AP® BIOLOGY SYLLABUS

Introduction

The AP Biology course is designed to be the equivalent of a college introductory biology course usually taken by biology majors during their first year. *After showing themselves to be qualified on the AP Examination, some students, as college freshman, are permitted to undertake upper-level courses in biology or to register for courses for which biology is a prerequisite. Other students may have fulfilled a basic requirement for a laboratory-science course and will be able to undertake other courses to pursue their majors.*

AP Biology should include those topics regularly covered in a college biology course for majors. The college course in biology differs significantly from the usual first high school course in biology with respect to the kind of textbook used, the range and depth of topics covered, the kind of laboratory work done by students, and the time and effort required of students. The textbooks used for AP Biology will be like those used by college biology majors. The kinds of labs done by AP students will be the equivalent of those done by college students.

The AP Biology course is designed to be taken by students after successful completion of CP/HP Biology and CP/HP Chemistry. It aims to provide students with the conceptual framework, factual knowledge, and analytical skills necessary to deal critically with the rapidly changing science of biology.

The Course

The AP Biology Development Committee conducts surveys in which professors at colleges regularly receive the most AP candidates. They respond to a questionnaire asking them to describe the content of their introductory biology courses for biology majors. The AP course description that follows was developed by the AP Biology Development Committee after a thorough analysis of survey results.

The AP Biology Examination seeks to be representative of topics covered by the survey group. Accordingly, goals have been set for percentage covered of three general areas:

I. Molecules and Cells, 25%

II. Heredity and Evolution, 25%

III. Organisms and Populations, 50%

The two main goals of AP Biology are to help students develop a conceptual framework for modern biology and to help students gain an appreciation of science as a process. The ongoing information explosion in biology makes these goals even more challenging. Primary emphasis in an AP Biology course should be on developing an understanding of concepts rather than on memorizing terms and technical details. Essential to this conceptual understanding are the following: a grasp of science as a process rather than as an accumulation of facts; personal experience in scientific biology; and application of biological knowledge and critical thinking to environmental and social concerns.

Topics, Concepts, and Themes as Used in AP Biology

Topic Outline		% of Course
I. **Molecules and Cells**		**25%**
A. Chemistry of Life	7%	
Water		
Organic molecules in organisms		
Free energy changes		
Enzymes		
B. Cells	10%	
Prokaryotic and eukaryotic cells		
Membranes		
Subcellular organization		
Cell cycle and it's regulation		
C. Cellular Energetics	8%	
Coupled reactions		
Fermentation and cellular respiration		
Photosynthesis		
II. **Heredity and Evolution**		**25%**
A. Heredity	8%	
Meiosis and gametogensis		
Eukaryotic chromosomes		
Inheritance patterns		
B. Molecular Genetics	9%	
RNA and DNA structure and function		
Gene regulation		
Mutation		
Viral structure and replication		
Nucleic acid technology and applications		
C. Evolutionary Biology	8%	
Early evolution of life		
Evidence for evolution		
Mechanisms of evolution		
III. **Organisms and Populations**		**50%**
A. Diversity of Organisms	8%	
Evolutionary patterns		
Survey of the diversity of life		
Phylogenetic classification		
Evolutionary relationships		
B. Structure and Function of Plants and Animals	32%	
Reproduction, growth, and development		
Structural, physiological, and behavioral adaptations		
Response to the environment		
C. Ecology	10%	
Population dynamics		
Communities and ecosystems		
Global issues		

Major Themes

In the attempt to develop unifying concepts in biology, the AP Biology Development Committee has identified eight major themes that recur throughout the course. AP Biology teachers will emphasize the pervasiveness of the themes to assist students in organizing concepts and topics into a coherent, conceptual framework.

Major Themes

I. Science as a Process
II. Evolution
III. Energy Transfer
IV. Continuity and change
V. Relationship of Structure to Function
VI. Regulation
VII. Interdependence in Nature
VIII. Science, Technology, and Society

Themes can be applied across the entire curriculum and serve to unify the course. The following chart presents examples of various ways this may be done.

Theme	Molecules and Cells	Heredity and Evolution	Organisms and Populations
Science as a Process	How did Melvin Calvin and his students discover the sugar-producing cycle of photosynthesis?	How do we know DNA is the genetic material?	What can long-term ecological research teach us about human impact on the biosphere?
	Experiments with artificial membranes have added to our understanding of structure and function of the plasma membrane	X-ray diffraction, model building, and analysis of base pairing led to the development of the double helix model of DNA.	Measurements of rates of transpiration using parts of plants have helped biologists understand the roles of the roots and leaves.
Evolution	Chemical evolution on a young Earth set the stage for the origin of life.	Mutations and genetic recombination generate heritable variation that is subjected to natural selection.	When a population's local environment changes unfavorably, the population adapts migrates, or dies.
	C4 and CAM plants represent structural and biochemical adaptations for photosynthesis in hot and dry climates.	Natural selection occurred in early pre-life forms, as coacervates possessing enzymes for synthesis of various metabolites had more options for energy utilization and thus were more likely to survive.	The system of taxonomy used by most biologists today reflects our currents understanding of phylogenetic relationships among organisms.

