

AP Biology

Course Syllabus

Introduction

Advanced Placement Biology affords students the opportunity to complete an introductory course at the college level. This course is focused on the building connections between biology at the cellular and molecular level though biology at the environmental level. It is important for students to understand the role biology has on society and the responsibility that students have to make informed decisions about issues raised by advancements and research in biology.

Course Overview

The curriculum is built around the four big ideas in AP Biology. They include the following

1. *The process of evolution drives the diversity and unity of life.*
2. *Biological systems utilize free energy and molecular building block to grow, reproduce and maintain dynamic homeostasis.*
3. *Living systems store, retrieve, transmit and respond to information essential to life processes.*
4. *Biological systems interact. These systems and their interactions possess complex properties.*

The big ideas are interconnected and cannot be taught in isolation. The students will create concept maps throughout the year that will connect the big ideas and enduring understanding with one another. These are indicated in this document as “Connecting Big Ideas” within each unit.

In order to investigate these four big ideas, the curriculum will focus on developed enduring understandings with identified essential knowledge. The essential knowledge in conjunction with the seven science practices are the foundation for the learning objectives for the course. The learning objectives for the course will be the basis for formative and summative assessments.

Laboratory Component

The source for many of the labs is *AP Biology Lab Manual*. Some of these laboratory investigations are modified to meet the time restrictions of the course or modified to allow the incorporation of probes. The course incorporates 25% of the instructional time. The majority of the laboratory investigations are inquiry based at various levels. They range from guided inquiry to open inquiry investigations. In addition to the investigations found in the *AP Biology Lab Manual*, students will be engaged in a number of other investigations that supplements the curriculum.

There is an emphasis on the math component of the course. There are some basic statistical tools that are essential in the analysis of biological experiments. This curriculum includes that students are familiar with Chi-square, standard deviation, standard error and the T-test. In addition the students need to understand the importance of identifying mathematic trends. This includes generating a line of best fit for certain data.

Student presentation of the laboratory investigation includes mini-posters, powerpoints, peer review, and laboratory reports. Full laboratory reports include introduction, hypothesis, procedure, data with statistical analysis, conclusion with limitations and recommendations.

The laboratory investigations are designed to incorporate the seven science practices with different investigations. These seven science practices 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 guide investigations within the context of the AP course*
4. *The student can plant 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.*

Ethical Issues

It is important that students are educated to make decisions that may affect society and the environment. This course will allow students to become familiar with many important biological issues in a variety of formats including peer discussion, role playing and poster displays. Below are some examples of issues. This list is not exhaustive and maybe modified as new research is published.

- Effects of using monoculture practices as an example of artificial selection (Big idea 1)
- Herbicide resistant species such a pigweed emerging a threat to crops (Big idea 1)
- Genetically modified food (Big idea 3)
- Genetic screening and the impact on the insurance company (Big idea 3)
- Global warming (Big idea 4)

Teaching Strategies

This course incorporates a variety of teaching strategies. These may include class discussion, internet activities, journal readings and current event presentations.

Textbook and Supplemental Materials

1. Campbell 11th edition *Biology*
2. *AP Exam Preparation*
3. Scientific Journal Readings, current event topics, lab guides
4. Web-based investigations.

Student Evaluations and Assessment

Summative assessments are given at the end of each unit of study during the grading period. There are 17 units of study for this course. These tests may consist of multiple choice questions, math problems, long free response, and/or short free response questions that are a reflection of what will be on the AP exam. Students are also given formative assessments in the form of laboratory assessments, quizzes, clicker-questions, math-set problems.

Classwork (quizzes, clicker questions, current event papers)	25 %
Laboratory Work	25%
Unit Tests	50%

Biochemistry Unit 1 (10 days)Essential Knowledge

- 1.D.1-2
- 2.B1-3; 2.C.2; 2.D.1
- 3.A.1
- 4.A.1-3; 4.B 1-2; 4.C.1

Reading

- Chemistry chapter 2

Topics

- Properties of carbon and its unique role in the process of life
- Survey of functional groups important in biology
- Survey of carbohydrates at both the monomer and polymer level
- Survey of various lipids and phospholipids
- Survey of proteins at both the monomer and polymer level
- Survey of nucleic acids at both the monomer and polymer level
- Discussion of free energy and biological reactions
- Explanation of enzymes and their role in metabolism

Labs and Activities.

