

AP Biology

Course Overview

My double period classes meet five days a week, for a total of 100 minutes every day. A typical day involves lecture for the first period followed by a lab or an activity the second period. Occasionally both periods are used for lectures or labs. The extended class time allows for at least partial, if not total, completion of the long, required AP labs in one day. The double period everyday also gives me the flexibility to delve further into a topic with enhancement activities and additional teacher-generated labs. The 12 required AP Labs and additional labs take up at least 25 to 30 percent of instructional time. In addition, I usually give the students a lab extension activity for the AP Labs which enable them to perform inquiry by designing their own experiment or researching the topic further. The course textbook is the fifth edition of Neil A. Campbell and Jane B. Reese's *Biology* (1999). We also use the *AP Biology Lab Manual for Students* (2001). Students are highly encouraged to purchase study manuals.

Teaching Strategies

There are eight major concepts that are woven through all of the topics covered during the year. These are:

- Science as a process
- Energy transfer
- Continuity and change
- Regulation
- Interdependence in nature
- Science, technology and society
- Form fits function
- Evolutionary trends/Adaptations for survival

As I introduce new material, I show how the new topic fits in with these themes. I try to show the connectedness of each system or component that we study. Since the students develop tunnel vision as they focus closely on one area, I want them to continually see "the big picture".

For each unit, a variety of techniques are used to explore the topic. Guided lecture notes are used to cover the large volume of material. In addition, the students will read pertinent articles, engage in discussions, perform labs, complete work packets and watch relevant videos. Students may partner up for some of these activities or work individually. All of the AP labs are performed in groups of four or five in assigned lab groups.

The student evaluation for each unit includes labs, assignments, numerous quizzes throughout the unit and the unit test. Tests account for 50 percent of the grade. Labs account for 25 percent and the remaining 25 percent involves homework, worksheets, presentations, etc. I have created a lab quiz for each of the 12 AP labs. That quiz consists of multiple choice questions based on the theory of the lab and an essay question. The essays for the lab quizzes and tests are based on essay questions from previous AP exams and might involve analyzing data, graphing or theory. The students will have multiple opportunities to practice their essay writing skills. The unit test questions are also similar to those on the AP exam. The tests are two periods long which also give the students experience in handling long exams. After each unit test, we go over the most missed questions to not only cover content, but to help strategize in making educated guesses when necessary.

Throughout the year, students will give presentations, whether individual or group, on an assigned or chosen topic. All students are required to present an end of the year AP Project that can focus on any topic in science. Students will teach the class this topic in the last few weeks of school after the AP exams are finished. This project counts as the student's final exam grade.

Course Planner

For each major topic below, I have included the approximate time for completion. The number of days is given for all the labs. I have also included the time necessary to complete activities if longer than 1 day is needed.

I. Molecules & Cells

A. Chemistry of Life

4 weeks

Ch. 1 Introduction

Activity: Candle Activity

Students must try to ignore all prior knowledge about a candle and justify whether it can be called a living thing. They may be very creative in their discussions.

Class Discussion: What is a living thing?

Activity: The Scientific Method Game

Students will use deductive reasoning to decipher a pattern created by a group member. They must use the steps of the scientific method to solve the problem.

Activity: Scientific Investigation

Students will design and perform a scientific experiment which has all the components of a controlled experiment. The experiment will answer one question relating to cardiovascular fitness such as, "Does gender have an effect on cardiovascular fitness?" They will use their collected data for analysis and critique their experiment for weaknesses and improvements.

Ch. 2 Basic Chemistry

Ch. 3 Water

Activity: Practice AP Essay on Water

Lab: Characteristics of Water

Students will learn about the physical properties of water, including adhesive and cohesive properties through simple demonstrations.

Ch. 4 Carbon

Ch. 5 Biochemistry

Activity: Student Protein Presentations (2 days)

Students give a 3 minute presentation on a protein of their choice (no duplicates). Each student must include a visual – poster, overhead, drawing, etc. showing the protein's level of structure.