Energy Transfer	Plants transform light energy into chemical energy. A proton gradient across membranes powers the synthesis of ATP in mitochondria, chloroplsts, and prokaryotes.	A cell must spend energy to transcribe and translate a gene because entropy decreases as monomers are organized into complex macromolecules. Energy released by the hydrolysis of ATP is used by cells in DNA synthesis, transcription, and translation.	Energy flows from producers to consumers in an ecosystem. Ion pumps in membranes reestablish a transmembrane resting potential after a neuron fires an impulse or a muscle fiber contracts.

Continuity and Change	The cell cycle clones a cell's DNA The process of mitosis allows for genetic continuity from generation to generation while at the same time, through mutation, it provides for diversity.	Like begets, but not exactly, as mutations and sex generate new genetic combinations. Changes in gene pools over time can be explained in part be natural selection for the most fit genotypes.	Homologous structures are variations on a common ancestral prototype. Organogenesis results from differential gene activation in various regions of an embryo at various times.

Relationship of Structure to Function	The distinctive functions of starch and cellulose reflect structural differences in these two polysaccharides. The membranous organization of the mitochondrion orders the process of cellular respiration.	By discovering the structure of DNA, Watson and Crick deduced how genes replicate. The complementary nature of the two DNA strands explains replication.	The large surface area of the mammalian small intestine increases absorption of nutrients. Morphological adaptations of parasites to their hosts enhance their survival.

Regulation	Control of the flow of molecules across the membrane maintains a favorable intracellular environment. Regulator molecules in the cell interact with some enzymes and control their activity by changing the shape of the enzymes.	Regulatory mechanisms switch genes on and off in response to environmental cues. A balanced polymorphism can exist within a population, in which two or more alleles can be kept in the gene pool by action of predators that selectively prey on the most common phenotype.	The nervous and endocrine systems mediate an animal's responses to changes in the environment. Hormones regulate the growth and development of both plants and animals.

Interdependence in Nature	At the metabolic level, photosynthesis and cellular respiration are mutually symbiotic. Energy for many biosynthetic processes is provided by the hydrolysis of ATP. In turn, the synthesis of ATP is coupled to the organic fuels.	An organism's phenotype is the synergistic product of genes and environment. The sporophyte and gametophyte generations of a plant are interdependent.	Destruction of tropical forests has global consequences. Competition, predation, and parasitism between populations in a food web contribute to the stability of an ecosystem.

Science, Technology, and Society	Advances in cancer research depend on progress in our basic understanding of how cells work. Various new techniques in microscopy have led us to a better understanding of basic cell structure and function	DNA technology is a double-edged sword, promising health advances and posing new ethical issues. Biotechnology has provided new treatments for various genetic diseases, developed crops with better yields, and provided solutions for environmental problems.	More people utilizing more technology have generated many current global problems. An understanding of basic ecological principles can help us to assess the human impact on the biosphere and to begin to develop solutions to some human-caused environmental imbalances.

The Laboratory Component

Students will work on the 12 required labs for AP Biology *and* several other labs to gain hands-on laboratory experience in each of the units covered. Most labs will take (2-3) 50 minute class periods making the 12 required labs over 40 days of the school year. Conducting the additional 8-10 labs/activities puts my course close to 30% of hands-on laboratory time in class. Students will be expected to perform the labs with little input from the instructor. Being able to read instructions carefully and follow procedure will be an integral part of the AP Biology lab. Laboratory work encourages the development of important skills such as detailed observation, accurate recording, experimental design, manual manipulation, data interpretation, statistical analysis and operation of technical equipment. Laboratory assignments offer the opportunity for students to learn about problem solving, the scientific method, the techniques of research, and the use of scientific literature. Laboratory investigations also encourage higher-order thinking, which may include evaluating and monitoring progress through an investigation, generating ideas, and formulating hypotheses.

Textbook: Campbell, Neil A., and Jane B. Reece. *Biology*. Upper Saddle River, NJ: Prentice Hall. *Seventh Edition*

AP Biology Lab Manual for Students (Organized into Packets) *

Book Report: All AP students are required to read one of James Rollins' books approved by the instructor and write a detailed book report linking the novel to concepts in biology. Book Titles: "*The Judas Strain*" or "*Black Order*"

Science Magazines: All AP students are required to subscribe to one science journal from these two (Scientific American or Discover). Each month we will compare magazines and discuss the "topics in science" that are happening now. *Up to 3 students may share one subscription to spread the cost.*

Grading

Tests	**50%**	
Labs & Lab reports	**30%**	*packets due the day after the lab
Quizzes	**10%**	
Projects/Readings/Homework	**10%**	

