

AP[®] Biology

Course Overview

AP[®] Biology is designed to be the equivalent of a two-semester college introductory biology course usually taken by biology majors during their first year. It conforms to the standards instituted by the College Board for all AP courses and covers all of the topics in the *AP Biology Course Description*. The course encompasses the eight major themes: science as a process; evolution; energy transfer; continuity and change; structure and function; regulation; interdependence; and science, technology and nature. [C⁶] Furthermore, recognition of evolution as the foundation of modern biological models and thought is used as a unifying theme throughout the course. [C⁵]

Goals and objectives for students of the course include the following:

- exhibit mastery of the major principles of biology
- apply biological knowledge and critical thinking to environmental and social concerns [C⁷]
- demonstrate skills in using various biological instrumentation and scientific methodologies
- recognize science as a process and to practice finding and using patterns in collected data to solve scientific problems [C⁴]
- write critical abstracts to scientific papers written by scientists in the field of biology
- create a laboratory notebook inclusive of all labs performed throughout the year [C⁸]
- author a number of projects and papers demonstrating proper use of research techniques and resources

The class meets five days per week for a 50 minute time period. In addition, we have found the integration of Saturday lab blitz days as well as before/after school beneficial in meeting the time required to complete our curriculum.

Prerequisites for the course include Biology I and Chemistry I.

Required text materials include:

Campbell & Reece, 2001. Biology, Sixth Edition, Benjamin Cummings Publishing Company.

Educational Testing Service, 2001. AP Biology Student Lab Manual, edition D

Campbell & Reece, 2001. Art Notebook for Biology, Sixth Edition, Benjamin Cummins Publishing Company.

Course Planner

The course is organized into 10 units. Each unit encompasses an average of three weeks to complete. The lab component comprises 25% of our allotted time.

Lecture and Lab Schedule for the course is as follows:

Unit	Lecture and Lab Titles	Chapter Correlation	Time Frame
1	<p>Chemistry of Life [C¹] (7%)</p> <ul style="list-style-type: none"> • Review structure of atoms, molecules and types of chemical bonding • Water, Acids, Bases, Buffers • Carbon, and functional groups • Classification and formation of macromolecules: carbohydrates, lipids, proteins, nucleic acids • Characteristics of enzymes, coenzymes, cofactors, rates of activity, regulation <p><i>Lab: Properties of Water (wet lab) [C⁸]</i> <i>Lab: McMush: Identification of macromolecules (wet lab) [C⁸]</i> <i>AP Lab 2: "Enzyme Catalysis" (wet lab) [C⁸]</i></p>	2, 3, 4, 5, 6	3 weeks
2	<p>Cellular Structure and Function [C¹] (10%)</p> <ul style="list-style-type: none"> • Prokaryotic and eukaryotic cells • Plant and animals cells • Structure and function of cell membranes • Structure and function of organelles subcellular components of mobility, cytoskeleton • Cell cycle, mitosis, cytokinesis <p><i>AP Lab 1: "Diffusion and Osmosis" (wet lab) [C⁸]</i> <i>Lab: Why cells are small – comparing surface area to volume ratios with diffusion. (wet lab) [C⁸]</i> <i>Lab: Compound Microscope, making wet mounts, examination of different cell types (wet lab) [C⁸]</i> <i>Lab: Modeling Mitosis (paper lab) [C⁸]</i> <i>Lab: Mitosis online tutorial: University of Arizona Biology Project</i> <i>AP Lab 3a: Mitosis (wet lab) [C⁸]</i></p>	7, 8, 12	3 weeks

