

Advanced Placement Biology Syllabus

2007-2008

Dear Parents:

Welcome to Advanced Placement Biology 2006 -2007! The AP Biology course is a demanding one, and many students find that it requires not only a true devotion to science, but also some adjustment in study habits. The AP Biology is a laboratory course in which students are expected to use collected data to solve biological problems. As a teacher of AP Bio, I'd like to take a minute to introduce the program, and to offer some ideas about how you can help to make your child's experience in this challenging class a successful one.

AP Biology is a college level class, which makes it somewhat different from regular or Honors level classes that your son or daughter has been taking to this point. College credit can be earned by achieving a score of 3 (out of possible 5) on the Advanced Placement Test Administered in May. This test is extremely rigorous!! Because the test is fairly costly for students who choose to take it, and because college credits are at stake, many of the labs, readings, and activities for this class will be designed to prepare students to succeed on that test. In a larger sense, however, the course aims to develop a deep appreciation for science and technology, through intense, in-depth investigation of each Biological theme & concept. Needless to say, it is imperative that students keep up with assigned readings.

The readings themselves cover a variety of themes that are considered part of the "canon" of outstanding scientific investigation in Biology. I will provide a reading list. The reading load for the course is quite demanding, and many students (especially those who are involved in a lot of extra-curricular activities) find that they have to budget their time carefully to keep up. I ask that you check with your daughter or son frequently to find out what assignments are due when, and to help keep her or him on track.

I look forward to getting to know your child and you better. I believe that supportive parents play a vital role in every child's education, and I hope that

we can work together to make this a productive & enjoyable year. I have asked each student to complete a Student Information Sheet, which requests information about how you can be reached at home or during the day.

Each student has also received a handout outlining classroom rules, expectations, required materials, and grading policy. Please take a few minutes to review this information with your son / daughter, and then sign it. Students will be asked to keep this paper in their folders.

Finally, here are a few things that you can do to help ensure your child's success:

- Get organized.
- Provide a quiet place to study.
- Expect homework.
- Secure student copy of text.
- Make wise decisions about extra-curricular activities.

I look forward to working with you and your son or daughter!!

Outline

The eight major themes from the AP Biology Course Description (Science as Process, Evolution, Energy transfer, Continuity and change, Relationship of Structure to Function, Regulation, Interdependence in Nature, and Science, Technology, & Society) are highly stressed throughout the course.

The course is divided into eight main units as follows; The Chemistry of Life, The Cell, Genetics, Mechanisms of Evolution, The Evolutionary History of Biological Diversity, Plant Form and Function, Animal Form and Function, and Ecology.

Each unit includes an exercise designed to integrate the topic of that unit into the eight major themes of Biology. Discussion of how the topic relates to and fits within each theme is highly emphasized.

The AP class meets every day for one block of 80 minutes for the whole school year. Mondays through Wednesdays are usually for lectures, discussions, reviews, and exams (60% of instructional time). Thursdays and Fridays are usually for the labs (40% of instructional time). This makes it possible to finish all of the 12 labs in the AP Lab Manual for Students.

Objectives:

Each student shall:

- Demonstrate skills in using various types of biological instruments and scientific methodologies,
- Learn how to read and critique papers written by scientists in the field of biology,
- Practice finding out and using patterns in collected data to solve scientific problems,
- Apply biological knowledge and critical thinking to environment and social concerns.

I. Molecules and Cells

25%

(First Semester, September-October)

Cells are the structural and functional units of life; cellular processes are based on physical and chemical changes.

A. The Chemistry of Life (3 weeks)

7%

1. Water (Chapters 1-3)

- How do the unique chemical and physical properties of water make life on Earth possible?
- Explain how do some life processes directly rely on these properties?

2. Organic molecules in organisms (Chapters 4 & 5)

- What is the role of carbon in the molecular diversity of life?
- How do cells synthesize and break down macromolecules?
- How do structures of biologically important molecules account for their functions?

3. Free energy changes & Introduction to Metabolism (Chapter 6)

- How do the laws of thermodynamics relate to the biochemical processes that provide energy to living systems?
- What is activation energy and why is it needed?

4. Enzymes (Chapter 6)

AP Lab #2, Enzyme Catalysis

- How do enzymes regulate the rate of chemical reactions?
- How does the specificity of an enzyme depend on its structure?
- How is the activity of an enzyme regulated?

