AP BIOLOGY SYLLABUS

	Curricular Requirements	**Pages**
CR1	Students and teachers use a recently published (within the last 10 years) college-level biology textbook.	3
CR2	The course is structured around the enduring understandings within the big ideas as described in the AP Biology Curriculum Framework.	5,6,7,8,10
CR3a	Students connect the enduring understandings within Big Idea 1 (the process of evolution drives the diversity and unity of life) to at least one other big idea	4,7,10
CR3b	Students connect the enduring understanding within Big Idea 2 (biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis) to at least one other big idea.	4
CR3c	Students connect the enduring understanding within Big Idea 3 (living systems store, retrieve, transmit, and respond to information essential to life processes) to at least one other big idea.	4,10
CR3d	Students connect the enduring understanding within Big Idea 4 (biological systems interact and these systems and their interactions possess complex properties) to at least one other big idea.	4,6,7,12
CR4a	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 1.	5,6,7
CR4b	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 2.	6,7,8
CR4c	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 3.	7
CR4d	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 4.	5,6
CR5	The course provides students with opportunities to connect their biological and scientific knowledge to major social issues (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens.	5,7,10,12
CR6	The student-directed laboratory investigations used throughout the course allow students to apply the seven science practices	3,5,6,7,

	defined in the AP Biology Curriculum Framework and include at least two lab experiences in each of the four big ideas.	9,10,11,12
CR7	Students are provided the opportunity to engage in investigative laboratory work integrated throughout the course for a minimum of 25 percent of instructional time.	3
CR8	The course provides opportunities for students to develop and record evidence of their verbal, written, and graphic communication skills through laboratory reports, summaries of literature or scientific investigations, and oral, written, or graphic presentations.	3,5,6,7,8, 10

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Course Overview

Advanced Placement Biology is a year-long laboratory based college level course. Students study using the framework of the Big Ideas (Evolution, Energy Processes, Living systems store, retrieve, transmit, and respond to information essential to life processes, and Biological systems interact). Students learn the methods and processes of science through a laboratory approach which emphasize development and testing of the hypothesis, collection, analysis and presentation of data, as well as discussion of results. The student directed and inquiry-based laboratory investigations used throughout the course enable students to apply the seven science practices as defined in the Curriculum Framework. Students are expected to take the Advanced Placement Biology Exam. (**CR6, CR7, CR8)**

CR7: Students are provided the opportunity to engage in investigative laboratory work integrated throughout the course for a minimum of 25 percent of instructional time.

Course Prerequisites

A student may take AP Biology if they have taken Honors Biology and Honors Chemistry.

CR1: Students and teachers use a recently published (within the last 10 years) college-level biology textbook.

Class Profile

The class size averages 10-15 students. This class will run every day for 60 minutes the entire school year. Labs will be scheduled on a regular basis. A minimum of two labs for each of the Big Ideas will be completed.

CR6: The student-directed laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Biology Curriculum Framework and include at least two lab experiences in each of the four big ideas.

Materials

- Campbell, Neil A., and Jane B. Reece (2005). ***Biology*** (7^{th} ed.). Upper Saddle River, NJ: Prentice Hall. (**CR1**)
- AP Biology Investigative Labs: An Inquiry-Based Approach, The College Board, 2012
- Outside reading: Books, journals
- AP Exam Review materials
- Pasco Probe and Lab ware
- Videos/various websites (ex. Learn.Genetics.Utah.edu)
- Campbell Media Manager

CR8: The course provides opportunities for students to develop and record evidence of their verbal, written, and graphic communication skills through laboratory reports, summaries of literature or scientific investigations, and oral, written, or graphic presentations.

Teaching Strategies

The four Big Ideas are integrated throughout the course. Students are put into groups and work cooperatively to complete some assignments. Group questions are used to review the four Big Ideas and correlate unit studies. When students are not involved in labs or activities described in the syllabus they are involved in class lectures. **(CR3a, CR3b, CR3c, CR3d)**

CR3a: Students connect the enduring understandings within Big Idea 1 (the process of evolution drives the diversity and unity of life) to at least one other big idea

CR3b: Students connect the enduring understanding within Big Idea 2 (biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis) to at least one other big idea.

