Course Syllabus for AP Biology

Personal Philosophy

In teaching AP Biology, I feel that it is important for the AP Biology student to have an understanding of the process of science as a whole instead of just a narrow understanding of Biology. Also, I feel that it is important for the AP Biology student (and all students) to see the connections between all aspects of science and biology and how they are involved in various societal and environmental concerns. In addition, after taking my class, it is my intent that students are able to be independent thinkers and are able to find and analyze information and data from published scientific journals and documents.

Overview of AP Biology Course

Since the foundation of modern Biology is based on evolutionary processes, my main goals of AP Biology are to help students develop a conceptual framework for modern biology and to help students gain an appreciation of science as a process. To ensure that these goals are met, I integrate the hierarchy of life (from the elements to the biosphere) to the lesson, unit, or concept that is being addressed in the classroom. This allows me to integrate the eight themes of AP Biology (Science as a Process, Evolution, Energy Transfer, Continuity and Change, Relationship of Structure to Function, Regulation, Interdependence in Nature, Science, Technology, and Society) into any or all of each level of this hierarchy. Each time I begin a new unit or lesson, I have my students apply any of the concepts being discussed to the eight themes which I have placed onto separate posters on my classroom wall. I feel that using this approach allows students to better see the progression of the curriculum and interrelatedness of these themes of biology and in the hierarchy of life.

Classes meet for 50 minutes a day, five days a week. Typically, four out of five days are spent lecturing and doing activities and the fifth day is used for laboratory investigations. Since time is limited during the normal day, labs are also completed before or after school and, on occasions, during Saturdays. The school year is divided up into four-9 week grading periods. However, due to the date of the AP Biology exam, missed classroom instruction due to standardized testing, school events, etc… I create my syllabus using a 34 week timeline. The majority of my AP Biology students have taken Pre-AP Biology under my instruction or another Pre-AP Biology teacher who follows the same Pre-AP syllabus. This allows for some components of the AP Biology curriculum, including some of the laboratories, to be covered in Pre-AP Biology. Also, students in my campuses Biology classes have been exposed to the same laboratories as Pre-AP Biology. This allows for increased access to AP Biology. For students that have not taken Pre-AP Biology, extra tutoring time is used in an as needed basis.

My classroom is equipped with all of the needed equipment needed to perform all of the twelve laboratories, per College Board's Lab Manual for Students. For some of the labs, I use Vernier sensors and probes that are linked to either Vernier LABPRO's and Ti84+ calculators or to desktop computers, installed with LoggerPro software, The lab use of these sensors are indicated in the Appendix. In addition to the minimum equipment, my classroom is also equipped with a thermocycler, for PCR lab as well as SDS-PAGE equipment for the separation of proteins.

Textbook & Resources

The textbook that is issued to my students is:
Campbell N. and Reece J, Biology, Benjamin Cummings, 2002. 6th Ed.
In addition to the textbook, students have access to:

Taylor R. Student Study Guide for Biology, Campbell, Reece Sixth Edition, Benjamin Cummings, 2002. 6th Ed.
For the laboratories, I use College Board's AP Biology Laboratory Manual for Students.
Supplemental texts, used for reference for students and lesson preparation, include:
Schofield, Carolyn. Student Handout for Reviewing the 12 AP Biology Labs. AP Strategies, Inc.
Lab Benches for Campbell Biology (CD-ROM)(6th Edition). Pearson Education, 2003
Raven, Peter H. and Johnson, George. Biology (6th Edition).
Purves, William, Sadava, David, Orians, Gordon, and Heller, H. Life The Science of Biology (7thEdition. Sinauer Associates, 2004.
Campbell, Neil and Reece, Jane. Biology (7th Edition). Pearson Education. 2005
Silent Spring, by Rachel Carson
Kendrew, John. The Encyclopedia of Molecular Biology. Blackwell Science, 1994
Tortora, Gerald, Grabowski, Sandra. Principles of Anatomy and Physiology, 7th Ed. Harper-Collins, 1993
Lehninger, Albert, Nelson, David, Cox, Michael. Principles of Biochemistry, 2nd Ed. Worth Publishers, 1993

