Name of the Course

AP Biology

Primary Text


Supplementary Course Texts and Ancillary Materials

Farabee, M. J., Online Biology Book (2002) Web:
http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookTOC.html


Biology Labs On-Line – Virtual Labs
http://www.biologylabsonline.com/

Course Long Plan

Course Description
The AP Biology course is designed to give students a first year introductory biology experience. Paramount to this experience is addressing content within the three basic subject areas, molecules and cells, heredity and evolution, and organisms and populations. Included in this experience are a variety of laboratory experiences, including the 12 AP Biology labs. Through completion of course activities, students acquire a framework for understanding science as a process, recognizing unifying themes, and applying the knowledge they gain to critical thought about environmental and social issues.

This course is designed to be highly teacher facilitated. Instructors give a great deal of specific and timely feedback per lesson as students progress through the course. Students have opportunities for oral examinations, discussions, and whiteboards. Additionally teachers conduct online synchronous Elluminate sessions that require critical thinking and analysis.

In addition, this course is accompanied by an online tutorial and review that uses released AP Exams. Students are given systematic and timed practice for all portions of the exam. Students receive specific feedback on progress and mastery levels on the practice exams.

Laboratory Experience

Laboratory activities are a critical component of the AP Biology course. There are 12 recommended labs for which College Board has provided guidelines and procedures. The laboratory manual from College Board is provided for each student in the AP Biology course. These 12 labs, as well as others, are completed through a variety of methodologies including hands-on student conducted labs and virtual or simulated labs. Simulated activities are correlated to the corresponding AP Lab and structured so that students are familiar with key concepts, experimental design, and data analysis as presented in the lab manual. At all stages of lab work students have one-on-one access to their instructors. Synchronous opportunities, such as graded oral assessment, phone calls, chats and/or whiteboard sessions are utilized to maximize student understanding of lab processes, design and concepts.

Lab Materials:
*The items in this list are sent to the students as part of their course materials.
Dual calibration spring scale, 1 (50mL) graduated cylinder, two test tubes, 1 plastic pipette, 1 glass
pipette (0.1mL), dialysis tubing, clear plastic tubing, 1 filter paper, 3 diastix test strips, 3 glucose tablets, 1 lambda DNA diagram, logarithmic graph paper.

Utilize this URL to access to the 12 AP Biology Labs:

ftp://169.139.166.12/aplabs
username = collegeboard
password = EpjX9b7

Once the site is open, please open the “index’ file and navigate from there.

Conceptual Connections and/or Skills:
The AP Biology course promotes connection to concepts by providing students with opportunities for manipulation of information and ideas related to the major topics and themes though a variety of methodologies including:

- reading of the course content
- readings and activities from text sources including the course text, ancillary texts, the text companion Web site, and a wide variety of current, external Web resources
- use of interactive content components in which data is often collected and analyzed
- streaming video and multimedia components that dimensional learning opportunities
- expression of thought and understanding through writing
- exposure to released AP Biology tests and practice with free response question types
- student conducted hands-on and simulated laboratory investigations

Student assessment occurs at a variety of levels throughout the lesson and course. Students are assessed via oral assessment and other synchronous sessions. Actual course assessment types include student assessed work, auto-graded, partially auto-graded, and totally instructor graded assignments.

---Semester 1--- (18 Weeks)

Topics, Themes and Laboratory Experiences (by module)

- **Module 1** (Molecules and Cells)
  - **The main themes** covered in module 1 include Science as a Process, and the Relationship of Structure to Function.
  - **The topics** covered will include the scientific method, basic chemistry, organic chemistry, polymerization, isomers, functional groups, biochemistry, and the properties of water.
  - **The lab experience** in module 1 will be:
    - **1.08 Water Lab** (60 – 90 minutes) - This lab activity is a hands-on, student performed lab during which the student carries out the experiment using materials gathered at home. The water lab is an activity that focuses student attention on the various properties of water and relates these properties to understanding the importance of water in biological processes.
  
