

# **AP Biology Syllabus**

## **Personal Philosophy**

**I take a very personal approach to teaching. I talk about a topic that I love, biology, and I present an intimate look at a place that I love, Earth. I try to develop a love of learning by creating a welcoming atmosphere in the classroom.**

**I truly feel that my students are the leaders of the future, and it is fun to encourage them to appreciate their own energy, their intelligence, their potential and their youth. Because I love biology, I have tried to examine and experience living things, both in the laboratory and by traveling near and far. By enthusiastically sharing my own experiences, I hope to nurture curiosity, a love of learning, and to develop life-long learners.**

**I encourage thought-provoking questions, even if those questions create a detour from the topic. Students learn to accept the ideas of others without ridicule or contempt because I encourage cooperation rather than competition.**

**By teaching the students the AP Biology curriculum, I try to show them science as a process of experimentation and discovery, and I hope to inspire confidence that they can and will contribute to the body of scientific knowledge, or any body of knowledge, in the future.**

## **Course Overview**

**This course is designed for students to have a good understanding of biological concepts and specific details, and to understand the relevance of the material to themselves and to society.**

**My curriculum follows the syllabus published by the College Board, and topics are correlated with the 8 major themes in biology. Biology is presented as an ongoing process with an emphasis on evolution.**

**All curricular requirements (see below) are met many times throughout the course, and are indicated in the Course Planner below.**

## Evidence of curricular requirement

- C1 Molecules and cells
- C2 Heredity and evolution
- C3 Organisms and populations
- C4 An understanding of science as a process rather than an accumulation of facts
- C5 Recognition of evolution as the foundation of modern biological models and thought
- C6 The integration of the general topics of biology through the eight major themes as specified in the AP Biology Course Description
  - Major Themes
    - Science as process
    - Evolution
    - Energy transfer
    - Continuity and change
    - Relationship of structure to function
    - Regulation
    - Interdependence in nature
    - Science, technology and society
- C7 Applications of biological knowledge and critical thinking to environmental and social concerns
- C8 The course includes a laboratory component that fulfills all of the objectives of the recommended AP Biology labs as listed in the AP Biology Course Description. Students must spend a minimum of 25% of instructional time engaged in hands-on laboratory work.

Textbook: Biology by Solomon, Berg and Martin 6th edition 2002  
Brooks/Cole

Lab manual: The AP Biology Lab Manual for Students Revised 2001  
The College Board

Review book CliffsAP Biology by Phillip Pack 2nd edition 2001  
IDG Books Worldwide, Inc.

## Additional instructional materials:

The AP Biology Lab Manual for Teachers Revised 2001, The College Board  
Campbell and Reece: Biology 6<sup>th</sup> edition 2002, Benjamin/Cummings  
Curtis and Barnes: Biology 5<sup>th</sup> edition 1989, Worth Publishers  
Princeton Review Biology, Anatomy coloring books  
Harper Collins Publishers Biology, Anatomy coloring books

## Teaching Strategies

Classes meet every day for 90 minutes and consist of lecture, discussion and laboratory activities. Student grades are based on exams, quizzes, lab reports and homework.

All topics are presented as examples of evolution and the unity and interdependence of nature. Almost every topic has an accompanying lab activity (see Course Planner).

## Course Planner

Topic: Molecules and Cells

Unit 1: The Organization of Life                      C1, C4, C8

Chapter 1. A view of Life

The Scientific Method

Activity: Answer a "design an experiment" free response question including all elements of scientific method

Chapter 2. Atoms and Molecules: the Chemical Basis of Life

Inorganic chemistry, bonding, properties of water, pH

Lab: Examine properties of water: cohesion, adhesion, expansion upon freezing

Chapter 3. The Chemistry of Life: Organic Compounds

Organic chemistry, carbohydrates, lipids, proteins, nucleic acids, dehydration synthesis