Lab: Model Building of Macromolecules (3 days)

Students will build 3 macromolecules (proteins, carbohydrates, lipids) using plastic models, wooden models and clay. Models will show the special bonding between monomers.

Activity: World of Chemistry - Proteins video

Test Ch. 1-5

Ch. 6 Enzymes

Activity: Not Ready for Prime Time Enzymes (1-2 days)

Using pop beads as substrates, students will assume the role of enzymes in building large compounds. Students will also demonstrate what happens to enzymes and the rate of chemical reactions in the presence of different types of inhibitors. Results will be graphed and analyzed.

Lab: AP Lab 2 – Enzyme Catalysis (2 days)

Test Ch. 6

B. Cells

2-3 weeks

Ch. 7 Cell Structures

Lab: Tomato and Onion Organelles (2 days)

Students will stain, draw, identify and label various organelles from plant cells.

Activity: Student Cell Presentations (2 days)

Students will individually present information on a specific plant or animal cell. They will discuss how the form fits its function and any unique features.

Ch. 8 Cell Membranes

Lab: AP Lab 1 - Diffusion (2 days)

Activity: Osmotic Potential Problems

Article: How Cells Obtain Glucose

Ch. 11 Cell Communication

Activity: Cell Signaling worksheet

Article: Signal Transduction

Test Ch. 7, 8, 11

C. Cellular Energetics

4 weeks

Ch. 9 Respiration

Activity: Hans Krebs article

Lab: AP Lab 5 – Respiration (2 days)

Activity: Washington Post Cytochrome Poisoning article

Test Ch. 9

Ch. 10 Photosynthesis

Activity: National Geographic video - Photosynthesis

Lab: AP Lab 4 – Photosynthesis & Chromatography (2 days)

Activity: Lab 4 Extension

Students may calculate R_f values for 9 unknown chromatography strips made from 3 different leafy plants using 3 different solvents. They may make only 3 known strips and use those to identify the unknown plant/solvent combinations.

Test Ch. 10

II. Heredity & Evolution

A. Heredity & Molecular Genetics

5-6 weeks

Ch. 16 DNA

Activity: Watson & Crick Article

Lab: DNA Extraction (1 day)

Students will analyze the steps necessary to extract DNA from a living tissue. They will then extract DNA from calf thymus.

Lab: Sizes of E. coli & DNA (1 day)

Students will use string and pill capsules to simulate bacteria's ability to encase a relatively massive amount of DNA in a small volume.

Lab: DNA Replication (1/2 day)

Students will perform a paper lab showing how a DNA strand replicates. They will record observations and facts about the process.

Lab: DNA Model Building (1/2 day)

Students will use plastic model kits to build a DNA strand. All models will be joined to show the correct twisting of the long strand. Individual models will be compared to observe the unique nature of the random nucleotide linkings.

Ch. 12 & 13 Mitosis & Meiosis

Lab: AP Lab 3 – Mitosis & Meiosis (3 days)

Activity: Lab 3 Extension

Students will explore the stages of cell division in an extensive work packet to be turned in with the lab.

Test Ch. 12, 13, 16

Ch. 17 Protein Synthesis

Activity: Synthesis work packet.

Multiple worksheets on transcription, translation and mutations.

Ch. 18 & 19 Gene Expression (Operons)

Activity: Operon modeling.

Use of student made paper models to understand eukaryotic and prokaryotic gene expression.

Test Ch. 17-19

Ch. 20 DNA Technology

Lab: AP Lab 6 – DNA Technology (4 days)

We add an extra restriction enzyme to the lab to compare with the other restriction cuts. They will also plot this extra data and interpolate the fragment lengths.

Test Ch. 20

Ch. 14 & 15 Mendelian Genetics

Activity: Genetics problem Packet

Students will use Punnett Squares to solve problems for monohybrid, dihybrid, trihybrid, incomplete and codominant crosses.

Students will also derive and calculate gene linkage positions on chromosomes.

Lab: M&M Chi-square Problem (1 day)

Students will determine if the observed ratio of M&M colors in a bag match the expected ratio. Good practice for the Fly Lab.

