

Advanced Placement Biology 1-2

Mr Kodros

<u>Grade Level:</u>	11-12 recommended
<u>Length of course:</u>	1 year
<u>Prerequisites:</u>	Biology and Chemistry recommended (both UC-D level lab science)
<u>Credits:</u>	10 units
<u>Text:</u>	Biology 8 th edition Campbell and Reece.

Course Description

This is a college biology course taught in high school. At the end of the year, the students are given a standardized exam that will determine their eligibility for advanced placement and/or credit in college biology courses. The course covers a vast amount of material and thus makes heavy demands on even the best-organized student. In addition to a thorough reading of a college biology textbook, the students will read scientific articles, and perform and write up numerous laboratories.

Goals of the Curriculum

- To prepare for college level work in the biological sciences
- To learn the relationships among data gathering and interpretation, hypothesis setting, and prediction
- To learn to design and execute a laboratory experiment to test an idea
- To communicate accurately and meaningfully about concepts, observations and conclusions
- To prepare for the Advanced Placement examination in biology
- To develop critical thinking skills and become self-directed learners

Units of Study

I. Molecules and Cells

A. Chemistry of Life

Water
Organic molecules in organisms
Free energy changes
Enzymes

B. Cells

Prokaryotic and eukaryotic cells
Membranes
Subcellular organization
Cell cycle and its regulation

C. Cellular Energetics

Coupled reactions
Fermentation and cellular respiration
Photosynthesis

II. Heredity and Evolution

A. Heredity

Meiosis and gametogenesis
Eukaryotic chromosomes
Inheritance patterns

B. Molecular Genetics

RNA and DNA structure and function
Gene regulation
Mutation
Viral structure and replication
Nucleic acid technology and applications

C. Evolutionary Biology

Early evolution of life
Evidence for evolution
Mechanisms of evolution

III. Organisms and Populations

A. Diversity of Organisms

Evolutionary patterns
Survey of the diversity of life
Phylogenetic classification
Evolutionary relationships

B. Structure and Function of Plants and Animals

Reproduction, growth, and development
Structural, physiological, and behavioral adaptations
Response to the environment

C. Ecology

Population dynamics
Communities and ecosystems & Global issues

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Content Outcomes

•Students will:

1. Have an advanced understanding of the chemistry of life including water, organic molecules in organisms, free energy changes, coupled reactions and enzymes.
2. Describe cells in detail including: prokaryotic and eukaryotic cells, membranes, subcellular organization, the cell cycle and its regulation, fermentation, cellular respiration and photosynthesis.
3. Have an advanced understanding of heredity and molecular genetics including: meiosis and gametogenesis, eukaryotic chromosomes, inheritance patterns, structure and function of RNA and DNA, gene regulation, mutation and nucleic acid technology.
4. Have a sophisticated understanding of evolutionary biology including: the early evolution of life, evidence for evolution and mechanisms of evolution.
5. Describe the diversity of all organisms including: evolutionary patterns, phylogenetic classification and evolutionary relationships.
6. Describe in detail the structure and function of plants and animals including reproduction, growth, development, responses to the environment, structural adaptations, physiological adaptations and behavioral adaptations.
7. Have a complex understanding of ecology including: population dynamics, communities, ecosystems and global ecology issues.
8. Have a sophisticated understanding of the nature and process of science including: research, experimental design and the advancement of scientific theories.
9. Be able to read, understand and evaluate new discoveries in the rapidly growing field of biology.
10. Apply their knowledge of biology to personal and societal issues.

Skill Outcomes

- Students are prepared for college level work in the biological sciences.
 - Students have learned the relationships among data gathering and interpretation, hypothesis setting, and prediction.
 - Students know how to design and execute a laboratory experiment to test an idea.
 - Students know how to communicate accurately and meaningfully about concepts, observations and conclusions.
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- Students are prepared for the Advanced Placement examination in biology.
 - Students have critical thinking skills and are self-directed learners.

Assessment Strategies

- Exams
- Laboratory work
- Projects

Instructional Strategies

- Lecture
- Laboratories
- Collaborative projects
- Guided reading assignments
- Student presentations
- Computer modeling

Instructional Materials

- Textbook
- Instructional videos
- Laboratory manual
- Internet resources
- Outside readings from reputable news sources
- STELLA (computer modeling software)

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Laboratory

I cover all of the AP labs required either exactly or in modified form. Students keep all labs in a composition style lab notebook. Students will do a *pre-lab* that includes questions on the concept covered, a hypothesis, title, purpose, procedure, and prepared data tables. Students collect data during our lab time. Graphs, calculations, analysis questions and conclusions are assigned to complete the lab report and are placed in the lab notebook.

Themes

The class begins the fall semester with a discussion of the major themes of biology as stated in the AP Course Description and our textbook. The major themes are presented in lecture and lab discussion throughout the year. Some examples involve *Science as a Process* in all our lab work, *Evolution* in all the topics taught, and *Interdependence in Nature* exhibited visually by mind maps or *Stella* computer models.

Supplemental Readings

Supplemental readings are assigned with various units to enrich the subject or relate evolution and/or any of the eight themes of biology to the unit being taught. Examples are an article from Scientific American magazine on the evolution of organic molecules on the primitive earth to excerpts from the Double Helix by Watson.

Activities

Class activities range from the dissection of a fetal pig, *PowerPoint* projects, short lab activities, concept/mind mapping or computer modeling, and traditional models, as in the creation of a cell model.

Field Trips/Guest Speaker

One field trip to a local biotechnology company and/or a practicing scientist will speak on the topic of biotechnology during the course of the year. Discussions of the positive and/or negative impacts on society are done with this activity.

My specific course unit plan can be found on the following pages.