The following sources are from the alternate labs used:
BIO-RAD Biotechnology Explorer. pGLO Bacterial Transformation Kit http://explorer.bio-rad.com
BIO-RAD Biotechnology Explorer. Chromosome 16: PV92 PCR Informatics Kit. http://explorer.bio-rad.com
BIO-RAD Biotechnology Explorer. Comparative Proteomics Kit: Protein Profiler Module http://explorer.bio-rad.com
BIO-RAD Biotechnology Explorer. ELISA Immuno Explorer Kit http://explorer.bio-rad.com
BIO-RAD Biotechnology Explorer. Restriction Digestion and Analysis of Lambda DNA http://explorer.bio-rad.com

Internet resources include regular use of the textbook's online website, where students take self-quizzes and submit their scores to me by way of email:
http://occawlonline.pearsoned.com/sms_files/campbell6e_awl/login.html
In addition to the above website, students also must work through the online version of each lab before we perform the lab in class. At this website, they are able to get a better understanding of what they are to expect ahead of time:
http://www.phschool.com/science/biology_place/labbench/index.html

Units Exams
Each exam, with a few exceptions, consists of a multiple choice section followed by a free response section. With only 50 minute class periods, the exams are distributed across two days. The first day, students are given a 60 multiple choice test, which is taken in the "AP Exam" format. The following day, students are given two Free Response prompts, taken from AP Biology released exams (http://apcentral.collegeboard.com and http://apbio.biosci.uga.edu/exam/Essays/html/index.html). On shorter units, the number of questions and free response prompts are divided in half and taken during one 50 minute class period. Also, for some units take home free response questions are given instead of two-day exams.
The exams are graded similarly to the AP Biology exam standards, where 60% of the points are taken from the multiple choice section and 40% are taken from the free response section.

For each unit exam, the majority of the multiple choice questions are taken from Campbell's Biology, 7th Edition test bank and some are taken from the 1990, 1994, 1999, & 2002 AP Biology released exams.. Multiple choice questions for the semester finals are taken from the 1990, 1994, 1999, & 2002 AP Biology released exams.

Laboratory Assessments

After completing my AP Biology class I expect my students to be able to design and perform a controlled experiment based upon observations made about a particular topic. In addition, students are also expected to be able to collect and analyze data, through basic statistical analysis, and draw conclusions based on their results. In order to be successful, students have to keep a laboratory journal, in which they record their procedures, data/results, and write their conclusions for each laboratory they perform. They are required to write a report for various laboratories performed, which they place in their journals. These reports must include a title, problem, hypothesis (in an "If…then…" format), prediction, background information, data (graphs, table, data analysis, etc…), conclusion, and sources of error.

Assignments

Since there is not enough time during the school year to cover the entire AP Biology curriculum, I assign both a summer assignment as well as holiday assignments. The summer assignment consists of online questions for chapters 50-55 of the textbook. These chapters cover ecology, so to reinforce the importance of this unit, students also read Silent Spring, by Rachel Carson, over the summer. The students that sign up after receiving the summer assignment are given three weeks from the start of the school year to complete the summer assignment. There are three major holidays, Thanksgiving week, winter break, as well as spring break. During these three holidays, students create power point presentations over a topic that relates to the unit that is being covered at that time.

Daily assignments include the re-organization of notes taken in class, notes taken from the textbook, and problems taken from the Student Study Guide that accompanies the textbook. Students are given a weekly pop quiz over the assigned textbook reading

Grading: Grades consist of 60% summative work and 40% formative work. Summative grades include written and oral tests, major projects, some quizzes and laboratory reports over the twelve required lab investigations. Formative grades include daily grades such as study guide questions, homework grades, some quizzes, and supplemental lab reports.

Syllabus

I have broken each unit of study into separate tables. The first table, below, explains how the following tables are organized.

Unit
The following units are listed in the progression in which they are taught through the academic school year.
Concepts Taught
The concepts listed, in the following units, cover either the Molecular and Cells (Mol & Cc), Heredity and Evolution (He & Ev), or Organisms and Populations (Org & Pop) or a combination of the three topics listed in the AP Biology Course Description.
Time (Total and Lab)
Time, in the following units, includes lectures, lessons, labs, activities, etc…

Assessment
Assessments, in the following units, includes exams
Laboratory and/or Activity (See Appendix)
Labs and activities, in the following units, include labs and activities which are explained in the appendix.
Reading Assignment
The reading assignments, in the following units, are taken from Campbell N. and Reece J, Biology, Benjamin Cummings, 2002. 6th Ed.

