

AP Biology Syllabus

Curricular Requirements	Page(s)
CR1 Students and teachers use a recently published (within the last 10 years) college-level biology textbook.	1
CR2 The course is structured around the enduring understandings within the big ideas as described in the AP® Biology Curriculum Framework.	1
CR3a Students connect the enduring understandings within Big Idea 1 (the process of evolution drives the diversity and unity of life) to at least one other big idea.	7
CR3b Students connect the enduring understandings within Big Idea 2 (biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis) to at least one other big idea	3
CR3c Students connect the enduring understandings within Big Idea 3 (living systems store, retrieve, transmit, and respond to information essential to life processes) to at least one other big idea.	5
CR3d Students connect the enduring understandings within Big Idea 4 (biological systems interact and these systems and their interactions possess complex properties) to at least one other big idea.	2,8
CR4a The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 1.	2,6
CR4b The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 2.	3,4
CR4c The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 3.	4,5,6
CR4d The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 4.	2,7,8
CR5 The course provides students with opportunities to connect their biological and scientific knowledge to major social issues (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens.	1,3,5,8
CR6 The student-directed laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Biology Curriculum Framework and include at least two lab experiences in each of the four big ideas.	1,2,3,4,5,6,7,8
CR7 Students are provided the opportunity to engage in investigative laboratory work integrated throughout the course for a minimum of 25 percent of instructional time.	1
CR8 The course provides opportunities for students to develop and record evidence of their verbal, written and graphic communication skills through laboratory reports, summaries of literature or scientific investigations, and oral, written, or graphic presentations.	1,2,3,4,5,6,7,8

Course Overview

The course is designed around the AP Biology Curriculum Framework that focuses on the major concepts in biology and their connections. [CR2] Additionally, the Curriculum Framework provides a basis for students to develop a deep conceptual understanding as well as opportunities to integrate biological knowledge and the science practices through inquiry-based activities and laboratory investigation. Journal article readings are used to supplement the curriculum in order to increase the students' awareness that science is an ongoing endeavor to increase our knowledge of the natural world. [CR5]

My goal is to actively engage students in the process of science through class assignments and laboratory experiences. Lab techniques make up at least 25% of instructional time. [CR7] Labs emphasize development and testing of the hypothesis, collection, analysis and presentation of data, as well as discussion of results to discover unanswered questions about the particular topics addressed. A minimum of two labs in each big idea will be conducted. [CR6] Students are required to provide either an oral or a written report on all laboratory investigations. [CR8] The student-directed and inquiry-based laboratory investigations used throughout the course enable students to apply the seven science practices as defined in the Curriculum Framework.

Textbooks/Resources

Reese, Urry, Cain, Wasserman, Minorsky, Jackson. 2011. *AP Edition Campbell Biology*, Ninth Edition. [CR1]

AP Biology Advanced Inquiry Labs, Flinn Scientific

The Biology Place LabBench Activities – Pearson Publishers

Scientific American articles

The Biology Project – University of Arizona

Course Schedule

Students meet for classroom instruction seven times during the course of one week. Three days per week the students meet for one 50 minute class. Twice a week the students have an extra 50 minute class. These two days are utilized for conducting laboratory experiments. Usually twice a month, during the second half of the school year, one of those class periods is used for preparation of the exam. Those preparations include both practicing the multiple choice portion of the exam and writing practice essays of released questions from previous years.

MOLCEULES, CELLS & ENERGY Big ideas 1, 2, 3 & 4 [CR2]

Biblical Worldview Essential Questions

As we study living organisms at the molecular and cellular level, how can we refute the theory of evolution? How can we defend the theory of creationism?

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
<p>A. MOLECULES (Big idea 4)</p> <p>1. Polarity of water & its importance to biological systems</p> <p>2. Carbon’s role in the molecular diversity of life</p> <p>3. Monomers, polymers & reactions involved in building & breaking them down considering polar/nonpolar interactions</p> <p>4. Various levels of structures in protein & carbohydrates</p> <p>5. Enzyme structure as a special protein</p> <p>6. Cohesion, adhesion, specific heat of water & its importance to biological systems</p> <p>7. Acids, bases, & buffers</p> <p>8. Identifying macro-molecules in our foods</p>	<p>Textbook: Ch. 2-5</p> <p><u>Scientific American</u> article</p>	<p>Carbon: Structure Matters activity [CR4d] (SP 1,5,6)</p> <p>Isotopes of Pennies activity [CR4d] (SP 1,2)</p> <p>Enzyme Catalysts online LabBench Activity [CR4d] (SP 4,5,6,7)</p> <p>Toothpickase Activity [CR4d]</p> <p>Peroxidase Enzyme Activity Advanced Inquiry Lab (Flinn Scientific) (EU 4.A connects to BI 2) [CR3d] & [CR6] (SP 4,5,6,7)</p>	<p>Reading quizzes</p> <p>Answers to activity questions</p> <p>Self quiz from online LabBench activity</p> <p>Written lab report [CR8]</p> <p>Participation in article discussion</p> <p>Free response practice</p> <p>Unit test</p>

