AP Biology Syllabus

Course Overview

This course is meant to be the equivalent of an introductory biology course in college. The objectives of the course are that each student shall demonstrate skills in using various types of biological instruments and scientific methodologies, learn to read and critique scientific genre, practice identifying and using patters in collected data to solve scientific problems, exhibit mastery of the major principles of biology, and apply critical thinking skills and their knowledge of biology to environmental and social concerns.

The entire AP Biology curriculum is covered in two classes, AP Biology and Advanced Biology which meet each day of the week for a total of 108 minutes each day. Students selecting to take the AP exam must take both AP Biology and Advanced Biology concurrently. Taken together the classes cover the entire AP Biology course work. Both courses provide a minimum of 25% of the course spent in laboratory work. Often, certain projects and some lab work necessitates that students spend additional time in the laboratory.

Students are expected to come to class prepared. The coursework is rigorous with a tremendous amount of material that needs to be discussed. AP Biology covers the following topics: from molecules and cells including energetic, cells, membranes, sub cellular organization, and cell cycle and regulation. Topics covered from heredity and evolution include gametogenesis, DNA and RNA structure and function, gene regulation, mutation, viral structure and replication, nucleic acid technology, early evolution of life, evidence for evolution and mechanisms of evolution. Topics covered from organisms and population include evolutionary pattern, survey of the diversity of life, phylogenetic classification, evolutionary relationships, reproduction, growth and development of plants and animals, structural, physiological, behavioral adaptations and responses to the environment, population dynamics, communities and ecosystems and global issues.

Advanced Biology covers the following topics: heredity, population genetics (including Hardy-Weinberg), basic biological chemistry of carbohydrates, lipids, proteins, and nucleic acids and the biochemistry of the light and dark reactions and the chemiosmotic synthesis of ATP, structure, function and biochemistry of the various vertebrate organ systems, the biochemistry of glycolysis and cellular respiration, and introductory biometrics.

Although these courses are divided into thirteen units based upon common topics, the eight major themes of AP Biology will serve as a conceptual framework for each of the units. These themes are: *Science as a Process; Evolution; Energy Transfer; Continuity and Change; Relationships of Structure and Function; Regulation; Interdependence in Nature; and Science, Technology and Society*. The Eight Themes will help the student appreciate the interrelationships of the topics discussed in AP Biology. This approach will help the student compartmentalize the vast amount of information that will be introduced throughout this course. Particular emphasis will be placed upon evolution and

the relationship between structure and function. The integration of the eight themes is indicated on the syllabus in italics.

Teaching Strategies:

The eight major themes from the AP Biology Course Description are emphasized throughout this course. Evolution is emphasized as a unifying theme for all topics and discussions, as well as the importance of application of critical thinking regarding social concerns relating to all topics. Students will have a solid understanding of the concepts of Biology and a grasp on the relevance of those concepts to them and the changing society in which we live. Always they will be taught how to appreciate and organize their new knowledge into the conceptual framework of the eight major themes.

All twelve AP labs in the AP Lab Manual for Students will be completed, as well as a number of additional labs and projects. A minimum of 25% of class time will be spent on lab work. All of these labs are student directed. Occasionally, classroom time constraints necessitate additional time spent outside of class in the lab. Students will demonstrate skills in the following areas:

Using various equipment and instruments related to biological scientific lab investigations.
Using collected data to discover and use patterns to solve problems
Mastery of major biological concepts.
Application of biological concepts to critical environmental and social concerns.

Time will be spent after labs answering questions in lab manual, analyzing data, both individual and group data, and drawing relevance to related course content and societal issues. Students will often be assessed after labs to verify students understanding of concepts and ability to analyze data. Students are also required to design their own lab based upon concepts learned. These designs must include hypothesis, accounting of all variable controlled, including the one being tested, a control group, quantitative measurements, statistical analysis of data, verification of experimental results, and a reevaluation of the hypothesis. Labs count and are graded individually.

This class is discussion oriented. Students will be expected to read the relevant material prior to class. Students will also be required to complete study guides that I have designed to specifically correspond with the text and emphasize the key points and concepts of the course. These study guides will be tools for AP Review before the AP exam. Lectures, which cover selected concepts from the course, are supplemented with diagrams, explanations, visuals, role-playing, examples and demonstrations. The use of manipulatives is always used to help students better grasp molecular and biochemical processes when possible. Occasionally students are required to prepare a presentation over an assigned topic or concept and share it with the class or just the instructor. Occasionally, students are assigned primary research articles as required reading for homework.

Students are expected to take the AP Biology Exam in the spring. With that as our goal, students are prepared by completing difficult multiple-choice assessments. These questions from AP Released Exams and other sources are designed to mirror the AP format and difficulty level. Free response questions are given often over lab and lecture content covered. Questions are either written by me or selected from prior AP Biology Exams. Students are taught how to respond to free response questions.

Texts

For use in 2007/2008 school year:
N. Campell and J. Reese (2002) *Biology*. Benjamin Cummins. New York, NY. 6th Edition.

For use in 2008/2009 school year:
N. Campbell and J. Reese (2005) *Biology*. Benjamin Cummins. San Francisco, CA. 7th Edition. (and *Student study guide for biology*. 7th Edition).

Taylor, M. (2002) *Student study guide for biology*. Benjamin Cummins. Ithaca, NY. 6th Edition

B. Berthelsen . (2001) Multiple-Choice & free-response questions in preparation for the ap biology examination. D&S Marketing Systems, Inc. Brooklyn, NY. 4th Edition.

