AP® Biology

Curricular Requirements	Page(s)
CR1 Students and teachers use a recently published (within the last 10 years) college-level biology textbook.	2, 6, 8, 10, 11, 13, 15, 16
CR2 The course is structured around the enduring understandings within the big ideas as described in the AP® Biology Curriculum Framework.	2, 6, 8, 9, 11, 13, 15, 16
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.	6, 7, 9, 13, 15, 16
CR3b Students connect the enduring understandings 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.	6, 8, 9, 10, 15
CR3c Students connect the enduring understandings within Big Idea 3 (living systems store, retrieve, transmit, and respond to information essential to life processes) to at least one other big idea.	6, 11, 13, 15, 16
CR3d Students connect the enduring understandings within Big Idea 4 (biological systems interact and these systems and their interactions possess complex properties) to at least one other big idea.	6, 7, 8, 9, 11, 12, 13, 15, 16
CR4a The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 1.	7, 9, 14, 16, 17
CR4b The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 2.	8, 9, 10
CR4c The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 3.	12, 14
CR4d The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 4.	14, 16, 17
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.	3, 16, 17
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, 7, 8, 9, 10, 12, 14, 16
CR7 Students are provided the opportunity to engage in investigative laboratory work	3, 7, 8, 9, 10, 12, 14, 16

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.	3, 7, 8, 9, 10, 12, 14, 16, 17

Course Overview

The course design supports the AP Biology Curriculum Framework. The content focuses on living systems and their connections to everyday life. The curriculum framework provides students with the opportunities to investigate the practical application of biology as well as the connections to other natural, human, and social sciences. Through inquiry-based activities and laboratory investigations, students explore the components of life, from molecules to ecosystems.

Textbooks/Resources

Campbell Biology, Jane B. Reece, Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, 10th Edition, Pearson **[CR1]**

Each student has access to the investigations contained in *AP Biology Investigative Labs: An Inquiry Based Approach*, as well as other laboratory investigations as deemed necessary. We also recommend the *Campbell Biology* 10th Edition Active Reading Guide as a supplemental resource.

Teaching Strategies

AP Biology is structured around four Big Ideas (Evolution, Energy Processes, Information, and Interactions) described in the Curriculum Framework, which encompass the core scientific principles, theories, and processes governing living organisms and biological systems. At least one of the Big Ideas will be incorporated in every lesson throughout the course. **[CR2]** Because evolution is the foundation upon which the entire course is based, it will be referenced throughout the entire course, and science as a process will be threaded throughout both the investigations and the class activities outside of the investigations.

Students begin each lesson with a list of learning objectives and essential questions to guide them throughout the main points of each lesson and to frame students' class notes. Students are encouraged to add to these notes, listing all questions that arise. Lessons may be based on multimedia resources from various sources (textbook, CDs, Internet, etc.) to help the students make critical connections between what they are learning and their everyday lives. Quizzes are interspersed throughout the module. These assessments provide information on how teachers may need to adjust instruction to improve student learning.

Students will have regular discussions with their instructor to apply biological, scientific knowledge and critical-thinking skills to major issues of social concern. During these discussions, students must explain the science and science processes being applied. In addition, students will need to be prepared to demonstrate their content mastery through a variety of assessment formats, some of which will be informed by readings from recent scientific journals. Students will also be given the opportunity to see that biology is in their everyday lives and is not just a chapter in a textbook. **[CR5]**

Investigative Laboratory Component

Laboratory investigations make up a minimum of 25 percent of instructional time. **[CR7]** Students will conduct a minimum of eight inquiry-based investigations (two per Big Idea). **[CR6]** Supplemental labs and activities are also used to widen the range of topics covered in a hands-on, discovery mode. By undertaking a variety of investigations throughout the course, students will use all seven science practice skills on a regular basis with a goal of moving toward open-inquiry investigations. Students' science practice skills need to be honed over the entire course and reinforced through opportunities to make observations, ask questions based on those observations, and investigate their own questions both in and out of the designated lab activities. It is critical to help students discover how the biological world works as we know it—and to learn how to investigate the biological world that is still unknown. That is why the investigations are a key to this entire course.