- **Readings and Ancillary Resources**
  - Campbell Biology:
    - Chapters 2, and 3
  - Online Biology Book
    - Chapter 2 - Chemistry I: Atoms and Molecules
    - Chapter 3 - Chemistry II: Water and Organic Molecules
Module 2 (Molecules and Cells)

- The main themes covered in this module include Science as a Process, Relationship of Structure to Function, and Energy Transfer.
- The topics in this module include metabolism and energy changes, enzyme activity as related to energy and biological processes, catalysis, and the connection between enzymes and Tay-Sachs Disease.
- The lab experiences in module 2 will be:
  - 2.04 Enzyme-Substrate Model (60 minutes) - This lab activity is a hands-on, student conducted lab during which the student carries out the experiment using materials gathered at home. This exercise is designed to enhance the understanding of enzyme-substrate interactions.
  - 2.05a Alka-Seltzer Activity (60 minutes) - This lab activity is a hands-on, student conducted lab during which the student carries out the experiment using household chemicals to show how a variable, such as temperature, can have an effect on the rate of reaction.
  - 2.05b AP Lab 2 Enzyme Catalysis (120 minutes) - This is a hybrid lab, combining both hands-on and simulated lab activities. Students utilize the Campbell Biology online companion Web site Lab Bench Activities; simulations, simulated data, and the procedure in the AP Lab manual to complete the lab. Students manipulate simulated equipment; collect data through the online lab materials to investigate the effect of variables on reaction rate in an enzyme-catalyzed reaction.

- Readings and Ancillary Resources
  - Campbell Biology:
    - Chapters 1, 2, 3 & 5
  - Campbell Biology online companion Website
    - Activities
      - 5A Energy Transformations, 5B Chemical Reactions and ATP, 5C The Structure of ATP, 5D How Enzymes Function
    - Lab Bench 2
      - Enzyme Catalysis
  - Brooklyn College (2.01)
    - Thermodynamics: Gibb’s Free Energy Equation
  - Brown, J. C. (2005). What the Heck is an Enzyme?
  - The Biology Project
    - Energy, Enzymes, and Catalysis Problem Set
Module 3 (Molecules and Cells)

- The main themes covered in module 3 include Science as a Process, Relationship of Structure to Function, Energy Transfer, Regulation, and Science, Technology & Society.
- The topics covered will include cell structure and function, cell processes, cell division, cell research including information on cancer cells, and gametogenesis.

- The lab experiences in module 3 will be:
  - 3.06a Cell Membranes and Permeability (120 minutes) - This lab activity is a hands-on, student conducted lab during which the student conducts the experiment using materials sent home to the student. Students observe a model of diffusion and osmosis and relate their findings to these processes in the cell.
  - 3.06b Design Your Own Lab (60 minutes) - Students follow up the previous lab session by choosing a variable, other than those tested originally and design a lab to test for movement across a cell membrane in the same kind of model they just worked with. Students submit the new lab protocol.
  - 3.07 AP Lab One Diffusion and Osmosis (120 minutes) - This is a hybrid lab, combining both hands-on and simulated lab activities. Students utilize some of the same materials used in the preceding modeling lab, the Campbell Biology online companion site Lab Bench Activities, simulations, simulated data, and the procedure in the AP Lab manual to complete the lab.
  - 3.09 AP Lab 5 Cell Respiration (120 minutes) - This is a simulated lab activity. Students utilize the Campbell Biology online companion Web site Lab Bench Activities, Cell Respiration Lab Simulation (to collect data), and the procedure in the AP Lab manual to complete the lab.
  - 3.11 AP Lab 3 Mitosis and Meiosis (120 minutes) – This is a hybrid lab, combining both hands-on and simulated lab activities. Using the procedure in the AP Lab manual the students utilize materials gathered at home to simulate/model the processes of mitosis and meiosis. Students observe images of prepared slides to collect data and calculate time in phase for mitosis and crossing over in meiosis and utilize the Campbell Biology online companion site Thinking As a Scientist activity to investigate on crossing over in meiosis.

Readings and Ancillary Resources

- Campbell Biology
  - Chapters 4-6, 8 and Sections 11.19, 28.1 - 28.9

- Campbell Biology online companion Website
  - Activities
    - 5E Membrane Structure, 5F Signal Transduction, 5G Selective Permeability of Membranes, 5H Diffusion, 5I Facilitated Diffusion, 5J Osmosis and Water Balance in Cells, 5K Active Transport, 5L Exocytosis and Endocytosis
6A Overview of Cellular Respiration, 6B Glycolysis, 6C The Citric Acid (Krebs) Cycle, 6D Electron Transport and Chemiosmosis, 6E Fermentation

8A The Cell Cycle, 8B & 8C Mitosis and Cytokinesis Animation & Video, 8E Meiosis Animation, 8F Origins of Genetic Variation

Thinking As a Scientist Activity
- How Does Osmosis Affect Cells?
- How is the Rate of Cellular Respiration Measured?
- How Is Crossing Over Measured in the Fungus Sordaria?

