CURRICULAR REQUIREMENTS	PAGE(S)
CR1 Students and teachers use a college-level textbook.	4
CR2 The course is structured around the enduring understandings within the big ideas as described in the AP Biology Curriculum Framework.	3,8,9,10,11,12,13,14,15
CR3a Students connect the enduring understandings with Big Idea 1 (the process of evolution drives the diversity and unity of life) to at least one other big idea.	9,10,12,13
CR3b Students connect the enduring understandings with 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.	10,12,13,15
CR3c Students connect the enduring understandings with Big Idea 3 (living systems store, retrieve, transmit, and respond to information essential to live processes) to at least one other big idea.	6,14,15
CR3d Students connect the enduring understandings with Big Idea 4 (biological systems interact and these systems and their interactions possess complex properties) to at least one other big idea.	10,11,16
CR4a The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 1.	6,9
CR4b The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 2.	12,13
CR4c The course provides students with opportunities outside of the	14

	laboratory investigations to meet the learning objectives within Big Idea 3.	
CR4d	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 4.	10,11,15
CR5	The course provides students with opportunity to connect their biological and scientific knowledge to major social issues (e.g., concerns, technological advances, innovations) to help them become scientifically-literate citizens.	6,13,14,15,16
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.	3,4,5,7,8
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.	4,7

Course Overview

My AP Biology course is designed to offer students an introductory college-level biology course. It is built around the four big ideas, the enduring understandings within the big ideas and the essential knowledge within the enduring understanding. **(CR2)**

The big ideas:

Big Idea 1- The process of evolution drives the diversity and unity of life.
Big Idea 2- Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.
Big Idea 3- Living systems store, retrieve, transmit and respond to information essential to life processes.
Big Idea 4- Biological systems interact, and these systems and their interactions possess complex properties.

Course Organization

AP Biology is only offered every other year to juniors and seniors. The students are expected to have successfully completed Biology and Chemistry prior to taking my class. Classes meet four days a week for 43 minutes. A fifth day is a double period lab running 86 minutes. With some labs running more than the scheduled lab day, student-directed laboratory investigations exceed 25% of the instructional time. **(CR7)** Students will conduct a minimum of eight inquiry-based investigations, two per big idea throughout the course. Additional labs will be conducted to deepen students' conceptual understanding and to reinforce the application of science practices within a hands-on, discovery-based environment. All levels of inquiry will be used and all seven science practice skills will be used by students on a regular basis in formal labs as well as activities outside of the lab experience. The course will provide opportunities for the students to develop, record, and communicate the results of their laboratory investigations. **(CR6)**

Textbook/Resources

Biology: The Unity and Diversity of Life, Cecie Starr and Ralph Taggart, Ninth Edition, 2001, Brooks/Cole. An additional resource is *AP Biology Investigative Labs: an Inquiry-Based Approach.* **(CR1)** When necessary, other labs investigations are used. Additionally, released multiple choice and free response questions from 1968 to the present from the AP Biology exams are used throughout the year.

Investigative Laboratory Component

The course is structure around inquiry in the lab and the use of the seven science practices throughout the course.

Students are given the opportunity to engage in student-directed laboratory investigations throughout the course. They will conduct a minimum of eight inquiry-based investigations, two per big idea throughout the course. **(CR6)** Additional labs will be conducted as appropriate to enhance student learning and understanding of concepts and to reinforce the application of science practices within a hands-on, discovery-based environment. The course will provide opportunities for students to develop, record, and communicate the results of all laboratory investigations. Students will prepare formal lab write-ups, powerpoint presentations, use white boards to communicate their results to the class, and/or present their lab work to the class as a group project. **(CR8)**

Big Ideas

The big ideas are interrelated so they will not be taught in isolation. The course will connect the enduring understandings from one big idea with those of the others whenever practical.

The Science Practices are:

1. The student can use representations and models to communicate scientific phenomena and solve scientific problems.
2. The students can use mathematics appropriately.
3. The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.
4. The student can plan and implement data collection strategies appropriate to a particular scientific question.
5. The student can perform data analysis and evaluation of evidence.
6. The student can work with scientific explanations and theories.
7. The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains.