CR3c: Students connect the enduring understanding within Big Idea 3 (living systems store, retrieve, transmit, and respond to information essential to life processes) to at least one other big idea.

CR3d: Students connect the enduring understanding within Big Idea 4 (biological systems interact and these systems and their interactions possess complex properties) to at least one other big idea.

Student Evaluation (Major Assignments/Assessments)

Emphasis is placed on scientific reasoning through analysis and synthesis, research, technique, and being able to present one's point of view in writing as stated in the seven science practices. One written research assignment is required. The research is to include the latest information on the topic, technology, and society issues. Each of these assignments includes a 3-5 minute summary presentation to the class. **(CR2, CR6)**

Students will create a PowerPoint showing knowledge on a chosen topic discussed during the year. A five-minute presentation to the class is required. **(CR5, CR8)**

Students are given a chapter test or unit test. The test is modeled after the AP Biology Exam. Vocabulary quizzes will be given for each new unit so students are familiar with the terminology of science.

Each Unit studied will have appropriate laboratory work. **(CR7)**

Students will attend one outside field trip, if possible which help meet the learning objectives of the four Big Ideas. **(CR4)**

The remaining part of the student grade will consist of homework assignments and class activities. **(C2, C4)**

CR5: The course provides students with opportunities to connect their biological and scientific knowledge to major social issues (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens.

CR6: The student-directed laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Biology Curriculum Framework and include at least two lab experiences in each of the four big ideas.

CR7: Students are provided the opportunity to engage in investigative laboratory work integrated throughout the course for a minimum of 25 percent of instructional time.

CR8: The course provides opportunities for students to develop and record evidence of their verbal, written, and graphic communication skills through laboratory reports, summaries of literature or scientific investigations, and oral, written, or graphic presentations.

Course Schedule

Readings are from the textbook/journal article. Activities/labs are integrated with a minimum of 2 laboratory activities per Big Idea

Molecules, Cells, and Energy *Big Ideas 1,2,3, & 4* ***(CR2)***

A. **Biological Chemistry Molecules** *(2.5 weeks)*

a. Topics

i. Review of atoms, molecules, bonding, pH.
ii. Polarity of water & its importance to biological systems.
iii. Carbon's role in the molecular diversity of life. The role of functional groups.
iv. Various levels of structure in carbohydrates, lipids, proteins, and nucleic acids
v. Chemical Reactions, Free energy changes
vi. Enzymes: rates of activity, regulation, role as a special protein.

b. Reading

i. Chapters 2-5 from textbook

c. Activities/Labs

i. Using kits to build macro-molecule models **(CR4a) (SP1)**
ii. Using models to illustrate protein folding **(CR4b)**
iii. Acid/base/buffer lab activity **(CR6) (SP 2)**
iv. Adhesion/cohesion lab **(CR3d) (SP4)**
v. Enzyme catalysis Lab **(CR4d)**
vi. Lab "Properties of the Molecules of Life" **(CR4d)**

d. Assessment

i. Student generated concept maps
ii. Vocabulary quizzes/Reading quizzes
iii. Unit test with free response practice
iv. Written lab reports **(CR8)**

B. Cells *(3 weeks)*

a. Topics

i. Prokaryotic/eukaryotic cells, plant/animal cells, structure/function of organelles.
ii. Evolutionary relationships between prokaryotic and eukaryotic cells.
iii. Structure/function of cell membrane
iv. Cell communication (signals, receptors, responses, hormones)
v. Methods of transport across membranes

b. Reading

i. Chapters 6,7, 12, & 13 from textbook
ii. Guided reading questions
iii. Journal articles on cell communication and relation to medical advances in disease treatment. **(CR5)**

c. Activities/Labs

i. Microscope lab – Drawings comparing structures of cells from 3 different kingdoms. **(CR3a, CR4a, CR4c, CR8)**
ii. Diffusion and Osmosis lab **(CR6) (SP 3,4)**
iii. Lab – Microscope techniques for observing/measuring different types of cells.

d. Assessment

i. Vocabulary quizzes
ii. Reading quizzes
iii. Chapters/Unit tests
iv. Written lab reports **(CR8)**
v. Microscope drawings and calculation
vi. Discussion of the endosymbiont hypothesis of the evolution of eukaryotic cells.