B. Cells (3 weeks)

10%

1. Prokaryotic and Eukaryotic cells (Chapter 7)

- What are their similarities and differences?
- What are their evolutionary differences?

2. Membranes (Chapter 7)

- How does compartmentalization organize a cell's function?
- How are the structures of various subcellular organelles related to their functions?
- How do organelles function together in cellular processes?
- What factors limit cell size?

3. Transport & Cell Communications (Chapters 8 & 11)

AP Lab #1, Diffusion & Osmosis

- What is the current model of the molecular architecture of membranes?
- How do variations in this structure account for functional differences among membranes?
- How does the structural organization of membranes provide for transport and recognition?
- What are various mechanisms by which substances cross membranes?

4. Cell Cycle and its regulation (Chapter 12)

AP Lab #3, Mitosis & Meiosis

- How does the cell cycle assure genetic continuity?
- How does mitosis allow for the even distribution of genetic information to new cells?
- What are the mechanisms of cytokinesis?
- How is the cell cycle regulated?
- How can aberrations in the cell cycle lead to tumor formation?

C. Cellular Energetics (2 weeks)

8%

1. Coupled reactions (Chapter 9)

- What is the role of ATP in coupling the cell's anabolic and catabolic processes?
- How does chemiosmosis function in bioenergetics?

2. Fermentation and cellular respiration (Chapter 9)

AP Lab #5, Cell Respiration

- How are organic molecules broken down by catabolic pathways?
- What is the role of oxygen in energy-yielding pathways?
- How do cells generate ATP in the absence of oxygen?

3. Photosynthesis (Chapter 10)

AP Lab #4, Plant Pigments & Photosynthesis

- How does photosynthesis convert light energy into chemical energy?
- How are the chemical products of the light-trapping reactions coupled to the synthesis of carbohydrates?
- What interactions exist between photosynthesis and cellular respiration?

II. Heredity and Evolution

25%

(First Semester, November-December)

Heredity events control the passage of structural and functional information from one generation to the next.

A. Heredity (2 weeks)

8%

1. Meiosis and Sexual Life Cycles (Chapter 13)

- What features of meiosis are important in sexual reproduction?
- Why is meiosis important in heredity?
- How is meiosis related to gametogenesis?
- What are the similarities and differences between gametogenesis in animals and gametogenesis in plants?

2. Mendel & Inheritance patterns (Chapter 14)

AP Lab #7, Genetics of Organisms

- How is genetic information organized in the eukaryotic chromosome?
- How does this organization contribute to both continuity of and variability in the genetic information?
- How did Mendel's work lay the foundation of modern genetics?
- What are the principle patterns of inheritance?

3. The Chromosomal Basis of Inheritance (Chapter 15)

B. Molecular Genetics (4 weeks)

9%

1. The Molecular Basis of Inheritance (Chapter 16 and 17)
 - Structure and function of DNA & RNA
 - Mutations
 - Structure of prokaryotic & eukaryotic chromosomes
 - Gene regulation
2. Microbial Models: The Genetics of Bacteria and Viruses (Chapter 18)
 - What is the structure of viruses?
 - What are the major steps in viral reproduction?
 - How do viruses transfer genetic material between cells?
 - Compare & contrast between bacteria and viruses
3. The Organization & Control of Eukaryotic Genomes (Chapter 19)
4. Nucleic acid technology and applications (Chapter 20 & 21)
 - AP Lab #6, Molecular Biology**
 - How do the structures of nucleic acids relate to their functions of information storage and protein synthesis?
 - What are the similarities and differences between prokaryotic and eukaryotic genomes?
 - What are some mechanisms by which gene expression is regulated in prokaryotes and eukaryotes?
 - In what ways can genetic information be altered?
 - What are some effects of these alterations?
 - What are some current recombinant DNA technologies?
 - What are some practical applications of nucleic acid technology?
 - What legal and ethical problems may arise from these applications?

C. Evolutionary Biology (2 weeks)

8%

1. Early evolution of life (Chapter 26)
 - What are the current biological models for the origins of biological macromolecules?
 - What are the current models for the origins of prokaryotic and eukaryotic cells?