Students will maintain a written record (lab notebook and field notes) of investigations conducted. In addition, they will be asked for the following throughout the course: **[CR8]**

- Formal lab report that emphasizes the development and testing of a hypothesis, the ability to organize collected data, and the ability to analyze and clearly discuss the results.
- Multimedia presentations (create presentations with main investigation components, present the material, and field questions).
- Self-reflection of their ability to work in group investigations that will often be conducted in teams of two or three so that students develop group skills and learn the importance of collaboration among scientists.

Course Schedule

The following table describes how the enduring understandings/essential knowledge statements, learning objectives, and seven science practices are the focus of each unit within the course. Due to the reduction in required content for AP Biology, all sections of each chapter will not be covered and/or may be used for reference as needed. The included timeline is approximate. Assignments include many ways to meet the objectives (self-assessment, quizzes, readings, dry labs, wet labs, Free Response writing, projects, etc.), and a few of these activities have been elaborated upon to fully demonstrate the incorporation of curricular requirements. These assignments connect biological content across Big Ideas.

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 strategies	5. perform data analysis and evaluation of evidence	6. work with scientific explanations/theories	7. connect and relate knowledge	Big Idea 1: Evolution	Big Idea 2: Energy Processes	Big Idea 3: Information	Big Idea 4: Interactions
Getting Started											
What Is Science?			x								
Scientific Theories vs. Laws			x			x					
Scientific Investigations	x	x	x	x	x	x	x				
Lab Expectations	x	x	x	x	x	x	x				
Safety				x							
Module 1: Evolution											
Origin of Life	x		x	x		x	x	x	x	x	x
Natural Selection	x	x			x		x	x			
Hardy-Weinberg Practice Activity	x	x			x		x	x			
Evolution of Populations	x	x		x	x	x	x	x			
Hardy-Weinberg Collaborative Lab	x	x	x	x	x	x	x	x			
Speciation	x			x	x	x	x	x			x
Evolutionary Changes	x		x		x			x			
Phylogenetic Trees and Cladograms Activity	x		x		x			x			
Module 2: Cells and Homeostasis											
Chemistry of Life	x					x	x		x		
Cell Structure and Function	x	x		x		x			x		x
Cell Membranes and Homeostasis	x		x				x		x		x
Cell Membrane Lab	x	x	x	x	x	x	x		x		x
Module 3: Capturing and Using Energy											
Energy and Living Systems		x				x			x		
Energy Pathways						x			x		
Energy Processes	x		x						x		x
Photosynthesis and Cellular Respiration						x			x		x
Leaf Disk Collaborative Lab	x	x	x	x	x	x	x		x		
Module 4: Biological Responses											
Feedback and Mechanisms				x	x	x	x		x		

for Response											
Biotic and Abiotic Interactions Part I	x		x	x			x		x		x
Biotic and Abiotic Interactions Part II					x			x	x		
Homeostatic Mechanisms	x				x	x	x	x	x		
Chemical Defenses	x								x		
Regulation of Development	x					x	x		x		
Physiological Events				x		x	x		x		
Lab Design Activity: Plant and Animal Behavior	x		x	x			x		x		
Environment and Behavior					x	x	x		x		
Module 5: Genetics											
Mitosis and Meiosis	x				x	x	x			x	
Mitosis and Meiosis Lab	x	x	x	x	x	x	x			x	
Chromosomal Inheritance	x	x	x				x			x	
Non-Mendelian Genetics	x					x				x	
DNA and RNA	x			x		x				x	x
Electrophoresis Virtual Lab	x	x	x	x	x	x	x			x	
Transcription and Translation	x					x				x	
Gene Expression	x					x	x			x	x
Module 6: Transmission											
Genotype to Phenotype	x					x	x	x		x	
Genetic Variation						x	x	x		x	x
Viruses	x					x		x		x	
Cell Communication	x		x			x	x	x	x	x	
Signal Transduction Pathways	x					x				x	
Information Exchange	x				x		x	x		x	
Nervous System	x					x	x			x	
Module 7: Systems and Populations											
Biochemistry	x				x	x	x	x	x	x	x
Form and Function	x			x					x		x
System Interactions	x		x			x					x
Populations and Communities	x	x		x		x				x	x
Population Dynamics Lab	x	x	x	x	x	x	x			x	x
Ecosystems	x	x				x			x		x
Module 8: Change and Biodiversity											
Ecosystem Changes						x	x	x			x
Environmental Influence on Genotype Expression						x	x			x	x
Diversity and Dynamics	x	x	x	x	x	x	x	x			x