LabBench Activity
- Lab 1: Diffusion and Osmosis
- Lab 5: Cell Respiration
- Lab 3: Mitosis and Meiosis

- AP Biology Lab Manual
  - AP Lab 1: Diffusion and Osmosis - Pages 1 – 18
  - AP Lab 5: Cell Respiration – Pages 54 – 63
  - AP Lab 3: Mitosis and Meiosis - Pages 29 – 44

- Biology Labs On-Line
  - Cell Respiration Lab

- Brooklyn College
  - Endomembrane System

- Cells Alive
  - Cell Models

- Puget Sound Blood Center
  - Introduction to Hematology

- University of California Museum of Paleontology
  - Bacteria: More on Morphology

- Biology Project
  - Metabolism Problem Set
  - The Cell and Cell Cycle Tutorial
  - Meiosis Tutorial
  - Online Onion Root Tips

- NASA Explorers News
  - Attacking Cancer with Light

- National Association for Down’s Syndrome
  - Facts about Down’s Syndrome

- Nebraska Wesleyan University
  - Mitosis Images

- Biology87.org
  - Cellular Respiration Lab Simulation

- Module 4 (Heredity and Evolution)

The topics covered will include inheritance, genetics, Mendel’s work in genetics, statistical analysis of genetic information, non-Mendelian patterns of inheritance, nuclear processes, mutations and how these can be seen in populations, and DNA technology.

The lab experiences in module 4 will be:
- 4.04 AP Lab 7 Statistical Analysis Section (90 minutes) (Chi-square) – Students use the procedure in the AP Lab Manual and material and data from the course content to complete this section of AP Lab Seven on statistical analysis - using the Chi-square test for significance.
- 4.05 AP Lab 7 Genetics of Organisms – (120 minutes) - This is a simulated lab activity. Students utilize the Campbell Biology online companion Web site Lab Bench and Thinking As a Scientist Activities; Biology Labs On-line Translation Lab, and the procedure in the AP Lab Manual to complete the lab.
- 4.07 Non-Mendelian Patterns of Inheritance (90 min) - This is a simulated lab activity. Students utilize the Campbell Biology online companion Web site Lab Bench and Thinking As a Scientist Activities; Biology Labs On-line Translation Lab, and the procedure in the AP Lab Manual to complete the lab.
- 4.14a & 4.14b AP Lab #6A Molecular Biology: Bacterial Transformation and Gel Electrophoresis (3 hours total) – This is a simulated lab. Students utilize the Campbell Biology online companion Web site Lab Bench Activities; Biology Labs On-line Molecular Biology Lab, images of lab results, and the procedure in the AP Lab Manual to complete the lab.

Readings and Ancillary Resources
- Campbell Biology
  - Chapters 8 – 12
- Campbell Biology online companion Website
  - Activities
    - 9A Monohybrid Cross, 9B Dihybrid Cross, 9C Gregor’s Garden, 9D Incomplete Dominance, 9E Linked Genes and Crossing Over, 9F Sex-Linked Genes
    - 10A The Hershey-Chase Experiment, 10B Phage T2 Reproductive Cycle, 10C DNA and RNA Structure, 10D DNA Double Helix, 10E DNA Replication: An Overview, 10F DNA Replication: A Closer Look, 10G Overview of Protein Synthesis, 10H Transcription, 10I Translation, 10J Phage Lysogenic and Lytic Cycles, 10K Simplified Reproductive Cycle of a DNA Virus, 10L Retrovirus (HIV) Reproductive Cycle
    - 12A Restriction Enzymes, 12B Cloning a Gene in Bacteria, 12C Gel Electrophoresis of DNA, 12D Analyzing DNA Fragments Using Gel Electrophoresis, 12F Connection: DNA Fingerprinting, 12H Connection: DNA Technology and Golden Rice

  - Thinking As a Scientist Activity
    - How Is the Chi-Square Test Used in Genetic Analysis?
    - How Can Antibiotic-Resistant Plasmids Transform E. coli?
    - How Can Gel Electrophoresis Be Used to Analyze DNA?

  - Lab Bench
    - Lab 7 Genetics of Organisms
    - Lab 6 Molecular Biology
Module 5 (Heredity and Evolution)
- The main themes in module 5 include Continuity and Change, Evolution, and Interdependence in Nature.
- The topics covered will include evolution, genetic drift, gene flow, mutations in populations, non-random mating, natural selection, Hardy-Weinberg equilibrium, and macroevolution.

