

AP Biology Syllabus

Introduction

This course is designed to be the equivalent of a two-semester college introductory biology course. Successfully completing this course will allow freshman to take upper-level courses in biology or register for courses for which biology is a prerequisite. Other students will be able to use this course to fulfill the basic requirement for a laboratory-science course in particular major.

Students who choose to take AP Biology should have completed the first course in high school biology and high school chemistry. Other factors that should be considered are student self-motivation and parental support. Working together, these factors should lead students in successful completion of the AP Biology goals.

Course Overview

The class meets five days a week for 149 days. Each class period is 94 minutes long. 25 percent of this time will be dedicated to laboratory experiences, the required 12 AP Labs and some additional labs. These will allow students to apply their knowledge of biological concepts while practicing the process of scientific investigation.

Topics

AP Biology will cover the biological concepts as they relate to three main topics. They are *Molecules and Cells*^{C1}, *Heredity and Evolution*^{C2} and *Organisms and Populations*^{C3}. Eight themes will unite the main topics.

- ^{T1}Students will be able to understand science as a process instead of an accumulation of facts.
- ^{T2}Students will grasp the idea that evolution is the foundation of biological models and thought. The text, Biology, states that “some element of evolutionary perspective is in every specialized field within biology”. (Page 8)
- ^{T3}Energy transfer is important to all living organisms. Learning how the sun begins the energy cycle between photoautotrophs and heterotrophs will help students understand the source of energy that fuels all organized, biological levels.
- ^{T4}Students will embrace the idea that continuity and change, relating to DNA, work together for species survival.
- ^{T5}Relating structure to function at all levels of organization will help students understand how living organisms and living systems operate so efficiently.
- ^{T6}Regulation is very important to consider because all living systems must be in balance with each other through positive and negative feedback mechanisms.
- ^{T7}This theory invites students to look for evidence of interdependency between organisms, as they exist in nature.
- ^{T8}Students will be able to recognize how scientific investigation has led to technological advances that can have positive and/or negative impacts upon society as a whole.

Textbooks

Solomon, Berg, and Martin. *Biology*, Thompson, 7th edition (2005)
Lab Manual: AP Biology. *Lab Manual for Students* (Revised 2001) *All students receive a copy of both the book and the lab manual.

Additional Resource Materials

The following are used in designing lessons, journal entries, tests, and labs.

- Solomon, Berg, and Martin. *Biology Instructor's Manual*, Thompson, 7th edition (2005)
- Daniel, Ronald S., Sharon Calloway Daniel, and Ronald R. Taylor. *Study Guide for Solomon, Berg, and Martin's, Biology*, Thompson, 7th edition (2005)
- Haskel, Sebastian. *AMSCO'S AP Biology, Preparing for the Advanced Placement Examination*, AMSCO, 2nd edition (2006)
- Carolina Biological Supply Catalogue: *AP Lab Supply Section* (Pages change with year published)

Magazine

- Science News, The Weekly Newsmagazine of Science; Editor, Elizabeth Marincola (Articles and Pictures reflecting current science news and technology)

Software

- Microsoft. *Multimedia Manager for Biology*: Solomon, Berg, and Martin's *Biology*, 7th edition, Thompson (2005)

Websites

- <http://bio.kimunity.com>: Great multimedia resource
- labbench/index.html: Great for AP Lab simulations to introduce the 12 labs
- www.cellsalive.com: Great videos and animations

Additional resources will be sited later as they specifically apply.

Curriculum Map

Biochemistry^{C1} (12 Days)

Content

- Water
- Organic molecules in organisms
- Free energy changes
- Enzymes

Skills^{T1,T5}

- Understand the relationships among these concepts
- Relate properties of water to the xylem of the plant
- Site specific examples of how organic molecules are used in the cells of plants and animals
- Relate free energy to the sodium/potassium pump and/or the xylem of the plant
- Relate enzymes to DNA synthesis

Resources

- Lecture (**Text; Chapters: 2-3, 6**); See resources above
- Visuals; See resources above