Application of the Science Practices in the Laboratory Program **(CR6)**

UNITS AND ACTIVITIES BIG IDEAS/SCIENCE PRACTICES MATRIX	1. USE REPRESENTATIONS AND MODELS	2. USE MATHEMATICS	3. ENGAGE IN SCIENTIFIC QUESTIONING	4. PLAN AND IMPLEMENT DATA COLLECTION STRATIEGIES	5. PERFORM DATA ANALYSIS AND EVALUATION OF EVIDENCE	6. WORK WITH SCIENCTIFIC EXPLANATIONS /THEORIES	7. CONNECT AND RELATE KNOWLEGE	Big Idea 1:Evolution	Big Idea 2: Energy Processes	Big Idea 3: Information	Big Idea 4: Interactions
Unit 1-Introduction											
Nature of Science: Design experiment lab**(CR6)**	X	X	X	X	X						
Science as a Process:Measurement Lab **(CR6)**		X		X	X						
Chemistry of Life Lab **(CR6)**	X		X	X	X						X
Enzyme Catalysis Models	X								X		
Toothpickase Activity	X	X		X	X				X		

Macromolecule Lab **(CR6)**			X	X	X		X				X
Unit 2-Evolutionary Biology and Diversity											
Hardy-Weinberg Lab **(CR6)**	X	X	X	X	X	X	X	X			
Dichotomous Key Activity	X			X				X			
Cladogram Activity- Students given a group of organisms and some of their distinguishing characteristics. Students construct a cladogram and interpret and analyze it in terms of common ancestry. **(CR4a)(CR4d)**	X		X	X	X	X	X	X			
Natural Selection and Peppered Moth Activity	X	X	X	X	X	X	X	X			
Bacterial Transformation Lab **(CR6)**	X	X	X	X	X	X	X	X			
Artificial Selection Lab **(CR6)**		X	X	X	X	X	X	X			
Origin of Life Lab- students form coacervates **(CR6)(CR8)**	X		X		X	X	X	X			
Unit 3: Ecology/Behavior											
Fruit Fly Behavior Lab **(CR6)(CR8)**	X	X	X	X	X	X	X				X
Aquatic Primary Productivity **(CR6)**	X	X	X	X	X	X	X	X	X		X
Quadrant Study Activity	X	X	X	X	X		X		X		X
Behavior:Competition/Cooperation Lab **(CR6)**	X			X	X	X					X
Student-Designed Biome Model. This is to show a knowledge of biological processes and concepts across the scales. Connects big idea 4 to enduring understanding 2.A **(CR3d)**	X		X				X				X
NOVA video-"What Darwin Never Knew". Students view followed by class discussions to examine Darwin's observations and conclusions and how modern day molecular biology is confirming what Darwin proposed. **(CR3c)(CR4a)(CR5)**	X		X		X		X	X			
Unit 4: Introduction to Homeostasis and Response to the Environment											
Diffusion and Osmosis Lab **(CR6)**	X	X	X	X	X	X	X		X		X

Microscopy		X		X			X		X		
Rate of Diffusion Activity									X		
Unit 5:Cell Processes/Connections: Respiration and Animal Homeostasis											
Cell Respiration Lab **(CR6)**	X	X	X	X	X	X	X		X		X
Exercise and Blood Pressure and Pulse Lab **(CR6)**		X	X	X	X	X	X		X		X
Unit 6: Cell Processes/Connections:Photosynthesis and Plant Homeostasis											
Photosynthesis Lab **(CR6)**	X	X	X	X	X	X	X	X	X		
Transpiration Lab **(CR6)**	X	X	X	X	X	X	X		X		X
Unit 7: Making New Cells and Organisms											
Cell Division Lab **(CR6)**	X	X	X	X	X	X	X	X		X	
Genetics of Corn Lab **(CR6)**		X	X	X	X	X	X				
Chi Square Activity		X	X			X	X				
Chi Square Problem-Solving Activity		X								X	
Genetics Problem-Solving Activity	X	X			X	X				X	
Unit 8:All About Proteins											
Biotechnology Lab I-Bacterial Transformation **(CR6)**	X	X	X	X	X	X	X	X		X	
Biotechnology Lab II- Restriction Enzyme Analysis of DNA **(CR6)(CR8)**	X	X	X	X	X	X	X			X	
Restriction Enzyme and Paper DNA Activity	X							X			

Units

At least one of the Big Ideas will be incorporated in every lesson throughout the course. **(CR2)**

Unit 1- Nature of Science; Chemistry of Life (CR2)

Enduring Understandings: 2A, 3A, 4A-B

Topics and Skills:

Introduction to the four big ideas and enduring understandings.

Essential Questions

- How have scientists built upon the discoveries of other scientists to develop the concepts of biology?
- How do scientists test the validity of their ideas?
- What are the structural and chemical adaptations leading to the success of organisms?
- How do individual species, populations, and biomes impact evolutionary change?
- How does energy transfer occur at the molecular level in cells?
- How is continuity within a species ensured while still allowing for gradual change over time?
- How does structure control function at the molecular level?
- How does structure control function at the cellular level?
- How does structure control function at the organism level?
- How is the movement of molecules in and out of cells regulated?
- How is homeostasis maintained by an organism?
- How can we see interdependence at the molecular level?
- How do cells of a tissue or an organ rely on the existence of cells in other tissues or organs?
- How are organisms interdependent on each other?
- How does organism interdependence relate to evolution?

