

## AP BIOLOGY

### OVERVIEW OF COURSE DESCRIPTION and GENERAL SYLLABUS

This AP Biology course will provide the student with an experience similar to a first-year biology course at the college level. The academic curriculum is rigorous; expectations are that the student will accept the challenges offered in a mature and academically inspired manner. Prerequisites are first year biology and chemistry at the honors level.

Participation in class discussions and projects is mandatory and essential for promoting science as a process, with all lab data analyzed by the class as a whole, regardless of any group or individual reports required. Classes meet every other day for 130 minutes with a block-scheduling format. More than twenty-five percent of class time is spent in the laboratory conducting investigations, learning skills, and reinforcing concepts with hands-on applications. All of the twelve College Board AP Biology laboratories are conducted with a full formal lab report due upon completion. Labs are done cooperatively, as well as individually at times, with historical context kept in mind. Collaboration on collecting and analyzing data, as well as reaching conclusions, provides the student with critical understanding of science as a process rather than just an accumulation of facts. Each chapter is assigned to be read and outlined by the student before class so minimal time is spent on lecture. Lectures consist of an overview, with power-point slides used as reinforcement. The Campbell companion CD and website

are utilized for the activities on each chapter. Some of the more important concepts are discussed with additional teacher generated diagrams, handouts, and activities. Time is spent outside of class reading scientific articles and book excerpts, some assigned, some chosen, with student written responses an integral part of these readings. These ongoing readings help the student apply biological knowledge and critical thinking to environmental and social concerns in our modern world of biology. Also, a thesis paper on a required topic of genetics is part of the first semester grade. This paper parallels the senior English paper format and must include numerous current reference sources. Our local college proves instrumental in the success of many of our students, enabling them to conduct research in a collegiate library. Unit exams cover several chapters and include free-response type questions that will help develop the writing skills needed in upper level biology classes, as well as help students perform well on the AP Exam. Assessments are regularly given at the chapter level, done either by the individual or by team. These assessments can take the form of a quiz, a problem to solve, or a model to explain. Unit exams are given at the end of each of the eight units and follow a format similar to the AP Exam.

The course provides students with an opportunity to develop a conceptual framework for modern biology as the topics in this course are integrated through the eight major themes as specified by the College Board in the AP Biology Course Description: Science as Process; Evolution; Energy Transfer; Continuity and Change; Relationship of Structure to Function; Regulation; Interdependence in Nature; Science, Technology and Society. Much of our work relates the

underlying theme of evolution to modern biological models and thought presented in all topics.

## **INTRODUCTION**

*chapter 1*

### TOPICS

- Ten Themes in the Study of Life

### ASSESSMENTS

- Class creates 10 posters of a collage nature to depict the ten major themes (as in the 8 themes defined by the College Board) of biology. Scientific and other journals are used for selective cutting. References to the Ecology chapters (summer reading) are encouraged. Rationale must be provided orally for each poster.

## **UNIT ONE: THE CHEMISTRY OF LIFE**

*chapters 2-6*

### TOPICS

- atomic structure
- chemical bonds
- water
- acids/bases/buffers
- functional groups
- macromolecules
- energy and metabolism
- enzymes

### ASSESSMENTS

- Toothpick-ase exercise
- AP LAB #2 Enzyme Catalysis
- Lab exercise #5 (Vodopich, Moore) Biologically Important Molecules
- Molecular models activity with atomic ball and stick kits

- Macromolecule organizer wall chart activity
- Journal article 1 synopsis
- Lab exercise #4 (Vodopich, Moore) Solutions, Acids, and Bases (pH)
- Loren Eiseley quote essay
- G. Evelyn Hutchinson quote essay
- Unit 1 exam

## **UNIT TWO: THE CELL**

*chapters 7-12*

### TOPICS

- microscopy
- cell structure
- plasma membrane structure/function
- cellular transport
- cellular respiration
- fermentation
- photosynthesis
- carbon fixation adaptations
- chemiosmosis
- cell signaling
- cell cycle and regulation
- mitosis

### ASSESSMENTS

- Lab topic 3: Microscopes and Cells (Morgan/Carter)
- Lewis Thomas quote essay
- Robinson Jeffers quote essay
- AP LAB #1 Diffusion and Osmosis
- AP LAB #5 Cell Respiration
- AP LAB #4 Photosynthesis
- Lab exercise #13 (Vodopich/Moore) Mitosis
- Class project - wall posters: to compare and contrast the details of...  
cellular respiration and photosynthesis
- Unit 2 exam

## **UNIT THREE: GENETICS**

*chapters 13-21*

## TOPICS

- sexual life cycles
- meiosis
- Mendelian genetics
- inheritance patterns
- chromosomal basis of inheritance
- molecular basis of inheritance
- history of search for genetic material
- DNA structure, replication
- transcription
- protein synthesis
- mutations
- genetics of viruses
- genetics of bacteria
- organization and control of eukaryotic genomes
- cancer
- cloning
- DNA analysis
- applications of DNA technology
- embryonic development
- gene expression