Lab: Using ball and stick model set to construct biological molecules

Lab: Use ball and stick molecules to demonstrate dehydration synthesis

Exam: chapters 1, 2, 3

Chapter 4. Organization of the Cell

prokaryote vs. eukaryote and plant vs. animal subcellular organization, organelles, microscopes

Lab: Microscope: Compare and contrast prokaryotic and eukaryotic cells; compare and contrast plant and animal cells

Chapter 5. Biological Membranes

fluid mosaic model, structure, diffusion, osmosis, various functions

Activity: Draw fluid mosaic model of plasma membrane

Activity: Create timeline of discoveries leading to current knowledge of membrane structure

AP Lab 1: Diffusion and Osmosis

**Unit 2: Energy Transfer**                      C1, C8

**Chapter 6. Energy and Metabolism**

free energy changes, coupled reactions, enzyme structure and function, biochemical pathways, feedback inhibition

**Lab:** Graphing enzyme kinetics: what is happening to concentration of enzyme, substrate and

product in

the test tube and in the cell?

**AP Lab 2:** Enzyme Catalysis

**Exam:** chapters 4, 5, 6

**Chapter 7. Cellular Respiration**

glycolysis, fermentation, Krebs cycle, chemiosmosis, mitochondria

**Activity:** Draw and label glycolysis, fermentation and Krebs cycle pathways indicating the carbons and any high energy molecules consumed or synthesized

**Activity:** Draw and label the electron transport chain, chemiosmosis and oxidative phosphorylation

**AP Lab 5:** Cell Respiration

**Exam:** chapter 7

**Chapter 8. Photosynthesis**

light energy, photosynthetic pigments, chloroplast, light dependent and light independent reactions

**Activity:** Create timeline of discoveries leading to current knowledge of photosynthesis

**AP Lab 4:** Plant Pigments and Photosynthesis

**Exam:** chapter 8

**Topic:** Heredity and Evolution

**Unit 3: The Continuity of Life: Genetics**                      C2, C4, C5, C6, C8

**Chapter 9. Chromosomes, Mitosis and Meiosis**

Chromosome structure and asexual cell division in prokaryotes and eukaryotes, cell cycle regulation, formation of gametes in eukaryotes, mammalian spermatogenesis and oogenesis, genetic variation

**Lab:** Assemble human karyotype: paper cut-out using Ward's kit

**Lab:** Crossing over: paper cut-out using chromosome cartoons and resultant chromatids after crossing over

**AP Lab 3:** Mitosis and Meiosis

**Chapter 10. Basic Principles of Heredity**

Mendelian genetics, segregation, independent assortment, modes of inheritance, genetic variation

Lab: Mendel's Laws: manipulate paper cut-outs of chromosome cartoons demonstrating segregation and independent assortment during meiosis

**Chapter 15. The Human Genome**

Symptoms and inheritance of human genetic

disease,

mutation, pedigrees

AP Lab 7: Genetics of Organisms, using Fruffy manipulative (Hubbard Scientific) and  $\chi^2$  statistical test

Exam: chapters 9, 10, 15

**Chapter 11. DNA: the Carrier of Genetic Information**

DNA and RNA structure, how do we know that DNA is the genetic material, DNA replication, mutation

Activity: Read Watson and Crick 1953 Nature article

Lab: Assemble DNA molecule: paper cut-outs of

component

molecules

**Chapter 12. RNA and Protein Synthesis**

Transcription, structure and function of mRNA, tRNA, rRNA, ribosomes, translation

Activity: Translation video, filmed by previous Genetics class

Lab: Transcription and translation: paper cut-outs of component molecules from DNA to protein

Exam: chapters 11, 12

**Chapter 13. The Control of Gene Expression**

Gene regulation: Prokaryotes: operons, positive and negative feedback, Eukaryotes: transcription factors, enhancers, activators

Lab: Lac operon mutation problems: how is regulation affected by mutations in the elements of the lac operon?