- What are the affects of scientific research and technology on society?

Process of science reviewed (CR4a)

- Scientific method- emphasizing problem-solving with application to many areas of life
- What is a theory?
- Practice data collection, analysis, and presentation of the data.

Evolution as a foundational theme (CR3a)

- Lamarck vs. Darwin- one is discredited, the other is accepted. Students to analyze the ideas of both and critique each.
- Define natural selection and explainexamples such as the Peppered Moth.
- Compare and contrast natural and artificial selection.

Chemistry of Life (CR4a)

- Why is carbon so important to life?
- Identify the macromolecules important to organisms.
- What are the unique characteristics of the water molecule?
- Why is water so unique?
- How is dehydration synthesis different from hydrolysis and why is each process important?

Ground Rules for Metabolism (CR4a)

- How do the first and second Laws of Thermodynamics apply to biological systems and how does evolution conform?
- How does life maintain a high degree of organization?
- How does enzyme structure relate to its functioning?
- What are the roles of substrates, intermediates, enzymes, cofactors, energy carriers, and products in various metabolic pathways?

Unit 2- Evolutionary Biology and Biodiversity (CR2)

Enduring Understandings: 1,2A, 2B, 2D, 2E, 3A, 3C, 4B, 4C

Topics and Skills

- What are the evidences of evolution?
- What do the evidences actually suggest/show?
- How do you distinguish between microevolution and macroevolution?
- How are gene pools, alleles, and allele frequency related to each other?
- How is gene frequency calculated in Hardy-Weinberg equilibrium?
- How is founder effect different from bottleneck?
- What is the biological species concept?
- How do pre and post zygotic mechanism contribute to speciation?
- How do allopatric and sympatric speciation contribute to speciation?
- How can a phylogenetic tree be evaluated to show evolutionary history?
- How can a model be made to illustrate mass extinctions?
- What is the current hypothesis for how and when life began?
- How do we know DNA is the hereditary material of life?
- What does the endosymbiosis theory say about the origin of eukaryotic cells?
- What is the basic timeline for the evolution of life?
- How do the kingdoms compare in relation to the evolution of structures, metabolism, and cellular organization?
- Discuss and compare the kingdoms in relation to evolution of structures, metabolism, and cellular organization; classification (systematic, phylogeny, cladograms); role in the biosphere; life cycles. **(CR3a)(CR3B)(CR3d)**

Unit 3- Ecology and Behavior (CR2)

Enduring Understandings: 1A, 2A, 2C, 2D, 2E, 3E, 4

Topics and Skills

1. Population Ecology **(CR3d)(CR4d)**

- How can logistic and exponential growth curves be analyzed and interpreted?
- How can data tables be converted into different survivorship curves and age structure diagrams?

2. Community Structure and biodiversity **(CR3d)(CR4d)**
    - What are the different types of symbiosis?
    - How is community interaction related to coevolution?
    - What are the different types of succession found in communities?
3. Ecosystems **(CR3d)(CR4d)**
    - How do the various biogeochemical cycles contribute to life on earth?
    - What is the difference between a food chain and food web?
    - What happens to energy as it flows through food chains?
4. Biosphere **(CR3d)(CR4d)**
    - What are the different biomes and how do the biotic and abiotic factors contribute to the biome?
    - What are the various ways humans impact the biosphere?
    - How can any negative human impact on the biosphere be changed?
5. Behavioral Ecology **(CR3d)(CR4d)**
    - How does animal behavior change in different environments?
    - What is the role of heredity vs. environment on behavior in plants and animals?
    - What are the different types of behavior and how does each promote an individual's reproductive success?

Unit 4-Introduction to Homeostasis and Response to the Environment (CR2)

Enduring Understandings: 1B, 1C, 2A, 2B, 2C, 2D, 3B, 3D, 3E, 4

Topics and Skills

1. What are the proper procedures in using a microscope?

2. Cell Structure and Function
    - What is surface area to volume ratio in cells?
    - What does surface area to volume ratio control?
    - What is the structure and function of the various cell organelles?
    - What is the evolution of cell organelles?
    - What are the differences between prokaryotic cells and eukaryotic cells?
3. A Closer Look at Cell Membranes
    - What is the fluid mosaic model?
    - Why is the cell membrane considered selectively permeable?
    - How does the fluid mosaic model explain permeability?
    - What is the difference between passive transport and active transport?
    - What are the various cell communication processes found in different types of organisms?
4. Plants and Animals-Common Challenges **(CR3a)(CR3b)**
    - What is homeostasis relative to an organism?
    - What is positive feedback mechanism and an example of it?
    - What is negative feedback mechanism and an example of it?
    - Using examples, how does a cell use osmosis and active transport to maintain homeostasis?
    - What is apoptosis?