The lab experiences in module 5 will be:
- 5.06 Natural Selection (90 minutes) – This is a simulated activity. Students utilize the Biology Labs On-line Evolution Lab to complete the lab.
- 5.07 AP Lab 8 Population Genetics and Evolution (120 minutes) – This is a hands-on student conducted lab. Students use materials gathered at home and the AP Lab Manual to complete this lab.
- 5.08 Speciation – (60 min) - This is a hands-on student conducted lab. Students utilize materials gathered at home to complete this lab.

Readings and Ancillary Resources
- Campbell Biology
  - Chapter 13, 14, & 15.1 – 5.8

- AP Biology Lab Manual
  - Lab Eight Population Genetics and Evolution

- Biology Labs On-Line
  - Evolution Lab

- Campbell Biology companion Website
  - Activity
    - 13D Causes of Microevolution
  - Thinking As a Scientist
    - How Do New Species Arise by Genetic Isolation?
- The TalkOrigins Archive: Exploring the Creation/Evolution Controversy
  - Introduction to Evolutionary Biology

- The Biology Project
  - Genetic Drift Simulation

- Time
  - Heroes of Medicine: A Dark Inheritance

- Iceland
  - Genetics

- Genetics Home Reference site
  - What is alpha-1 antitrypsin deficiency?


- Scientific American
  - How is antibiotic immunity acquired?

---Semester 2 (18 weeks)

Topics, Themes and Laboratory Experiences (by module)

Module 6 (Organisms and Populations)

- **The main themes** in module 6 include Relationship of Structure to Function, Continuity and Change, and Interdependence in Nature.
- **The topics** covered in this module include systematics, viruses, bacteria, and fungi.

**Readings and Ancillary Resources**

- Campbell Biology
  - Chapters 10, 15, 16, and 17
- University of California Museum of Paleontology
  - Journey into Phylogenetic Systematics
  - History of Life Through Time
- Department of Natural Resources - Nova Scotia
  - Kingdom Monera
- Annenberg Media: Online Textbook
  - Unit 3: Evolution and Phylogeny
- Microbe World: Meet the Microbes
  - Bacteria
  - Fungi

Module 7 (Organisms and Populations)

- **The main themes** in module 7 include Relationship of Structure to Function, Evolution, Energy Transfer, Regulation, and Interdependence in Nature.
- **The topics** covered in this module include plant evolution and diversity, alternation of generations, plant life cycles, plant structure and function, plant growth, plant reproduction, plant nutrients and hormones, and photosynthesis.
- **The lab experiences** in module 7 will be:
  - Flower and Seed Dissections – This activity is a hands-on lab; students investigate the structure and function in flowers and seeds through this dissection activity.
  - AP Lab #4 Photosynthesis: (120 minutes) - This activity is a hybrid lab, combining both hands-on and simulated lab activities. Students utilize materials sent to them to complete the hands-on portion and use an online simulation to measure the rate of photosynthesis.
  - AP Lab #9 Transpiration: (120 minutes) – This activity is a hand-on lab. Students utilize materials sent to them and the AP Lab Manual to complete the lab.

**Readings and Ancillary Resources**

- Campbell Biology
  - Chapters 7, 17, 31, 32, 33
- Campbell Biology online companion Website
  - Activities
    - 7A The Sites of Photosynthesis, 7B Overview of Photosynthesis, 7C Light Energy and Pigments, 7D Light Reactions,
• 31A Root, Stem, and Leaf Sections, 31B Primary and Secondary Growth
• 32A Transpiration

  ▪ Thinking As a Scientist
    • How Does Paper Chromatography Separate Plant Pigments?
    • How Is the Rate of Photosynthesis Measured?
    • How Is the Rate of Transpiration Calculated?
  ▪ Lab Bench
    • Lab 4 Plant Pigment and Photosynthesis
    • Lab 9 Transpiration

 o AP Biology Lab Manual
  ▪ Lab 4 Plant Pigment and Photosynthesis
  ▪ Lab 9 Transpiration

 o Biology Labs On-Line
  ▪ Leaf Lab

 o Online Biology Book
  ▪ Chapter 13 - Photosynthesis

 o Plant Life Cycles and Alternation of Generation by Susan R. Singer

 o Plant Physiology Information Website

 o Plant Nutrition
  • Plant Nutrients

 o El Dorado Chemical Company
  • Roles of the 16 essential nutrients in Crop Development