2. Evidence for evolution (Chapter 22 & 23))

- Historical background behind Darwin's theory: voyage of the Beagle
- Evidences of evolution
- Evolution in action today
- Modern synthesis, population genetics, Hardy-Weinberg law of genetic equilibrium
- Natural selection, microevolution events, types of selection, and preservation of variation
- Speciation, prezygotic and postzygotic mechanisms, allopatric and sympatric speciation
- Gradualism/punctuated equilibrium
- Fossil record, extinctions, and dating of fossils

3. Mechanisms of evolution (Chapter 24)

AP Lab #8, Population Genetics and Evolution

- What types of evidence support an evolutionary view of life?
- What is the role of natural selection in the process of evolution?
- How are heredity and natural selection involved in the process of evolution?
- What mechanisms account for speciation and macroevolution?
- What different patterns of evolution have been identified and what mechanisms are responsible for each of these patterns?

III. Organisms and Populations

50%

(Second Semester, January-April)

The relationship of structure to function is a theme that is common to all organisms; interaction of organisms within their environment is the major theme in ecology.

A. Diversity of Organisms (4 weeks)

8%

1. Evolutionary patterns (Chapter 27-34)
2. Survey of the diversity of life (Chapters 27-34)
3. Phylogenetic classification (Chapters 27-34)
 - What are representative organisms from the Bacteria, Archaea, and Eukarya?
 - What are representative members of the major animal phyla and plant divisions?
 - What are the distinguishing characteristics of each group (domains, kingdoms, and the major phyla and divisions of animals and plants)?
4. Evolutionary relationships (Chapter 25)
 - What is some evidence that organisms are related to each other?
 - How do scientists study evolutionary relationships among organisms?
 - How is this information used in classification of organisms?

B. Structure and Function of Plants and Animals 32%
(10 weeks)

1. Reproduction, growth, and development (Chapters 35-38 & 40-49)

AP Lab #9, Transpiration

 - What patterns of reproduction and development are found in plants and animals and how are they regulated?
 - What is adaptive significance of alternation of generations in major groups of plants?
 - How does the organization of cells, tissues and organs determine structure and function in plant and animal systems?
 - How are structure and function related to various organ systems?
 - How do the organ systems of animals interact?
 - What adaptive features have contributed to the success of various plants and animals on land?
 - What are the responses of plants and animals to environmental clues, and how do hormones mediate them?

2. Structural, physiological, and behavioral adaptations (Chapters 36, 37, 42 and 51)

AP Lab #10, Physiology of the Circulatory System

AP Lab #11, Animal Behavior

3. Response to the environment (Chapters 39, 48, and 49)

C. Ecology (2 weeks)

10%

1. Population Dynamics (Chapter 50, & 52)

- What models are useful in describing the growth of a population?
- How is population size regulated by abiotic and biotic factors?

2. Communities and ecosystems (Chapter 53 and 54)

AP Lab #12, Dissolved Oxygen & Aquatic Primary Productivity

- How is energy flow through an ecosystem related to trophic structure (trophic levels)?
- How do elements (carbon, nitrogen, phosphorous, sulfur, and oxygen) cycle through the ecosystems?

3. Global issues (Chapter 55)

- How do organisms affect the cycling of elements and water through the biosphere?
- How do biotic and abiotic factors affect community structure and ecosystem function?
- In which ways are humans affecting biogeochemical cycles?

Course Overview

Personal Philosophy:

I enjoy teaching AP Biology because I see it as an opportunity to encourage high school students to make a difference in this world. I see everything as connected to Biology in some way, so I modify my teaching to help my students make correct decisions about the environment and their health, and to see that their decisions can and will affect others. I also like to highlight the cultural differences in the naming of plants and animals, because it includes everyone in my ethnically diverse class.

Textbook:

Each student is required to have a Biology textbook (Campbell & Reece Biology, 6th Edition, Prentice Hall), as well as either Barron's or Cliff's AP Biology book. The big college textbook will be kept at home for reading assignments, while the other book should be in the class with the student every day. Assigned chapters are to be read in advance before coming to the class & AP students are responsible for all the topics on the syllabus that are not otherwise assigned.

Barron's / Cliff's chapters will be assigned on a weekly basis. Each student has to read the chapter and complete the assigned questions.