Unit 5-Cell Processes/Connections: Respiration and Animal Homeostasis (CR2)

Enduring Understandings: 1B, 1C, 2A, 4

Topics and Skills

1. How cells release chemical energy **(CR4b)**
    - What are the differences between aerobic and anaerobic respiration?
    - What cell organelles are involved in respiration?

- How is aerobic respiration in plants and animals?
- Other than glucose, what are some other fuels in respiration?

2. Animal homeostasis-What is the role of each in maintaining homeostasis in animals?
    - Neural control
    - Sensory perception
    - Endocrine control
    - Immunity
    - Internal environment
    - Why is hypertension called the silent killer?
    - What can be done to avoid hypertension? **(CR5)**

Unit 6- Cell Processes/Connections:Photosynthesis and Plant homeostasis (CR2)

Enduring Understandings-1B, 2A, 2E, 4A, 4C

Topics and Skills

1. Photosynthesis **(CR3a)(CR4b)**
    - What plant structures are necessary to photosynthesis?
    - Compare the energy use between autotrophs and heterotrophs.
    - What are the major processes that occur in the dark and light reactions of photosynthesis?
    - How do the noncyclic and cyclic pathways relate to evolution?
    - What are the evolutionary implications seen in C3, C4, and CAM plants?
2. Plant Homeostasis and Transport **(CR3b)**
    - What are bulk flow, translocation, and cohesion-tension theory?
    - How do plant cells regulate the movement of water and organic materials?

- What were the experiments that led to the understanding of each class of plant hormone?
- Given data from the activity of organisms with circadian cycles, what can be understood about these organisms and those without photoperiodic responses?
- What is phytochrome and its role in long-day, short-day, and day-neutral plants?

Unit 7- Making New Cells and Organisms (CR2)

Enduring Understandings- 1A, 1C, 2A, 2E, 3A, 3C, 4A, 4C

Topics and Skills

1. How cells reproduce **(CR3c)(CR4c)**
    - What are the similarities and differences between normal and cancerous cells?
    - How is mitosis different between animal cells and plant cells?
    - What is the process by which cancer cells form? **(CR5)**
    - What does the experimental data tell us about cell differentiation?
2. Meiosis and sexual reproduction **(CR3c)**
    - What are the similarities and differences between mitosis and meiosis?
    - How are somatic cells distinguished from germ cells?
    - Why is meiosis important for the survival of a species?
    - How is meiosis important to evolution?
    - What are the events that occur in each step of meiosis I and meiosis II?
    - What is crossing over and why is it so important in sexual reproduction?
3. Reproductive mechanisms **(CR3c)**
    - What mechanisms increase genetic variation?
    - How are these mechanisms important to evolutionary fitness?
    - What is the role of alternation of generations in evolution?

- What is the double fertilization that occurs in flowering plants?
- What are modern biotechnological techniques including vegetative propagation and tissue culture propagation? **(CR5)**
- How is growth different from development and what are the regulation mechanisms?

4. Observing patterns in inherited traits **(CR3c)**
    - Why and how is Mendel's work significant?
    - Given data from several different inheritance patterns, what can be learned about the inheritance of those traits?
    - What is the product rule and how does it apply to inheritance?
    - How do Punnett squares work?
    - How is a pedigree constructed?
5. Chromosomes and human inheritance **(CR5)**
    - What are the different modes of human inheritance?
    - What are some of the benefits of genetic screening?

Unit 8- All About Proteins (CR2)

Enduring understandings-1, 2E,3 A, 3B, 3C, 4A, 4C

Topics and Skills

1. DNA structure and function **(CR3b)(CR4d)**
    - What historical events led to our current knowledge of DNA?
    - What is the molecular structure of the DNA molecule?
    - How do DNA nucleotides contribute to the DNA molecule?
2. From DNA to protein **(CR3c)**
    - How are DNA and RNA alike?
    - How are DNA and RNA different?
    - What are the steps of transcription?

- What are the steps of translation?
- What is the heterozygote advantage of sickle cell anemia? **(CR5)**
- What are the types of mutations?
- Why is a mutation in a germ cell more of a problem than a mutation in a somatic cell?
- What are some of the causes of mutations?
- Why is the genetic code considered to be universal?
- What are the evolutionary implications of a universal genetic code?

3.Controls over genes **(CR3d)**

- Compare and contrast gene control in eukaryotes with prokaryotes.

4. Studying and manipulating genomes **(CR3d)(CR5)**

- How is recombinant DNA used in transgenic organisms?
- How does knowing the composition of genes help scientists in fighting rapidly mutating organisms?
- How does knowing the genetic makeup of an earthly organism helpful in reconstructing the evolutionary history of life?
- What societal and environmental problems might be involved in trying to clone extinct animals? **(CR3d)(CR5)**