- Lab: **Time (.75 days)**: Teacher-created (Organic Compounds in My Kitchen; use indicators like Iodine, Benedicts, and Biuret)
- Lab: **Time (1.25 days)**: **AP Lab 2** (Enzyme Catalysis) Carolina Biological Supply Company
- Journal Entries; See resources above

Assessment

- Unit Test
- Lab Entries
- Journal Entries

The Cell: Structure and Function^{C1} (14 Days)

Content

- Prokaryotic and Eukaryotic Cells
- Membranes
- Subcellular Organization
- Cell Cycle and Its Regulation

Skills^{T1, T2, T5, T6}

- Compare/Contrast bacteria and animal cells; Phylogeny of cells
- Active and Passive Transport with membrane components
- Organelle structure and function in plant and animal cells
- Relate the cell cycle and surface area to volume ratio of the cell

Resources

- Lecture (**Text; Chapters 4-5**); See resources above
- Visuals; See resources above
- Lab: **Time (1.25 Days)**: **AP Lab 1** (Diffusion and Osmosis) Carolina Biological Supply Company
- Lab: **Time (.5 Days)**: Teacher-created (Microscope; Plant and Animal Cells, Differentiation)
- Lab: **Time (.5 Days, in the classroom)**: Holt, Rinehart and Winston. *BioSources; Cell Size*, E1, Harcourt Brace & Company (1999)
- Cell Structure/Function Worksheet: Teacher-created (Analogy, High School)
- Journal Entries; See resources above

Assessments

- Unit Test
- Homework Check: Analogy
- Lab Entries
- Journal Entries

Molecular Genetics^{C2} (13 Days)

Content

- RNA and DNA Structure and Function
- Gene Regulation
- Mutation
- Viral Structure and Replication
- Nucleic Acid Technology and Applications

Skills^{T1, T4, T5, T6, T7, T8}

- Relate the history of DNA
- Compare/Contrast DNA and RNA structure and function
- Explain processes of transcription and translation, including regulators involved
- Compare base mutations to chromosomal mutations and explain these mutations
- Interpret the idea that DNA is the code of life and point out how this relates to evolution
- Elucidate DNA technology and interpret the uses for this technology

Resources

- Lecture (**Chapters 11-14**); See resources above
- Visuals; See resources above
- Student-lead Presentations on the History of DNA (Facts about scientists and research that lead to the discovery of DNA): Internet, Texts, Visuals (See resources above)
- Manipulative; Prokaryote Operons (AP Biology Daily Lesson Plans, Genetics): Dotti, Kristen Daniels. www.catalystlearningcurricula.com, sample lesson (2005)
- Gene Mutations and Proteins Worksheet (MiniLab 11.2): Glencoe Science. Biology, *The Dynamics of Life*, McGraw Hill (2005), Page 300
- AA Comparison Chart: Holt, Rinehart and Winston. *Biology*; Text; Chapter 17, Pages 334-335; Harcourt Brace & Company (1999)
- Lab: **Time (3 Days): AP Lab 6** (Molecular Biology/Bacterial Transformation-DNA Extraction) Bio-Rad Laboratories; Bacterial Transformation Kit, Catalog # 166-0003
- Journal Entries; See resources above

Assessments

- Unit Test
- Student-lead Presentations: Rubric Completion
- Classwork Check: Gene Mutation and Proteins Worksheet
- Lab Entry
- Journal Entries

Classical Genetics^{C2} (12 Days)

Content

- Meiosis and Gametogenesis
- Eukaryotic Chromosomes
- Inheritance Patterns

Skills^{T1, T4, T5, T8}

- Relate meiosis to gametogenesis with product differences noted
- Recognize eukaryotic DNA as it relates to the cell cycle
- Explain the genetic diseases that relate to faulty meiotic processes and chromosomes
- Make predictions about many types of inheritance patterns, using Mendelian and Non-Mendelian Genetics with Punnett squares
- Describe how the human genome is related to current technology (Human Genome Project, Cloning, Gene Therapy, and Genetic Testing and Counseling)