Lab: AP Lab 7 – Drosophila Genetics (3 weeks)

The class does an alternate version of this lab that involves more inquiry for the student. Students are given 1 of 2 assignments. One assignment has the lab group design their own experiment by deciding on their own fly cross, performing it and testing results with a Chi-square. For the other, the lab group receives an unknown cross, observes their offspring, theorizes the cross and tests with a Chi-square. All students will submit a formal lab report showing all of the steps of the scientific method.

Activity: Class discussion – “Would you want to know if you were predisposed to a harmful medical condition?”

Ch. 51 Behavior

Lab: AP Lab 11 – Behavior (1 day)

I add this chapter here since we have the fruit flies for the genetics lab.

Test Ch. 14, 15, 51

B. Evolutionary Biology

2-3 weeks

Ch. 23 Population Genetics

Lab: AP Lab 8 – Population Genetics & Evolution (2 day)

Activity: Lab 8 Extension

Packet on Hardy-Weinberg problems turned in with the lab book.

Ch. 22 & 24 Darwin and Origin of Species

Lab: Natural Selection Bean Activity (1 day)

Students will measure 100 beans to observe and graph variation. They will also predict what will happen to the population as factors affect the environment for or against natural selection.

Lab: Barbellus Evolutionary Tree (1 day)

Students will use physical characteristics and placement in the fossil record to create a phylogenetic tree for the imaginary Barbellus species.

Ch. 25 Phylogenetic Trees and Cladograms

Lab: Evolutionary Changes in Primates (2 day)

Extensive lab where students will prepare and justify a proposed evolutionary tree of ancient and modern man using the following data: comparing class height and weight averages with ancient man, measuring angles of replica skulls and other skull features, measuring angles of uprightedness of ancestors, analyzing amino acid comparisons of other species, calculating age based on similarity of mitochondrial DNA.

Lab: Nailing Cladistics (1 day)

Students will observe a bag of nuts and bolts to distinguish primitive and derived characteristics to create a cladogram for these “species”.

III. Organisms & Populations

A. Diversity of Organisms

2-3 weeks

Ch. 26 Origin of Life & Classification

Activity: Life is Impossible Video

Activity: Class discussion on theories, personal and/or factual, on the origin of life.

Activity: Whittaker Classification/Domain Article

Lab: Classification Activities (2 day)

Students will use dichotomous keys to identify 20 different species of fish. They will collect evergreen leaf samples from campus and use a key to identify them. They will also create their own key to classify some mythical creatures.

Ch. 18 Viruses

Activity: Disease Simulation

Class will simulate the rapid spread of a virus. Students share liquid from a chosen set of test tubes with one tube possessing the virus (NaOH). Teacher will assume the role of CDC by "testing" for virus using indicator to find the original carrier.

Ch. 43 Immune System

Activity: Wash. Post Inflammation Article

I add this chapter here to coincide with the virus and bacteria unit. Students learn the dangers of the immune response. After reading the article, they will write an in-depth question and answer on the topic. The best question will be the test essay.

Ch. 27 Bacteria

Lab: Monera Lab (2 days)

Students will gram stain live bacteria, answer questions, observe and diagram prepared slides of 15 different types of bacteria including the blue green algae. They will also prepare an informative pamphlet or website mock up on bacteria.

Test Ch. 18, 26, 27, 43

Ch. 28 Protists

Lab: Protist Identification Lab (2 days)

Students will observe, identify, draw, color, size and label 20 different prepared slides of protists. They may use samples on the laser disc to help with identification. They must make accurate drawings as they may use this packet on the lab practical.

Activity: Protista Paradox

Lab practical where students, working with their lab group, may use labs and notes to identify species and characteristics for prepared slides of 12 unknown protists.

Ch. 31 Fungi

Lab: Fungi Lab (1 day)

Students observe live and prepared specimens for identification and drawing.

B. Structure and Function of Plants

2 weeks

Ch. 29 Plant Introduction - Bryophytes

Lab: Kingdom Plantae (1 day)

Students observe live and prepared specimens of primitive plants to answer questions, identify and draw.

