

# AP Biology Course Syllabus

## School Year 2012-2013

### Course Overview:

This Biology AP course is designed for college-bound students, with demonstrated self-motivation to succeed and unwavering work ethic. It aligns with the standards instituted by the College Board, and covers all of the topics stated in the AP Biology Course Description. The three general areas covered will be:

- Molecules and Heredity (25%)
- Heredity and Evolution (25%)
- Organisms and Populations (50%)

The goals of the course are to help students develop a conceptual framework for modern biology and an appreciation of science as a process. The primary emphasis, during the course is on developing an understanding of concepts and not just memorization of facts.

The themes of this course are the all-encompassing features of Biology that extend throughout the curriculum, and they are stated below:

- Science as a Process
- Evolution
- Energy Transfer
- Continuity and Change
- Relationship of Structure to Function
- Regulation
- Interdependence in Nature
- Science, Technology and Society

### Course Objectives

The objectives of this course include:

- Apply biological knowledge and critical thinking to environmental and social concerns
- Practice finding and using patterns in collected data to solve biological problems
- Exhibit mastery of the major principles of Biology
- Demonstrate skills in using various types of biological tools and procedures

### Instructional Materials:

AP Edition, Biology by Campbell and Reece, (Eighth edition), along with the AP Lab Manual for Students.

### Topics

The alignment of the AP Biology topics and the chapters/concepts of the textbook, to be covered during the course, are as follows:

AP Biology Topics	Sub-topics	Units	Chapter
Molecules and Cells	Chemistry of Life	1-2	3-10
	Cells		6-12
	Cellular Energetics		8-10
Heredity and Evolution	Heredity	3-5	13-15
	Molecular Genetics		16-20
	Evolutionary Biology		22-26
Organisms and Populations	Diversity of Organisms	4-8	25-34
	Structure and Function of Plants and Animals		29-51
	Ecology		52-56

### Advanced Placement Biology Content

My AP course is structured around the four big ideas, the enduring understandings within the big ideas, and the essential knowledge within the enduring understanding.

**The “Big Ideas”:**

**Big idea 1:** The process of evolution drives the diversity and unity of life.

**Big idea 2:** Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.

**Big idea 3:** Living systems store, retrieve, transmit and respond to information essential to life processes.

**Big idea 4:** Biological systems interact, and these systems and their interactions possess complex properties

**Laboratory Component**

This course includes a laboratory component. Lab work will consist of 25 to 30% of class time. In depth and exploratory labs will be assigned, that allow the student to learn and reinforce skills and concepts that align with the lectures, readings and class discussion. Students will maintain a laboratory notebook or portfolio throughout the course, that documents all of their laboratory investigations. The skills we expect to develop include:

- Detailed observation
- Accurate recording
- Experimental design
- Manual manipulation
- Data interpretation
- Statistical analysis
- Operation of technical equipment

**The Science Practices the students will be expected to exhibit include:**

- 1. The student can use representations and models to communicate scientific phenomena and solve scientific problems.
- 2. The student can use mathematics appropriately.
- 3. The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.
- 4. The student can plan and implement data collection strategies appropriate to a particular scientific question.
- 5. The student can perform data analysis and evaluation of evidence.
- 6. The student can work with scientific explanations and theories.
- 7. The student is able to connect and relate knowledge across various scales, concepts and representations in and across domains.

**The AP Biology “Big 12” Labs**

The AP Biology 12 Recommended Lab Exercises will be assigned as well as other supporting labs. The following are the 12 recommended Biology Labs of the College Board:

1. Diffusion and Osmosis
2. Enzyme Catalysis
3. Mitosis and Meiosis
4. Plant Pigments and Photosynthesis
5. Cell Respiration
6. Molecular Biology
7. Genetics of Organisms
8. Population so genetics and Evolution
9. Transpiration
10. Physiology and Circulatory System
11. Animal Behavior
12. Dissolved Oxygen and Aquatic Primary Productivity