 o Kimball Biology Pages
  • Transport of Water and Minerals in Plants

Module 8 (Organisms and Populations)
• The main themes in module 8 include Relationship of Structure to Function, Evolution, Regulation, Science as a Process, and Interdependence in Nature.
• The topics covered in this module include phylogeny and animal diversity, transport in animal systems, immunology, osmoregulation, chemical regulation, reproduction and development, the nervous system, and the muscular and skeletal systems.
• The lab experiences in module 8 will be:
  • AP Lab #10 Physiology of the Circulatory System: (120 minutes) – This is a hybrid lab combining both hands-on and simulated lab activities. Students complete the blood pressure portion in a student performed activity. They then watch videos of Daphnia heart rates to collect data on rate of respiration.
  • AP Lab #11 Animal Behavior: (120 minutes) – This is a hybrid lab, combining both hands-on and simulated lab activities. Students observe pill bug’s or comparable organism’s behavior, and design an experiment to investigate the organism’s responses to environmental variables. Students will view videos on various animal behaviors as well.

• Readings and Ancillary Resources
  o Campbell Biology
    ▪ Chapter 18, 20, 21, 22, 23, 24, 25, 27, 28, 30, 35
Campbell Biology Companion Web site
- Activities
  - 23A Mammalian Cardiovascular System Structure, 28A Neuron Structure, 28B Nerve Signals: Action Potentials
  - 30A The Human Skeleton, 30B Skeletal Muscle Structure, 30C Muscle Contraction
  - 35A Honeybee Waggle Dance

- Videos
  - Chimp Cracking Nut
  - Mating Behaviors of Albatross, Blue-footed Boobies, Giraffe
  - Wolves Agonistic Behavior
  - Snake Ritual Wrestling
  - Chimp Agonistic Behavior

- Thinking As a Scientist
  - How is Cardiovascular Fitness Measured?
  - How does Temperature Affect the Metabolic Rate of Daphnia?
  - How Can Pillbug Responses to the Environment be Tested?

- Lab Bench
  - Lab10 Physiology of the Circulatory System
  - Lab 11 Animal Behavior

Tree of Life Web Project
- Tree of Life

American Museum of Natural History
- Tree of Life: Major marine Phyla

St. Matthew’s Parrish School
- Daphnia Video Segments

National Institute of Health
- The Immune System

Diving Educational Enrichment Project
- Daphnia Video

Discovery Learning - United Streaming
- Reproduction and Development
  - Asexual and Sexual Reproduction (overview)
  - Sexual Reproduction
  - Asexual Reproduction in Species
- Nervous system
- Skeletal System
  - Bones: Light and Strong
  - Inside our Bones
- Animal Behavior
  - Ostrich Courtship Behavior
  - Dogs and Wolves
  - Social Insects: Ants and Bees
Module 9 (Organisms and Populations)

- **The main themes** in module 9 are Energy Transfer, and Interdependence in Nature.

- The topics **covered in this module include levels of organization, biotic & abiotic factors, ecosystems, populations, communities, symbiosis, food webs, keystone predators, and biogeochemical cycles in the environment.**

- The lab experiences in module 8 will be:
  - AP Lab #12 Dissolved Oxygen and Primary Productivity: (120 minutes) – This activity is a simulated lab. Students use an online simulation activity to measure and analyze the dissolved oxygen of water and simulated data to analyze the primary productivity of water that has a decrease in light according to the depth of the water. This is a simulated lab activity.

- **Readings and Ancillary Resources**
  - Campbell Biology
    - Chapters 34, 35, 36
  - Campbell Biology online companion Web site
    - Activities
      - 34C Aquatic Biomes, 34D Terrestrial Biomes
      - 36A Techniques for Estimating Population Density and Size
      - Thinking As a Scientist: How Does Light Affect Primary Productivity?
    - Lab Bench
      - Lab 12 Dissolved Oxygen and Primary Productivity
  - Online Biology Book
    - Chapter 36
  - Voyage to the Deep
    - [Hydrothermal Vents](#)
  - Memorial University of Newfoundland
    - [Acid-Base Titration Video Demonstration](#)
  - Discovery Learning – United Streaming
    - Types of Interactions within Ecosystems
    - The Food Web
      - Food web and Keystone Predator
  - American Museum of Natural History
    - [Food Web: Sea Otter Food Web](#)
  - University of California
    - [Killer whales feed on sea otters, pushing coastal ecosystems off kilter](#)