C. Energy Transformations *(3.5 weeks)*

a. Topics

i. ATP structure and function, energy transfer, coupled reactions, chemiosmosis, coenzymes, cofactors, rates of activity, regulation
ii. Enzyme catalysis
iii. Activation energy & specificity
iv. Cellular respiration glycolysis, citric acid cycle, electron transport chain & chemiosmosis.
v. C3 and C4 Photosynthesis
vi. Alternative mechanisms

b. Reading

i. Chapters 8,9, & 10 from textbook.
ii. Guided reading/notes

c. Activities/Labs

i. Pre-lab LabBench Enzyme catalysis
ii. Enzyme Activity Lab **(CR3d, CR6)**
iii. Enzyme: Factors affecting rate of Activity Lab **(CR6) (SP2)**
iv. Cellular Respiration lab **(CR6) (SP2)**
v. Photosynthesis lab **(CR4b)**

d. Assessment

i. Student generated concept maps/posters
ii. Reading quizzes
iii. Chapters/Unit test with free response questions

CR2: The course is structured around the enduring understandings within the big ideas as described in the AP Biology Curriculum Framework.

iv. Lab group presentation of data and results to class **(CR8)**
v. Formal lab writeup and analysis **(CR8)**
vi. Student constructed chart comparing energy transfer methods. **CR4b)**

D. **Immunity** *(2 weeks)*

a. **Topics**

i. Innate vs Acquired Response
ii. Humoral responses ; B vs T cells
iii. Self vs. non-self

b. Reading

i. Textbook Chapter 43

c. Activities/Lab

i. Case study – Immune response
ii. Student generated map of immune response

d. Assessment

i. Section test
ii. Presentation of Case Studies analysis **(CR8)**

II. Heredity and Evolution *Big Ideas 1,3* ***(CR2)***

A. Molecular Genetics *(3 weeks)*

a. Topics

i. DNA structure and replication
ii. RNA structure
iii. Eukaryotic chromosomal structure, nucleosomes, transposable elements, regulation of genes
iv. Recombinant DNA, DNA cloning, hybridization, DNA sequencing.
v. Mutations – basis for natural selection
vi. Regulation of gene expression
vii. Biotechnology – DNA,PCR, Gel electrophoresis
viii. Comparing genomic sequences in relation to evolution

b. Reading

i. Text Chapters 16-21
ii. Journal Article readings
iii. Article on PCR.

c. Activities/Lab

i. DNA extraction
ii. Comparison of DNA and protein sequences from BLAST internet activity **(SP7)**
iii. DNA gel electrophoresis lab

iv. Bacterial Transformation and Restriction Enzyme Analysis of DNA Lab **(CR6)**

d. Assessment

i. Reading quizzes
ii. Formal Lab reports
iii. Test with Free Response questions
iv. Journal article discussions

B. Heredity *(3 weeks)*

a. Topics

i. Mendel's Laws
ii. Probability and inheritance patterns: chromosomes, genes, alleles
iii. Gene linkage and mapping
iv. Mutations/Human genetic defects

b. Reading

i. Chapters 14, 15 from textbook.
ii. Journal article reading

c. Activities/Labs

i. Activity – Analyzing corn crosses
ii. LabBench – population genetics
iii. Mendelian genetics Internet web quest

d. Assessment

i. Test with Free Response questions
ii. Journal Article Discussion
iii. Reading quizzes