<p>B. CELLS – STRUCTURE & FUNCTION (Big idea 1 & 2)</p> <ol style="list-style-type: none"> 1. Similarities, differences, & proposed evolutionary relationships between prokaryotic & eukaryotic cells 2. Cell membrane structure & function 3. Cell communication (signals, receptors, responses, & hormones) 4. Methods of transport across membranes 	<p>Textbook: Ch. 6,7,11</p> <p><u>Scientific American</u> article – “The Inner Life of the Genome” (February 2011)</p>	<p>Diffusion & Osmosis online LabBench Activity [CR4b] (SP 2,4,5)</p> <p>Diffusion and Osmosis Advanced Inquiry Lab (Flinn Scientific) [CR6] (SP 2,4,5)</p> <p>Water Potential Advanced Inquiry Lab (Flinn Scientific) [CR6] (SP 2,4,5)</p>	<p>Reading quizzes</p> <p>Self quiz from online LabBench activity</p> <p>Written lab reports [CR8]</p> <p>Participation in article discussion (EU 2.D connects to BI4) [CR3b]</p> <p>Free response practice</p> <p>Unit test</p>
<p>C. IMMUNITY (Big idea 2 & 3)</p> <ol style="list-style-type: none"> 1. Innate vs. acquired responses 2. Humoral responses; B cells vs T cells 3. Self vs non-self 	<p>Textbook: Ch. 43</p> <p><u>Scientific American</u> article</p>	<p>HIV/AIDS/ELISA Assay Activity (The Biology Project) (SP 5)</p> <p>Student groups are given a discussion question from the HIV activity to research and lead in a classroom discussion [CR5] (SP 6)</p>	<p>Reading quizzes</p> <p>Student-led classroom discussions of HIV/AIDS [CR5] & [CR8]</p> <p>Participation in article discussion</p> <p>Free response practice</p>

<p>D. CELL ENERGY (Big idea 1, 2, 3, & 4)</p> <ol style="list-style-type: none"> 1. ATP structure & function 2. Redox reactions in relation to cellular respiration 3. Enzyme catalysis 4. Activation energy & specificity 5. Cellular respiration: glycolysis, citric acid cycle, electron transport chain, & chemiosmosis 6. Mitochondria form & function 7. Photosynthesis mechanisms: light & dark reactions 8. Comparison & contrast of respiration to photosynthesis 9. Alternative mechanisms to respiration & photosynthesis 	<p>Textbook: Ch. 8,9,10</p>	<p>Cell Respiration online LabBench Activity [CR4b] (SP 1,2,3,6,7)</p> <p>Cellular Respiration Advanced Inquiry Lab (Flinn Scientific) [CR6] (SP 1,2,3,6,7)</p> <p>Plant Pigments & Photosynthesis online LabBench Activity [CR4b]</p> <p>Photosynthesis in Leaf Disks Advanced Inquiry Lab (Flinn Scientific) [CR6] (SP 1,2,3,6,7)</p>	<p>Reading quizzes</p> <p>Self quizzes from online LabBench activity</p> <p>Written lab reports [CR8]</p> <p>Free response practice</p> <p>Unit test</p>
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<p>HEREDITY, GENETICS & EVOLUTION Big ideas 1 & 3 [CR2]</p>			
<p><u>Biblical Worldview Essential Questions</u></p>			
<p>What data in the field of genetics refutes the theory of evolution?</p>			
<p>What scientific evidence exists that supports the creationist theory of origins?</p>			
<p>TOPICS</p>	<p>READINGS</p>	<p>ACTIVITY/LABS</p>	<p>ASSESSMENT</p>
<p>A. MOLECULAR BASIS OF INHERITANCE (Big idea 1 & 3)</p> <ol style="list-style-type: none"> 1. DNA structure & replication 	<p>Textbook: Ch. 16,17</p>	<p>Protein Synthesis Modeling [CR4c]</p>	<p>Reading quizzes</p>