Resources

- Lecture (**Text; Chapters 9-10; 15-16**); See resources above
- Visuals (Including Karyotypes); See resources above
- Meiosis Concept Map; Teacher-created
- Genetics Problems Worksheets (Designed to encompass examples related to all types of genetic inheritance); Teacher-created accumulations from previous years
- Student-lead Presentations on current technology relating to the human genome: Use Texts, Internet, Periodicals, and Visuals (See resources above)
- Lab: **Time (3 Days): AP Lab 3** (Mitosis and Meiosis) Carolina Biological Supply Company
- Lab: **Time (2.5 Days, initially and small parts of lab periods in the ensuing 3 weeks): AP Lab 7** (Genetics of Organisms) Carolina Biological Supply Company
- Journal Entries; See resources above

Assessment

- Unit Test
- Homework Check: Genetics Problems
- Student-lead Presentations: Rubric Completion
- Lab Entries
- Journal Entries

Evolution^{C2} (12 Days)

Content

- Early Evolution of Life
- Evidence for Evolution
- Mechanisms of Evolution

Skills^{T1, T2, T4, T5, T6}

- Relate conditions on early earth to hypotheses about cell development and early life
- Discern the differences in structural evidence for evolution and their inferences for common ancestry and divergent and convergent evolution
- Reveal the importance of fossil records, vestigial structures, embryological, chemical, biogeographical, and molecular evidences for evolution

- Site and explain the mechanisms of evolution, including genotype, phenotype, and gene frequencies (Hardy-Weinberg Principle); microevolution (non-random mating, mutations, genetic drift, gene flow, and natural selection); speciation (prezygotic and postzygotic barriers, allopatric and sympatric speciation; and macroevolution (adaptive radiation and extinctions)

Resources

- Lecture (**Text; Chapters 17-19**); See resources above
- Visuals; See resources above
- Skulls of vertebrates, including human; Study the skulls, making inferences about the phylogeny of vertebrates and relating jaw and teeth adaptations to the habitat and niche of the vertebrate; Teacher-created (Skull collection in classroom)
- Completing problems using the Hardy-Weinberg Principle; Review section (Page 356) and the Post-Test (Page 366; problems), Text; See resources above
- Use guided reading questions to enhance lecture-guided classroom discussion about mechanisms of evolution; Teacher-created
- Amino acid sequences among primates: *How Do Human Proteins Compare with Those of Other Primates*. McGraw-Hill, Biolab and Minilab Worksheet Workbook; Chapter 19, Page 74; Glencoe (1995)
- Lab: **Time (1 Day): AP Lab 8** (Population Genetics and Evolution) Carolina Biological Supply Company
- Journal Entries; See resources above

Assessments

- Unit Test
- Lab Entry
- Journal Entries

Energetics^{C1} (11 Days)

Content

- Coupled Reactions
- Fermentation and Cellular Respiration
- Photosynthesis

Skills^{T1, T3, T4, T5, T7}

- Make relationships among anabolic and catabolic reactions, endergonic and exergonic reactions, catabolism and anabolism, and equations of cellular respiration and photosynthesis
- Compare/Contrast photosynthesis and cellular respiration (including reactants, products, coenzymes, energy transference, intermediate compounds, cellular organelles involved, heterotrophs, and autotrophs)
- Describe the relationship of plant pigments to the visible spectrum and wavelength, and the importance to photosynthesis
- Learn the structure of the leaf and its importance in the photosynthetic process
- Relate fermentation to cellular respiration, using equations for both, relationships to cellular structures, and citing organisms that use each and explanations for this

- Recall the phylogeny of energy as it was used and converted as organism evolved

Resources

- Lecture (**Text; Chapters 6-8**); See resources above
- Lab: **Time (.5 Days, in the classroom)**: Teacher-created (Answer the questions relating to cellular respiration, including “Is cellular respiration breathing?” Use crickets, elodea and Bromothymol Blue)
- Lab: **Time (1.5 Days): AP Lab 4** (Plant Pigments and Photosynthesis) Carolina Biological Supply Company
- Lab: **Time (1.5 Days): AP Lab 5** (Cell Respiration) Carolina Biological Supply Company
- Fermentation Demonstration; Teacher-created (Apple juice, yeast, balloons, test tubes, and a heat source)
- Journal Entries; See resources above