Unit
Introduction to Biology & the Scientific Method, Graphing, & Statistics
Concepts Taught
Overview of the eight themes of AP Biology. Students learn the importance of homeostasis in living systems. Students learn how to create hypotheses, based on observations, controlled experiments, graph and analyze collected data, and to write a lab report based on their experiment. Students learn concepts of behavior biology, such as orientation behavior, agonistic and altruistic behaviors, mating behaviors, fixed-action patterns, learned verses innate behaviors, classical conditioning, etc…(Ev & Org)
Time (Total and Lab)
1.5 weeks
Assessment
Lab report and graphs
Laboratory and/or Activity (See Appendix)
Lab 10. Animal Behavior
Reading Assignment
Chapter 1 and Chapter 51, pages 1122-1124, 1128-1130, 1133-1142, 1144-1147

Unit
Chemistry
Concepts Taught
Elements, bonding, water properties, pH, functional groups, organic molecules, including the structure and function of carbohydrates, lipids, proteins, and nucleic acids. (Mol)
Time (Total and Lab)
1.5 weeks
Assessment
Two day exam; first day 60 multiple choice and second day two free response
Laboratory and/or Activity (See Appendix)
Making molar solutions
Reading Assignment
Chapters 2-5

Unit
Thermodynamics
Concepts Taught
Students learn enzyme structure and function, and enzyme control mechanisms. Students learn the basics of thermodynamics and how it applies to living systems. (Mol & Cc)
Time (Total and Lab)
1 week

Assessment
Informal lab report
Laboratory and/or Activity (See Appendix)
Lab 2. Enzyme Catalysis
Reading Assignment
Chapter 6

Unit
Digestion
Concepts Taught
Students learn the structure, function, and evolution of digestive systems, including chemical (enzymatic) and mechanical digestion in mammalian systems. (Mol & Cc, Ev, & Org)
Time (Total and Lab)
1 week
Assessment
Exam, including enzymes from previous unit
Reading Assignment
Chapter 41, pages 857-868

Unit
Cells, Cell Membranes, and Tissues
Concepts Taught
Students learn the structure and function of Prokaryotic and Eukaryotic cells, including organelles and the cell membrane. They also must compare and contrast Prokaryotic and Eukaryotic cells, as well as, plant and animal cells. Students learn the theory of endosymbiosis and the evolution of cell structures. Students learn the four animal tissue types and the different cells that make these tissues. Also, they learn how the structure of cells determine their function in tissues. (Mol, Cc, Ev, & Org)
Time (Total and Lab)
2 weeks
Assessment
Two day exam and lab report on Osmosis lab
Laboratory and/or Activity (See Appendix)
Making Molar Solutions Lab 1B and 1C. Diffusion and Osmosis. Students perform lab 1B in Biology and Pre-AP Biology and AP Biology students perform lab 1C that they design on their own.
Reading Assignment
Chapters 7 and 8, 40, pages 834-839

Unit
Nerve Cell Physiology
Concepts Taught
Students learn the physiology of a nerve impulse, including the regulation (EPSP and IPSP) of a synapse. Students apply concepts learned from cell membrane behavior to physiology of action potential in nerve cells. (Mol, Cc, Ev, & Org)
Time
2-3 days
Assessment
Multiple choice exam with Free Response prompt given with excretory systems exam
Reading Assignment
Chapter 48, 1023-1037

Unit
Excretory Systems
Concepts Taught
Students learn the evolution of the physiology and anatomy of excretory systems starting with protonephridia to the vertebrate nephron. Students apply concepts learned from cell membrane behavior to physiology of excretory systems. Students learn the evolution of each system across different animal phyla. (Mol, Cc, Ev, & Org)
Time (Total and Lab)
2-3 days
Assessment
Multiple choice exam with Free Response prompt given with action potential exam
Laboratory and/or Activity (See Appendix)
Urinalysis lab, if time permits
Reading Assignment
Chapter 44, 936-950

Unit
Cellular Respiration
Concepts Taught
Students learn the general biochemistry of cellular respiration with emphasis on how the structure of mitochondria allows for the production of ATP through oxidative phosphorylation. Students also must apply concepts learned about enzymatic function. (Mol & Cc)
Time (Total and Lab)
1.5 weeks
Assessment
Multiple choice with Free Response prompt
Laboratory and/or Activity (See Appendix)
Lab 5, Cellular Respiration with formal lab write-up
Reading Assignment
All of chapter 9