Lab Title	Scientific Practices
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Diffusion and Osmosis	<ul style="list-style-type: none"> <li>• Accurate recording</li> <li>• Detailed observation</li> <li>• models to communicate scientific phenomena</li> </ul>
Enzyme Catalysis	<ul style="list-style-type: none"> <li>• Data interpretation</li> <li>• Manual manipulation</li> <li>• work with scientific explanations and theories</li> </ul>
Mitosis and Meiosis	<ul style="list-style-type: none"> <li>• Manual manipulation</li> <li>• models to communicate scientific phenomena</li> </ul>
Plant Pigments and Photosynthesis	<ul style="list-style-type: none"> <li>• Operation if technical equipment</li> <li>• Manual manipulation</li> <li>• Accurate recording</li> </ul>
Cell Respiration	<ul style="list-style-type: none"> <li>• Data interpretation</li> <li>• Manual manipulation</li> <li>• Accurate recording</li> </ul>
Molecular Biology	<ul style="list-style-type: none"> <li>• Operation if technical equipment</li> <li>• Manual manipulation</li> <li>• Detailed observation</li> <li>• work with scientific explanations and theories</li> </ul>
Genetics of Organisms	<ul style="list-style-type: none"> <li>• Statistical analysis</li> <li>• Detailed observation</li> <li>• use mathematics</li> </ul>
Population of genetics and evolution	<ul style="list-style-type: none"> <li>• Statistical analysis</li> <li>• use mathematics</li> <li>• scientific questioning</li> <li>• able to connect and relate knowledge across various scales,</li> <li>• concepts and representations in and across domains</li> </ul>
Transpiration	<ul style="list-style-type: none"> <li>• Data interpretation</li> <li>• models to communicate scientific phenomena</li> </ul>
Physiology and circulatory system	<ul style="list-style-type: none"> <li>• Manual manipulation</li> <li>• work with scientific explanations and theories</li> </ul>
Animal Behavior	<ul style="list-style-type: none"> <li>• Experimental design</li> <li>• Detailed observation</li> <li>• scientific questioning</li> <li>• plan and implement data collection strategies</li> </ul>
Dissolved Oxygen and Aquatic	<ul style="list-style-type: none"> <li>• Data interpretation</li> </ul>

## **Units of Instruction**

### **Unit 1: First Week and Introduction** (Review summer assignment, 4 Classes)

**Big ideas:** 1, 2

**Connected to enduring understandings:**

1. A Change in the genetic makeup of a population over time is evolution.
2. A Growth, reproduction and maintenance of the organization of living systems require free energy and matter.

**Chapters:**

1. Introduction: Themes in the Study of Life
2. The Chemical Context of Life
3. Water and the Fitness of the Environment

**Activities :** Demonstrate the unique characteristics of water, through design of their own mini-labs.

### **Unit 2: Biochemistry and Introduction to the Cell** (11 Classes)

**Big ideas:** 1, 2, 3, 4

**Connected to enduring understandings:**

- 1.D The origin of living systems is explained by natural processes.
- 2.A Growth, reproduction and maintenance of the organization of living systems require free energy and matter.
- 2.B Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.
- 3.A Heritable information provides for continuity of life.
- 4.A Interactions within biological systems lead to complex properties.
- 4.B Competition and cooperation are important aspects of biological systems.
- 4.C Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

**Chapters:**

4. Carbon and the Molecular Diversity of Life
5. The Structure and Function of Large Biological Molecules
6. A Tour of the Cell
7. Membrane Structure and Function

**Activities:**

Construct models connecting the movement of molecules across membranes with membrane structure and function.

### **Unit 3: Cellular Energy and Related Processes** (14 Classes)

**Big ideas:** 1, 2, 4

**Connected to enduring understandings:**

- 1.A Change in the genetic makeup of a population over time is evolution.
- 1.D The origin of living systems is explained by natural processes.
- 2.B Growth, reproduction and maintenance of the organization of living systems require free energy and matter.
- 4.A Interactions within biological systems lead to complex properties.
- 4.B Competition and cooperation are important biological systems.