Assessments

- Unit Test
- Lab Entries
- Journal Entries

Domains of Life, Biodiversity^{C3} (12 Days)

Content

- Evolutionary Patterns
- Survey of the diversity of life
- Phylogenetic Classification
- Evolutionary Relationships

Skills^{T1, T2, T3}

- Evaluate the evolutionary patterns of organisms, using the geologic time scale, characteristics revealed through the fossil record, and the hypothesized environmental conditions on a changing earth
- Describe the importance of systematics in the study of organisms, relating taxonomy and classification to this idea
- Explain general characteristics of groups of organisms and individual and/or group relationships based on taxonomic categories and binomial nomenclature
- Apply the concept of shared derived characteristics to the classification of organisms
- Identify methods of molecular biology now used by taxonomists, and summarize the advantages of molecular taxonomy
- Contrast monophyletic, paraphyletic, and polyphyletic taxa
- Compare and contrast two approaches to systematics: evolutionary systematics and cladistics (phylogenetic systematics)

Resources

- Lecture (**Chapters 20-26**); See resources above

- Dry Lab: **Time (.5 Days)**: Teacher-created (Use general characteristics to place specimen into kingdoms); Use pictures that demonstrate a wide variety of organisms
- Visuals to depict diagrams of molecular taxonomy, evolutionary relationships, and the two major approaches to systematics; See resources above
- Study Guide Worksheet for Chapters 20 and 22; See resources above
- Journal Entry: See resources above

Assessments

- Unit Test
- Lab Entry
- Homework Check:
- Study Guide Worksheets
- Journal Entries

Plant Anatomy and Physiology^{C3} (15 Days)

Content

- Reproduction, Growth, and Development
- Structural, Physiological, and Behavioral Adaptations
- Response of the Environment

Skills^{T1, T4, T5, T6, T7}

- Compare/Contrast the alternation of generations in the life cycles of mosses, ferns, pines, and flowering plants
- Relate the differences in life cycles to the phylogeny of plants
- List and describe the adaptations needed for plants to live as terrestrial organisms
- Make clear the differences between monocots and dicots, including stem growth
- Illuminate the important functions of leaves and flowers, using their anatomy
- Explain at least 2 behavioral adaptations in stems, flowers, roots, and leaves that aid plants in the struggle to survive
- Illustrate the coevolution of plants and pollinators
- Interpret behavior in plants through hormones and environmental influences
- Relate plant hormones to technology (commercial applications)

Resources

- Lecture (**Text; Chapters 26-27; 31-35**); See resources above
- Visuals; See resources above
- Lab: **Time (.25 Days)**: Seed Anatomy, using germinating peas: McLaren, James E. and Lissa Rotundo. *Interpreting and Applying*; Study Guide 22A, D. C. Heath and Company (1989)
- Students bring to class and explain 2 behavioral adaptations in plant structures
- Student-lead Class Discussion; Hormones and Plant Behavior
- Lab: **Time (1 Day)**; **AP Lab 9** (Transpiration) Carolina Biological Supply Company

- Lab: **Time (.5 Days)**; Wet Lab; Teacher-modified (Given to me several years ago); (Gravitropism in corn plants); Minimum time over several days to record data. Complete analysis questions out of class.
- Journal Entries; See resources above

Assessments

- Unit Test
- Student-lead Class Discussion: Rubric
- Lab Entries
- Journal Entries

Animal Anatomy and Physiology^{C3} (30 Days)

Content

- Reproduction, Growth, and Development
- Structural, Physiological, and Behavioral Adaptations
- Response to the Environment

Skills^{T1, T2, T4, T5, T6}

- Establish the phylogeny of animals, using symmetry, presence of a coelom, and animal examples
- Create a chart that includes the major animal phyla and the type of digestion, circulatory, excretory, respiratory, nervous, muscular, and skeletal organs/systems that are common to each
- A study of the following systems in the human body and the homeostatic and adaptive roles they play: Muscular/Skeletal, Digestive, Circulatory, Excretory, Nervous, Immune and Endocrine
- Identify examples of innate and learned behavior that aid animals in their ability to adapt to the environment