Unit
Photosynthesis
Concepts Taught
Students learn the general biochemistry of photosynthesis with emphasis on how the structure of chloroplasts allows for the creation of both ATP (by photophosphorylation) and sugars. Students learn the how the properties of plant pigments make use of electromagnetic spectrum energy. Students learn the mechanisms in which plants have evolved to counter photorespiration. Students also compare and contrast between the structure and function of mitochondria and chloroplast. (Mol & Cc)
Time (Total and Lab)
1.5 weeks
Assessment
Multiple choice with Free Response prompt
Laboratory and/or Activity (See Appendix)
Lab 4, Plant Pigments and Light Reactions with informal lab report. Students observe and identify structures in the cross sections of both monocot and dicot plant leaves.
Reading Assignment: All of chapter 10

Unit
Circulation and Respiration
Concepts Taught
Students learn the evolution of the physiology and anatomy of both circulatory and respiratory systems. Students apply concepts learned from cell respiration to the physiology of these systems. Also, students apply concepts learned about pH, buffers, and gas diffusion to the homeostatic regulation of blood composition. Students learn the evolution of each type of respiratory and circulatory system across different animal phyla. (Mol, Cc, Ev, & Org)
Time (Total and Lab)
1.5 weeks
Assessment
Short multiple choice exam with take home Free Response prompt
Laboratory and/or Activity (See Appendix)
Lab 10 Physiology of the Circulatory System and Respiration Activity
Reading Assignment
All of chapter 42

Unit
Cell Cycle & Meiosis
Concepts Taught
Students learn the stages of the eukaryotic cell cycle, with emphasis on mitosis. Also, students must understand how the cell cycle is regulated. Students also learn the process and function of meiosis. Students know how to compare and contrast mitosis and meiosis. Students understand aneuploidy, caused by non-disjunction, and the various syndromes it leads to. Students know how to read a karyotype. Finally, students learn the process of gametogenesis and sexual reproduction. (Mol, Cc, He, Ev, & Org)
Time (Total and Lab)
1 week
Assessment
Multiple choice exam
Laboratory and/or Activity (See Appendix)
Lab 3 Mitosis & Meiosis
Reading Assignment
All of chapters 12 and 13

Unit
Mendelian & Morgan Genetics
Concepts Taught
Students are to understand patterns of inheritance (sex-linked, autosomal dominant/recessive, etc….) discovered by Gregor Mendel and Thomas Morgan. Students are to be familiar with examples of various genetic disorders. Students are to become proficient in solving a wide range of genetic problems. Students learn how to use the Chi-squared statistic test to analyze a set of collected data with that of expected results. Students also learn how to create and analyze various pedigrees of genetic disorders. (He, Ev, & Pop)
Time (Total and Lab)
2 weeks
Assessment
Exam with genetics problems
Laboratory and/or Activity (See Appendix)
Lab 7, Genetics of Organisms, using ears of corn.
Reading Assignment
All of chapters 14 and 15

Unit
DNA Replication & History of DNA Discovery
Concepts Taught
Students understand how the structure of DNA relates to its function, including replication. Students understand the significance of scientist's discovery of DNA structure and function. (Mol, Cc, He)
Time (Total and Lab)
1 week
Assessment
Exam with multiple choice questions and free response. Project (winter break) over four groups of scientists discoveries of DNA structure (two groups) and function (two groups).
Laboratory and/or Activity (See Appendix)
PCR lab
Reading Assignment
All of chapter 16

Unit
Central Dogma of Molecular Biology (DNA → RNA → Protein → Trait)
Concepts Taught
Students understand the biochemistry of transcription and translation in both prokaryotic and eukaryotic cells. Students understand gene regulation mechanisms in both prokaryotic and eukaryotic cells (operons, enhancers, etc…). (Mol & Cc)
Time (Total and Lab)
2.5 weeks
Assessment
Two-day exam, multiple choice and free response
Laboratory and/or Activity (See Appendix)
Translation and Operon models
Reading Assignment
Chapter 17, pages 305-324; Chapter 18, pages 347-351; Chapter 19, pages 355-358, 363-386; Chapter 21, pages 403, 408, 410-421

Unit
DNA Technology
Concepts Taught
Students understand the various DNA technologies, including bacterial transformation, restriction digestion and separation of DNA (gel electrophoresis), southern blotting, and Restriction Fragment Length Polymorphisms (RFLP). (Mol)
Time (Total and Lab)
1 week
Assessment
Lab write-up and questions from lab manual
Laboratory and/or Activity (See Appendix)
6a, 6b Transformation & DNA Electrophoresis
Reading Assignment
Chapter 20, pages 377-380, 382-386