- Making models of various organic compounds (SP 1.1-3)
- AP Lab 13: Enzyme Activity- Modified enzyme lab that uses catalase and directly captures oxygen. Students using guided inquiry will investigate variables of their choosing and their effects of reactions rates. (SP 2.1, 2.2, 2.3; SP 4.1, 4.2, 4.3, 4.4; SP 5.1, 5.2, 5.3; SP 7.2)
- Making models of proteins to illustrate various levels of proteins structure. (SP 1.1-3)
- Examining models of enzymes and demonstrating competitive and noncompetitive inhibition. (SP 1.1-3)

Connecting Big Ideas

- Is a discussion evolution involves changes in DNA which is a polymer and ultimately changes the structure of protein. (Big Ideas #1 and #2)
- Is a discussion of how polymers are made from monomers which determine the properties of the polymer (Big Idea #4)

Cells and Cell Communication Unit 2 (8 Days)Essential Knowledge

- 1.B, 11.B2
- 2.A.1-3; 2.B.1-3; 2.C.1; 2.D.13
- 3.A.1-3
- 4.A.2-3; 4.C.1

Reading

- Cell chapters 4,6
- Cell communication chapter 206

Topics

- Survey of cellular anatomy from the different domains with emphasis on prokaryotes, eukaryotic plant and animal cells
- Evolution of prokaryotes into eukaryotes (folding membranes and endosymbiosis)
- Explanation of cell membrane and cell wall structure
- Explanation of the limits of cell size with emphasis on surface area to volume ratio
- Examination of transport across the membrane to include osmosis, passive diffusion, active transport, facilitated transport, endo- and exocytosis
- Survey of proteins at both the monomer and polymer level
- Survey of nucleic acids at both the monomer and polymer level
- Detailed explanation of cell communication

Labs and Activities.

- Making models of various types of transport (SP 1.1-3)
- Making model of the cell membrane. Students will compare and contrast their membranes with other students' membrane. (SP 1.1-3)
- Making models of various types of cell communication (SP 1.1-3)
- Cell Type Survey- Student inquiry into a survey of various cells and proper staining technique (SP 1.1.-4)
- AP Lab 4 Diffusion and Osmosis. Examination of semi-permeable membranes, passive diffusion and osmosis, cell size, plasmolysis, calculations of water potential of different types of tissues. (SP .1.-5; SP 2.1-3, SP 4.3; SP 5.1-3, SP 6.2, 6.4; SP 7.1-2)

Connecting Big Ideas

- Is a discussion evolution of various cells. (Big Ideas #1 and 3)
- Is a discussion of how polymers are a part of cell membrane (Big Ideas #2 and 3)
- Is a discussion of the role of the nucleus and ribosome in transmitting inheritance (Big Ideas 2 and 3)

Photosynthesis Unit 3 (8 days)

Essential Knowledge

- 1.B, 11.B2
- 2.A.1-3; 2.B.1-3; 2.C.1; 2.D.13
- 3.A.1-3
- 4.A.2-3; 4.C.1

Reading

- Photosynthesis chapter 8

Topics

- Survey of leaf anatomy and various adaptations that have evolved
- Discussion of chloroplasts evolution and photosynthesis in prokaryotes
- Examination structure and the function of chlorophyll and chloroplasts
- Light reaction of photosynthesis with cyclic and noncyclic photophosphorylation
- Chemiosmosis

- Calvin cycle and its modification of C3, C4 and CAM photosynthesis
- The role of photosynthesis in global warming

Labs and Activities.

- Making a model of the chloroplast (SP 1.1-3)
- Inquiry lab for plant pigments (SP 2.1-3, SP 3.2-3, SP 4.1, 4.3-4; SP 5.1-2; SP 7.1)
- AP Lab 5 Photosynthesis (SP .1.-5; SP 2.1-3, SP 4.3; SP 5.1-3, SP 6.2, 6.4; SP 7.1-2)
- Current events on man's impact and global warming with students displays with posters

Connecting Big Ideas

- Is a discussion evolution of photosynthesis. (Big Ideas #1 and 2)
- Is a discussion of the evolution of chloroplasts (Big Ideas #1 and 2)

Cell Respiration Unit 4 (8 days)

Essential Knowledge

- 1.B, 11.B2
- 2.A.1-3; 2.B.1-3; 2.C.1; 2.D.13
- 3.A.1-3
- 4.A.2-3; 4.C.1

Reading

- Cell Respiration chapter 7

Topics

- Discussion of mitochondrion evolution and cell respiration in prokaryotes
- Comparison of aerobic and anaerobic respiration
- Function of fermentation and its role in respiration
- Krebs' and modifications to respire other nutrients other than glucose
- Chemiosmosis
- The role of respiration in global warming

Labs and Activities.

- Making a model of the mitochondrion and the pathway for respiration (SP 1.1-3)
- AP Lab 6 Cellular Respiration(SP .1.-5; SP 2.1-3, SP 4.3; SP 5.1-3, SP 6.2, 6.4; SP 7.1-2)
- Current events on man's impact and global warming.

Connecting Big Ideas

- Is a discussion evolution of respiration. (Big Ideas #1 and 2)
- Is a discussion of the evolution of mitochondrion (Big Ideas #1 and 2)

Cell Reproduction and DNA replication Unit 5(10 days)

Essential Knowledge

- 1.A.3-4; 1.B.1
- 2.C.1-2; 2.E1-3

- 3.A.1-2; 3.C.3, 3.D.1
- 4.A.1-2; 4.B.1-2

Reading

- Cell Reproduction chapter 8 and DNA structure and replication chapter 25

Topics

- Discussion of sexual versus asexual reproduction
- Examination of binary fission, mitosis and meiosis and cytokinesis
- Comparison of mitosis with meiosis.
- Examination of the historical background of DNA with experimental evidence
- Identifying the structure of DNA
- Discussion of the process of DNA replication
- Discussion of various DNA replication errors or mutations

Labs and Activities.

- Making a model of the chromosomes and modeling mitosis and meiosis (SP 1.1-3)
- AP Lab 7 Cellular Division Mitosis and Meiosis including statistical analysis. (SP .1.-5; SP 2.1-3, SP 4.3; SP 5.1-3, SP 6.2, 6.4; SP 7.1-2)
- Problems involving chromosomal mapping. (SP 5.1-3)

Connecting Big Ideas

- Is a discussion DNA constructed from nucleotides to build polymer. (Big Ideas #1 and 2).

Protein Synthesis Unit 6 (9 days)

Essential Knowledge

- 2.A.3; 2.B.3; 2.D.1; 2.E.1
- 3.A.1; 3.B.3.1-2;3.C.1-3
- 4.A.1-2; 4.B.1

Reading

- Protein synthesis unit chapter 25

Topics

- Discussion of gene definition
- Examination of the genetic code and codons with emphasis on its universality and redundancy
- Identifying the structure of RNA
- Discussion of transcription and modification of various RNA molecules
- Discussion of translation and modification of various post-translation proteins
- Comparison of gene expression in the three different domains

Labs and Activities.

- Using a model simulate the process of protein synthesis (SP 1.1-3)
- Protein Gel Electrophoresis Lab separating proteins based on their chemical properties. (SP 3.1; SP 5.1; SP 6.1)

Connecting Big Ideas

- Is a discussion RNA constructed from nucleotides to build polymer. (Big Ideas #1 and 2)
- Is a discussion of how organisms obtain nucleotides to make RNA molecules and certain things from the environment can influence gene expression (Big ideas # 3 and #2)

Gene Regulation and Development Unit 7 (10 days)

Essential Knowledge

- 2.A.3; 2.B.3; 2.D.1; 2.E.1
- 3.A.1; 3.B.3.1-2;3.C.1-3
- 4.A.1-2; 4.B.1

Reading

- Gene regulation and development chapter 25

Topics

- Discussion of the regulation of bacterial genes with inducible and repressible operons.
- Examination of
 - DNA packaging
 - methylation or acetylation
 - transcription factors
 - RNA processing
 - degrading of the mRNA
 - protein post-translational modifications.
- Examination of cell differentiation to include
 - genetic program for embryonic development
 - cytoplasmic determinants
 - sequential regulation of gene expression during development.
- Discussion pattern formation
- Discussion of axis establishment
- Examination of gene regulation
- Examination of cancer and gene regulation

Labs and Activities.

- Using a model simulate the process of an operon (SP 1.1-3)
- Using a model simulate the process of eukaryotic gene regulation

Connecting Big Ideas

- Is a discussion of how organisms must exchange matter with the environment to grow and reproduce and that these exchanges can have an effect on cell specialization (Big Ideas #2 and 3)
- Is a discussion of the subcomponents of biological molecules and their sequence determine the properties of that molecule which can have an effect on cell specialization. (Big ideas # 3 and #4)

Biotechnology Unit 8 (9 days)

Essential Knowledge

- 1.A.2-4; 1.B.1-2
- 3.A.3-4

- 4.A.1-2; 4.B.1-2

Reading

- Biotechnology chapters 26

Topics

- Exposure to skills in biotechnology such as electrophoresis, micropipetting, extraction and recombination of plasmids using restriction enzymes and PCR
- Analysis of electrophoretic gels, cloning, RFLP analysis and genomic libraries.
- Examining basic virus structure and viral replication (lytic and lysogenic cycles and retroviruses)
- Discussion of viroids, prions, and emerging viruses

Labs and Activities.

- AP Lab 8 Biotechnology Bacterial Transformation. (S2.1-3; SP 3.1-3; SP 4.1-4; SP 1-3; SP 6.1-5; SP 7.1-2)
- AP Lab 9 Biotechnology : restriction Enzyme Analysis of DNA (S2.1-3; SP 3.1-3; SP 4.1-4; SP 1-3; SP 6.1-5; SP 7.1-2)
- Analysis of Harris Hawks Gels to determine parentage and investigate behavior. (SP3.1-3, SP 5.1-3)
- DNA Technology current events assignment. Students will independently research topics recent discoveries and the implication for society

Connecting Big Ideas

- Is a discussion of how restriction enzymes work and their origin and evolution (Big ideas #1 and #2)

Genetics Unit 9 (10 days)

Essential Knowledge

- 1.A.2-4; 1.B.1-2; 1. C.3
- 3.A.1-4; 3.B.2; 3.C.1-2
- 4.A.3; 4.C.2-3

Reading

- Genetics 23, 24

Topics

- Explanation of Mendelian genetics, probability, 1st law of segregation and 2nd law of independent assortment and its relation to meiosis
- Explanation of dominant versus recessive, incomplete and co-dominance
- Explanation of non-Mendelian patterns of inheritance such as polygenic inheritance, epistasis, complementary genes, linked genes, and multiple alleles
- Discussion of sex linked genes
- Examination of karyotyping and pedigree analysis

Labs and Activities.

- *Drosophila* simulation cross lab with Chi-square analysis.
<http://www.sciencecourseware.org/vcise/drosophila/> (SP 2.1-3; SP 4.1, 4.3-4; SP 5.1-3; SP 6.1-5)
- Students will solve Mendelian and non-Medelian genetic problems (SP 2.1; SP 4.1, 4.3-4; SP 5.1-3; SP 6.1-5)

- Analysis of karyotypes from HIPS biology (SP 1.1, 1.3-4; SP 4.1, 4.3-4; SP 5.1-3; SP 6.1-5)
- Analysis of Harris Hawks Gels to determine parentage and investigate behavior. (SP3.1-3, SP 5.1-3)

Connecting Big Ideas

- Is a discussion of how organisms must exchange matter with the environment to grow and reproduce and that these exchanges can have an effect on phenotypic expression (Big Ideas #2 and 3)

Unit 10 Microevolution (8 Days)

Essential Knowledge

- 1.A.1-4; 1.B.2; 1.C.3; 1.D1-2
- 3.D.1

Readings

Evolution, chapter 27

Topics

- Evolution sources of mutation; point mutations substitutions (neutral mutations), frame shift mutations (deletions and additions), chromosomal mutations deletions, translocation, transductions, replications, meiosis recombination, crossing over, random fertilization, mate selection.
- Gene pool and allele frequency
- Hardy-Weinberg Equilibrium
- Changes in allele frequency, impact of environment, adaptations, selection pressure
- Genetic drift, founder effect, bottle neck populations
- Sexual selection, directional selection, disruptive selection and stabilizing selections
- Maintaining genetic variability, balanced polymorphism and heterozygote advantage