## ASSESSMENTS

- Lab exercise #14 (Vodopich/Moore) Meiosis
- Exercise 5 Cellular Reproduction, part B only (Abramoff/Thomson)
- AP LAB #3 Mitosis and Meiosis
- DNA extraction (wheat germ, onions)
- Lab exercise #16 (Vodopich/Moore) Genetics
- AP LAB #7 Genetics of Organisms, with statistical analysis
- Genetics problems
- Exercise 12 Human Genetics (Abramoff/Thomson)
- Working clay models of operons
- AP LAB #6 Molecular Biology
- Journal article topic 3 analysis/reaction
- Karyotype activity
- Readings from *Genome*
- Genetics topic thesis paper
- Role play presentations on historical DNA search
- *Double Helix* movie, with reaction essay

- Unit 3 exam

## **UNIT FOUR: MECHANISMS OF EVOLUTION**

*chapters 22-25*

### TOPICS

- history of Darwinism
- evidence of evolution
- population genetics
- Hardy-Weinberg theorem
- genetic drift and natural selection - microevolution
- speciation
- macroevolution
- systematics

### ASSESSMENTS

- "Teddy Graham" investigation of population genetics
- AP LAB #8 Population Genetics and Evolution
- Evolution Poster Project with Symposium held for the public
- Darwin quote essay
- Robinson Jeffers quote essay
- Lab topic 11: Population Genetics I: Hardy-Weinberg Theorem (Morgan/Carter)
- *GATTACA* movie, essay on metaphorical analysis
- Journal article topic 4 synopsis
- Unit 4 exam

## **UNIT FIVE: THE EVOLUTIONARY HISTORY OF BIOLOGICAL DIVERSITY**

*chapters 26-34*

### TOPICS

- history of life timeline
- origin of life
- analysis of lineages of life
- prokaryotes
- structure/function of prokaryotes
- ecological impact of prokaryotes
- eukaryotic diversification

- protist diversity
- overview of land plant evolution
- seed plant evolution
- plant diversity
- fungi diversity
- fungal ecology
- animal phylogeny
- animal diversity
- animal body "plans"
- invertebrates
- parazoa
- radiata
- protostomia
- deuterostomia
- chordates and vertebrate origin
- vertebrate phylogeny
- primate evolution

## ASSESSMENTS

- Create a timeline of the history of life using adding machine tape
- Timeline using Evolution colorbook template
- Lab exercise #26 (Vodopich/Moore) Survey of the Kingdom Fungi
- Taxonomy quote by Stephen Jay Gould essay
- Creation of charts of generalized plant life cycles (moss, fern, gymnosperm, angiosperm)
- Lab topic 16: Plant Diversity II: Seed Plants
- Outside class for plant identification using field guides
- Lab topic 17: Animal Diversity I (Morgan/Carter)
- Lab topic 18: Animal Diversity II (Morgan/Carter)
- Journal article topic 5 synopsis
- Lab exercise #18 (Vodopich/Moore) Human Evolution
- Hominid skull collection examination
- Unit 5 exam

## **UNIT SIX: PLANT FORM AND FUNCTION**

*chapters 35-39*

## TOPICS

- plant structure

- plant growth and development
- transport in plants
- plant responses

## ASSESSMENTS

- Lab exercise 31: Plant Anatomy (Vodopich/Moore)
- AP LAB Transpiration #9
- Journal article topic 6 synopsis
- Unit 6 exam

## **UNIT SEVEN: ANIMAL FORM AND FUNCTION**

*chapters 40-49*

## TOPICS

- animal tissue types
- bioenergenics
- nutrition
- feeding mechanisms
- food processing
- transport systems
- mammalian cardiovascular system
- gas exchange
- mammalian respiratory system
- immunity
- homeostasis
- thermoregulation
- water balance
- mammalian kidney form and function
- vertebrate endocrine system
- animal reproduction
- animal embryonic development
- morphogenesis and differentiation
- nerve signals
- evolution and diversity of nervous systems
- sensory and motor mechanisms

## ASSESSMENTS

- Lab exercise 40: Vertebrate Animal Tissues (Vodopich/Moore)



- Fetal Pig Dissection using the following:
  - Lab topic 21: Vertebrate Anatomy I; 21.2, 21.3 (Morgan/Carter)
  - Lab topic 22: Vertebrate Anatomy II
  - Lab topic 23: Vertebrate Anatomy III
- AP LAB #10 Physiology of the Circulatory System
- Lab topic 24: Animal Development; 24.1 only (Morgan/Carter)
- Lab exercise 45 Human Biology, Sensory Perception (Vodopich/Moore)
- Journal article topic 7 synopsis
- Cat Dissection as ongoing demo along with the pig dissection - selected systems using references from lab manual (Tortora, Anagnostakos, and Tallitsch)
- Unit 7 exam

## **UNIT EIGHT: ECOLOGY**

*chapters 50-55*

This unit is done as a summer reading assignment. The labs and activities are done over the first few classes at the beginning of the school year.

### TOPICS

- organism distribution factors
- biomes
- animal behavior
- population ecology
- community ecology
- ecosystems
- models of chemical cycling
- conservation biology
- biodiversity

### ASSESSMENTS

- AP LAB #12 Dissolved Oxygen and Aquatic Primary Productivity
- Sir John Arthur Thompson quote essay
- Naturalist of choice biographical sketch/contributions
- AP LAB #11 Animal Behavior
- Journal article topic 8 synopsis
- Lab topic 25 Ecology I: Terrestrial Ecology (Morgan/Carter)
- Unit 8 exam