Unit
Viruses & Bacteria
Concepts Taught
Students learn the structure of viruses and bacteria. Students learn viral life cycles and mating between bacteria. Students learn the role that both viruses and bacteria play in organisms, populations, communities, and ecosystems. Students also learn the evolutionary importance of viruses and bacteria. (Mol, Cc, He, Ev)
Time (Total and Lab)
3-4 days
Assessment
Multiple choice exam
Laboratory and/or Activity (See Appendix)
Short power point project on roles of viruses and bacteria
Reading Assignment
Chapter 18, pages 328-346; Chapter 27, pages 526-539

Unit
Evolution
Concepts Taught
Students learn the history of evolutionary biology, including the works of scientists that influenced and were influenced by Charles Darwin's work. Students learn population evolution and study examples of populations that have evolved and are evolving. Also, students learn about the mechanisms of speciation. (Ev, He, & Pop)
Time (Total and Lab)
2 weeks
Assessment
Multiple choice and free response exam
Laboratory and/or Activity (See Appendix)
Lab 8, Population Genetics & Evolution
Reading Assignment
Chapter 22, pages 429-442; Chapter 23, pages 446-461; Chapter 24, pages 464-480; Chapter 25, pages 484, 493-503

Unit
Animal Phylogeny and Development
Concepts Taught
Students learn the developmental and phylogenetic characteristics and patterns across the animal phyla. Students learn the taxonomy system that is based on the current three-domain system of classification. Students learn how the evolutional history of each phyla determines their classification. Students learn how and why the animal phyla are organized. Students learn how to read and create a cladogram. (He, Ev, & Org)
Time (Total and Lab)
1 week
Assessment
Take home Free Response
Laboratory and/or Activity (See Appendix)
Cladistics activity
Reading Assignment
Chapter 32, pages 634-640; Chapter 47, pages 1002-1008

Unit
Protist and Fungus Kingdoms
Concepts Taught
Students learn the phylogenetic characteristics and patterns across the protist and fungal phyla. Students learn the importance of both kingdoms to all other ecosystems. (Cc, Ev, & Org)
Time (Total and Lab)
3-4 days
Assessment
Multiple choice test
Reading Assignment
Chapter 28, pages 555-572, all of Chapter 31

Unit
Plant Diversity & Evolution
Concepts Taught
Students learn the developmental and phylogenetic characteristics and patterns of the plant phyla. Students learn how the life cycles and alternation of generations of each phyla determine their classification. Students learn how and why the plant phyla are organized. (He, Ev, Org & Pop)
Time (Total and Lab)
3-4 days
Assessment
Multiple choice test
Reading Assignment
Chapter 29, pages 575-577, 580-593; all of chapter 30

Unit
Plant anatomy and transport.
Concepts Taught
Students learn the anatomy of monocot and dicot plants and to differentiate between the various structures. Students learn the physiology of the transport of materials throughout plants. (Mol, Cc, Org)
Time (Total and Lab)
1.5 weeks
Assessment
Informal lab report. Multiple choice test
Laboratory and/or Activity (See Appendix)
Lab 9, Transpiration and examination of leaf and stem cross sections
Reading Assignment
Chapter 35, pages 720-737; Chapter 36, pages 748-764

Unit
Plant reproduction, responses, hormones
Concepts Taught
Students learn chemical signals (hormones) used by plants and how plants respond to these signals as well as environmental signals. Students learn the difference between short-day and long-day plants and the mechanisms that are responsible for these responses. Students learn the various structures used in the different phyla of plants, with emphasis on angiosperm reproduction. (Mol, Cc, Org)

Time (Total and Lab)
1 week
Assessment
Multiple choice test
Reading Assignment
Chapter 38, pages 783-787, 789-792; Chapter 39, pages 806-816, 818-825

Unit
Immune, Endocrine, & Reproductive Systems
Concepts Taught
1 week
Time (Total and Lab)
Students learn the functions of the immune, endocrine, and reproductive systems and the structures involved in these functions. Students learn the evolution of each system across different animal phyla. Students learn various interrelationships between these three systems, with emphasis on the human systems. (Ev, & Org)
Assessment
Free response and multiple choice test.
Laboratory and/or Activity (See Appendix)
ELISA Lab. Powerpoint over how two or more systems interact with each other in humans
Reading Assignment
Chapter 43, pages 901-909, 913-914; Chapter 45, pages 955-956, 958-961, 963, 967-968

