

# AP<sup>®</sup> Biology

AP<sup>®</sup>Biology is intended to provide a rigorous introductory college level biology course with laboratory activities for high school students. The following course materials are in no way intended to replace the extensive materials provided by the College Board. The AP<sup>®</sup> course outline and recommended laboratory experiences are revised periodically by the College Board. Each teacher of this course should be sure to have the most up-to-date AP<sup>®</sup> Biology course description book and materials from the College Board. These materials are available at the AP<sup>®</sup> Central website <http://apcentral.collegeboard.com>.

The AP<sup>®</sup> Biology course is equivalent to a two-semester introductory college biology course. This course covers in greater scope and scale the concepts, knowledge, and skills introduced in a first level high school biology program. Greater amounts of time and effort are expected on the part of the student.

The major themes for this course are expected to permeate the entire course. The purpose of these themes is to tie the curriculum together and assist students in assimilating the materials into an expandable understanding. The eight major themes are:

1. Science as a Process
2. Evolution
3. Energy Transfer
4. Continuity and Change
5. Relationship of Structure to Function
6. Regulation
7. Interdependence in Nature
8. Science, Technology, and Society

The College Board website will provide additional detail and support as well as a list of recommended laboratories that are an integral part of the AP<sup>®</sup> Biology course.

## **Competency Goal 1: The learner will develop abilities necessary to do and understand scientific inquiry.**

- 1.01 Identify questions and create hypotheses that can be answered through scientific investigations.
- 1.02 Design and conduct scientific investigations to answer biological questions.
  - Identify variables.
  - Use a control or comparison group when appropriate.
  - Select and use appropriate measurement tools.
  - Collect and record data.
  - Organize data into charts and graphs.
  - Analyze and interpret data.
  - Communicate findings.
- 1.03 Formulate and revise scientific explanations and models using logic and evidence to:
  - Explain observations.
  - Make inferences and predictions.
  - Explain the relationship between evidence and explanation.
  -

- 1.04 Apply safety procedures in the laboratory and in field studies:
- Recognize potential hazards.
  - Safely manipulate materials and equipment needed for scientific investigations.
- 1.05 Analyze reports of scientific investigations from an informed scientifically literate viewpoint including considerations of:
- Appropriate sample.
  - Adequacy of experimental controls.
  - Replication of findings.
  - Consideration of alternative interpretations of the data.

**Competency Goal 2: The learner will develop an understanding of cells as the structural and functional units of life.**

**Objectives**

- 2.01 Compare and contrast prokaryotic and eukaryotic cells.
- Relationship to each other.
  - Evolution.
- 2.02 Analyze cellular membranes.
- Structure and function.
  - Variations.
  - Investigate mechanisms of transport.
  - Recommended laboratory - *Diffusion and Osmosis*
- 2.03 Examine sub cellular organization.
- Describe the structure of cell organelles.
  - Relate structure to function.
  - Identify factors that limit cell size.
  - Interpret function of organelles in cellular processes.
- 2.04 Analyze the continuity and diversity provided by the cell cycle.
- Mechanisms of mitosis and cytokinesis.
  - Regulation.
  - Possible aberrations.
- 2.05 Examine past and present research on cells, their structure and function.

**Competency Goal 3: The learner will develop an understanding that cellular processes are based on physical and chemical changes.**

**Objectives**

- 3.01 Analyze the chemical and physical properties of water.
- 3.02 Examine the structure and function of organic molecules.
- Role of carbon in molecular diversity.
  - Synthesis and breakdown of macromolecules.
  - Including:
    - Carbohydrates.
    - Lipids.
    - Proteins.
    - Nucleic Acids.

- 3.03 Analyze free energy changes in biochemical processes.
  - Relate to laws of thermodynamics.
  - Examine process participants.
- 3.04 Describe the structure and function of enzymes.
  - Regulation by enzymes of chemical reactions.
  - Dependence of specificity to structure.
  - Regulation of enzymes.
  - Recommended laboratory - *Enzyme Catalysts*
- 3.05 Analyze bioenergetic reactions.
  - Compare and contrast:
    - Fermentation.
    - Cellular respiration.
    - Photosynthesis.
  - Examine the purpose, interactions, and adaptations of bioenergetic reactions.
  - Recommended laboratories - *Plant Pigments and Photosynthesis, Cell Respiration*
- 3.06 Examine past and present research on biochemistry and cellular processes.