Biology lab manual for students. (2001). The College Board. Advanced Placement Program.

Course Outline for AP Biology covered in AP Biology and Advanced Biology classes

I. **Molecules and Cells** (25%) (2 weeks)

A. Chemistry of Life

Overview first the Themes of Biology, compare Campbell to the eight themes by AP Board.
Structure of the atom
Types of chemical bonding
Functional groups
Classification and characteristics of macromolecules
Water and its unique chemical and physical properties
Free energy changes
Enzymes and their structure and function
Energy Transfer
The role of carbon in the molecular diversity of life
Relationship of Structure to Function
Interdependence in Nature

Labs: AP Lab 2: Enzyme Catalysis
Properties of Water
Models: Functional Groups and basic macromolecules from each organic group.

Demos: Polarity of bonds
Protein levels and structure
Solubility versus bond type

B. **Cells** (10%) (3 weeks)

Sub-cellular organization
Membrane structure and function, transport across membrane.
Energy Transfer
Cell wall of bacteria, plants
Prokaryotic and eukaryotic cells
Evolution
Mitosis: cell cycle and regulation
Relationship to Structure and Function

Lab Components:
AP Lab 1: Diffusion and Osmosis
AP Lab 3A Mitosis
Sodium Potassium Pump Manipulatives
Compound Microscope Use

C. **Cellular Energetics** (8%) (2 weeks)

Free Energy Changes
Metabolic molecular reactions
Coupled reactions: role of ATP
Photosynthesis: light & dark reactions; oxidative phosphorylation & chemiosmosis
Regulation

Energy Transfer
Cellular respiration
Fermentation
Energy Transfer
Physiological effect of health and fitness on respiration, mitochondrial function
Science, Technology and Society
Lab Components:
AP Lab 4: Plant Pigments & Photosynthesis
AP Lab 5: Cellular Respiration
Light Reactions Manipulative
Dark Reactions Manipulative

II. **Heredity and Evolution** (25%)

A. **Heredity** (8%) (2 weeks)

Meiosis and gametogenesis.
Prokaryotic and eukaryotic chromosomes
Continuity and Change, Regulation
Mendelian (and other) patterns of inheritance
Science as a Process
Anomalies in inheritance patterns and their effects
Relationship to Structure and Function
Continuity and Change
Science, Technology and Society
Lab Components:
AP Lab 3B: Meiosis
AP Lab 7: Genetics of Organisms
Karyotype Manipulation

B. **Molecular Genetics** (9%) (3 weeks)

Structure and Function of RNA and DNA
Gene Regulation
Mutation
Viral structure, replication
Bacterial transformation
Regulation
Nucleic acid technology and its applications: ethical and legal implications
Science, Technology and Society
Science as a Process
Evolution
Lab Components:
AP Lab 6A and 6B Bacterial Transformation, Electrophoresis
DNA Extraction
Micropipette Use

Mitochondrial DNA Sequencing
DNA Technology and the Crime Lab

C. **Evolutionary Biology** (8%) (2 weeks)

Evidences for early evolution of life
Evidences for evolution throughout life history
Mechanisms for evolution
Role of natural selection, heredity in evolution
Speciation and macroevolution
Evolution
Interdependence in Nature

Lab Component:

AP Lab 8: Population Genetics and Evolution

I. Organisms and Populations

A. **Diversity of Organisms** (8%) (2 weeks)

Evolution and its patterns: major body plans of plants and animals
Diversity of life: Kingdoms & major phyla & divisions of animals and plants
Phylogenic classification
Evolutionary relationships: evidence, classification
Evolution
Interdependence in Nature
Relationship of Structure and Function

Lab Components:

AP Lab 9: Transpiration
Gross Anatomy Variations in Animal Phyla

B. **Structure & Function of Plants and Animals** (32%) (5-6 weeks)

Reproduction, growth, and development
Structural, physiological, and behavioral adaptations
Response to the environment
Regulation
Relationship to Function and Structure
Continuity and Change
Science Technology and Society
Interdependence in Nature

Lab Components:

AP Lab 10 Circulatory Physiology
AP Lab 11 Animal Behavior
Dissection of Sheep Brain and Fetal Pig
Blood Typing Investigation

C. **Ecology** (10%) (2 weeks)

Population Dynamics

- Growth dynamics; models examined
- Effects of biotic and abiotic factors

Communities and Ecosystems

- Trophic levels and energy flow
- Chemical cycles and their effects on living organisms
- Effects of biotic and abiotic factors
- *Interdependence in Nature*
- *Continuity and Change*
- *Energy Transfer*

Global Issues

- Human affects on biological and chemical cycles
- *Science, Technology and Society*

Lab Components:

AP Lab 12: Aquatic Primary Productivity

II. Review (3 weeks)

Student Evaluation

Student learning is evaluated in several ways, including quizzes (short answer) over lecture and lab content, multiple choice tests, free response questions, homework assignments that include written responses to chapter/unit objectives, informal and formal lab reports, and projects related to class material. For example, while covering the immune response students are required to research the work of a Nobel Laureate whose research was related to immunology. And while covering the structure of the cell, students build a model of a particular cellular component, using household materials. Students are also required on occasion to prepare and present to the class a portion of content being covered. The presentation incorporates environmental and social concerns where applicable.