Generally speaking, we will cover 2-3 chapters every week. We have a total of 55 chapters & approximately 30 weeks to finish till the AP test.

Labs & Lab reports:

Each student should have the "AP Biology Lab Manual for Students". All the labs in the AP Biology Lab Manual for Students are covered. Two field trips are usually squeezed in over the school year (one trip to The Franklin Institute Science Museum "Body Worlds" in Philadelphia, PA, and the other trip to Duke Farms in Hillsborough, NJ)

Labs are usually running on Thursdays & Fridays every week (40% of instructional time). Completed lab reports are due the following Monday. Each lab report should include the following information; title, introduction, background information, purpose, procedure, data/results, analysis, and recommendations. Some labs require only well-organized data summary and brief conclusions. Others, such as dissections and microscope labs, merely consist of a well-drawn diagram. For labs that come from the AP Lab Manual, students must complete the graphs, answer the questions in the manual, or write a brief evaluation (analysis, conclusion, limitations, and recommendations) of the lab.

Research Project:

All students are required to do an independent research project outside of class time. This is usually assigned in September and is due on April, one project for each marking period. Students do most of the work independently and at home. Independent research projects require full lab reports. Excellent presentation of data and discussion of results are highly emphasized.

Tests & Quizzes:

There are approximately 3-5 tests per marking period (approximately one big test every 2 weeks). Quizzes are taken once a week usually with a previous notice after reading assignments. Surprise quizzes will serve to verify that reading is done & comprehended. Tests will be scheduled in advance. Make up tests can be taken within three days, with no penalty.

Scientific American / Science News / Discover / NY Times Science articles:

Scientific readings from different resources will be implemented throughout the course, thus making modern environmental and social concerns associated with Biology a continuing theme.

A list of the offprint will be provided to each student. This list will also serve as a record of offprint read in each category (the eight themes of biology). Each Friday, AP students will borrow one offprint, read it & write

(type) a two-paged synopsis / analysis (single spaced, 12 point font, proofread and properly formatted).

AP students must turn in these reports every Monday until seven have been completed each marking period. Students are free to choose from available offprint as long as they have covered one of each before duplicating themes.

Each report will earn a score of 100 if the analysis is accurate, contains no misspellings, punctuation or scientific nomenclature errors, if it is from an appropriate theme/category and is recorded properly. If all the reports are of this caliber, the marking period grade for SA / NY reports will be A+. If a report really zeros in on the theme of study of an offprint and the report demonstrates a complete understanding of the study described (provided there are none of the errors described above) a score of 125 will be earned and the marking period grade will increase by a point for each outstanding report.

Miscellaneous:

Each student should have:

- Lab notebook for labs.
- A separate class notebook for taking notes and class work.
- A folder for the numerous handouts he/she will receive.
- Another folder for SA / NY reports. AP students need to attach the list to the inside cover of that folder.

In the event of an absence, any assignments must be made up and handed in on the proper time. It is the student responsibility to find out about the missed work.

If the assigned work is handed late; 10 points will be taken off the grade for every late day with a maximum of 3 days. After the third day, absolutely, no work will be accepted.

Student Evaluation:

Students are evaluated in a number of ways that reflects the nature of the course. Examples are; scientific reasoning through analysis and synthesis, research technique, and being able to present one's point of view in writing. Students are encouraged to develop group and individual work skills, and these are considered a part of the lab evaluation.

- 50% Tests (multiple-choice questions and essays)
- 25% Labs
- 15% Scientific writing
- 10% Independent research project

AP Biology Test:

The AP Biology test usually runs at the first week of May every year. This year it will be Monday May 14th, 2007. It is three hours in length & designed to measure a student's knowledge & understanding of modern biology.

It is formed of two sections:

- I. Section I has 100 multiple-choice questions. It lasts for 90 minutes, and equals 60% of the total grade.
- II. Section II has 4 open ended free responses (essays). It lasts 90 minutes, and equals 40% of the total grade.

The AP Biology total raw scores are converted to AP's 5-point scale as follow:

<u>AP GRADE</u>	<u>QUALIFICATIONS</u>
5	Extremely well qualified
4	Well qualified
3	Qualified
2	Possibly Qualified
1	No recommendations

Most colleges will accept a score of 3 or higher.