<p>2. RNA structure 3. Protein synthesis transcription & translation 4. Mutations and why they are considered the basis for natural selection</p>	<p><u>Scientific American</u> article</p>	<p>(SP 1)</p>	<p>Answers to activity questions Participation in article discussion Free response practice</p>
<p>B. MITOSIS & MEIOSIS (Big idea 1 & 3)</p>	<p>Textbook: Ch. 12,13</p>	<p>Mitosis & Meiosis online LabBench activity (SP 1)</p>	<p>Reading quizzes Self quiz from online LabBench activity</p>
<p>1. Cell cycle mechanism & control 2. Chromosomes 3. Sexual vs. asexual reproduction 4. Stages of meiosis 5. Genetic variation in offspring, mechanisms, & possible impact on evolution 6. Environmental influences on genetics</p>	<p>Environmental Effects on Mitosis Advanced Inquiry Lab (Flinn Scientific) (EU 3.A connects to BI 1) [CR3c] & [CR6] (SP 1,5,6,7)</p>	<p>Cancer and the Loss of Cell Cycle Control Advanced Inquiry Activity (Flinn Scientific) [CR5] & [CR6] (SP 1,2,5,6,7)</p>	<p>Written lab reports [CR8] Free response practice Unit test</p>
<p><i>Sordaria</i> Genetics Advanced Student Lab (Flinn Scientific) [CR6] (SP 2)</p>			

<p>C. MENDELIAN GENETICS (Big idea 1 & 3)</p> <ol style="list-style-type: none"> 1. Patterns of inheritance 2. Predicting genetic outcomes and using the information in genetic counseling 3. Gene linkage & mapping 	<p>Textbook: Ch. 14,15</p> <p><u>Scientific American</u> article</p>	<p>Chi Square Modeling with M&M's Activity (SP 2)</p> <p>Genetics of Organisms online LabBench activity [CR4c] (SP 1,3,4,5,6)</p> <p>Genetics of <i>Drosophila</i> Eye Color Advanced Evolution Lab (Flinn Scientific) [CR6] (SP 1,3,4,5,6)</p>	<p>Reading quizzes</p> <p>Answers to activity questions</p> <p>Self quiz from online LabBench activity</p> <p>Written lab report [CR8]</p> <p>Participation in article discussion</p> <p>Free response practice</p>
<p>D. MOLECULAR GENETICS (Big idea 3)</p> <ol style="list-style-type: none"> 1. Regulation of gene expression 2. Viruses 3. Gene expression in bacteria 4. Biotechnology – DNA technology, recombinant DNA, PCR, & gel electrophoresis 5. Applications of DNA technology 	<p>Textbook: Ch. 18-21</p> <p><u>Scientific American</u> article</p>	<p>Molecular Biology online LabBench activity (SP 1)</p> <p>Bacterial Transformation Lab (Flinn Scientific) [CR6] (SP 1,3,5,6,7)</p> <p>Restriction Enzyme Analysis of DNA Lab (Flinn Scientific) [CR6] (SP 3,6)</p> <p>Blackett Family DNA Activities (The Biology Project) [CR4c] (SP 5)</p>	<p>Reading quizzes</p> <p>Self quiz from online LabBench activity</p> <p>Written lab reports [CR8]</p> <p>Participation in article discussion</p> <p>Free response practice</p> <p>Unit test</p>

<p>E. EVOLUTIONARY BIOLOGY (Big idea 1)</p> <p>1. Darwin’s explorations & theory of descent with modification & natural selection</p> <p>2. Galapagos Islands overview</p> <p>3. Evidence for evolution</p> <p>4. Phylogeny & systematics</p> <p>5. Evolution of populations</p> <p>6. Hardy-Weinberg Law</p>	<p>Textbook: Ch. 22-25</p> <p><u>Scientific American</u> article</p>	<p>Population Genetics online LabBench activity [CR4a] (SP 1,2,5,6,7)</p> <p>Hardy-Weinberg Practice Problems [CR4a] (SP 2)</p> <p>Artificial Selection Advanced Inquiry Lab (Flinn Scientific) [CR6] (SP 1,2,5,7)</p>	<p>Reading quizzes</p> <p>Self quiz from online LabBench activity</p> <p>Answers to practice problems [CR4a]</p> <p>Written lab report [CR8]</p> <p>Participation in article discussion</p> <p>Free response practice</p> <p>Unit test</p>
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<p>ORGANISMS & POPULATIONS Big ideas 1, 3 & 4 [CR2]</p>			
<p><u>Biblical Worldview Essential Questions</u></p>			
<p>What scientific evidence exists that supports the creationist theory of origins?</p>			
<p>In what ways does creation declare the glory of God?</p>			
<p>Is it important for Christians to study ecology?</p>			
<p>How can man be good stewards of the earth God has created for us?</p>			
<p>TOPICS</p>	<p>READINGS</p>	<p>ACTIVITY/LABS</p>	<p>ASSESSMENT</p>
<p>A. BIOLOGICAL DIVERSITY, MICROBIOLOGY, AND HISTORY OF LIFE (Big idea 1 & 4)</p>			