Big Ideas and enduring understandings connect with science practice skills; thus all assignments will help students meet the learning objectives identified throughout the AP Biology Curriculum Framework.

Many of the Free Response questions used for practice also cross Big Ideas and apply various science practices (e.g., read/create graphs, calculate rate, apply mathematical formulas, analyze data to draw conclusions, etc.).

Module 0: Getting Started (2–4 days)
Reading: Getting Started lessons 1, 2, and 3, Course Syllabus, and College Board AP Central resources
Scientific Practices addressed: 1–7

Essential questions are presented here to demonstrate how the Big Ideas cross the entire curriculum:
- How do scientists work together to investigate the science behind the concepts of biology?
- How have scientists built upon the discoveries of other scientists to develop a more complete picture of the world around us?
- How are scientists able to test the validity of their ideas?

Topics:
Processes of science reviewed:
- Introduction to the AP Biology Curriculum Framework
- Connecting Big Ideas and enduring understandings with scientific practices
- Lab expectations and safety
- Scientific method, with emphasis on the fact that there is not one way to do science
- Scientific theory and investigation
- Scientific lab safety practices
- Practice with data collection, analysis, and presentation

Activities:
- AP Exam Requirements: self- assessment: emphasis on expectations for AP-level coursework and the AP Exam
- Nature of Science: self- assessment: emphasis on development of testable hypothesis; identification of independent, dependent, and controlled variables; procedure development; and data analysis using mathematics and graphing
- Graphing Practice: self assessment: emphasis on fine-tuning graphing skills and presentation
- Experimental Design Activity: focuses on best practices in experimental design and provides students with criteria for successful completion

Module 1: Evolution (15–20 days) [CR2][CR3a][CR3b][CR3c][CR3d]
Reading: e-text sections **[CR1]**: 25.1, 25.3, 26.6, 4.1, 22.2, 23.1, 23.2, 23.4, 22.3, 25.2, 23.3, e- 24.1, 24.2, 24.3, 24.4, 25.4, 26.1, 26.2, 26.3 and supplemental lesson content and activities from lessons 1.01–1.07

Enduring understandings to be addressed: 1B1, 1B2, 1D1, and 1D2
Scientific Practices addressed: 1.1–1.5, 2.1, 2.2, 3.1, 3.3, 4.1, 4.2, 4.4, 5.1–5.3, 6.1, 6.3–6.5, 7.1, 7.2

Essential questions are presented here to demonstrate how the Big Ideas cross the entire curriculum:

- How is the origin and evolution of life on Earth supported by evidence of conserved core processes and shared features?
- What is the role of natural selection in the evolution of a population?
- How can data reflect the evolutionary changes of a population over time?
- How can mathematical and biological data support the theory of evolution and analyze its mechanisms?
- How can extinction and speciation support predictions for future populations?
- How can we use models to represent evolutionary relationships?
- How does convergent evolution affect the field of taxonomy and the construction of a phylogeny?