**Chapters:**

8. An Introduction to Metabolism
9. Cellular Respiration
10. Photosynthesis

**Activities:** Measure the cellular respiration rates of peas that have germinated, vs. those that have not.

#### **Unit 4: Cell Communication and the Cell Cycle (9 Classes)**

**Big ideas: 1, 2, 3**

**Connected to enduring understandings:**

- 2.E Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination
- 3.A Heritable information provides for continuity of life
- 3.B Expression of genetic information involves cellular and molecular mechanisms.
- 3.D Cells communicate by generating, transmitting and receiving chemical signals.

**Chapters:**

- 11. Cell Communication
- 12. The Cell Cycle

**Activities:** Investigate different types of cells in the human body and compare and contrast those that proceed with the cycle in full and the rate, with those that may stop mid cycle, and the frequency with which they do that.

#### **Unit 5: Genetic Basis of Life (7 Classes)**

**Big ideas: 1, 3, 4**

**Connected to enduring understandings:**

- 1.A Change in the genetic makeup of a population over time is evolution.
- 3.A Heritable information provides for continuity of life.
- 3.C The processing of genetic information is imperfect and is a source of genetic variation.
- 4.C Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

**Chapters:**

- 13. Meiosis and Sexual Life Cycles
- 14. Mendel and the Gene Idea
- 15. The Chromosomal Basis of Inheritance

**Activities:** Explain the connection between genetic variations in organisms and phenotypic variations in populations., using sample data provided.

#### **Unit 6: Gene Activity and Biotechnology (13 Classes)**

**Big ideas: 1, 2, 3, 4**

**Connected to enduring understandings:**

- 1.A Change in the genetic makeup of a population over time is evolution
- 2.C Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis.
- 2.E Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.
- 3.A Heritable information provides for continuity of life.
- 3.B Expression of genetic information involves cellular and molecular mechanisms.
- 3.C The processing of genetic information is imperfect and is a source of genetic variation.
- 4.A Interactions within biological systems lead to complex properties.

**Chapters:**

- 16. The Molecular Basis of Inheritance
- 17. From Gene to Protein
- 18. Regulation of Gene Expression
- 19. Viruses
- 20. Biotechnology
- 21. Genomes and their Evolution

**Activities:** Students will view *Gattaca*, or another science/science fiction film and evaluate the ethical and scientific merits of the film.

**Unit 7: Evolution and Phylogeny (19 Classes)**

**Big ideas: 1, 3, 4**

**Connected to enduring understandings:**

- 1.A Change in the genetic makeup of a population over time is evolution.
- 1.B Organisms are linked by lines of descent from common ancestry.
- 1.C Life continues to evolve within a changing environment.
- 1.D The origin of living systems is explained by natural processes.
- 3.A Heritable information provides for continuity of life.
- 3.C The processing of genetic information is imperfect and is a source of genetic variation.
- 4.C Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

**Chapters:**

- 22. Descent with Modification: A Darwinian View of Life
- 23. The Evolution of Populations
- 24. The Origin of Species
- 25. The History of Life on Earth
- 26. Phylogeny and the Tree of Life
- 27. Bacteria and Archae

**Activities:** Research and report how MRSA and other bacteria with anti-biotic resistance ..have to come to be.

## **Unit 8 Diversity in the Biological World: Organism Form and Function**

(22 Classes)

**Big ideas: 1, 2, 3, 4**

**Connected to enduring understandings:**

- 1.A Change in the genetic makeup of a population over time is evolution.
- 1.B Organisms are linked by lines of descent from common ancestry.
- 2.A Growth, reproduction and maintenance of the organization of living systems require free energy and matter.
- 2.C Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis.
- 2.D Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.
- 2.E Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.
- 3.E Transmission of information results in changes within and between biological systems.

- 4.A Interactions within biological systems lead to complex properties.
- 4.B Competition and cooperation are important aspects of biological systems.

**Chapters:**

- 40. Basic Principles of Animal Form and Function
- 43. The Immune System
- 48. Neurons, Synapses, and Signaling
- 49.2 The Vertebrate Brain

**Activities:** In an essay, students will identify emerging diseases and compare the effects of the interactions of pathogens and hosts.

