

Course Title:	AP Biology
Grade(s):	10, 11, 12

Course Description
AP Biology is an introductory college-level biology course. Students cultivate their understanding of biology through inquiry-based investigations as they explore the following topics: evolution, cellular processes, energy and communication, genetic information transfer, ecology, and interactions amongst the living and nonliving components of ecosystems. The AP Biology course is equivalent to a two-semester college introductory biology course for biology majors. Students should have successfully completed high school courses in biology and chemistry. This course requires that 25 percent of the instructional time will be spent in hands-on laboratory work, with an emphasis on inquiry-based investigations that provide students with opportunities to apply science practices: designing plans for experiments, making predictions, collecting and analyzing data, applying mathematical routines, developing explanations, and communicating their work. Colleges may require students to present their laboratory materials from AP science courses before granting college credit for laboratory work, so students should be encouraged to retain their laboratory notebooks, reports, and other materials.
Approved Curricular Materials/Textbook(s)
<i>Biology for the AP Course</i> Morris, Lepri, Castignetti, Relyea Bedford, Freeman & Worth New York/Boston 2022

Unit Title	Unit Description (Include Unit Objectives)	Unit Pacing
Unit 1: Ecology	UNIT DESCRIPTION The content in this unit explores how interactions within living systems are directly related to the system's available energy and its ability to evolve and respond to changes in its environment. When highly complex living systems interact, communities and ecosystems change based on those interactions. The more	4 weeks (September)

	biodiversity present in a system, the more likely that system is to maintain its health and success in the face of disruption. Energy flows through systems, and the rate of flow determines the success of the species within the systems. Students should be able to accurately determine what happens within biological systems when disruptions occur. LEARNING OBJECTIVES By the end of this unit, students will be able to explain how organisms respond to changes in their environment and analyze how energy flows through ecosystems to support life at different trophic levels. They will investigate population ecology by examining factors that affect population density, patterns of population growth, and the ecological limits that shape these trends. Students will also describe how interactions among species—such as competition, predation, and symbiosis— influence community structure and stability. Additionally, they will evaluate the importance of biodiversity in maintaining resilient ecosystems and assess how natural and human-driven disruptions can alter ecosystem dynamics, threaten species survival, and impact overall ecological balance.	
Unit 2: Chemistry of Life	UNIT DESCRIPTION This unit sets the foundation for student understanding of the chemical basis for life, which is needed for mastery of future areas of focus and provides students with a survey of the elements necessary for carbon-based systems to function. Students learn that water and the properties of water play a vital role in the survival of organisms and biological systems. They also learn that living systems exist in a highly complex organization that requires input of energy and the exchange of macromolecules. This unit also addresses in detail how and in what conformations molecules called monomers bond together to form polymers. The structure of monomers and polymers determines their function. In the units that follow, students will need to understand and explain the interaction and bonding of atoms to form molecules. LEARNING OBJECTIVES In this unit, students will develop an understanding of how the structure of water and the nature of hydrogen bonding give rise to essential biochemical properties that support life. They will examine the elements most critical to biological systems and explore how these atoms form the foundation of biological	5 weeks (October-November)

	macromolecules. Students will be introduced to the major classes of macromolecules and investigate how their chemical properties and structural characteristics determine their specific functions in living organisms. Through focused study of carbohydrates, lipids, proteins, and nucleic acids, learners will connect molecular structure to biological activity, including the storage and expression of genetic information. Finally, students will analyze the structure and function of enzymes, explaining how they catalyze reactions and how factors such as temperature, pH, and substrate concentration influence their activity.	
Unit 3: Cell Structure & Function	UNIT DESCRIPTION The cell is the basic unit of life. Cells contribute to the organization of life and provide the environment in which organelles function. Organelles in turn provide compartmentalization and organize cellular products for dispersal and waste for disposal. Cells have membranes that allow them to establish and maintain an internal environment. These membranes also control the exchange of material with the cell's external environment—an important, foundational concept. The maintenance of the internal and external conditions of a cell is called homeostasis. Student understanding of these concepts will be necessary in later units when the focus of instruction shifts to cellular products and by-products and when students learn why cellular exchange of energy and materials matters. LEARNING OBJECTIVES By the end of this unit, students will be able to describe the structure and function of major plant and animal cell organelles and explain how cell compartmentalization enhances cellular efficiency and specialization. They will analyze how cell size influences surface-area-to-volume ratios and impacts cellular processes. Students will investigate the structure and roles of plasma membranes, including how membrane permeability is determined by lipid composition and embedded proteins. They will compare and model different mechanisms of membrane transport—such as simple diffusion, facilitated diffusion, and active transport—and predict the movement of molecules across membranes under varying conditions. Additionally, students will explore osmoregulation and water potential to explain how cells maintain internal equilibrium. Finally, they will examine the origins of cell compartmentalization in early life forms to understand how complex cells evolved.	4 weeks (November - December)