Topics:
Evolution established as foundational theme [CR3a]

- Hypotheses about the origin of life on Earth
- Selection of ecological, physical, and chemical data that reveal early Earth conditions
- Conserved core biological processes and features that support the concept of common ancestry for all organisms
- Evolutionary changes in a population over time
- Natural selection
- Genetic drift, migration, and artificial selection
- Hardy-Weinberg equilibrium
- Speciation and extinction throughout Earth's history
- Phylogenetic trees and cladograms

Activities and Assignments [CR4a][CR6][CR8]:

- Tutorial: Natural Selection
- Tutorial: Mechanisms of Evolution
- **Hardy-Weinberg Collaborative Lab: hands-on lab [CR7]**
- Math problems for allele frequency and graphical analysis of data
- Tutorial: Defining Species
- Investigation: How do environmental changes affect a population?
- Investigation: The Uninvited Guest
- Tutorial: Constructing Phylogenetic Trees
- Cladograms and phylogenetic trees: Students will understand the nature of cladograms and phylogenetic trees based on various types of data; learn how to read and analyze cladograms and phylogenetic trees; and construct cladograms and phylogenetic trees from provided data. **[CR3d]**

- AP Practice: Grid-in Response and Reflection
- Comprehensive Module Discussion

Module 2: Cells and Homeostasis (15–20 days) [CR2][CR3b][CR3d]
Reading: e-Text sections **[CR1]**: 3.1–3.3, 4.1–4.2, 6.2–6.5, 7.1–7.5, 36.2 and supplemental lesson content and activities from lessons 2.01–2.05

Enduring understandings to be addressed: 2A3, 2B3, and 4A2
Scientific Practices addressed: 1.1, 1.4, 2.2, 3.1, 4.1, 6.2, 6.4, 7.1, and 7.2

Essential questions are presented here to demonstrate how the Big Ideas cross the entire curriculum:

- How do bonding, polarity, and other chemical properties determine the structure and properties of matter?
- How does structure facilitate function for each part of the cell?
- How does the unique structure and properties of cell membranes account for their broad impact on cell processes and transport?

Topics:
Energy Processes at the Cellular Level [CR3b]

- Properties of Carbon and Water
- Chemical Bonding
- Cell Structure and Function
- Biogeochemical Cycles
- Cell Membranes and Homeostasis

Activities and Assignments [CR4b][CR6][CR8]:

- Activity: Cohesion of Water
- Tutorial: Hydrogen Bonding in Water
- Activity: The Endomembrane System
- Tutorial: Tour of Animal Cells: Structure and Function
- Tutorial: Tour of Plant Cells: Structure and Function
- Activity: Prokaryotic Cell Structure and Function
- Video: Golgi Complex in 3D
- Video: Mitochondria in 3D
- Video: Chloroplast Movement
- Activity: Membrane Structure
- Membranes and Homeostasis Collaborative Lab: hands-on lab [CR7]
- AP Practice: Data-Based Questions and Reflection
- Comprehensive Module Discussion

Module 3. Capturing and Using Energy (20–25 days) [CR2][CR3b][CR3d]

Reading: e-Text sections **[CR1]**: 8.1–8.3, 9.1–9.6, 10.1–10.3, 40.3, 40.4, 53.3, 53.4, and 55.1–55.3 and supplemental lesson content and activities from lessons 3.01–3.06
Enduring understandings to be addressed: 2A1 and 2A2
Scientific Practices addressed: 1.4, 3.1, 6.1, 6.2, and 6.4,

Essential questions are presented here to demonstrate how the Big Ideas cross the entire curriculum:

- How does the amount of available free energy affect biological systems, from cells to ecosystems?
- How are the various chemical processes that occur within an organism organized and regulated?
- How are increased disorder and entropy offset by biological processes that maintain or increase order?
- How does the need for free energy influence the structures and functions of all living organisms?
- How do the structures and processes of plant and animal cells suit the needs for capturing, storing, and using free energy effectively?

Topics:
Capturing and Using Energy [CR3b]

- Energy and Living Systems
- Math Applications in Energy Transfer
- Energy Pathways
- Energy Processes
- Photosynthesis and Cellular Respiration

Activities and Assignments [CR4b][CR6][CR8]:

- Tutorial: Basic Energy Concepts
- Activity: Chemical Reactions and ATP
- Activity: Modeling Population Growth
- Interpreting Data: Net Primary Production
- Tutorial: Energy Flow through Ecosystems
- Activity: Consuming at Different Trophic Levels
- Math Practice: Trophic Levels and Energy Transfer
- Activity: Glucose Metabolism
- Tutorial: Thermoregulation
- Tutorial: Cellular Respiration
- Tutorial: Photosynthesis
- Tutorial: Energy Flow in Plants
- Short Essays on cycles
- **Photosynthesis and Cellular Respiration Collaborative lab: hands-on lab [CR7]**
- AP Practice: Multiple Choice Strategies and Reflection
- Comprehensive Module Discussion

Module 4. Biological Responses (25–30 days) [CR2] [CR3a][CR3b][CR3d][CR4a]
Reading: e-Text sections **[CR1]:** 11.1, 11.5, 18.2–18.4, 24.1, 38.1, 39.2, 39.3, 39.5, 40.2, 40.3, 43.1–43.4, 44.1, 44.2, 51.1–51.4, 52.2, 53.1–53.5, 54.1–54.5, 55.1–55.4, and supplemental lesson content and activities from lessons 4.01–4.11
Enduring understandings to be addressed: 2C1, 2C2, 2D1, 2D2, 2D3, 2D4, 2E1, 2E2, and 2E3
Scientific Practices addressed: 1.1–1.4, 3.2, 4.1, 4.2, 5.1, 5.3, 6.1, 6.2, 6.4, 7.1, and 7.2

Essential questions are presented here to demonstrate how the Big Ideas cross the entire curriculum:

- How do various mechanisms allow organisms to respond to changes in their internal and external environment?
- How can various biotic and abiotic factors interact to affect biological systems such as cells, organisms, populations, and communities?
- How do adaptations in homeostatic mechanisms reflect both common ancestry and divergence?
- How have organisms evolved to defend themselves from attack by various forms of pathogens?
- How do various mechanisms work together to coordinate the specific events necessary for an organism's development?
- How do multiple mechanisms work together to regulate the timing and coordination of physiological events?
- How does the coordination of behaviors play a role in natural selection?

Topics:
Biological Responses [CR3b]

- Feedback and Mechanisms for Response
- Biotic and Abiotic Interactions
- Lab Design
- Homeostatic Mechanisms
- Chemical Defenses
- Regulation of Development
- Physiological Events
- Environment and Behavior

Activities and Assignments [CR4b][CR6][CR8]:

- Activity: Negative and Positive Feedback
- Activity: Homeostasis
- Activity: Experiment Critique
- Tutorial: Energy Flow in Ecosystems
- Experimental Inquiry: Can a species' niche be influenced by interspecific competition?
- **Experimental Design: Abiotic and Biotic Interactions [CR7]**
- Activity: What do you need to consider when analyzing communities of organisms?

- Activity: What effects can disturbance have on a community?
- Activity: How can distance from the mainland and island size affect species richness?
- Graphing: Global Fisheries and Overfishing
- Interpreting Data: Primary and Secondary Immune Responses
- Activity: Immune Responses
- Tutorial: Human Immune System
- Illustrative Activity: Comparison of Specific and Nonspecific Immune Responses
- Tutorial: Regulation of Gene Expression in Eukaryotes
- Activity: Control of Gene Expression
- Activity: Overview of Cell Signaling
- **Experimental Design: Physiological Events [CR7]**
- Interpreting Data: Optimal Foraging Model in Wagtails
- Tutorial: Animal Behavior and Learning
- AP Practice: Multipart Laboratory Experience Essays and Reflection
- Comprehensive Module Discussion

Module 5. Genetics (20–25days) [CR2][CR3c][CR3d]
Reading: e-Text sections **[CR1]**: 5.5, 12.1–12.3, 13.1–13.3, 14.1–14.4, 15.1–15.5, 16.1, 16.2, 17.1–17.4, 18.1–18.5, 19.2, 20.1, 20.2, 27.1, and supplemental lesson content and activities from lessons 5.01–5.08
Enduring understandings to be addressed: 3A1, 3A2, 3A3, 3A4, 3B1, 4A3
Scientific Practices addressed: 1.1µ1.4, 2.2, 3.1, 4.1, 5.3, 6.2–6.5, 7.1, and 7.2

Essential questions are presented here to demonstrate how the Big Ideas cross the entire curriculum:

- How do eukaryotes pass on heritable information to the next generation of cells?
- How do Mendelian genetics and the chromosomal basis of inheritance help us understand the pattern of gene transmission from parents to offspring?
- How do scientists study the inheritance pattern of traits that cannot be explained by simple Mendelian genetics?
- How does the inheritance of organelle genes affect inheritance patterns?
- How are replicated DNA strands proofread and edited?