**Unit 9: Ecology** (17 Classes)

**Big ideas: 1, 2, 3, 4**

**Connected to enduring understandings:**

- 1.A Change in the genetic makeup of a population over time is evolution.
- 1.C Life continues to evolve within a changing environment.
- 2.A Growth, reproduction and maintenance of the organization of living systems require free energy and matter.
- 2.C Organisms use feedback mechanisms to regulate growth, reproduction and dynamic homeostasis.
- 2.D Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.
- 2.E Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.
- 3.E Transmission of information results in changes within and between biological systems.
- 4.A Interactions within biological systems lead to complex properties.
- 4.B Competition and cooperation are important aspects of biological systems.
- 4.C Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

**Chapters:**

- 51. Animal Behavior
- 52.2. Interactions between organisms and the environment limit the distribution of species.
- 53. Population Ecology
- 54. Community Ecology
- 55. Ecosystems
- 56. Conservation Biology and Global Change

**Activities:**

- Students will work with a data set that investigates the influence of interactions on the Hardy-Weinberg law of genetic equilibrium.
- Students will create an illustration tracing the path of a carbon atom from the air into a plant during photosynthesis and then follow the journey of the same carbon atom from an ancient dinosaur and into a modern human through food webs (e.g., carbon cycle).



- Students will complete a comparative study where altruism is investigated among animal populations in preparation for an oral report.

## Course Outline

Week of... (days in that week)	Chapter #, Name	Lab #, Name	Assignments	Exams
(Off Monday: Labor Day) 9/7 (4)	1 Themes 2 Chemical Context of Life 3 Water	11 Animal Behavior	Reading guide chap 1  Reading guide chapters 2 & 3	
9/13 (3)	4 Carbon 5 Macromolecules	Building Macromolecules  Acid/ Base Lab Enzyme Lab Carb/Lipid Lab	Reading Guide Chapter 4  Reading Guide Chapter 5	
9/20 (5)	7 Cells	BIG Cell	3 lab reports  Reading guide ch5  Chapter 7 Reading guide	Ch 1-5
9/27 (5)	8 Membranes	1 Diffusion/Osmosis	Test corrections due this week Ch8 Reading Guide	
10/4 (4.5) 1/2 day PD for teachers	44 Internal Environment 48 Nervous Systems	Discovery Videos and worksheets	Ch 44 & 48 Reading Guides	<b>Ch 7, 8</b>

<b>(off Monday for Columbus Day)</b>				
<b>10/12 (4)</b> <b>end mp1</b>	6 Metabolism/Enzymes 9 Respiration	2 Enzymes 5 Cell Respiration	Test Corrections Ch 6&9 Reading Guides	<b>Ch 44, 48</b>
<b>10/18 (5)</b>	10 Photosynthesis	5 Cell Respiration (complete) Use of Spectrophotometer Mini-Lab 4 Plant Pigments	Ch 6 Test corrections Ch 10 Reading guide	Ch 6
<b>10/25 (5)</b>	12 Cell Cycle	3 Mitosis	Ch 12 Reading Guide	Ch 9, 10
<b>11/1 (2)</b> <b>NJEA convention= 2days</b> <b>Election Day= 1 day</b>	14 Mendelian Genetics	7 Genetics of Drosophila	Ch 9&10 Test Corrections Ch 14 Reading Guide	
<b>11/8 (4)</b> <b>Veterans Day</b>	13 Meiosis		Ch 13 Reading guide	Ch 12, 13, 14
<b>11/15 (5)</b>	16 DNA	DNA Extraction	Ch 12-14 Test corrections Ch 16 Reading Guide	
<b>11/22 (2.5)</b> <b>Thanksgiving recess begins</b>	17 Genes to Protein	6a Transformation	Ch 17 Reading Guide	
<b>11/29 (4.5)</b> <b>1/2 day PD for teachers</b>	18 Virus and Bacteria 19 Eukaryotic Genome	6b Restriction Analysis	Ch 18&19 Reading Guide	Ch 16, 17
<b>12/6 (5)</b>	15 Chromosomal Basis of Inheritance	Plasmid prep/ Protein purification Family Tree Project	Ch 16&17 Test Corrections Ch 15 Reading Guide	