Unit
Nervous & Sensory Systems
Concepts Taught
Students learn the structures of nervous systems and their evolution across different animal phyla. Students learn the anatomy of vertebrate nervous system and the control mechanisms involved in maintaining their functions. Students understand how the structure of various sensory systems relate to their function. Students learn the physiology of the sliding filament model of muscle contraction. (Mol, Cc, Ev, & Org)
Time (Total and Lab)
1 week
Assessment
Multiple choice test
Laboratory and/or Activity (See Appendix)
Balancing activity. Students compete in a relay race where they must run around an obstacle after spinning themselves, head-down, around a stick or baseball bat. This reinforces the function of the vestibular apparatus in the inner ear.
Reading Assignment
Chapter 48, pages 1040-1051; Chapter 49, pages 1060-1066, 1068-1072, 1077-1085

Unit
Ecology
Concepts Taught
Students learn the different biomes and their biotic and abiotic make up. Students learn aspects of population and community ecology and examples of each. Students learn the science and math behind ecology. Students must understand the impact of humans, and other populations, on ecosystems. Students learn the geochemical cycles and their importance in ecosystems. Students understand the interrelatedness between all levels of ecosystems. Students understand the flow of energy through food chains and webs. (Mol, & Pop)

Time (Total and Lab)
3 weeks
Assessment
Free response and multiple choice test
Laboratory and/or Activity (See Appendix)
Lab 12, Dissolved Oxygen and Aquatic Primary Productivity; Presentation over a conservation method. Students are given a point of view on sea turtle conservation and debate, based on their research, the point of view that is assigned to them. The points of view range from a coastal land developer to shrimp fishermen and sea turtle conservationist.
Reading Assignment
Chapter 50: 1092-1095, 1099-1117; Chapter 52: 1151-1155, 1159-1170; Chapter 53: 1176-1182, 1189-1191; Chapter 54: All; Chapter 55: 1224-1232

Appendix
Laboratory and Activities Outline

Lab Title
Diffusion & Osmosis (Exercise 1A, B, &C)
Days Required
3
Objectives
Students to understand concepts of diffusion of solutes & water across a semi-permeable membrane. To design an experiment that demonstrates diffusion of solutes & water in a biological system. AP Students complete exercise 1C outside of class. Dialysis tubing experiment (Activities A & B) is performed in Pre-AP Biology.
Assessment
Informal lab report

Lab Title
Enzyme Catalysis
Days Required
3
Objectives
Students to perform an enzyme catalyzed reaction using catalase and hydrogen peroxide as a model. Students will measure, quantify, graph, and analyze the results of reaction.
Assessment
Informal lab report

Lab Title
Mitosis & Meiosis
Days Required
1
Objectives
Students observe and identify cells in the different stages of mitosis in an onion root tip and the stages of meiosis in *Sordaria*.
Assessment
Questions in lab manual

Lab Title
Photosynthesis (Pigment Chromatography)
Days Required
1
Objectives
Students separate plant pigments by their polar properties as explained in College Board's Lab Manual for Students. Students understand the properties of pigments (and other molecules)
Assessment
Questions in lab manual

Lab Title
Photosynthesis (DPIP & Light Reactions)
Days Required
3
Objectives
Students to perform an experiment that quantifies light reactions using DPIP dye-reduction technique as explained in College Board's Lab Manual for Students.
Assessment
Informal lab report

Lab Title
Cellular Respiration
Days Required
3
Objectives
Students to create and perform an experiment that measures the effects of temperature on the rate of cellular respiration in an ectothermic organism. Students use Vernier-brand CO_2 gas sensors and Ti-84+ calculators to collect data.
Assessment
Formal lab report

Lab Title
Bacterial Transformation
Days Required
2
Objectives
Students transform a benign strain of *E. coli* bacteria with a plasmid that contains *bla* (ampicillin resistance) gene and the gene for green fluorescent protein (GFP) that is linked with an inducible operon (araC). Students learn the functions of heat shock and $CaCl_2$ solution and how selection of particular traits (ampicillin resistance) works. Bio-Rad's pGLO Transformation kit is used for this lab.
Assessment
Informal lab report

Lab Title
DNA Restriction Analysis
Days Required
2
Objectives
Students perform a restriction digest with different endonucleases on lambda phage DNA. The digested DNA is then run through agarose gel electrophoresis to separate the fragments.