3	<p>Cellular Energetics (8%)</p> <ul style="list-style-type: none"> • ATP, energy transfer, coupled reactions, chemiosmosis • C3 and C4 photosynthesis • Glycolysis, fermentation, aerobic respiration <p><i>AP Lab 4: “Plant Pigments and Photosynthesis” (wet lab) [C⁸]</i> <i>Lab: Chlorophyll fluoresce (teacher demo) [C⁸]</i> <i>AP Lab 5: Cell Respiration (wet lab) [C⁸]</i></p>	9, 10	2 weeks
4	<p>Heredity [C²] (8%)</p> <ul style="list-style-type: none"> • Meiosis • Mendel’s Laws, probability • Genetics problems • Inheritance patterns: chromosomes, genes, alleles, interactions • Cancer <p><i>AP Lab 3b: “Meiosis” (wet lab) [C⁸]</i> <i>Lab: Meiosis online tutorial: University of Arizona Biology Project</i> <i>Project: Karyotype Analysis (presentation of work)</i> <i>Lab: Probability Coin Toss (hands-on activity) [C⁸]</i> <i>Lab: Chi Square M & M’s (hands-on activity) [C⁸]</i> <i>AP Lab 7: “Genetics of Organisms” (wet lab) [C⁸]</i></p>	13, 14, 15	3.5 weeks
5	<p>Molecular Genetics [C²] (9%)</p> <ul style="list-style-type: none"> • DNA, structure and replication • Eukaryotic chromosomal structure, nucleosome, transposable elements • RNA: transcription, mRNA editing, translation • Regulation of gene expression • Mutations • Recombinant DNA, DNA cloning, hybridization, DNA sequencing • DNA and RNA viruses <p><i>Lab: DNA Isolation and Extraction (wet lab) [C⁸]</i> <i>Lab: Paper Plasmid Cloning (dry lab) [C⁸]</i> <i>Lab: Restriction Enzymes (dry lab) [C⁸]</i> <i>*AP Lab 6: “Molecular Biology” (wet lab) [C⁸]</i> <i>*Saturday lab blitz day</i></p>	16, 17, 18, 19, 20	5 weeks

6	<p>Mechanisms of Evolution [C²] (8%)</p> <ul style="list-style-type: none"> • Origin of life • Evidence for evolution • Natural Selection • Hardy-Weinberg principle, factors influencing allelic frequencies • Speciation, isolating mechanisms, allopatry, sympatry, adaptive radiation • Patterns of evolution, gradualism, punctuated equilibrium <p><i>Lab: Natural Selection (hands-on activity) [C⁸]</i> <i>Lab: Hardy-Weinberg Equilibrium Lab (dry lab)[C⁸]</i> <i>AP Lab 8: "Population Genetics and Evolution" [C⁸]</i></p>	22, 23, 24, 25	2.5 weeks
7	<p>Diversity of Organisms [C³] (8%)</p> <ul style="list-style-type: none"> • Evolutionary patterns • Survey of the diversity of life – Monera, Protista, Fungi • Phylogenetic classification • Evolutionary relationships <p><i>Parade Through the Kingdoms – A guided reading activity assigned over vacation break.</i> <i>Lab: Identification of Pond Life (wet lab) [C⁸]</i> <i>Lab: Microscope and bacterial slides (wet lab) [C⁸]</i> <i>Lab: Mushroom Lab (wet lab) [C⁸]</i></p>	26, 27, 28, 31, 32, 33, 34	Vacation Assign. Plus, 1 week
8	<p>Plants [C³] (12%)</p> <ul style="list-style-type: none"> • Diversity, classification, phylogeny, adaptation to land, alternation of generations • Structure and physiology of vascular plants • Seed formation, germination, growth in seed plants • Hormonal regulation of plant growth • Plant response to stimuli: tropisms, photo-periodicity <p><i>Lab: Survey of plant specimens-identification of structure and function for lab practical. (wet lab) [C⁸]</i> <i>Lab: Flower Dissection [C⁸]</i> <i>AP Lab 9: "Transpiration" (wet lab) [C⁸]</i></p>	29, 30, 35, 36, 37, 38, 39	2 weeks

