

SCIENCE DEPARTMENT

ADVANCED BIOLOGY (H/AP): COURSE #451

Contact Information

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The Department's Educational Philosophy

We believe that students should be exposed to the process of scientific inquiry so they can acquire and interpret scientific knowledge, and begin to realize the wider applicability of scientific problem-solving methods. By making the laboratory the focal point of learning, we seek to foster students' appreciation for the experience of doing science.

Guiding Principles

- Students must be able to collect and analyze data and formulate hypotheses.
- Inductive and deductive problem-solving skills are central to science education.
- An effective program in science addresses the limitations of data and conclusions.
- Students should be able to use or design a strategy for testing scientific concepts.
- A comprehensive science program will emphasize the delicate checks and balances in man's abiotic and biotic environments and the stresses upon these ecosystems, which could affect the destiny of the world.
- Science is integrally related to mathematics.
- An effective science program builds students' ability to communicate accurately and precisely.
- An effective science program stresses both cooperative and independent learning.

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Course Frequency: Full-year course, seven times per six-day cycle

Credits Offered: Six

Prerequisites: Departmental Recommendation

Background to the Curriculum

Until ten years ago, this was not an AP course. It was a second year, advanced biology course that dealt with specific topics in great depth. The teacher had the curriculum flexibility to concentrate on topics of interest, and time for coverage was not really a factor. However, due to student and parent interest, and due to competitive college requirements, we felt obligated to restructure the course to comply with the College Board's coverage intensive Advanced Placement format. To prepare students for the AP exam, it is now necessary for us to do the suggested College Board labs and to cover the college level text in a broad and comprehensive manner. This course is heavily subscribed, and the vast majority of our students take the AP examination in the spring.

Core Topics/Questions/Concepts/Skills

- Molecules and Cells: chemistry of life, cells, cellular energetics,
- Heredity and Evolution: heredity, molecular genetics, evolutionary biology
- Organisms and Populations: diversity of organisms, structure and function of plants and animals, ecology

Major Themes

The AP Biology Development Committee has identified the following eight major themes. Each recurs throughout the course and receives special emphasis at the points in the course when the objectives in *italics* are being addressed.

- I. Science as a Process:** *Learning Objectives – Molecules and Cells: c; Genetics and Evolution: c, g; Organisms and Populations: a*
- II. Evolution:** *Learning Objectives – Molecules and Cells: d, e; Genetics and Evolution: d, g; Organisms and Populations: e, i*
- III. Energy Transfer:** *Learning Objectives – Molecules and Cells: a, b, g; Genetics and Evolution: a, g; Organisms and Populations: i*
- IV. Continuity and Change:** *Learning Objectives – Molecules and Cells: f; Genetics and Evolution: a, b, c, d, e, f, g; Organisms and Populations: i*
- V. Relationship of Structure to Function:** *Learning Objectives – Molecules and Cells: a, b, d, e; Genetics and Evolution: g; Organisms and Populations: a, c, d, g, h*
- VI. Regulation:** *Learning Objectives – Molecules and Cells: b, f; Genetics and Evolution: b, f; Organisms and Populations: e*

VII. Interdependence in Nature: *Learning Objectives – Molecules and Cells: c; Genetics and Evolution: g; Organisms and Populations: i*

VIII. Science, Technology, and Society: *Learning Objectives – Molecules and Cells: b; Genetics and Evolution: a, e, g; Organisms and Populations: i*

Course-End Learning Objectives

| <u>Learning objectives</u> | <u>Corresponding State Standards, where applicable</u> |
|---|---|
| <u>Molecules and Cells</u> | |
| 1] Identify and describe carbohydrates, lipids, proteins and nucleic acids. | 1.3 |
| 2] Identify and describe the structure and function of enzymes and the law of thermodynamics. | 1.4, 1.5 |
| 3] Describe the major themes of the cell theory. | 2.1 |
| 4] Compare and contrast prokaryotic and eukaryotic cells. | 2.2 |
| 5] Compare and contrast animal and plant cells. | 2.3 |
| 6] Describe the cell cycle. | 2.10 |
| 7] Describe the processes of photosynthesis and cellular respiration. | 2.6, 2.8, 2.9 |
| <u>Genetics and Evolution</u> | |
| 1] Describe and explain the principles of molecular genetics. | 3.1 |
| 2] Describe the process of protein synthesis. | 3.2, 3.3 |
| 3] Describe the mechanisms involved in recombinant DNA, hybridization and DNA sequencing. | 3.1, 3.4 |
| 4] Analyze and solve Mendelian genetic problems. | 3.5, 3.6, 3.7 |
| 5] Identify and describe several types of human genetic abnormalities. | 3.4 |
| 6] Describe and illustrate the processes of mitosis and meiosis. | 2.10, 3.8 |
| 7] Explain the mechanisms of evolution. | 5.1, 5.2, 5.3 |
| <u>Organisms and Populations</u> | |
| 1] Describe the principles of taxonomy. | 5.3 |
| 2] Identify and describe the five kingdoms. | 5.3 |
| 3] Describe the structure and function of lower plants. | 2.3, 2.5, 5.3 |
| 4] Describe the structure and function of higher plants. | 2.3, 2.5, 5.3 |

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| 5] Describe the process of “alternation of generations.” | 2.3, 2.10, 5.3 |
| 6] Describe the processes of plant responses to various stimuli. | 2.5 |
| 7] Describe the classification and phylogeny of animals. | 5.3 |
| 8] Describe the structure and function of animal organ systems. | 4.1, 4.2, 5.3 |
| 9] Describe the principles of population dynamics. | 6.1, 6.2, 6.3, 6.4, 6.5 |

Assessment

- Tests: mostly from a college AP test bank. (These tests stress higher-order thinking skills.)
- Quizzes: unannounced – open notebook
- Formal AP lab reports: Preparation, organization, data presentation, completeness, accuracy and participation are considered part of the assessment of the labs.
- Project / Presentation: last quarter assignment
- Dissection laboratory: last quarter assignment

Technology Learning Objectives Addressed in This Course

(This section is for faculty and administrative reference; students and parents may disregard.)

| <u>Course activity: skills &/or topics taught</u> | <u>Standard(s) addressed through this activity</u> |
|--|---|
| <p>1] Students utilize computers, and do research, mainly to supplement their text and lab assignments throughout the year. We encourage our students to explore the myriad AP Biology websites that are available to them.</p> <p>2] In addition, most of the students are choosing to do PowerPoint presentations as part of their project at the end of the year.</p> | |

Materials and Resources

Student text: Mader, Sylvia S. **Biology**, 5th edition (1996), McGraw Hill Publishing.

Reference text: Solomon, et al. **Biology**, 5th edition (1999), Saunders College Publishing.

Recommended study guides: The Princeton Review, Barrons, and Cliff’s AP Biology.

Numerous audio-visual and lab materials are also used to supplement the course.