Topics:

- Cell Cycle and Mitosis
- Review cell Theory
- Cancer As a Disruption of Cell Cycle Control
- Mitosis and Meiosis
- Asexual and Sexual reproduction
- Rules of Probability
- Chromosomal Inheritance
- Dihybrid Cross Design

- Incomplete and Codominance
- Genetic Disorders
- Civic Issues in Genetics
- Non-Mendelian Genetics
- Sex-Linked Genes
- DNA and RNA
- Hershey-Chase Experiment
- Avery-McLeod–McCarty Experiments
- Microbial Genetics
- Coordination of Gene Control
- Inducers and Repressors
- DNA Replication
- Transcription and Translation
- Salient Features
- Genetic Engineering Techniques
- Microbial Genetics
- Gene Expression

Activities and Assignments [CR4c][CR6][CR3d][CR8]:

- Tutorial: Mitosis
- Tutorial: Meiosis
- Tutorial: Comparing Mitosis and Meiosis
- Activity: Asexual and Sexual Life Cycles
- Video: Mitosis vs. Meiosis
- **Mitosis and Meiosis Lab [CR7]**
- Dihybrid Cross Practice
- Tutorial: Mendel's Law of Independent Assortment
- Tutorial: Chromosomal Mutations
- Pedigree Analysis: Galactosemia
- Tutorial: Inheritance in Fur Color of Mice
- Case Study Research with Peer Review Collaboration: Chromosomal Disorders
- Tutorial: Chromosomal Basis of Inheritance
- **Experimental Inquiry: What Is the Pattern of Sex-Linked Traits? [CR7]**
- Investigative Case: X-Files
- Activity: The Hershey-Chase Experiment
- Activity: DNA Double Helix
- Activity: DNA and RNA Structure
- Tutorial: DNA Structure and Replication Machinery
- Tutorial: DNA: Synthesis of the Leading and Lagging Strands
- Activity: The Genetic Code
- Activity: RNA Synthesis
- Activity: Transcription

- Activity: Protein Synthesis
- Activity: Analyzing DNA Fragments Using Gel Electrophoresis
- Tutorial: DNA to RNA to Protein
- **Electrophoresis Virtual Lab [CR7]**
- Activity: Regulation of Gene Expression in Bacteria
- Creative Presentation: Interactions of External Stimuli and Gene Expression
- Case Study: Shhh … Silencing the Hedgehog Pathway
- Comprehensive Module Discussion

Module 6. Transmission (15–20 days) [CR2] [CR3a] [CR3b][CR3c][CR3d]
Reading: e-Text sections **[CR1]**: 11.1–11.4, 13.4, 15.4, 16.2, 17.5, 18.1–18.4, 19.1, 19.2, 23.4, 27.2, 48.1- 48.4, 49.2, 51.1, and supplemental lesson content and activities from lessons 6.01–6.09
Enduring understandings to be addressed: 3B2, 3C1, 3C2, 3C3, 3D1, 3D2, 3D3, 3D4, 3E1, 3E2, 4C1
Scientific Practices addressed: 1.1, 1.2, 1.4, 1.5, 3.1, 5.1, 6.1, 6.2, 7.1, and 7.2

Essential questions are presented here to demonstrate how the Big Ideas cross the entire curriculum:

- How can alterations of chromosome number or structure cause some genetic disorders?
- How do proteins work together in DNA replication and repair?
- How do mutations of nucleotides affect protein structure and function?
- How do genome sizes vary among the domains of life?
- How does genetic variation in sexual life cycles contribute to evolution?
- How are external signals converted to responses within a cell?
- How can sensory inputs stimulate simple and complex behaviors?
- How do neuron organization and structure reflect function?

