

Advanced Placement Biology

2014-2015

Course Description

This course is designed to be equivalent to a two-semester college introductory biology course sequence. AP Biology covers topics regularly covered in college biology courses. Lectures and laboratory activities will be equivalent to those experienced by college students. Laboratory work will require students to collect data to examine biological problems. A major component of this course will center around scientific inquiry. Developing critical thinking skills is a cornerstone of any scientific discovery.

This course is designed for students willing to complete advanced work to prepare for the Advanced Placement Examination in Biology. The level of material and instruction is equivalent to a first year biology course sequence in college. Evolutionary relationships unify all biological disciplines and will be examined in every unit as change in a population over time.

Four Big Ideas

The Advanced Placement Biology curriculum centers around four major concepts.

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.

Text

Reece, Jane, et al., *Campbell Biology*, 9th Edition (AP Edition). Boston: Pearson Benjamin Cummings, 2011.

Laboratory Activities

Laboratory investigations are a crucial part of this course. A minimum of twenty-five percent of the course will be devoted to laboratory activities. Students will complete at least eight inquiry-based investigations (two representing each big idea). Additional labs will also be completed to reinforce science skills. Some of the additional labs listed in the syllabus may be completed by smaller groups of students who will then present information and results to the rest of the class.

Laboratory Notebook

Students are required to keep a laboratory notebook. This book must be a grid-lined composition book. All labs will be formally written up in this book following standard guidelines.

Projects

Each marking period students will complete an independent investigation related to the topics discussed in that quarter. These projects will be presented to the class.

Homework

Students are expected to complete the required reading from the course textbook as well as define important vocabulary terms for each chapter. They are also expected to utilize the textbooks corresponding CD-ROM and online resources which provide additional questions to assess their understanding. Students will also receive case studies and current articles for their analysis.

Grading

Grades are weighted to give the intended importance to each learning goal and to each assessment. Grades in this class during the semester include assignments and activities in the following categories:

Achievement Factors 75%
Tests, Lab Notebooks, Projects, Essays

Practice Factors 25%
Homework, Quizzes

Grades are calculated in the following manner:

A	94.5	C	74.5
A-	89.5	C-	69.5
B+	87.5	D+	67.5
B	84.5	D	64.5
B-	79.5	D-	59.5
C+	77.5	E	0

Science Practices [SP]

1. Students will use representations and models to communicate scientific phenomena and solve scientific problems.
2. Students will use mathematics appropriately.
3. Students will engage in scientific questioning to extend thinking or to guide investigations.
4. Students will plan and implement data collection strategies appropriate to a particular scientific question.
5. Students will perform data analysis, evaluation of evidence, and represent data effectively.
6. Students will work with scientific explanations and theories.
7. Students will connect and relate knowledge across various scales, concepts, and representations in and across domains.

Marking Period Projects

1st Marking Period: Natural History Collection

Students will create a presentation identifying and describing various organisms native to Michigan. All photographs must be original and show all key features of the plant, animal, and habitat. A component of this presentation is also identification of invasive species and descriptions of the organisms they are displacing or the habitat they are impacting.

2nd Marking Period: Genetic Disorder Paper

Students will research a genetic disorder and its mechanism of action and compose a research paper. Students should describe the molecular basis for the genetic disorder and possible screening techniques. The ethical issues surrounding screening and treatment techniques will also be discussed.

3rd Marking Period: Research Experiment

Students will conduct primary research experiments to test a question of their choosing related to the concepts studied this year. The culmination of this project is a presentation and formal lab report.

4th Marking Period: Video Project

Students will represent a biological concept through a short video. This project will be completed after the AP Exam.