**Chapter 14. Genetic Engineering**

Nucleic acid technology and applications:

Restriction

enzymes and digestion, cloning, gel electrophoresis, PCR, DNA sequencing, Southern blots

**Lab:** Construct restriction map from DNA sequence  
**AP Lab 6A:** Molecular Biology: Transformation  
**AP Lab 6B:** Molecular Biology: Restriction digestion  
and gel electrophoresis  
**Exam:** chapters 13, 14

**Unit 4:** The Continuity of Life: Evolution            C2, C3, C5, C6, C8

**Chapter 17. Introduction to Darwinian Evolution**  
Evidence supports evolution, natural selection  
**Lab:** Examination of fossils: different ways fossils are  
formed

**Chapter 18. Evolutionary Change in Populations**  
Mechanisms of evolution: microevolution, Hardy-  
Weinberg equilibrium  
**AP Lab 8:** Population Genetics and Evolution

**Chapter 19. Speciation and Macroevolution**  
Mechanisms of evolution: macroevolution

**Chapter 20. The Origin and Evolutionary History of Life**  
Early evolution of life  
**Exam:** chapters 17, 18, 19, 20

**Topic:** Organisms and Populations

**Unit 5:** The Diversity of Life                            C1, C2, C3, C8

**Chapter 22: Systematics**  
Evolutionary patterns and relationships, morphology,  
taxonomy, classification, phylogenetic trees,  
cladograms, 3 domains  
**Lab:** Construct cladogram from specimens

**Chapter 23. Viruses and Bacteria**  
Viral structure and replication, lysogenic and lytic life  
cycles, Bacterial structure and metabolism,  
transduction, conjugation, transformation  
**Lab:** Examine microscope slides and plastimounts

**Chapter 24. The Protists**  
Protozoa, algae, fungus-like protists, life cycles  
**Lab:** Examine microscope slides and plastimounts

**Chapter 25. Kingdom Fungi**  
Structure and functions, life cycles

**Lab:** Examine microscope slides and plastimounts  
**Exam:** chapters 22, 23, 24, 25

**Unit 6:** Structure and Life Processes in Plants C1, C3, C6, C8

**Chapter 26. The Plant Kingdom: Seedless Plants**  
Plants from water to land; bryophytes, ferns

**Lab:** Examine live specimens, microscope slides and plastimounts

**Chapter 27. The Plant Kingdom: Seed Plants**  
Gymnosperms and angiosperms, monocots and dicots

**Lab:** Examine live specimens, microscope slides and plastimounts

**Chapter 31. Plant Structure, Growth and Differentiation**  
Plant cells and tissues

**Lab:** Examine microscope slides

**Lab:** Examine growing lima beans in petri dish

**Chapter 32. Leaf Structure and Function**  
Leaf tissue, stomates

**Lab:** Examine microscope slides, leaf dissection

**Exam:** chapters 26, 27, 31, 32

**Chapter 33. Stems and Plant Transport**  
Herbaceous and woody stem structure, xylem and phloem

**Lab:** Examine specimens and microscope slides,

**Chapter 34. Roots and Mineral Nutrition**  
Root structure and function, nutrition

**Lab:** Examine specimens and microscope slides

**Chapter 35. Reproduction in Flowering Plants**  
Flower structure and function; fruits, seeds

**Lab:** Examine specimens, flower dissection

**Chapter 36. Growth Responses and Regulation of Growth**  
Hormones; phytochrome

**AP Lab 9:** Transpiration: demo and discussion

**Exam:** chapters 33, 34, 35, 36

**Unit 7:** Structure and Life Processes in Animals C1, C3, C6, C8

**Chapter 28. The Animal Kingdom: Animal Diversity**  
Animal phylogeny: tissue type, symmetry, germ

layers, cleavage, coelom,  
**Lab:** Examine specimens and microscope slides

**Chapter 37. The Animal Body**  
Tissue types, thermoregulation  
**Lab:** Examine microscope slides

**Chapter 38. Skin, Skeleton and Muscle**  
Epithelial tissue, bone tissue, muscle structure and  
muscle contraction  
**Lab:** Examine microscope slides  
**Exam:** chapters 28, 37, 38