	<p>Plants (continued) [C³]</p> <p><i>Lab: Observation and calculation of leaf stomata (wet lab) [C⁸]</i></p> <p><i>Lab: Celery stem transport of red dye in vaseline vs. non-vaseline coated leaves (wet lab) [C⁸]</i></p>		
9	<p>Animals [C³] (20%)</p> <ul style="list-style-type: none"> • Diversity, classification, phylogeny, survey of acoelomate, pseudocoelomate, protostome, and deuterostome phyla • Structure and function of vertebrate tissues, organs, and systems, homeostasis, and immune response • Gametogenesis, fertilization, embryogeny, development • Behavior <p><i>Lab: Survey of animal specimens-identification of structure and function for lab practical. (wet lab) [C⁸]</i></p> <p><i>*Lab: Earthworm dissection (wet lab) [C⁸]</i></p> <p><i>*Lab: Clam dissection (wet lab) [C⁸]</i></p> <p><i>*Lab: Crayfish dissection (wet lab) [C⁸]</i></p> <p><i>*Lab: Squid dissection (wet lab) [C⁸]</i></p> <p><i>*Lab: Frog dissection (wet lab) [C⁸]</i></p> <p><i>Lab: Fetal Pig dissection (wet lab) [C⁸]</i></p> <p><i>AP Lab 10: “ Physiology of the Circulatory System” (wet lab) [C⁸]</i></p> <p><i>Lab: Brain Caps (hands-on activity) [C⁸]</i></p> <p><i>*Saturday lab blitz day</i></p>	40, 41, 42, 43, 44, 45, 46, 47, 48, 49	6 weeks
10	<p>Ecology [C³]</p> <ul style="list-style-type: none"> • Population dynamics, biotic potential, limiting factors • Ecosystem and community dynamics, energy flow, productivity, species interactions, succession, biomes • Biogeochemical cycles <p><i>AP Lab 12: “Dissolved Oxygen and Aquatic Primary Productivity” (wet lab) [C⁸]</i></p> <p><i>AP Lab 11: “Animal Behavior” with Siamese Fighting Fish, Pill Bugs, Brine Shrimp (wet lab) [C⁸]</i></p>	50, 51, 52, 53, 54, 55	2 weeks

Teaching Strategies

My lectures focus on the relationship between the eight themes presented in the AP Biology curriculum requirements and each unit of study. [C⁶] In particular, evidence that evolution is the foundation of modern biological models and thought. I incorporate the factors used in making phylogenetic trees (i.e.: the endosymbiotic event, presence of the process of glycolysis in all domains, universal genetic code, embryology, symmetry, common ancestors, homologous structures, etc.) [C⁵]

In general, class time is spent in lecture/class discussion or in lab activities. Students are given guided reading questions for each chapter to use in taking notes in preparation for lecture. A great deal of outside reading and independent work is required of each student. The time commitment equates to a minimum of one hour per evening. Lectures are supplemented with diagrams, visuals, explanations and examples to connect the new concepts to pre and post chapters. [C⁴]

In reviewing for the AP Exam we practice multiple-choice questions from AP Central, the Released Exams, and test preparation books. The *end of year review* begins approximately 1-2 weeks prior to the AP Exam. We revisit our ten units of study and the twelve AP labs.

In a continual effort to develop student's written expression we practice writing and scoring past Free-Response questions. Students are also required to read, analyze and critique scientific articles in the form of abstracts. All students write a research paper using proper research techniques and resources which focuses on the ethics of genetic engineering as it relates to societal concerns. [C⁷]

Lab Component

Students work in pairs to complete all of the labs in the *AP Biology Lab Manual for Students*, as well as a variety of labs I have designed or taken from other sources. [C⁸]

Students perform a lab or more each week and are required to present their findings for evaluation. These write-ups vary depending on the type of lab and may include the following: an organized data table with graph and conclusions, a dissection diagram with labels of structure and function, the actual wet slides or models created in lab, answers to lab questions or their solution to a problem.

For the AP labs, students are required to complete a pre-lab assignment, all questions in the *AP Biology Lab Manual* and present a full lab report at the conclusion of the lab. Students are given a week to complete all formal lab write-ups. I stress quality over length and am looking to see that they have made the connection between the facts and the biological process that is occurring. [C⁴]

The students are required to keep a laboratory notebook to submit as evidence of coursework for college credit. The notebook will include all laboratory work for the

year. As most lab work is completed with very little assistance from me, the development of critical thinking skills and the ability to solve problems on their own is an essential part of their laboratory experience.

Student Evaluation

Students are evaluated on their performance on the unit exams, research paper/presentations, free-response questions, labs, and the homework they complete.

Category	Percentage of Grade
Unit Exams and Final	65%
Research Paper/Presentations/Formal Labs/Quizzes	25%
Homework/Abstracts/Essays/Informal Labs	10%
	100%