Topics:

- Genotype to Phenotype
- DNA Mutations
- Pesticide Resistance Mutations
- Sickle Cell Disorder
- Genetic Variation
- Transformation, Transduction, Conjugation and Transposition
- Reproduction Processes That Increase Genetic Variation
- Viruses
- Viral Replication
- HIV
- Transduction in Bacteria
- Cell Communication
- Signal Transmission
- Chemical Messengers
- Pheromones

- Neurotransmitters
- Plant Immune Response
- Endocrine signals
- Signal Transduction Pathways
- Receptor Proteins
- G-protein Linked Receptors
- Receptor Tyrosine Kinases
- Signaling Cascades
- Effects of Neurotoxins, Poisons, and Pesticides
- Drugs That Effect Signal Transduction
- Information Exchange
- Herbivory Responses
- Territorial Marking
- Migration Patterns
- Pack Behavior in Animals
- Nervous System
- Na+/K+ Pumps
- Neurotransmitters
- Cerebral Hemispheres in Humans

Activities and Assignments [CR4a][CR4c][CR4d][CR6][CR8]:

- Activity: Mistakes in Meiosis
- Tutorial: Chromosomal Mutations
- Tutorial: Experimental Inquiry: Does DNA Replication Follow the Conservative, Semi-conservative, or Dispersive Model?
- Tutorial: Protein Synthesis: Translation and Protein Targeting Pathways
- Experimental Inquiry: Did Natural Selection of Ground Finches Occur When the Environment Changed?
- Creative product and explanation: illustration and an explanation how changes in DNA nucleotide sequence can result in the polypeptide produced
- Make Connections: Bacterial Conjugation
- Make Connections: Binary Fission
- Tutorial: Meiosis: Determinants of Heredity and Genetic Variation
- Activity: Retrovirus (HIV) Reproductive Cycle
- Essay with banked prompts: lysogenic cycle, lytic cycle, DNA viruses, RNA viruses, retroviruses
- Tutorial: Homeostasis: Regulating Blood Sugar
- Activity: Cell Signaling
- Activity: Reception
- Activity: Signal Transduction Pathways
- Activity: Build a Signaling Pathway
- Activity: Cellular Responses
- Essay: Based on prompt for Signal Transduction Pathways

- Video: Honeybee Waggle Dance
- Tutorial: How Neurons Work: Neuron Structure and Resting Potential
- Tutorial: How Neurons Work: The Action Potential
- **Lab: Animal Behavior [CR7]**
- Activity: illustration of nervous system processes
- Creative product: illustration and description about how the vertebrate brain integrates information to produce a response.
- Comprehensive Module Discussion

Module 7. Systems and Populations (15–20 days) [CR2] [CR3a] [CR3b][CR3c][CR3d]
Reading: e-Text sections **[CR1]**: 5.1–5.4, 8.4, 8.5, 35.1, 36.1–36.3, 40.1, 41.2–41.4, 42.1–42.7, Chapter 53 Overview, 53.1–53.6, 55.1, 56.1, and supplemental lesson content and activities from lessons 7.01–7.07
Enduring understandings to be addressed: 4A1, 4B1, 4C1
Scientific Practices addressed: 1.3, 1.4, 2.2, 3.3, 4.1, 5.1, 6.1, 6.2, 6.4, and 7.1

Essential questions are presented here to demonstrate how the Big Ideas cross the entire curriculum:

- How do molecular interactions affect structure and function?
- How is the basic functioning of enzymes affected by its shape, active sites, and interaction with specific molecules and the environment?
- How does structure relate to function in living systems from the cellular to the organismic level?
- How do specialized organs contribute to the overall function of the organism?
- How do interactions between organ systems allow organisms to function more efficiently?
- How does an interruption in one system impact other systems and ultimately the organism?
- How do populations change?
- How can you use mathematical models to predict population trends?
- How can interactions among ecosystems result in movement of matter and energy?