**Chapter 39. Neural Signaling**  
Neuron structure and function, impulse generation,  
synapses

**Chapter 40. Neural Regulation**  
Vertebrate brain, nervous systems

**Chapter 41. Sensory Reception**  
sensory receptors: mechano-, chemo-, thermo-,  
electro-, photo-

**Chapter 47. Endocrine Regulation**  
Hormones, endocrine organs  
**Exam:** chapters 39, 40, 41, 47

**Chapter 42. Internal Transport: Circulation**  
Circulatory systems, heart, blood  
**AP Lab 10:** Physiology of the circulatory system (10A,  
10B)  
**Lab:** Examine microscope slides

**Chapter 44. Gas Exchange**  
Respiratory systems, gills, lungs  
**Exam:** chapters 42, 44

**Chapter 45. Processing Food and Nutrition**  
Digestive tract, digestion, nutrition

**Chapter 46. Osmoregulation and Disposal of Metabolic Wastes**  
Excretory systems, kidney structure and function

**Chapter 43. Internal Defense**  
Immune System, nonspecific, specific, antibody  
mediated, cell mediated

**Exam:** chapters 45, 46, 43

**Chapter 48. Reproduction**

Male and female structures and functions, hormones, menstrual cycle, conception, birth

**Lab:** Examine microscope slides

**Chapter 49. Animal Development**

Fertilization, cleavage, gastrulation, extraembryonic membranes

**Activity:** Development video: A Dozen Eggs: Time-Lapse Microscopy of Normal Development by Fink 1991  
Sinauer Associates

**Lab:** Examine microscope slides

**Chapter 16. Genes and Development**

Cell differentiation

**Lab:** Examine microscope slides

**Exam:** chapters 48, 49, 16

**Chapter 50. Animal Behavior**

Learning, communication, sexual selection

**AP Lab 11:** Animal Behavior, demo and discussion

**Exam:** chapter 50

**Unit 8:** Interactions of Life: Ecology

C3, C5, C6, C7, C8

**Chapter 51. Population Ecology**

Mathematical models

**Chapter 52. Community Ecology**

Nutritional types, Niche, competition

**Chapter 53. Ecosystems and the Biosphere**

Carbon, phosphorus, nitrogen and water cycles

**AP Lab 12:** Dissolved Oxygen and Aquatic Primary Productivity, demo and discussion

**Chapter 54. Ecology and the Geography of Life**

Biomes and ecosystems

**Chapter 55. Humans in the Environment**

Global issues, human damage: habitat destruction

**Exam:** chapters 51, 52, 53, 54, 55

## **Lab Component**

The importance of laboratories in the course not only reinforces the topic material, but also emphasizes the idea that science is a process, and emphasizes the question "How do you know?"

Students perform AP Biology Laboratories 1, 2, 3, 4, 5, 6, 7 and 8 as hands-on labs. With the exception of the remaining AP Biology Labs (which are presented as demonstrations with discussion and are so indicated in the Course Planner), all labs are hands-on and are indicated in the Course Planner. For almost all chapters, students perform labs written by me. Students must write a complete lab report for all labs. In this way, 25% of class time is devoted to hands-on laboratory exercises.

All microscope labs and labs with observations of specimens and plastimounts require detailed drawings. Drawings are made with colored pencils and must accurately indicate the specimen. Each drawing must indicate the name of the specimen and be fully labeled. The lab report includes a discussion with appropriate questions relating to the major themes. For example, the discussion may ask the student to associate structure and function, or to construct a cladogram.

## **Student Evaluation**

Written exams generally consist of 40 multiple choice and 2 free response questions. Students take approximately 60 short unannounced quizzes throughout the year. They write homework from the textbook or worksheets, and they write laboratory reports as described above.