Ch. 30 Gymnosperms and Angiosperms

Lab: Gymnosperms (1 day)

Students observe live and prepared specimens of primitive plants to draw, identify and answer questions.

Activity: Alternation of Generations

Students will diagram and analyze moss and fern reproductive life cycles.

Ch. 35 Growth

Lab: Tissue Lab (1 day)

Students will draw and label plant tissues from prepared slides.

Ch. 36 Transport

Lab: AP Lab 9 – Transpiration (2 days)

Ch. 37 Plant Nutrition

Ch. 38 Plant Reproduction

Lab: Flower Dissection (1 day)

Students will draw and label the reproductive features of a live flower. They will dissect it to find the ovary and ovule. They will also draw the reproductive cycle of a flower.

Lab: Angiosperm Development (1 day)

Students will dissect 3 fruits to draw and label the reproductive and embryonic features.

Ch. 39 Plant Hormones & Response

Test Ch. 29, 30, 35, 36, 37, 38, 39

C. Structure and Function of Animals

3-4 weeks

Ch. 32-34 Animal Development

Lab: Animal Classification (1 day)

Students will observe preserved specimens of animals from all phyla. Using a dichotomous key, they will match the specimen to its phyla and/or class.

Test Ch. 32-34

Ch. 40 Tissues

Lab: Awful Autopsy (1 day)

In their lab groups, students will match prepared slides of tissues to their description. Students will use notes and books to aide their identification.

Ch. 41 Digestive System

Lab: Digestion and Taste (1/2 day)

Students will sample the 4 basic tastes to map the taste regions of their tongue. They will also investigate the relationship between smell and taste.

Activity: Systems Study Packets

For each body system, students will receive very detailed questions and diagrams to analyze and answer questions. Packets are checked for accuracy and used by student to prepare for the test. Numerous quizzes are also given to cover each of the major systems.

Ch. 42 Respiratory/Circulatory Systems

Lab: AP Lab 10 – Circulation (2 days)

Ch. 44 Excretory System

Ch. 45 Endocrine System

Activity: Hormone packet

Students will list the major glands in the body and identify which hormones originate there and how these glands are simulated.

Ch. 46 Reproductive System

Ch. 48 Nervous System

Ch. 49 Skeletal/Muscular System

Lab: Skeletal Study

Students will examine a life-size replica skeleton to label, measure and identify all bones of the body.

Ch. 40-49 All Systems

Lab: Animal dissections & Seminar (5 days)

Students will have 3 days to dissect an assigned animal. They will have their own animal but will work near those with like animals. Animals include earthworm, starfish, frog, perch, pigeon, turtle, rat, pregnant rat and dogfish shark. Students will use notes, guidebooks, online sources, etc. to help identify the animal's major organ systems. For the next 2 days, we have seminar presentations where the animal groups present their findings to the rest of the class. This information is used to complete the lab report and to prepare for the test.

Test Ch. 40-42, 44-49

D. Ecology

Ch. 50, 52 & 53 Biomes & Population Ecology

Activity: Ecology Packet

1 week

Extensive worksheets that help students investigate population growth and curves, distinguish between r and K strategists, identify limiting factors for a population and its carrying capacity, and explore symbiotic relationships.

Ch. 54 Ecosystems

Lab: AP Lab 12 – Dissolved Oxygen (1 day)

Activity: Food Web Packet

Students will analyze a given ecosystem to create a food web. They will also discuss energy flow and the ecology pyramids.

Ch.55 Conservation Biology

Activity: Class discussion comparing man's need for land vs. native and endangered species.

AP Review (1 week)

The year's topics are divided into 8 sections and 2 sections will be reviewed each day. Each review session will end with a short quiz for evaluation. On the fifth day, the students will take a sample AP test (multiple choice section) to review, analyze individual performance and find out how AP grades are determined.

AP Project

The students will design and complete a project which demonstrates one specific scientific topic. Students will choose one science subject of interest, which is always very diverse, like biometrics, biological and chemical weapons and horse evolution to name a few. The project will include a clear visual (power point, poster, video, etc) and an oral presentation.