

Brief Description of Course

COURSE DESCRIPTION

Advanced placement biology is a sophisticated, college level course offered to students who have successfully completed the prerequisites. Eight major themes will recur throughout the course: science as a process; evolution; energy transfer; continuity and change; relationship of structure to function; regulation; interdependence in nature; science, technology, and society. These themes are the unifying constructs in modern biology. Laboratory exercises are designed to parallel the lecture units. The labs will develop important skills such as detailed observation, accurate recording, experimental design, manual manipulation, data interpretation, statistical analysis, and operation of technical equipment. Laboratory assignments offer the opportunity for students to learn about problem solving, the scientific method, the techniques of research, and the use of scientific literature. Students in the course are encouraged to take the national advanced placement biology examination. Since biology will lead science into the new millennium, there will be a host of careers with biological components. Areas like genetic engineering, criminology, DNA technology, medicine, microbiology, environment, agricultural and food related sciences are but a few possibilities.

Unit Information

Unit Name or Timeframe:

Introduction – Themes in the Study of Life (1 week)

Content and/or Skills Taught:

The student will be able to:

1. Describe unifying themes that pervade the science of biology.
2. Diagram the hierarchy of structural levels in biology.
3. Distinguish between the five kingdoms of life.
4. Relate how Charles Darwin's ideas contributed to the conceptual framework of biology.
5. Outline the scientific method.
6. Distinguish between inductive and deductive reasoning.
7. Explain how science and technology are interdependent.
8. Summarize the philosophies of vitalism and mechanism.

Lab Component: Scientific Method

Objectives: After completing this exercise the student will be able to:

1. define scientific method, mechanist, vitalist, cause and effect, teleology, induction, deduction, experimental group, control group, independent variable, controlled variables, dependent variable, correlation, theory, principle, bioassay.
2. explain the nature of scientific knowledge
3. describe the basic steps of the scientific method
4. state the purpose of an experiment
5. explain the difference between cause and effect and correlation
6. describe the design of a typical research article.

Unit Name or Timeframe:

Taxonomy (1-2 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Compare and contrast several classification systems and explain the rationale for each
2. Describe the major taxonomic categories from the most to least inclusive.
3. Classify a human being using the most recent methodology.
4. Relate the importance of the fossil record to the study of taxonomy.

Lab Component: Students will be assigned ten organisms and using field guides, Internet, etc. they will write the complete taxonomy of each organism.

Unit Name or Timeframe:

Microbiology (2 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Recount the history leading up to the discovery of bacteria and viruses.
2. Distinguish between lytic and lysogenic cycles of viruses.
3. Explain why viruses do not fit our usual definition of life.
4. Categorize bacteria according to morphology.
5. Use sterile techniques to subculture bacteria colonies.
6. Identify the causative agent of selected human diseases.
7. Perform a Gram stain using proper laboratory technique.

Lab Component: Microbiology – Using proper sterile techniques, students will collect, culture, subculture bacteria.

Unit Name or Timeframe:

Biochemistry (3-4 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Describe how carbon skeletons may vary and relate how this variation contributes to the complexity of molecules.
2. Compare and contrast the distinguishing characteristics of carbohydrates, lipids, proteins, and nucleic acids.
3. Distinguish between saturated and unsaturated fat.
4. Discuss primary through quaternary protein structure.
5. Define denaturation and explain how proteins maybe denatured.
6. Explain the importance of hydrophilic and hydrophobic interactions.

Lab Component: Enzyme Catalysis

Unit Name or Timeframe:

Cytology (2 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Distinguish between prokaryotic and eukaryotic cells.
2. Describe the structure and function of the cytoskeleton.
3. Summarize the structure and function of the nucleus, the endomembrane system, and other organelles.
4. Relate the work of earlier researchers to our current model of the plasma membrane.
5. Differentiate between active and passive transport.
6. Predict the direction of water movement in varying osmotic systems.
7. Explain the various functions of membrane proteins.

Lab Component: Diffusion and Osmosis

Unit Name or Timeframe:

Botany (3 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Summarize the taxonomy of the major plant groups.
2. Identify the characteristics of the different plant tissues.
3. Describe the components of roots, stems and leaves and flowers.
4. Compare and contrast the life cycles of moss, ferns, gymnosperms and angiosperms.
5. Explain how the evolution of the flower enhanced the reproductive efficiency of plants.
6. Discuss how fruits are modified in ways that help disperse seeds.
7. Hypothesize how animals may have influenced the evolution of terrestrial plants and vice versa.

Lab Component 1: Plant Form Identification

Lab Component 2: Plant Tissue Identification

Lab Component 3: Transpiration

Unit Name or Timeframe:

Photosynthesis (3-4 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Distinguish between photosynthetic & chemosynthetic autotrophs.
2. Write a summary equation for photosynthesis.
3. Trace electron flow through photosystems II and I.
4. Summarize the steps of the light and dark reactions.
5. Compare C₃ and C₄ photosynthesis and predict when each would occur.
6. Determine the role of ATP and NADPH in the Calvin Cycle.
7. Describe the major consequences of photorespiration.
8. Describe the fate of photosynthetic products.

Lab Component: Plant Pigments and Photosynthesis

Unit Name or Timeframe:

Cell Respiration (3-4 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Diagram energy flow through the biosphere.
2. Describe the overall summary equations for cellular respiration.
3. Relate how redox reactions are involved in energy exchanges.
4. Discuss the role of ATP.
5. Summarize the steps of cell respiration.
6. Explain how mitochondrial membrane structure relates to membrane function in chemiosmosis.
7. Distinguish between lactic acid and alcoholic fermentation and predict under what conditions each would occur.