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Unit 1 Introduction, Ecology and Animal Behavior

Readings

- Themes of Biology, Chapter 1
- Selected sections of Chapters 51-55
- Receive learning objectives & assignment list

Lecture Topics

- Themes of biology
- Animal Behavior (behavioral ecology, learning, animal cognition)
- Ecology (biosphere, population ecology, community ecology, ecosystems)

Lab

- AP Lab 11A – Animal Behavior
- AP Lab 12 – Dissolved Oxygen

Unit 2 Biochemistry

Readings

- Selected sections of chapters 2 – 5
- Supplementary reading
- Receive learning objectives & assignment list

Lecture Topics

- Biochemistry
- Water
- Carbon and biological molecules
- Structure and function of large biological molecules

Lab

- Molecular models

Unit 3 Cell Structure & Transport

Readings

- Chapters 6 & 7
- Receive learning objectives & assignment list

Lecture Topics

- Techniques for cell study
- Cell structure
- Cell transport

Lab

- AP Lab 1 – Diffusion & Osmosis

Unit 4 Metabolism

Readings

- Chapter 8
- Receive learning objectives & assignment list

Lecture Topics

- Metabolic pathways
- Laws of energy thermodynamics
- Free energy
- Enzymes

Lab

- AP Lab 2 Enzyme Catalysis

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Unit 5 Cell Respiration

Readings

- Chapter 9
- Receive learning objectives & assignment list

Lecture Topics

- Basic cellular respiration concepts
- Process of cellular respiration
- Alternate ATP manufacturing paths

Lab

- AP Lab 5 - Cell Respiration

Unit 6 Cell Reproduction: Cell Cycle and Cell Division

Readings

- Chapters 12 & 13
- Receive learning objectives & assignment list

Lecture Topics

- General cell division
- Mitotic cell cycle
- Cell cycle regulation
- Intro to Heredity
- Role of meiosis in sexual life cycles
- Origins of genetic variation

Lab

- AP Lab 3A - Mitosis
- AP Lab 3B – Meiosis (modeling)

Unit 7 Heredity and Genetics

Readings

- Chapter 14 and 15
- Receive learning objectives & assignment list

Lecture Topics

- Gregor Mendel's Discoveries
- Extending Mendelian genetics
- Mendelian Inheritance in humans
- Relating Mendelism to chromosomes
- Sex chromosomes
- Errors and exceptions in chromosomal inheritance

Lab

- AP Lab 7 - Genetics of Organisms (alternate virtual lab)

Unit 8 DNA Replication

Readings

- Chapter 16
- Receive learning objectives & assignment list

Lecture Topics

- DNA as genetic material
- DNA replication and repair

Lab

- Modeling DNA replication

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Unit 9 Protein Synthesis

Readings

- Chapter 17
- Receive learning objectives & assignment list

Lecture Topics

- Connection between gene and protein
- Synthesis and processing of RNA
- Synthesis of protein

Lab

- Protein Synthesis Modeling

Unit 10 Viral & Bacterial Genetics; Control of Gene Expression; Control of Eukaryotic Genomes

Readings

- Chapters 18 and 19
- Receive learning objectives & assignment list

Lecture Topics

- Genetics of viruses
- Genetics of bacteria
- Eukaryotic chromatin structure
- Genome Organization at the DNA level
- Control of gene expression

Unit 11 Evolution

Readings

- Chapters 22 -25
- Receive learning objectives & assignment list

Lecture Topics

- Historical context for evolutionary theory
- Darwinian revolution
- Population genetics
- Causes of microevolution
- Natural selection
- Species and speciation
- Modes of speciation
- Fossil record and geological time

Lab

- AP Lab 8 - Population Genetics

Unit 12 Diversity of Organisms

Readings

- Chapters 26 – 34
- Receive learning objectives & assignment list

Lecture Topics (mostly covered in student group projects)

- Prokaryotes
- Protists
- Fungi
- Plants
- Animals

Lab

- Organism “ID”

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Unit 13 Biotechnology

Reading

- Chapter 20
- Selected Readings from study guide

Lecture Topics (covered in lab and student portfolio)

- Transformation
- Polymerase chain reaction
- Gel electrophoresis
- Biotechnology

Lab

(AP Lab 6 - Molecular Biology)

- Pipet Review: Lab A1
- pGlo Transformation Lab: In Class
- Alu Repeat ID Lab

Unit 14 Animal Systems: Anatomy & Physiology I

Readings

- Chapters 40 -44
- Receive learning objectives & assignment list

Lecture Topics

- Intro to animal structure and function
- Animal Nutrition
- Circulation and gas exchange
- The body's defenses
- Regulating the internal environment

Lab

- AP Lab 10 - Physiology of the Circulatory System

Unit 15 Animal Systems: Anatomy & Physiology II

Readings

- Chapters 45 – 50
- Receive learning objectives & assignment list

Lecture Topics

- Chemical signals in animals
- Animal reproduction
- Animal development
- Nervous system
- Sensory and motor mechanisms

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Unit 16 Plant Anatomy & Physiology

Readings

- Chapters 35 – 39
- Receive learning objectives & assignment list

Lecture Topics

- Plant form and function
- Transport in plants
- Plant nutrition
- Plant reproduction
- Plant responses to internal and external signals

Lab

- AP Lab 9 – Transpiration

Unit 17 Photosynthesis & Respiration Review

Readings

- Chapter 10
- Receive learning objectives & assignment list

Lecture Topics

- Photosynthesis in nature
- Pathways of photosynthesis
- Cellular respiration review

Lab - AP Lab 4 – Plant Pigments and Photosynthesis

Unit 18 Dissection

Read

- Selected Reading from dissection manual
- Receive learning objectives & assignment list

Lab

- Fetal pig dissection