<b>12/13 (5)</b>	20 DNA Technology	Chi Square/Problems	Ch 20 Reading Guide	
<b>12/20 (3.5)</b> <b>Winter recess begins</b>	20 DNA Technology			Ch 18, 19, 20
<b>12/27 VACATION</b>	<b>VACATION</b>			
<b>1/3 (5)</b>	22 Darwin 23 Evolution of Populations	8 Population Genetics	Ch 18-20 Test Corrections Ch 22&23 Reading Guide	
<b>1/10 (5)</b>	24 Origin of Species 25 Phylogeny (Classification Overview)		Ch 24 &25 Reading Guide	
<b>1/18 (4)</b> <b>MLK day</b>	29 Plant Diversity I 30 Plant Diversity II		Ch 29&30 Reading Guide	Ch 22-25
<b>1/24 (5)</b>	Midterm Week 35 Plant Structures	Plant Structures Lab	Ch 22-25 test corrections Ch 35 Reading Guide	midterm
<b>1/31 (4.5)</b> <b>end mp 2</b> <b>1/2 day PD for teachers</b>	36 Plant Transport 37 Plant Nutrition	9 Transpiration in Plants	Ch 36 & 37 Reading Guide	Ch 29, 30, 35-37
<b>2/7 (5)</b>	38 Plant Reproduction 39 Plant Control		Ch 20 Test Corrections Ch 38 Reading Guide	Ch 38, 39
<b>2/14 (4)</b> <b>spring recess begins</b>	41 Animal Nutrition		Ch41 Reading Guide	Ch 41

<b>2/23</b> <b>spring recess 2 days</b>	VACATION Vacation Assignment: TBA			Ch 27, 28, 29, 31, 32, 33
<b>2/28 (5)</b> <b>HSPA testing m,w, th</b>	Review Vacation Assignment 42 Circulation and Gas Exchange	10-Physiology of Circulation	Ch 42 Reading Guide	Vacation Exam
<b>3/7 (5)</b>	43 Bodies Defenses	Discovery Videos	Ch 43 Reading Guide	
<b>3/14 (5)</b>	45 Chemical Signals 11 Cell Communication		Ch 45 & 11 Reading Guide	Ch 42, 43
<b>3/21 (5)</b>	49 Sensory and Motor Systems		Ch 42-43 Test Corrections Ch 49 Reading Guide	Ch 45, 11
<b>3/28 (4.5)</b> <b>1/2 day PD for teachers</b>	46 Reproduction 47 Development		Ch 45&11 Test Corrections Ch 46&47 Reading Guide	
<b>4/4 (5)</b> <b>end mp3</b>	Complete Repro and Development 50-55 Ecology	12 Dissolved Oxygen	Ch 50-55 Reading Guide	Ch 46, 47, 49
<b>4/11 (5)</b>	50-55 Ecology		Test Corrections Ch 46 Test	
<b>4/18 (0)</b>	<b>VACATION ASSIGNMENT:</b> AP Review Assignment			
<b>4/25-29</b>	50-55 Ecology and review			<b>Ch 50-55</b>
<b>5/2 (5)</b>	Review		Test Corrections CH 50 Test	

5/9	AP EXAM IN BIOLOGY (AM)			
5/16-end	Student Moviemaker Projects  Research Paper and Projects			

**Teaching Strategies:** The basic format for teaching each chapter will be a combination of lecture, class discussion, cooperative groups for worksheets, lab activities, review sessions, and test corrections after every test.

**Grading Policy:**

Tests/ Lab Reports 50%	Quizzes 30%	Homework 20%
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**Research Paper and Presentation:** The final exam grade will consist of a research paper and project, on a topic covered during the year. More details will follow.

**Moviemaker Projects:** Students will create presentations using I-movie or moviemaker, on assigned concepts, that will be used by Biology teachers in the school, to teach freshman Biology classes. Presentations should be informative but creative enough to capture and hold the attention of a younger class.

**Instructor Contact Information:**

E-mail:

Phone:





