

# Biology

2007 - 2008

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## **Brief Description of Course**

This Advanced Placement Biology course has been designed to follow the guidelines set forth by the College Board and covers the topics listed in the AP Biology Course Description handbook. Topics include: basic chemistry, biochemistry, cell structure and function, cellular energetics; photosynthesis and cellular respiration, cell reproduction, Mendelian genetics, molecular genetics, evolution, classification, plant and animal structure and function, and ecology. Topics are presented in an arrangement which will stress and integrate the 8 underlying themes as emphasized in the AP Biology curriculum requirements. Above all, topics are presented in a sequence which will emphasize the underlying theme of evolution. Evolution is the one unifying theme of the biological sciences. Therefore, a strong emphasis is placed on development from the simple to the complex levels of life. Also I integrate the systems of the body with topics that they are related to, this enables the students to make connections between the concepts and how they function in the human body. The school operates on a 6-day cycle. AP Biology meets 4 times per cycle for a single period (45 minutes) and 2 double periods (90 minutes). The academic calendar is based on a four quarter system from September to approximately June 15th. All students enrolled in AP Biology are required to take the AP exam in May. COURSE PREREQUISITES Students are required to have one year of Biology and one year of Chemistry before entering into AP Biology. COURSE GOALS: Students will use problem solving skills including logic, intuition, trial and error to solve difficult biological and scientific questions. Students will develop a solid foundation and conceptual framework in the science of biology. Students will gain an appreciation of biology and its relationship to the other sciences and daily living. Students will learn, practice, and plan safe, accepted laboratory skills using an array of scientific measuring tools. Students will hone their use of the scientific process to solve and explain a variety of biological phenomena. Students will become better critical thinkers. Students will become more socially aware of ethical and environmental issues that are of worldwide concern. LABORATORY Students perform all twelve of the required labs from the AP Biology Lab Manual for Students. Other lab experiences are also integrated. Seven of the required laboratory exercises employ the use Vernier software and probes. In these labs, students develop and demonstrate skills using various biological instrumentation and computers. Data collection, graphical analysis and biological principles are stressed. Each student is required to complete a formal written lab report for each lab experiment completed. In addition each student must keep a separate lab notebook that serves as a pre-lab report. This lab book insures that the student has become familiar with the procedure and underlying theory prior to the lab. Both the pre-lab and formal lab reports follow the protocol from the Lab Write program developed by North Carolina State University. I also arrange one field trip per year to the Cold Spring Harbor Laboratory where the students are able to do a DNA lab using PCR Techniques. I usually arrange to do the mitochondrial DNA. This lab includes a lecture about evolution as well as what is going to show up on the gel. TEACHING STRATEGIES All units are covered by means of lecture, class discussion and laboratory experiences. Students are provided with teacher questions for each chapter studied. These questions are to be answered and turned in for credit on the day of the test. These directed questions provide for focused chapter reading and indicate topics believed to be most relevant. Each quarter the students will prepare a chart illustrating how each topic covered during the quarter applies to the eight major themes. Information presented is discussed as a class. By the end of the year, students will have a complete picture of biology as it relates to: Science as Process; Evolution; Energy transfer; continuity and Change; Relationship of structure to Function; Regulation; Interdependence in Nature

and Science, Technology and Society. TESTING AND ASSESSMENT: I administer weekly quizzes modeled upon the free-response questions found in past AP Exams, lab quizzes administered two days after the lab, and vocabulary quizzes based on our text book. I also administer 90 minute tests following every unit (2-3 per quarter), a semester exam in January and again in May. The 90 minute tests are usually multiple choice (100 questions) followed the next day with an essay question. The grading of the test is done similar to that of the AP test with the multiple choice section being 60% of the grade and the essay section being 40% of the grade. STUDENT GRADES ARE BASED ON THE FOLLOWING: 50% tests 10% quizzes 30% Laboratory 10% homework Homework grades include: free response questions, directed questions, worksheets, various biological articles their reaction to the article, and various other assignments. Throughout the course students are required to read various biological articles and write a reaction paper to the article. The usual sources for these articles are HHMI. Previously given AP tests are used as a means of preparing for the AP test. After the AP test is over, the class will do an assignment based on ethical issues the topics include; Stem cell research, genetic enhancement, Cloning, Gene therapy and others. The students follow a rubric and have a series of questions to answer and then present their topic to the class.

## **Unit Information**

### **Unit Name or Timeframe:**

SUMMER ASSIGNMENT

I have found that in order to complete the course the students must do a summer assignment. It keeps the students academically sharp and will allow more class time to be spent on more difficult concepts. The students start Unit One during these months and we complete the unit in September.

UNIT 1: EVOLUTION (July and August, 1 weeks of September)

Readings:

Chapters 22, 23, 24, 25, and 26

Full House: The spread of Excellence from Plato to Darwin, by Stephen Jay Gould

River out of Eden: A Darwinian View of Life, by Richard Dawkins.

### **Content and/or Skills Taught:**

TOPICS:

Chemical evolution

Taxonomic schemes

Darwin vs. Lamarck

Natural Selection

Population Genetics

Hardy-Weinberg Theorem

Origin of Species

Reproductive isolation

Phylogeny/Systemics

Laboratory:

Population Genetics and evolution (AP Lab 8).

Bioinformatics and building a phylogenetic tree

Class Activity to end the unit is watching portions of the DVD Evolution

### **Major Assignments and/or Assessments:**

The students are required to have read the two books and to write a 5 to 6 page compare and contrast paper. They are to include specific references from the books to reinforce their opinions.

Unit 1 test on evolution is usually a take home test. The students will be given the test on a Friday with test due on Monday.

**Unit Name or Timeframe:**

UNIT TWO: ECOLOGY AND BEHAVIOR

4 Weeks

Readings: Chapters 1, 50-55

**Content and/or Skills Taught:**

Topics:

Chapter 1 ( 1-2 days)

Levels of biological Organization

Biological systems

Three Domains of Life

Evolution

Scientific inquiry

Themes of Biology

ECOLOGY AND BEHAVIOR (4 weeks)

Biosphere

Biotic/Abiotic factors

Population Distribution

Climate/climate patterns

Biomes

Behavior

FAP

Imprinting

Kinesis vs. Taxis

Communication

Habituation

Classical conditioning/operant conditioning

Agnostic behavior/Altruism

Population Ecology

Dispersion patterns

Population Growth Models

Exponential vs. Logistic

Population Regulation

Community Interactions

Interspecific interactions

Competitive exclusion

Food chain/food web

Ecosystems

Energy flow/energy

Biogeochemical cycles

Gross/net productivity

Biodiversity

Lab 11: Animal Behavior (AP lab manual, supplies from Wards Scientific)

Lab 12: Dissolved Oxygen and Aquatic Productivity (AP Lab Manual, Wards AP Biology/Lab Pro Vernier Software.

**Major Assignments and/or Assessments:**

Independent Work:

Students are asked to find an example of an introduced species. they must tell how it was first introduced, how it has survived and benefits/non-benefits of that species in its new environment.

Students are given a biome to research using the internet and Chapter 50 in thier textbook. The

students will then do a PowerPoint presentation to the class. The presentation includes a one page handout and worksheet that goes along with a five minute presentation to the class. This assignment is done outside of the class and they have 3 days to complete it.

Unit 2 test on ecology is given during class time. It consists of multiple choice and essay questions.

**Unit Name or Timeframe:**

Unit 3: CHEMISTRY OF LIFE ( 2 weeks)

Readings: Chapter 2-5

**Content and/or Skills Taught:**

Topics:

Atomic structure

Water

Carbon

Functional groups

Macromolecules: Structure & Function

Labs: Manipulation of Molecular models

Drawing structural Arrangements of Macromolecules

Carbohydrate lab: Laboratory Investigations for Biology

**Major Assignments and/or Assessments:**

Independent assignment: Students will research the molecular structure of proteins. Students are given a specific macromolecule and are instructed to draw or build a model of that molecule. In a data table the student will tell what structures are present, function, and what elements make up the molecule. The student has one week in which to complete the assignment.

Unit 3 test on chemistry of life is given during class time and consists of multiple choice and essay questions.

**Unit Name or Timeframe:**

Unit 4: CELLULAR STRUCTURE AND FUNCTION, BACTERIA AND VIRUSES

3 weeks

Readings: Chapter 6, 18, 27

**Content and/or Skills Taught:**

Topics:

Microscopy

Prokaryotic vs. Eukaryotic Cell

Eukaryotic Organelles: structure and function

Tissue structure and function

Organs and organ systems

Intercellular junctions

Cell wall of bacteria and plants

Viral Structure

Viral Life Cycle

Bacteria reproduction and nutritional modes

Bacteria: classification and their roles, both harmful and beneficial

Evolutionary adaptations

Labs: Examination of different cell types (Investigations for Biology)

Gram-staining techniques and the effect of antibiotics on bacteria (Investigations for Biology)

Unit 4 test on Cellular structure and function, viruses, and bacteria consists of multiple choice and essay questions.

**Major Assignments and/or Assessments:****Unit Name or Timeframe:**

Unit 5: Cell Communication

2 weeks

Readings: Chapters 11, 45, 46, 48

**Content and/or Skills Taught:**

Topics:

Cell signaling

Signal Transduction Pathway

Membrane Receptors

Second Messengers

Hormones/Chemical Signaling

Human Hormones and function

Human Menstrual cycle

Nerve Cell Structure

Nerve Impulse/Action Potential

Evolutionary adaptations

**Major Assignments and/or Assessments:**

Independent Assignment: Students are given a cell to cell communication project. They are given a disease and they must research the disease and what causes the disease. In particular they must find the signaling pathway that has gone wrong. They are then to do a poster presentation to the class. Each presentation is to last no more than 10 minutes. They do the assignment outside of class and work with a partner. They have two weeks to do the assignment.

Unit 5 test on cell communication consists of multiple choice and essay questions.

**Unit Name or Timeframe:**

Unit 6: MEMBRANE STRUCTURE AND FUNCTION, OSMOREGULATION AND EXCRETION  
(2 weeks)

Readings Chapter 7, 44

**Content and/or Skills Taught:**

Topics:

Fluid Mosaic Model of Cell Membrane

Membrane structure

Mechanisms of Cellular Transport

Osmoregulation

Diverse excretory systems

Nephrons and blood vessels

Mammalian Kidney

Evolutionary adaptations

Lab 1: Diffusion and Osmosis (Wards AP Biology Lab Pro Vernier software)

**Major Assignments and/or Assessments:**

Unit 6 test on membrane structure, function, osmoregulation and excretion.

**Unit Name or Timeframe:**

Unit 7: METABOLISM, CELLULAR RESPIRATION, ANIMAL NUTRITION, CIRCULATORY SYSTEM (3 to 4 weeks)

Readings Chapters 8, 9, 40, 41, 42

**Content and/or Skills Taught:**

Topics:

Thermodynamics

Free energy changes

Bioenergetics

Influences on Metabolic Rates

Energy budgets

ATP

Enzyme Action /regulation

Redox reactions

Glycolysis

Fermentation

Krebs Cycle

Electron Transport Chain

Chemiosmosis

Homeostatic mechanisms

Animals diet

Food processing

Evolutionary adaptations

Circulatory System

Evolution of animal circulatory systems

Mammalian circulatory system

Structure and function of mammalian heart

LABS:

Lab 2: Enzyme Catalysis (AP Lab Manual, Wards AP Biology/Lab Pro Vernier Software)

Lab 5: Cellular Respiration (AP Lab Manual, Wards AP

Lab 10: Physiology of the Circulatory System (AP Lab Manual, Ward's AP Biology/Lab Pro Vernier Software)

Biology/Lab Pro Vernier Software)

Energy Found in Food (Biology for Computers Vernier Software)

**Major Assignments and/or Assessments:**

Independent assignment: the students are told to investigate the effects of either high blood pressure or low blood pressure and what treatments are available for the condition. This project is done outside of class. The students will submit the assignment as a paper with a data table. They will have 3 weeks to complete the assignment.

Unit 7 test on Metabolism, cellular respiration, animal nutrition, and circulatory system.

**Unit Name or Timeframe:**

UNIT 8: PHOTOSYNTHESIS AND PLANTS (3 to 4 weeks)

Readings Chapters 10, 35, 36, 37, 38, 39

**Content and/or Skills Taught:**

Topics:

Light Dependent Reactions

Calvin Cycle

Comparison of chemiosmosis in Chloroplast and mitochondria

C3, C4, CAM pathways

Photorespiration

Characteristics of plants

Plant life cycles and Reproduction

Plant tissue  
Plant organs: roots; stems; leaves  
Transport in plants  
Water potential  
Stomate function  
Evolutionary adaptations and benefits

**LABS:**

LAB 4: Photosynthesis (AP Lab Manual, Wards AP Biology/Lab Pro Vernier Software)

LAB 9: Transpiration (AP Lab Manual, Wards AP Biology/Lab Pro Vernier Software)

Microscopic examination of Prepared slides of leaf, root, stem, cross sections of Monocot and dicot.

Students will observe draw and label structures.

Flower dissection

Students also do some plantings of various seeds and stem cuttings.

**Major Assignments and/or Assessments:**

Unit 8 test on Photosynthesis and plants

**Unit Name or Timeframe:**

UNIT 9: ORGANISM DIVERSITY (Independent study, 4 weeks)

Readings Chapters 28, 29, 30, 31, 32, 33, 34

**Content and/or Skills Taught:**

Topics:

Protists

Fungi

Evolution of seed plants

Animal Diversity

Invertebrates

Vertebrates

**Major Assignments and/or Assessments:**

Students are given a handout of questions to be answered by reading the chapters. They are then instructed to make a poster linking the evolution of the organisms.

Unit 9 test is given as a take home test

**Unit Name or Timeframe:**

Unit 10: CELLULAR REPRODUCTION AND ANIMAL REPRODUCTION (3 weeks)

Readings Chapters 12, 13, 46

**Content and/or Skills Taught:**

Topics:

Binary fission

Mitosis

Meiosis

Alternation of Generations

Spermatogenesis and Oogenesis

Genetic variation

Reproductive organs

Hormonal regulation

Human development to birth

**LABS:**

LAB 3: Mitosis and Meiosis (AP lab Manual)  
Mitosis intern tutorial form the University of Arizona biology project

**Major Assignments and/or Assessments:**

If time permits the video MIRACLE OF LIFE is shown.  
Unit 10 test on cellular reproduction and animal reproduction

**Unit Name or Timeframe:**

UNIT 11: GENETICSMENDELIAN/NONMENDELIAN (2 weeks)  
Readings chapter 14, 15

**Content and/or Skills Taught:**

Topics:  
Laws of Probability, segregation, independent assortment  
Chi-square  
Monohybrid/dihybrid  
Co dominance/multiple alleles/epistasis/polygenic  
Pedigree analysis  
Human genetic disorders  
Genetic testing: Amniocentesis; CVS  
Gene/sex linkage  
Gene map  
Recombination frequencies  
Chromosomal disorders  
Genetic internet tutorial from the University of Arizona biology project.

**LABS:**

Probability lab: teacher generated using dice and the probability of rolling certain numbers.  
LAB 7: Genetics of organisms (Drosophila) (AP Manual, Wards AP Biology)  
Analysis of a pedigree  
Karyotype analysis activity  
M & M Lab-using variations in m & m colors to illustrate the Chi-Square Formula and the null hypothesis

**Major Assignments and/or Assessments:**

Independent Assignment: The students are given a genetic disorder to investigate. Presentations are given to the class. Presentation maybe either a PowerPoint or poster presentation. Presentation will last no more than 5 minutes. Topics to be included what effect does it have the affective individual, the family, and the prognosis. This assignment is done outside of class and the students will two weeks in which to do it.

Unit 11 test on genetics

**Unit Name or Timeframe:**

UNIT 12: MOLECULAR GENETICS (5 weeks)  
Readings: Chapter 16, 17, 18, 19, 20

**Content and/or Skills Taught:**

Topics:  
DNA historical background, experimental evidence  
DNA structure  
DNA replication  
RNA

Protein synthesis, transcription, and translation

Mutations

Eukaryotic control of gene expression

Biotechnology techniques: cloning, PCR, principles of electrophoresis, RFLP analysis

DNA sequencing

LABS:

DNA Extraction: Bio Rad 166-2000 EDU

Protein synthesis investigation: hands on manipulation. Teacher generated

LAB 6A: transformation of E. coli (AP Lab Manual, Bio Rad)

LAB 6B: DNA Fingerprinting (Gel electrophoresis, Bio Rad)

Introduction to Restriction Enzymes (Carolina Biological Supply)

Lab: ELISA Immuno Explorer Kit (Bio Rad 155-2400)

Bioinformatics. Teacher generated, using the ncbi genbank.

**Major Assignments and/or Assessments:**

Unit 12 test on molecular genetics

**Unit Name or Timeframe:**

Unit 13: ANIMAL FORM AND FUNCTION (3 weeks)

Readings: Chapters 40,43, 47, 49

**Content and/or Skills Taught:**

TOPICS:

Physical laws and animal size

Exchange with the environment

Ectotherms and Endotherms

Modes of heat exchange

Balancing Heat Loss and gain

Evolutionary advantage of one over the other

Internal and External defenses

Invertebrate immune mechanisms

Antigen and Antibody

Humoral and cell-mediated defenses

Distinguish self from non-self

Sensory receptors

Invertebrate and vertebrate skeletons

Locomotion on land and in water

Evolutionary adaptations

Laboratory:

No major labs for this unit

**Major Assignments and/or Assessments:**

Independent assignment on the immune system will be given. This assignment will have the students investigate HIV and its effect on the immune system. The students will also find out how has the virus mutated and how that ability enables the virus to evolve and survive.

Unit 13 test will be given.

**Unit Name or Timeframe:**

Review if time permits.

**Content and/or Skills Taught:**

After all the units have been completed the students will take a practice AP exam and review the various topics.

**Major Assignments and/or Assessments:****Alternate Approaches**

During the course of the year the students are assigned various scientific articles to read. They then have to write a reaction paper to the article. The reaction paper is 1-2 pages long. The articles come from a variety of sources including HHMI, Scientific American, and other internet sources.

**Textbooks**

**Title:**Biology

**Publisher:** Pearson Education Inc.

**Published Date:** 2006

**Author:** Neil Campbell

**Second Author:** Reece Jane

**Description:**

ISBN: 0-8253-6777-2

**Other Course Materials**

**Material Type:**Software

**Description:**

Vernier Logger Pro 3.5 Use with Vernier probware.

AP Biology Exam Preparation CD-ROM. Neo/Sci Corporation, Rochester, N. Y.

Ward's AP Biology Lab Companion CD-ROM Series. v.2.1

**Material Type:**Primary Source

**Description:**

College Board AP Biology Lab Manual for Students, 2001

Laboratory Investigations for Biology, Jean Dickey. The Benjamin Cummings Publishing Company, 1995. ISBN 0-8053-0932-2

Biology with Computers. Vernier Logger Pro lab manual

Investigation Biology Lab Manual. Judith G. MOrgan, M. Eloise Brown Carter. Pearson Education, Inc., 2005. ISBN 0-8053-7179-6

Ward's AP Biology LabPro Series

**Material Type:**Primary Source

**Description:**

Senior Biology 1 and 2, Richard Allen. Biozone International,2006. ISBN 1-877329-68-1.

## Websites

**URL:**[www.labwrite.ncsu.edu](http://www.labwrite.ncsu.edu)

**Description:**

Explains how to write a formal lab report.

**URL:**[www.campbellbiology.com](http://www.campbellbiology.com)

**Description:**

companion website for textbook.

**URL:**[www.biology.arizona.edu](http://www.biology.arizona.edu)

**Description:**

The Biology Project. Helps students understand the concepts.

**URL:**<http://biology.clc.uc.edu/courses/bio104/dna.htm>

**Description:**

Help with transcription and translation

**URL:**[www.ncbi.nih.gov/genbank/](http://www.ncbi.nih.gov/genbank/)

**Description:**

data bank of genetic codes