Labs and Activities

- AP Lab 1 Artificial Selection: Modified using brine shrimp and selecting for some variable. (SP 1.5, SP 2.2, SP 5.3, SP 7.1)
- AP Lab 2 Mathematical Modeling: Using a spreadsheet. (SP 2.1-3; SP 5.1-3; SP 6.1-5)
- Math Problems doing Hardy-Weinberg Equilibrium problems
- Analyzing amino acid sequences to determine relatedness

Connecting Big Ideas

- Is a discussion of how the environment impacts evolution (Big Idea#1).
- Is a discussion of how changes in molecules (DNA and protein) ultimately is the basis for evolution (Big Idea #2)
- Is a discussion of how DNA is the blue print for life and provides for the continuity of life through the process of transcription and translations. Changes in the DNA results in changes in phenotypic expression upon which natural selection can act. (Big Idea #3)

Macroevolution Unit 11 (8 Days)

Essential Knowledge

- 1.A.1-4; 1.B1-2; C.1-3; 1.D1-2
- 2.E.3
- 3.D.1

Readings

- Evolution, chapter 27

Topics

- Definition of a species
- Allopatric speciation and geographic isolation (3 reasons why speciation occurs).
- How speciation occurs temporal versus spatial
- Sympatric speciation
- Rate of evolution gradual versus punctuated
- Origin of life
- Classification and relatedness
- Comparison of three domains of life
- Construction and analysis of cladograms and phylogenetic trees
- Trends in evolution

Labs and Activities

- AP Lab 3 Comparing DNA sequences to understand evolutionary relationships with BLAST. BLAST lab is used to compare genomes to determine evolutionary history (SP 4.1-4; SP 5.1-3)
- The Great Clade Race-Used to aid in the understanding of cladograms and phylogenetic trees (SP 1.1, 1.5, SP 6.2, 6.4)
- Cladogram Problem set for analysis of cladograms and data tables. (SP 1.1, 1.5, SP 6.2, 6.4)

Connecting Big Ideas

- Is a discussion of how the environment impacts evolution (Big Idea#1)
- Is a discussion of how timing and coordination of behavior are regulated by various mechanisms are important in natural selection (Big Idea #2)
- Is a discussion of interactions between and within population influence patterns of species distribution and abundance (Big Idea #4)

Unit 12 Ecology (14 Days)

Essential Knowledge

- 1.A.1-4; 1.B1
- 2.A.1-3; 2.C.2;2.D1-4
- 3.E.1-2
- 4.A.5-6; 4.B.2-4; 4.C.3-4

Readings

Ecology, chapters 32-36

Topics

- Population structure and growth, human population and growth, K strategies versus r strategies
- Energy and the environment, energy pyramids, population pyramids, food webs

- Community ecology, concept of a niche, intra-and interspecific competition resource partitioning
- Biogeochemical cycles- carbon cycle, water cycle, nitrogen cycle, phosphorous cycle, and eutrophication.
- Investigation of behavior, learned behavior, innate behavior and other examples.

Labs and Activities

- AP Lab 12: Animal behavior. Open inquiry lab to investigate the behavior of pill bugs (SP 3.1-3; SP 4.1-4; SP 5.1-3)
- AP Lab 10: Energy Dynamics. Modified to pill bugs and cabbage leaves (SP 2.1-2; SP 4.1, 4.3; SP 5.1, 5.3; SP 7.1-2)
- Lab Exponential Population Growth SP 1.1, 1.4, SP 2.1, 2.3
- Lab Predator/Prey Lab SP 1.1, 1.4, SP 2.1, 2.3
- Math Problem Set for population growth problems
- Current Events Activity-Investigating environmental issues and human impact (3 minutes presentation).

Connecting Big Ideas

- Is a discussion of how the environment impacts evolution (Big idea#1).
- Is a discussion of free energy and it flow through the ecosystem affecting different trophic levels (Big idea #2)
- Is a discussion how communities are regulated by both biotic and abiotic factors (Big idea #2)

Botany Unit 13 (10 Days)

Essential Knowledge

- 1.B.1-2; 1.C.1-3
- 2.C.1-2, 2.D.2; 2.E.3
- 3.C.1-2; 3.D.1
- 4.C.1-3

Reading

- Botany chapter 9, 10, 29

Topics

- Evolution of the plant kingdom and trends
- Alternation of generations and how it relates to evolutionary trends
- Basic angiosperm structure including xylem and phloem
- Basic plant physiology emphasis on water regulation and nutrition absorption

Labs and Activities

- AP Lab 9 : Modified to do whole plant transpiration. Students design an experiment to measure the different variables on the rate of transpiration. (SP 2.1-3; SP 4.1-4, SP 5.1-3, SP 6.1-2, 6.4)
- Flower Reproduction Lab: Students dissect a variety of flowers identifying parts and adaptations for each type of flower (SP 3.1)
- Seed Germination Lab: Student investigate factors that might affect the rate of germination. (SP 3.1; SP 4.1-3.