Topics:

- Biochemistry
- Form and Function of Macromolecules
- System Interactions
- Digestion of Food
- Stomach and Small Intestines
- Roots, Stems, and Leaves
- Respiratory and Circulatory Systems
- Plant Vascular and Leaf Systems
- Form and Function of Organisms
- Populations and Communities
- Structure of Communities

- Population Growth Models
- Predator/Prey Relationships
- Demographics Data
- Ecosystems
- Energy and Matter Flow in Ecosystems
- Primary Productivity
- Ecosystem Limitations
- Human Impact on Ecosystems
- Adaptations of Organisms in Response to Environment

Activities and Assignments [CR4a][CR4d][CR6][CR8]:

- Activity: Carbohydrate Structure and Function
- Activity: Lipids
- Activity: Protein Function
- Activity: Protein Structure
- Activity: Nucleic Acid Structure
- Activity: How Enzymes Work
- Activity: Epithelial Tissue
- Activity: Connective Tissue
- Activity: Muscle Tissue
- Activity: Nervous Tissue
- Activity: Digestion and Absorption of Food
- Activity: Hormonal Control of Digestion
- Tutorial: Water Transport in Plants: The Transpiration-Cohesion-Tension Mechanism
- Tutorial: Gas Exchange
- Activity: Transport of Xylem Sap
- Activity: Mammalian Cardiovascular System Function
- Activity: The Human Respiratory System
- Essay: Case Study Research: Diseases That Impact Multiple Systems **[CR5]**
- Tutorial: Population Ecology
- Activity: Investigating Survivorship Curves
- Tutorial: Population Ecology: Logistic Growth
- Activity: Modeling Population Growth
- Interpreting Data: Human Population Growth
- Graphing: Age Pyramids and Population Growth
- **Population Diversity Lab: hands-on lab [CR7]**
- Graphing: Animal Food Production Efficiency and Food Policy
- Activity: Energy Flow and Chemical Cycling
- Graphing: Global Fisheries and Overfishing
- Math Practices: Movement of Energy and Matter in Ecosystems
- AP Practice: Developing a Study Plan and Reflection
- Comprehensive Module Discussion

Module 8. Change and Biodiversity (20–25 days) [CR2] [CR3a][CR3c][CR3d]
Reading: e-Text sections **[CR1]**: 14.3, 23.1–23.3, 25.4, 54.1, 54.2, 56.1, 56.4, and supplemental lesson content and activities from lessons 8.01–8.07
Enduring understandings to be addressed: 4B3, 4B4, 4C2, 4C3, 4C4
Scientific Practices addressed: 5.2, 6.1, 6.2, 6.3, and 6.4

Essential questions are presented here to demonstrate how the big ideas cross the entire curriculum:

- How do human activities impact Earth's biodiversity?
- How does Earth change as a result of human actions?
- How do geological and meteorological events impact diversity?
- How does nature and nurture impact phenotype?
- How does genetic variation make evolution possible?

Topics:

- Species Interactions
- Human Impact on Ecosystems
- Interactions between Populations
- Geological and Meteorological Events and Impact on Ecosystem Distribution
- Impacts on Biological Diversity
- Ecosystem Changes
- Environmental Influence on Genotype Expression
- Diversity and Dynamics
- Population Response to Environmental Change
- Biodiversity
- Species Richness vs. Relative Abundance
- Predicting Species Diversity in an Ecosystem

Activities and Assignments [CR4a][CR4d][CR6][CR8]:

- Activity: Introduced Species: Fire Ants
- Activity: The Greenhouse Effect
- Research/Position Paper: Ecosystem Changes **[CR5]**
- Activity: Adaptive Radiation
- Essay: Environmental Influence on Genotype Expression
- **Lab: Data Analysis of Species Diversity [CR7]**
- **Lab: Population Genetics and Evolution [CR7]**
- Comprehensive Module Discussion

Practice Tests; Semester Tests; Review of Course (10–15 days)

- Released FRQ items used throughout the course for practice
- Full-length, practice exam used for review purposes prior to the AP Exam.
- Review format and study plans determined by needs of students.