Lab Component: Cell Respiration

Unit Name or Timeframe:

DNA (3-4 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Summarize experiments performed by scientists, which provided evidence that DNA is the genetic material.
2. State the components of a nucleotide.
3. Compare and contrast DNA with RNA.
4. Describe the process of DNA replication.
5. Explain how information flows from gene to protein.
6. Relate the evolutionary significance of a nearly universal genetic code.
7. Describe several types of mutations and discuss their consequence.
8. Discuss the pros and cons of DNA technology.
9. Hypothesize the impact of cloning on society.

Dry Labs: DNA Scissors and DNA Goes to the Races

Lab Component: Molecular Biology: Extraction of DNA and gel electrophoresis.

Unit Name or Timeframe:

Cell Reproduction (2-3 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Overview the major events of cell division that enable the genome of one cell to be passed on to two daughter cells.
2. Describe the sequence of events that occurs during each phase of the cell cycle.
3. List the phases of mitosis and describe the events characteristic of each phase.
4. Compare cytokinesis in animals and plants.
5. Compare and contrast mitosis with binary fission.
6. Discuss the formation of male and female gametes.
7. Compare and contrast mitosis and meiosis.

Lab Component 1: Mitosis & Meiosis

Lab Component 2: Crossing Over in Sordaria.

Unit Name or Timeframe:

Embryology (1 week)

Content and/or Skills Taught:

The student will be able to:

1. Discuss the mechanism of fertilization.
2. Identify the various stages of embryonic development and summarize the characteristics of each stage.
3. Explain the functions of the extraembryonic membranes.
4. Compare and contrast development in birds and mammals.
5. Determine which of the three primary tissue layers give rise to the major body organs.
6. Discuss how cell extension, death, contraction and adhesion are involved in shaping the embryo.

Lab Component: Students will examine fertilized chicken eggs stereoscopically to identify and age embryos.

Unit Name or Timeframe:

Genetics (3 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Explain how Mendel's hypothesis of inheritance differed from the blending theory.
2. Use a Punnett square to predict the results of mono, di, and trihybrid crosses.
3. Discuss the use of a test cross.
4. Hypothesize how the laws of probability can be used to predict the outcomes of genetic situations.
5. Describe the inheritance of the ABO and Rh blood systems.
6. Deduce the genotypes of family members by analyzing pedigrees.
7. Describe the inheritance and expression of selected genetic disorders.
8. Compare and contrast population genetics with individual genetics.

Lab Component: The Genetics of Drosophila with statistical analysis.

Unit Name or Timeframe:

Evolution (1 week)

Content and/or Skills Taught:

The student will be able to:

1. Summarize Hardy Weinberg equilibrium and relate its significance in evolution.
2. Compare and contrast the following theories of speciation: Creationism, Lamarckian theory, Punctuated equilibrium, Evolution.
3. Assess the impact of Darwin's work on society.
4. Enumerate evidence that supports the theory of evolution.
5. Summarize the research of Stanley Miller and interpret how it relates to prebiotic evolution.

Lab Component: Evolution in action – the Peppered Moth.

Lab Component: Population genetics and Evolution

Unit Name or Timeframe:

Structure and Function of Animals (3 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Differentiate the body plans of various animal taxa
2. Describe the organ systems of various animal taxa; their main components and associated functions.
3. Apply evolutionary concepts to the hierarchy of animal taxa based on form and function.
4. Integrate the molecular basis of cellular respiration and cell biology to the ultimate forms of Kingdom Animalia.

Lab Component: Physiology of the Circulatory System

Lab Component: Comparative dissections.

Unit Name or Timeframe:

Ecology (2-3 weeks)

Content and/or Skills Taught:

The student will be able to:

1. Explain why the field of ecology is a multidisciplinary science.
2. Describe the characteristics of the major biomes.
3. Compare and contrast the types of freshwater ecosystems.
4. Summarize S and J population growth curves.

5. Identify density-dependent and density-independent factors in population growth.
6. Demonstrate how ecologists predict the density of a population.
7. Illustrate energy flow in an ecosystem.
8. Differentiate between clumped, random, and uniform dispersion of populations.
9. Discuss the major nutrient cycles.

Lab Component: Animal Behavior

Lab Component: Dissolved Oxygen and Aquatic Primary Productivity

Alternate Approaches

Textbooks/Course Materials

Author:Campbell, Neil A.

Second Author:Reece, Jane B.

Title:Biology, Sixth Edition

Publisher:Benjamin Cummings

Published Date:11 December, 2001

Other Course Materials

Material Type:Other

Description:Student Study Guide for BIOLOGY Campbell, Reece 6th edition:to reinforce the understanding of material. This study guide contains Framework sections, Chapter summaries, Interactive Questions, Word Roots, Structure Your Knowledge, Concept Maps, Test Your Knowledge, and a complete Answer Section.

Material Type:Other

Description:The College Board BIOLOGY Lab Manual, For Students, Revised 2001

Websites

Periodicals

Title:various

Publication:JAMA

Date:current to school year

Description:Journal of the American Medical Association:This source is utilized to acclimate the students to higher levels of scientific writing. Analysis of abstracts and discussion of select articles spur the students to higher levels of critical thinking.

Additional Information

Requirement:Research Paper

How Course Meets Requirement:All of my AP Biology students are required to research and present an approved topic surrounding a central theme, gather indepth information and evidence to share with their peers. They must submit a typed paper supported by in-text citations; statistical data; visual data, when applicable, and references assembled in a works cited. Themes and associated topics covered have included: Embryology:Tissue Development and Origin of Cell Types; Taxonomy: The Diversity Project; and Cytology: Cellular Biology Review Paper. c Papers from prior years are displayed and discussed and are oftentimes used as the basis of additional discussion.