Connecting Big Ideas

- Is a discussion of organisms must exchange matter with the environment to grow, reproduce and maintain organization. (Big Idea 2).
- Included is a discussion of organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes (Big Idea 2)
- Is a discussion of populations continuing to evolve which are reflected in the adaptations of plants. (Big Idea #1)

Nervous System Unit 14 (9 Days)

Essential Knowledge

- 2.A.1-3; 2.B.1-3; 2.C.1-2; 2.D.1-3; 2.E.1-2
- 3.D.1-4; 3.E.1-2
- 4.A.4, 4.A.6; 4.B.1-3

Reading

- Nervous System chapter 17

Topics

- Basic anatomy of neurons, nerves and the nervous system to include detail about the CNS and PNS.
- Physiology of a nervous impulse and transmission with a reflex arc.
- Explanation of how a nervous impulse is an example of cell communication.
- Discussion of sensory perception and sensory organs (ears, nose, tactile, eyes)
- Coordination and homeostasis of the nervous system.

Labs and Activities

- Response time lab(SP 1.1,1.2-3)

Connecting Big Ideas

- Is a discussion that cell membranes are selectively permeable to the membrane due to their structure. (Big Idea #2)
- Is a discussion of how organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes (Big Idea #2)
- Is a discussion of the interaction between molecules affect their structure (Big Ideas #2 and 4)

Endocrine System Unit 15 (9 days)

Essential Knowledge

- 2.A.1-3; 2.B.1-3; 2.C.1-2; 2.D.1-3; 2.E.1-2
- 3.D.1-4.
- 4.A.4, 4.A.6; 4.B.1-2

Reading

- Endocrine System chapter 20

Topics

- Explanation of how a signaling molecules are involved in cell communication
- Comparison of the structure and mechanism of different classes of hormones
- Survey of endocrine glands and the production of various hormones. .
- Discussion feedback mechanisms between antagonistic hormones in the maintenance of homeostasis.
- Role of endocrine glands in regulating metabolism, homeostasis, development and behavior. .

Labs and Activities.

- Termite lab and pheromones. Students will inquire about a phenomenon in which termites follow a trail of ink due to a pheromone like substance found in the ink. (SP 3.1-3.2; SP 4.1-4.4, SP 5.2; SP 6.1)
- Use of models in simulating hormonal action.

Connecting Big Ideas

- Is a discussion that growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes. (Big Idea #2).
- Is a discussion of how organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes (Big Idea #2)
- Is a discussion of timing and coordination of physiological event are regulated by multiple mechanisms.
- Is a discussion of the interaction between molecules affect their structure (Big Idea #4)

Immune System Unit 16 (9 Days)

Essential Knowledge

Essential Knowledge

- 2.A.1-3; 2.B.1-3; 2.C.1-2; 2.D.1-4; 2.E.1-2
- 3.D.1-4.
- 4.A.4, 4.A.6; 4.B.1-2
- 4.A.1-3; 4.B 1-2; 4.C.1

Reading

- Immune chapter 13

Topics

- Description of the innate immune system to include both chemical and cellular aspects of the system
- Description of the acquired immune system to include the humoral response and the cell mediated response.
- Survey of the function and structure of various antibodies.
- Discussion of active versus passive immunity and natural versus artificial immunity.
- Survey of autoimmune diseases and AIDS.

Labs and Activities.

- ELISA Lab: <http://www.hhmi.org/biointeractive/vlabs/> (SP 3.1-3.2; SP 4.1-4.4, SP 5.2; SP 6.1)
- Use of paper plate models to illustrate the immune system (SP 1.1-1.3)

Connecting Big Ideas

- Is a discussion that growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes. (Big Idea #2 and #4)
- Is a discussion of how organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes (Big Idea #2)
- Is a discussion of the interaction between molecules affect their structure (Big Idea #4 and #2)