Course Planner

Unit	Lecture Topics and Subunits	Labs	Chapters	Month
First Quarter/Grading Period				
1	**Cellular & Molecular Biology** • Biochemistry • Cell structure & function (incl. Prokaryotes & Viruses) • Protein structure/function & enzymes • Macromolecules • Metabolism & Cellular Energy (animal) • Cell Cycle & Mitosis	**AP Labs:** • **1 -** Diffusion & Osmosis • **2 –** Enzyme catalysis • **5 –** Cell Respiration	1 – 9 11 – 12 & 27 *Read & Discuss Science Articles for Sept.	**Sept.**
2	**Genetics** • DNA/RNA Structure & Function • Central Dogma • Chromosomes & Alleles • Meiosis & Inheritance • Gene Control & Manipulation	**AP Labs:** • **3 –** Mitosis & Meiosis • **6 –** Molecular Biology • **7 –** Genetics of Organisms **Other Labs:** • Meiosis "Pop Bead" lab (pg. 159) *dry* • Mutation lab (pg. 223) *dry* • Pea Plant Seedlings lab *wet lab*	13 – 21 *Read & Discuss Science Articles for Oct.	**Oct.**

Unit	Lecture Topics and Subunits	Labs	Chapters	Month
Second Quarter (First Semester)/Grading Period				
3	**<u>Evolution of Organisms</u>** • The Origin of Life • Evidence for Evolution • Processes and Mechanisms • Phylogeny & Cladistics • Evolutionary Patterns & Relationships	**<u>AP Labs</u>:** • **8 –** Population Genetics & Evolution **<u>Other Labs</u>:** • Natural Selection lab (pg. 219) *dry • Genetic Drift lab (pg. 224)*dry* • Geologic Time lab (pg. 234)*dry* • Fossil Record & Human Evolution (pg. 236) *dry*	22 – 26 *Read & Discuss Science Articles for Nov/Dec	**Nov/Dec**
4	**<u>Plants & Fungi</u>** • Origin & Evolution • Plant Structures, Functions, & Adaptations • Photosynthesis • Reproduction, growth, & development • Plant Development & Responses to the Environment	**<u>AP Labs</u>:** • **4 –** Plant Pigments & Photosynthesis • **9 -** Transpiration **<u>Other Labs</u>:** • External Structure of a Flower lab (pg. 369) *wet lab* • Seedling lab (pg. 378) *wet lab*	10 & 29-31 35-39 *Read & Discuss Science Articles for Jan.	**Jan.**

Unit	Lecture Topics and Subunits	Labs	Chapters	Month
Third Quarter/Grading Period				
5	**<u>Animals & Protists</u>** • Origin & Evolution • Animal Development • Invertebrate form/function • Vertebrate form/function • Animal Behavior	**<u>AP Labs</u>:** • **11 –** Animal Behavior **<u>Other Labs</u>:** • Bird lab (pg. 494) *dry lab* • Mammal lab (pg. 496) *dry lab* • Mouse Maze lab *dry lab*	28 & 40 32 – 34 *Read & Discuss Science Articles for Feb.	**Feb.**
6	**<u>Comparative Anatomy & Physiology</u>** • Body Systems & Homeostasis • Skeletal/Muscular Systems • Digestive/Excretory Systems • Nervous/Endocrine Systems • Reproductive System • Circulatory/Respiratory Systems	**<u>AP Labs</u>:** **10 –** Physiology of the Circulatory System **<u>Other Labs</u>:** • Mammal Dissection (Rat or Pig) *wet lab* • Analysis of an Organ (pg. 536) *dry lab* • Systems lab (pg. 537) *dry lab*	40 – 49 *Read & Discuss Science Articles for Mar.	**Mar.**

Unit	Lecture Topics and Subunits	Labs	Chapters	Month
Fourth Quarter (Second Semester)/Grading Period				
7	**Ecology** • Population Ecology • Community Structure & Biodiversity • Ecosystem Structure & Biodiversity • The Biosphere & Humans	**AP Labs:** • **12 –** Dissolved Oxygen lab **Other Labs:** • Food Web & Energy Flow lab (pg. 713) *dry lab* • Survivorship lab (pg. 715) *dry lab* • Biological Sampling lab (pg. 730) *dry lab*	50 – 55 *Read & Discuss Science Articles for Apr.	**Apr.**
	Review for the AP Exam & Final Exam	Exam on May 9th 8:00 A.M.		**May**

Assessments:

Students are assessed several times a week. Reading assignments and graded notes will be assigned nightly (incl. weekends). Quizzes will follow a day of lecture. The "Post-lecture Quizzes" are designed to connect the previous day's lecture to continue forward with the material. The lecture will fill in the gaps and misunderstandings from the reading and it is also designed to discuss the topics being studied. There may be **one or two** tests in a unit that are 30-40 questions designed similarly to the MC questions on the AP examination. Each Unit will end with a **Unit Exam** that has multiple choice questions as well as **one or two** *free response* questions.