C. Evolution *(3 weeks)*

a. Topics

i. Darwin's explorations and theory of descent with modification & natural selection.
ii. Origin of Life
iii. Evidence of evolution, natural selection (molecular analyses & morphological analyses
iv. Hardy-Weinberg Principle – factors influencing allelic frequencies
v. Specification: isolating mechanisms, allopatry, sympatry, adaptive radiation, patterns of evolution, gradualism, punctuated equilibrium
vi. Evolution of populations

b. Reading

i. Chapters 22-26 in Textbook
ii. Guided Readings

c. Activities/Labs

i. Discussion of selected reading
ii. Mathematical Modeling: Hardy Weinberg **(CR6)**
iii. Analysis of traits of people around us

d. Assessment

i. Unit test with Free response questions
ii. Formal lab report

D. Mitosis& Meiosis (1.5 weeks)

a. Topics

i. Cell cycle mechanism & control
ii. Chromosomes
iii. Sexual vs asexual reproduction & evolutionary advantages
iv. Stages of meiosis
v. Genetic variation in offspring, mechanisms & impact on evolution
vi. Environmental influences on genetics

b. Reading

i. Textbook Chapter 12 & 13

c. Activities/Lab

i. Mitosis/Meiosis lab – Crossing Over **(CR3c, CR6)**
ii. Karyotyping activity/ genetic disorder

d. Assessment

i. Test
ii. Presentation of karyotypes and Genetic Disorder **(CR8)**
iii. Formal Lab report

III. Organisms and Populations *Big Ideas 1,3, & 4* ***(CR2)***

A. Biological Diversity and Microbiology*(2 weeks)*

a. Topics

i. Taxonomy and Systematic
ii. Kingdom and domain systems

b. Reading

i. Chapter 25-27, 29,30
ii. Journal articles

c. Activities/Labs

i. Penquin Cladogram activity
ii. Student research on recombination in prokaryotes (**CR5**)
iii. Gene analysis with BLAST **(CR3a, CR6)**

d. Assessment

i. Section test
ii. Presentation with argument on penguin cladogram
iii. Article presentation

B. Plants and Their Diversity *(3 weeks)*

a. Topics

i. How plants colonized land
ii. Evolution of seed plants
iii. Structure growth and development
iv. Plants responses to internal and external stimuli

v. Plant nutrition
vi. Angiosperm reproduction

b. Reading

i. Chapters 35-39

c. Activities/Labs

i. Transpiration Lab (**CR3a, CR6)**
ii. Flower dissection lab
iii. Student generated lab on plant growth from seeds under various greenhouse conditions. **(CR6) (SP3,5,6,7)**

d. Assessment

i. Student generated concept map
ii. Section test
iii. Formal lab report

C. Animals *(3 weeks)*

a. Topics

i. Characteristics (body plans & systems) of invertebrates as you go up phylogenetic tree.
ii. Basic anatomy principles
iii. Analysis of structure and function of body systems
iv. Digestive, Circulatory, Respiratory, Excretory, Endocrine, Nervous, and muscular systems.
v. Homeostasis

b. Reading

i. Chapters 32-34 and 40-49

c. Activities/Labs

i. Survey of animal phyla in chart form. Student generated
ii. Lab – Human physiology
iii. Lab Daphnia Heart Rate **(CR6, SP7)**
iv. Dogfish shark dissection
v. Blood Typing Lab

d. Assessment

i. Test with Free Response questions
ii. reading quiz
iii. Practical quiz using the animal phyla chart students generated

D. Ecology *(4.5 weeks)*

a. Topics

i. Behavioral ecology
ii. Population dynamics, biotic potential, limiting factors
iii. Ecosystem and community dynamics – Biotic and abiotic
iv. Energy flow
v. Productivity, species interaction
vi. Succession
vii. Biomes

viii. Biogeochemical cycles
ix. Human influences – positive and negative

b. Reading

i. Chapters 51-54 in textbook

c. Activities/Lab

i. Lab – Insect Behavior lab: Taxis, Kinesis, and Agonistic – Student generated lab **(CR6)**
ii. Dissolved Oxygen & Aquatic Primary Productivity Lab **(CR3d, CR5, CR6) (SP 2,3,4,5,6,7)**

d. Assessment

i. Test with Free response questions
ii. Formal lab reports