Students then calculate unknown fragment sizes by linear regression to a known fragment size.
Assessment
Questions in lab manual

Lab Title
Genetics of Organisms
Days Required
1
Objectives
Students make predictions of phenotypes in genetic corn. Then the predictions are compared to the actual outcomes using Chi Square analysis. Students repeat this process with several other models to ensure understanding.
Assessment
Sample problems

Lab Title
Population Genetics & Evolution
Days Required
1
Objectives
Students model random mating, fatal recessive traits, heterozygote advantage, and genetic drift, using paper alleles as explained in College Board's Lab Manual for Students. Class data are taken under each of the conditions and then students use the Hardy-Weinberg equations to calculate their genetic frequencies.
Assessment
Questions in lab manual & sample problems

Lab Title
Transpiration
Days Required
2
Objectives
Students measure the rates of transpiration in plants under different environmental conditions as explained in College Board's Lab Manual for Students. Students record changes in pressure, caused by transpiration, using Vernier pressure sensors attached to potometers.
Assessment
Informal lab report

Lab Title
Physiology of the Circulatory System
Days Required
3
Objectives
Students learn how to measure their blood pressure and heart rates and then observe the affects of different conditions on their blood pressure and heart rate as explained in College Board's Lab Manual for Students. Students observe and record and graph the respiration rate of either *Daphnia* (in a dissecting scope) or goldfish by measuring the animal's gill movement. Students then understand the affects of temperature on respiration rate in both ectothermic and endothermic organisms.
Assessment
Questions in lab manual

Lab Title
Animal Behavior
Days Required
2
Objectives
Students create and perform a controlled experiment to test their hypotheses on pill bug movement behavior.
Assessment
Questions in lab manual

Lab Title
Dissolved Oxygen & Aquatic Primary Productivity
Days Required
3
Objectives
Students learn the affects of biotic and abiotic factors on dissolved oxygen. Students learn how to determine the primary productivity of an aquatic ecosystem using the light-dark bottle method as explained in College Board's Lab Manual for Students. Students learn how to measure dissolved oxygen using both a Vernier brand dissolved oxygen sensor and the Winkler titration method.
Assessment
Informal lab report

Lab Title
PCR of PV92
Days Required
2
Objectives
Students isolate check cell DNA and amplify (PCR) an *Alu* insert in PV92 gene on chromosome 16. Students then observe their genotype of this gene through gel electrophoresis.
Assessment
Informal lab report

Lab Title
Comparative Proteomics Kit: Protein Profiler Module
Days Required
2
Objectives
Students extract and separate, by size, multiple fish proteins using SDS-PAGE (protein electrophoresis). Students have to compare fish protein fingerprints based on evolutionary relatedness.
Assessment
Informal lab report

Lab Title
Spectrophotometry of Plant Pigments
Days Required
1

Objectives
From the pigment chromatography, students isolate and extract the plant pigments and create an absorption spectrum using a spectrophotometer. This activity is used as an extra credit assignment. AP students complete this lab outside of the classroom..
Assessment
Graph

Lab Title
Graphing Skills
Days Required
2
Objectives
For students to create various graphs from different data. Students are to be able to differentiate between the types of graphs they are to create.
Assessment
Graphs and data

Lab Title
Making Molar Solutions
Days Required
1
Objectives
Students learn how to create various molar solutions, using sugar, salts, etc….from a stock solution and from having to calculate molarity as a function of moles of solute per volume of solution.
Assessment
Demonstration of making solutions

Lab Title
ELISA
Days Required
2
Objectives
Students to understand how antibodies/antigens are identified using the Enzyme-Linked ImmunoSorbent Assay
Assessment
Informal lab report

Lab Title
Operon Modeling
Days Required
1
Objectives
Students will assemble an operon model including, DNA, DNA polymerase, inhibitors, coding regions, and products.
Assessment
Model

Lab Title
Membrane Modeling
Days Required
1
Objectives
Students will assemble a model membrane from phospholipids, cholesterol, integral and peripheral proteins, and carbohydrates. Then the students will use models of glucose and water to show directions of transport.
Assessment
Model

Lab Title
Cladistics
Days Required
1
Objectives
Students create a cladogram of a set of organisms based on given traits
Assessment
Cladogram