**Competency Goal 4: The learner will develop an understanding of the basis of heredity and the role of molecular genetics.**

**Objectives**

- 4.01 Analyze meiosis and gametogenesis.
  - Analyze heredity.
  - Compare and contrast gametogenesis in plants and animals.
  - Recommended laboratory - *Mitosis and Meiosis*
- 4.02 Assess the organization of eukaryotic chromosomes.
  - Assess contribution of continuity.
  - Assess contribution of variability.
  - Recommended laboratory - *Genetics of Organisms*
- 4.03 Interpret and use the principal patterns of inheritance.
- 4.04 Compare and contrast the structure and function of RNA and DNA.
  - Investigate replication and the complimentary nature of DNA.
  - Examine transcription.
  - Examine translation.
  - Explore the role of amino acids.
  - Analyze energy requirements.
  - Compare structure as it relates to function.
  - Analyze genomes in prokaryotes and eukaryotes.
- 4.05 Assess gene regulation and the mechanisms by which it occurs.
- 4.06 Analyze the ways in which mutations can occur and the possibility of genetic variation.
- 4.07 Investigate viruses.
  - Examine structure.
  - Analyze steps of replication.
  - Assess ability to transfer genetic information between cells.
  - Explore current applications and research.

- 4.08 Examine current nucleic acid technology and its applications.
- Analyze recombinant technology.
  - Examine practical applications in medicine, forensics, agriculture, and environmental issues.
  - Assess legal and ethical issues that may arise.
  - Recommended Laboratory – *Molecular Biology*
- 4.09 Examine past and present research on heredity and molecular genetics.
- Explore the work of Mendel.
  - Explore the work of Watson and Crick.

**Competency Goal 5: The learner will develop an understanding of biological evolution.**

**Objectives**

- 5.01 Examine the evidence that supports an evolutionary view of life.
- 5.02 Recognize the implications of chemical evolution and its impact on the origin of life.
- 5.03 Analyze current models for the early evolution of life.
- Biological macromolecules.
  - Prokaryotic cells.
  - Eukaryotic cells.
- 5.04 Analyze the mechanisms of evolution, their role, results and implications.
- Identification of patterns and the responsible mechanisms.
  - Analyze heredity and its link to natural selection.
  - Examine speciation.
  - Examine macroevolution.
  - Recommended laboratory - *Population Genetics and Evolution*
- 5.05 Investigate the contributions of early researchers, (e.g. Pasteur and Darwin) and their impact on the current view of evolutionary biology.

**Competency Goal 6: The learner will develop an understanding of the unity and diversity of life.**

**Objectives**

- 6.01 Analyze evolutionary patterns.
- Examine DNA analysis.
  - Examine biochemical analysis.
  - Examine morphological research.
- 6.02 Survey the diversity of life.
- Use keys to identify organisms.
  - Examine representative organisms.
- 6.03 Analyze and apply current phylogenetic classification including:
- Domains.
  - Kingdoms.
  - Major Phyla and divisions of animals and plants.
- 6.04 Analyze evolutionary relationships.
- Investigate evidence.

- Explore research methods.
  - Analyze use of research.
- 6.05 Examine the structure and function of plants and animals.
- Analyze reproduction, growth, and development.
    - Patterns.
    - Adaptations (e.g. alternation of generations).
    - Regulation as by hormones.
  - Recommended laboratory - *Transpiration*
  - Analyze structural, physiological, and behavioral adaptations.
    - Cell level.
    - Tissue level.
    - Organ level.
    - Interactions between levels of organization.
  - Recommended laboratories - *Physiology of the Circulatory System, Animal Behavior*
  - Identify responses to the environment.
- 6.06 Examine past and present research on the unity and diversity of life.

**Competency Goal 7: The learner will develop an understanding of basic ecological principles.**

**Objectives**

- 7.01 Analyze population dynamics.
- Examine models to describe growth.
  - Explore affects of abiotic and biotic factors.
  - Analyze the impact of population changes.
- 7.02 Examine the actions and interactions of communities and ecosystems.
- Analyze energy flow.
  - Examine trophic structure.
  - Investigate water and element cycling.
  - Assess affects of abiotic and biotic factors.
  - Analyze relationships with in communities and ecosystems.
  - Recommended laboratory - *Dissolved Oxygen and Aquatic Primary Production*
- 7.03 Assess current global issues.
- Analyze affects of human population.
  - Analyze affects of technology.
  - Examine causes.
  - Assess consequences.
- 7.04 Examine past and present research on ecological principles.