Unit 4: Cellular Energetics	UNIT DESCRIPTION Living systems are complex in the organization and require constant energy input. This unit provides students with the knowledge necessary to master the concepts of energy capture and usage. Students gain a deeper understanding of the processes of photosynthesis and cellular respiration, which is knowledge they will use in our next units when they study how cells use energy to fuel life processes. LEARNING OBJECTIVES Students will develop a deep understanding of how cells acquire, transform, and utilize energy to sustain life. They will explore the processes of cellular respiration and photosynthesis, analyzing how energy flows through cells and ecosystems. Students will learn to compare and contrast these pathways, understand the molecular mechanisms that drive them, and evaluate their efficiency and regulation. Additionally, students will connect energy transformations to organismal fitness, examining how energy availability and utilization influence survival and reproduction. Through these studies, students will gain the ability to link cellular processes to broader biological concepts and the principles of evolutionary success.	3 weeks (December - January)
Unit 5: Cell Communication & The Cell Cycle	UNIT DESCRIPTION Students focus on how cells use energy and information transmission to communicate and replicate. Through systems of complex transduction pathways, cells can communicate with one another. Cells can also generate and receive signals, coordinate mechanisms for growth, and respond to environmental cues. To maintain homeostasis, cells respond to their environment. They can also replicate and regulate replication as part of the cell cycle that provides for the continuity of life. LEARNING OBJECTIVES Students will develop a comprehensive understanding of cellular communication and division by exploring the mechanisms and regulation of signal transduction. They will learn to describe how cells receive and respond to signals, analyze the consequences of changes in signal transduction pathways, and evaluate the role of feedback in maintaining cellular homeostasis. Additionally, students will examine the stages of the cell cycle and investigate the molecular controls that regulate cell division, gaining the ability to explain how disruptions in these	3 weeks (January - February)

	processes can lead to cellular dysfunction. Through this study, students will build the skills to connect molecular signaling events with broader cellular outcomes and understand their importance in maintaining organismal health.	
Unit 6: Heredity	UNIT DESCRIPTION This unit focuses on heredity and the biological concepts and processes involved in ensuring the continuity of life. Students learn that the storage and transmission of genetic information via chromosomes from one generation to the next occur through meiosis. Meiotic division ensures genetic diversity, which is crucial to the survival of a species. In this unit, students gain a deeper understanding of Mendelian genetics and learn how non-Mendelian genetics describes patterns of inheritance that seem to violate Mendel's laws. This unit also covers the roles played by chromosomal inheritance, environmental factors, and nondisjunction on an individual's phenotype. In our next unit, students move on to learn about gene expression and regulation. LEARNING OBJECTIVES Students will develop a comprehensive understanding of meiosis and its role in generating genetic diversity, including how the processes of crossing over and independent assortment contribute to variation within populations. They will study Mendelian genetics, exploring inheritance patterns, and extend this knowledge to non-Mendelian genetics, examining exceptions such as incomplete dominance, codominance, and multiple alleles. Students will also investigate how environmental factors can influence phenotype, integrating the interplay between genes and environment in shaping traits. Finally, they will analyze chromosomal inheritance, understanding how the transmission of chromosomes and chromosomal abnormalities impact heredity and organismal development. Through these topics, students will develop the ability to predict inheritance patterns, interpret genetic data, and connect cellular processes to observable traits in organisms.	4 weeks (February - March)
Unit 7: Gene Expression & Regulation	UNIT DESCRIPTION Students gain in-depth knowledge about nucleic acids and their role in gene expression. There is also a finer focus on the comparison between the structures of DNA and RNA. This unit highlights how an individual's genotype is physically expressed through their phenotype, thus emphasizing the importance of protein	3 weeks (March)

	synthesis (transcription and translation) in gene expression. Regulation of gene expression and cell specialization are instrumental in ensuring survival within an individual and across populations. LEARNING OBJECTIVES Students will develop a thorough understanding of the molecular basis of genetics, beginning with the structure of DNA and RNA and the processes of replication, transcription, and RNA processing, as well as translation into functional proteins. They will explore the regulation of gene expression and how differential gene expression drives cell specialization, linking molecular mechanisms to the development and function of multicellular organisms. Students will also investigate mutations, understanding their causes, types, and effects on gene function and phenotype. Finally, they will examine biotechnology, applying knowledge of molecular genetics to techniques such as DNA sequencing, gene editing, and genetic engineering. Through these topics, students will gain the skills to analyze molecular data, predict the consequences of genetic changes, and connect molecular processes to organismal traits and biotechnological applications.	
Unit 8: Natural Selection	UNIT DESCRIPTION Students discover natural selection— a mechanism of evolution. Natural selection is the theory that populations that are better adapted to their environment will survive and reproduce. Thus, the evolution of a species involves a change in its genetic makeup over time. In this unit, students study the evidence for and mechanisms of evolutionary change. Students also learn what happens when a species does not adapt to a changing or volatile environment and about the Hardy–Weinberg equilibrium as a model for describing and predicting allele frequencies in nonevolving populations. Students will learn to calculate and draw conclusions about the evolution, or lack thereof, of a population from data related to allele frequencies. LEARNING OBJECTIVES Students will develop a comprehensive understanding of evolutionary processes and the mechanisms that drive them. They will explore the principles of natural selection, artificial selection, and population genetics, including the application of the Hardy-Weinberg equilibrium to study allele frequencies. Students will examine	4 weeks (April)

	the evidence of evolution, concepts of common ancestry, and how populations continue to evolve over time. They will analyze phylogeny, speciation, and extinction, as well as variations within populations in order to understand patterns of biodiversity and evolutionary change. Finally, students will investigate the origin of life on Earth, connecting molecular and ecological processes to the history of life. Through these topics, students will gain the skills to interpret evolutionary data, evaluate evidence, and explain how genetic and environmental factors shape the diversity of life.	
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