Resources

- Lecture (**Text; Chapters 37-50**); See resources above
- Visuals; See resources above
- Student-created charts using the text (resources above) and internet websites
- Lab: **Time (1.5 Days): AP Lab 10** (Physiology of the Circulatory System) Carolina Biological Supply Company
- Lab: **Time (1 Day)**: Teacher-created (Ascaris, Earthworm, and Frog Dissections: Used to demonstrate coelom types, anatomical complexity, and make relationships to human anatomy: McLaren, James E. and Lissa Rotundo. *Heath Biology*, D. C. Heath and Company (1989)
- Lab: **Time (2 Days): AP Lab 11** (Animal Behavior) Carolina Biological Supply Company
- Journal Entries; See resources

Assessments

- Unit Quiz: Chart (overview of animals)
- Unit Test: Human Anatomy and Physiology

- Unit Quiz: Animal Behavior
- Lab Entries
- Journal Entries

Ecology^{C3} (16 Days)

- Population Dynamics
- Communities and Ecosystems
- Global Issues

Skills^{T1, T3, T6, T7, T8}

- Define population density and dispersion, and describe the main types of population dispersion
- Explain four factors that produce changes in population size
- Describe the differences and similarities between the J-shaped and S-shaped growth curves, indicating populations examples for each
- Contrast density-dependent and density-independent factors and indicate their influence on populations size, supporting this with examples
- Distinguish between r and K strategists and site examples of organisms who fit neither category
- Summarize the history of human population growth
- Explain the differences in population characteristics for highly developed and developing countries
- Define niche, habitat, competition, and symbiotic relationships, and succession and how these interact to give structure and function to a community
- Describe the flow of energy and biological magnification through food webs and chains
- Compare gross primary productivity and net primary productivity as they relate to ecosystems
- Explain how the earth is a closed system, using four biogeochemical cycles in the explanation
- Relate the affects of abiotic factors (solar radiation, atmosphere, ocean, climate, and fire) on ecosystems
- Briefly describe the nine major biomes, including climate, soil, flora, and fauna
- Distinguish among threatened, endangered, and extinct species and the causes for declining biological diversity
- Explain how humans are addressing the issue of declining biological diversity
- Review global issues like deforestation, global warming, and a declining stratospheric ozone.

Resources

- Lecture (**Text; Chapters 51-55**); See resources above
- Visuals; See resources above
- Use guided reading questions to enhance and provide depth to classroom discussion about the terms and concepts associate with ecosystems; Teacher-created

- Lab: **Time (1.5 Days): AP Lab 12** (Dissolved Oxygen and Aquatic Primary Productivity) Carolina Biological Supply Company
- Student Project; Biome Buddies (Creatures, a 3-D new animal species, created to exemplify a chosen biome), paper (1-2 pages), and oral presentation; Teacher-created with a rubric Later, we will classify these new creatures, using characteristics and taxonomic groups
- Journal Entry on global issues; Text, Internet, and Current Periodicals
- Journal Entry; See resources above

Assessments

- Unit Test
- Biome Buddies Project Grade
- Lab Entry
- Journal Entries

The remaining 2 days of class before the AP Exam will be spent reviewing a released AP Exam (using it as a diagnostic tool to guide deeper review) and discussing AP test-taking skills. Every student is expected to take the AP Exam.

After the AP Exam

The students will classify the Biome Buddies, use owl pellets (Carolina Biological Supply Company) to reconstruct a prey skeleton (discussing the habitat of the owl and prey, and adaptations, physical and behavioral, of the owl), and dissect a fetal pig (Carolina Biological Supply Company), using it’s anatomy to make a comparison to human anatomy.

Grade Determination

The county mandates the grading rules at this high school. We are to adhere to the following grading rules.

Tests	60%
Classwork/Labs/Quizzes/Essays/Projects	30%
Homework	10%

The AP labs are graded as lab tests because of the comprehensive knowledge required by the students to complete the lab entry or write-up. Journal entries will be graded as essays. The two entries for each unit will be elaborations on a concept in the unit and a practice free-response question.

