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AP BIOLOGY

Course Content

Based on the Understanding by Design® (Wiggins and McTighe) model, this course framework provides a clear and detailed description of the course requirements necessary for student success. The framework specifies what students must know, be able to do, and understand, with a focus on the big ideas that encompass core principles, theories, and processes of the discipline. The framework also encourages instruction that prepares students for advanced work in STEM and life science–related majors.

Big Ideas

The big ideas serve as the foundation of the course and allow students to create meaningful connections among course concepts. Often, they are abstract concepts or themes that become threads that run throughout the course. Revisiting the big ideas and applying them in a variety of contexts allow students to develop deeper conceptual understandings. Following are the big ideas of the course and a brief description of each:

BIG IDEA 1: EVOLUTION (EVO)

The process of evolution drives the diversity and unity of life. Evolution is a change in the genetic makeup of a population over time, with natural selection as its major driving mechanism. Darwin's theory, which is supported by evidence from many scientific disciplines, states that inheritable variations occur in individuals in a population. Due to competition for limited resources, individuals with more favorable genetic variations are more likely to survive and produce more offspring, thus passing traits to future generations. A diverse gene pool is vital for the survival of species because environmental conditions change. The process of evolution explains the diversity and unity of life, but an explanation about the *origin* of life is less clear.

In addition to the process of natural selection, naturally occurring catastrophic and human-induced events as well as random environmental changes can result in alteration in the gene pools of populations. Scientific evidence supports that speciation and extinction have occurred throughout Earth's history and that life continues to evolve within a changing environment, thus explaining the diversity of life.

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BIG IDEA 2: ENERGETICS (ENE)

Biological systems use energy and molecular building blocks to grow, reproduce, and maintain dynamic homeostasis. Cells and organisms must exchange matter with the environment. Organisms respond to changes in their environment at the molecular, cellular, physiological, and behavioral levels. Living systems require energy and matter to maintain order, grow, and reproduce. Organisms employ various strategies to capture, use, and store energy and other vital resources. Energy deficiencies are not only detrimental to individual organisms but they can cause disruptions at the population and ecosystem levels. Homeostatic mechanisms that are conserved or divergent across related organisms reflect either continuity due to common ancestry or evolutionary change in response to distinct selective pressures.

BIG IDEA 3: INFORMATION STORAGE AND TRANSMISSION (IST)

Living systems store, retrieve, transmit, and respond to information essential to life processes. Genetic information provides for continuity of life, and, in most cases, this information is passed from parent to offspring via DNA. Nonheritable information transmission influences behavior within and between cells, organisms, and populations. These behaviors are directed by underlying genetic information, and responses to information are vital to natural selection and evolution. Genetic information is a repository of instructions necessary for the survival, growth, and reproduction of the organism. Genetic variation can be advantageous for the long-term survival and evolution of a species.

BIG IDEA 4: SYSTEMS INTERACTIONS (SYI)

Biological systems interact, and these systems and their interactions exhibit complex properties. All biological systems comprise parts that interact with one another. These interactions result in characteristics and emergent properties not found in the individual parts alone. All biological systems from the molecular level to the ecosystem level exhibit properties of biocomplexity and diversity. These two properties provide robustness to biological systems, enabling greater resiliency and flexibility to tolerate and respond to changes in the environment.

UNITS

The course content is organized into commonly taught units. The units have been arranged in a common sequence frequently found in many college courses and textbooks.

The eight units in AP Biology, and their weightings on the multiple-choice section of the AP Exam, are listed below.

Pacing recommendations at the unit level and on the Course at Glance provide suggestions for how you can teach the required course content and administer the Personal Progress Checks. The suggested class periods are based on a schedule in which the class meets five days a week for 45 minutes each day. While these recommendations have been made to aid in planning, teachers should of course adjust the pacing based on the needs of their students, alternate schedules (e.g., block scheduling), or their school's academic calendar.

TOPICS

Each unit is broken down into teachable segments called topics. The topic pages (starting on p. 34) contain all required content for each topic. Although most topics can be taught in one or two class periods, teachers should pace the course to suit the needs of their students and school.

Units	Exam Weighting
Unit 1: Chemistry of Life	**8–11%**
Unit 2: Cell Structure and Function	**10–13%**
Unit 3: Cellular Energetics	**12–16%**
Unit 4: Cell Communication and Cell Cycle	**10–15%**
Unit 5: Heredity	**8–11%**
Unit 6: Gene Expression and Regulation	**12–16%**
Unit 7: Natural Selection	**13–20%**
Unit 8: Ecology	**10–15%**

Course Content

Expand All | Collapse All

Unit 1: Chemistry of Life

You'll learn about water's role as the basis of life and the functions of macromolecules like lipids and proteins.

Topics may include:

- The structure and chemical properties of water
- The makeup and properties of macromolecules
- The structure of DNA and RNA

On The Exam
8%–11% of exam score

Unit 2: Cell Structure and Function

You'll study the makeup of cells and the fundamentals of evolution.

Topics may include:

- Cellular components and functions of those components
- Cell interaction with its environment
- The cell membrane structure and function
- Cell regulatory mechanisms like osmosis and selective permeability
- Cellular compartmentalization

On The Exam
10%–13% of exam score

Unit 3: Cellular Energetics

You'll explore how cells interact with their environment and how fundamental biological processes work at the cellular level.

Topics may include:

- The structure and function of enzymes
- The role of energy in living systems
- The processes of photosynthesis
- The processes of cellular respiration
- Molecular diversity and cellular response to environmental changes

On The Exam
12%–16% of exam score

Unit 4: Cell Communication and Cell Cycle

You'll learn how cells grow and reproduce, as well as how cells communicate.

Topics may include:

- The mechanisms of cell communication
- Signal transduction
- Cellular responses and feedback mechanisms
- The events in a cell cycle

On The Exam
10%–15% of exam score

Unit 5: Heredity

You'll learn how traits are passed down from one generation to the next.

Topics may include:

- The process and function of meiosis
- The concepts genetic diversity
- Mendel's laws and probability
- Non-mendelian Inheritance
- Factors affecting inheritance and gene expression

On The Exam
8%-11% of exam score

Unit 6: Gene Expression and Regulation

You'll study how hereditary information passes from parent to offspring and how those traits are expressed.

Topics may include:

- The roles and functions of DNA and RNA
- The mechanisms of gene expression
- How genotype affects phenotype
- Mutations, genetic diversity, and natural selection
- Genetic engineering and biotechnology

On The Exam
12%-16% of exam score

Unit 7: Natural Selection

You'll learn about Darwin's theory, the concept of natural selection, and evolution.

Topics may include:

- Evidential support for evolution and common ancestry
- The mechanisms of natural selection and speciation
- Environmental and human-caused factors in evolution
- Charting species ancestry through phylogenetic trees and cladograms
- Extinction
- Models of the origin of life on Earth

On The Exam
13%-20% of exam score

Unit 8: Ecology

You'll explore biological concepts at a broader organism level and analyze how populations interact within ecosystems.

Topics may include:

- Communication and responses to environmental changes
- Energy flow within and across ecosystems
- Factors in the growth, density, and success of populations
- Factors in community and ecosystem dynamics
- Invasive species, human interaction, and environmental changes

On The Exam
10%-15% of exam score