations, microscope skills</p> <p>2] The following topics related to health are covered in the core biology curriculum: the role of macromolecules in nutrition, common genetic disorders, pathogenic / parasitic viruses, bacteria, protists, fungi, vaccines, antibiotics, and diseases (e.g., AIDS, Influenza, diabetes) that disrupt homeostasis to the systems of the human body.</p>	

### **Materials and Resources**

- Student text: Miller, Kenneth R. and Joseph Levine. Biology Prentice Hall (2002).
- Numerous audio-visual, web sites, and lab materials to supplement the material taught in this course.