<p>1. Theories of how macro-molecules could have joined to support origin of life 2. Was RNA the 1st genetic material? 3. What is the age of the earth? 4. Early life on earth 5. Proposed evolution of prokaryotes & eukaryotes</p> <p>B. PLANTS & THEIR DIVERSITY (Big idea 1, 3, & 4)</p>	<p>Textbook: Ch. 25-28</p> <p><u>Scientific American</u> article</p>	<p>Radioactive Decay: A Sweet Simulation of Half-Life activity [CR4a] (SP 2)</p> <p>The Case of the Melting Ice [CR4a] (SP 1,2)</p>	<p>Reading quizzes</p> <p>Answers to activity questions</p> <p>Participation in article discussion</p> <p>Free response practice</p> <p>Unit test</p>
<p>1. How plants colonized land 2. Proposed evolution of seed plants 3. Structure, growth, & development 4. Plant responses to internal & external stimuli 5. Plant nutrition 6. Angiosperm reproduction</p>	<p>Textbook: Ch. 29,30, 35-39</p> <p><u>Scientific American</u> article – “Tiny Plants That Once Ruled the Seas” (June 2013)</p>	<p>Transpiration online LabBench Activity [CR4d] (SP 1,2,4,5,6)</p> <p>Rate of Transpiration Advanced Inquiry Lab (Flinn Scientific) [CR6] (SP 1,2,4,5,6)</p>	<p>Reading quizzes</p> <p>Self quiz from online LabBench activity</p> <p>Written lab report [CR8]</p> <p>Participation in article discussion (EU 1.C connects to BI4) [CR3a]</p> <p>Free response practice</p> <p>Unit test</p>

<p>C. ANIMAL DIVERSITY (Big idea 1, 3, & 4)</p> <ol style="list-style-type: none"> 1. Characteristics (body plans & systems) of invertebrates as you go up the phylogenetic tree 2. Basic anatomy principles 3. Analysis of structure & function of body systems 4. Digestive, circulatory, respiratory, excretory, endocrine, nervous, and muscular systems 	<p>Textbook: Ch. 32-34, 40-50</p> <p><u>Scientific American</u> article</p>	<p>Circulatory Physiology online LabBench activity [CR4d] (SP 1)</p> <p>Understanding Evolutionary Relationships Advanced Inquiry Activity (Flinn Scientific) [CR6] (SP 1,5)</p> <p>Environmental Tobacco Smoke and Lung Development Activity (The Biology Project) [CR4d] (SP 2,5)</p>	<p>Reading quizzes</p> <p>Self quiz from online LabBench activity</p> <p>Written lab report [CR8]</p> <p>Interpretation of activity results</p> <p>Participation in article discussion</p> <p>Free response practice</p> <p>Unit test</p>
<p>D. ECOLOGY (Big idea 1 & 3)</p> <ol style="list-style-type: none"> 1. Ecological interactions – biotic vs. abiotic 2. Behavioral ecology – proposed natural selection involvement 3. Population dynamics – growth & its regulations 4. Communities & ecosystems – energy levels & flows, cycles, symbiosis & suspected impact on evolution 5. Human influences, both positive & negative 	<p>Textbook: Ch. 51-56</p> <p><u>Scientific American</u> article</p>	<p>Dissolved Oxygen online LabBench activity (EU 4.A connects to BI 1) [CR3d] & [CR5]</p> <p>Animal Behavior online LabBench activity [CR4d] (SP 1,3,4,5,6,7)</p> <p>Fruit Fly Behavior Advanced Inquiry Lab (Flinn Scientific) [CR6] (SP 1,3,4,5,6,7)</p>	<p>Reading quizzes</p> <p>Self quizzes from online LabBench activities</p> <p>Written lab report [CR8]</p> <p>Participation in article discussion</p> <p>Free response practice</p> <p>Unit test</p>