Course Plan

Unit	Description	Chapters
Ecology and Behavior (Big Ideas 1, 3, & 4)	Behavioral adaptations, population dynamics, communities and ecosystems, and global issues LAB: Dissolved Oxygen and Aquatic Primary Productivity [SP 2, 3, 4, 5, 6, & 7] LAB: Energy Dynamics (AP Lab 10) [SP 1, 2, 4, & 5] FOCUS TOPIC: Climate Change/Ecological Footprint - Students will read articles about these topics and write written analysis. FIELD TRIP: University of Michigan Matthaei Botanical Gardens and Nichols Arboretum	52 - Introduction to Ecology 53 - Population Ecology 54 - Community Ecology 55 - Ecosystems 56 - Conservation Biology
Chemistry of Life (Big Ideas 1 & 4)	Atoms and molecules, elements and compounds, water, organic molecules, polymers LAB: Paper Chromatography of Food Dyes [SP 2, 3, 5, 6] LAB: Polarity of Water [SP4] LAB: Molecular Models [SP1] ACTIVITY: Shape and Chemistry of Molecules [SP1] ACTIVITY: Mono and Polysaccharides [SP1] - Students will build models and relate structure to function. ACTIVITY: Structural Proteins [SP1] - Students will build models and relate structure to function.	2 - Chemical Context of Life 3 - Water and Life 4 - Carbon and the Molecular Diversity of Life 5 - Structure and Function of Large Biological Molecules
Cell Structure and Function (Big Ideas 1 & 2)	Prokaryotic and eukaryotic cells, membranes, cellular organization LAB: Diffusion and Osmosis (AP Lab 4) [SP 3 & 4] LAB: Diffusion and Cell Size [SP 1 & 3] LAB: What Dissolves What? [SP 3 & 6] ACTIVITY: Membranes and Surface Area - Students will draw a membrane that outlines various means of transport across a membrane. Students will also participate in a role play of membrane transport. ACTIVITY: Organelles - Students will complete a chart including a drawing, description of structure, and description of function for various organelles. ACTIVITY: Endosymbiosis - Student will draw an evolutionary progression for how chloroplasts and mitochondria started out as independent prokaryotic organisms to organelles used by eukaryotic cells.	6 - Tour of the Cell 7 - Membrane Structure and Function
Cell Energetics (Big Ideas 1 & 2)	Coupled reactions, free energy changes, enzymes, fermentation, cellular respiration, and photosynthesis LAB: Enzyme Activity (AP Lab 13) [SP 1, 3, 4, & 6] LAB: Cellular Respiration (AP Lab 6) [SP 2] LAB: Photosynthesis (AP Lab 5) [SP 6] LAB: Raw vs. Cooked Meat [SP 1, 6, & 7]	8 - Introduction to Metabolism 9 - Cellular Respiration and Fermentation 10 - Photosynthesis

Unit	Description	Chapters
Cell Communication and Cell Cycle (Big Ideas 1, 2, 3, & 4)	Cellular communication, cell cycle, mitosis, cytokinesis, cell cycle regulation, and tumor formation LAB: Cell Division: Mitosis and Meiosis (AP Lab 7) [Part I Only] [SP 2, 3, 4, 5, & 6] FOCUS TOPIC: Cancer Development and Treatment - Students will read articles about current methods of cancer treatment and relate that to the biological mechanism impeding the cancer in a written response.	11 - Cell Communication 12 - The Cell Cycle
Chromosomal Inheritance (Big Ideas 1 & 3)	Meiosis, gametogenesis, chromosomes, Mendelian genetics, and inheritance patterns LAB: Mitosis and Meiosis (AP Lab 3) [Part 2 Only] [SP 2, 3, 4, 5, & 6] LAB: Mitosis and Meiosis Lab Extension [SP 1] ACTIVITY: Heredity of of Human Traits	13 - Meiosis and Sexual Life Cycles 14 - Mendel and the Gene Idea 15 - The Chromosomal Basis of Inheritance
Molecular Genetics (Big Ideas 1, 3, & 4)	RNA & DNA structure and function, gene regulation, mutations, viral structure and replication, and genetic technology LAB: Comparative DNA Sequences (AP Lab 3) [SP 2, 4, & 5] LAB: Biotechnology: Bacterial Transformation (AP Lab 8) [SP 3, 4, & 6] LAB: DNA Fingerprinting Lab [SP 2, 3, 5, & 6] LAB: Biotechnology: Restriction Enzyme Analysis of DNA [SP 3, 4, & 6] ACTIVITY: DNA Model ACTIVITY: Microbial Detective Story - Students will examine case studies to determine solutions to biology related problems. ACTIVITY: Determination of Amino Acid Sequence of a Peptide FOCUS TOPIC: Genetic Testing, Genetic Counseling, and Genetic Disorders FOCUS TOPIC: Stem Cells - Students will read portions of the 2001 and 2006 NIH reports as well as more current articles and discuss the ethical constraints of stem cell research. FOCUS TOPIC: Privacy and Genetic Information	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
Evolutionary Biology (Big Ideas 1 & 4)	Darwinian view, evidence for evolution, population evolution, and mechanisms of evolution LAB: Natural Selection [SP 1] LAB: Population Genetics and Evolution [SP 1, 2, 3, 5, 6, & 7] LAB: Artificial Selection (AP Lab 1) [SP 2, 3, 4, 5, 6, & 7] LAB: Mathematical Modeling (AP Lab 2) [SP 2, 4, 5, & 7] FOCUS TOPIC: Antibiotic Resistance - Students will read articles about instances of antibiotic resistance and discuss the consequences of this and how it will impact future medical research.	22 - Descent with Modification 23 - Evolution of Populations 24 - The Origin of Species 25 - History of Life on Earth

Unit	Description	Chapters
Diversity of Organisms (Big Ideas 1 & 4)	Evolutionary patterns, survey of the diversity of life, phylogenetic classification, and evolutionary relationships LAB: Sex in a Dish [SP 3, & 6] LAB: Transpiration in Celery [SP 3, & 6] ACTIVITY: Comparison of Preserved Samples ACTIVITY: Reproduction - Students will examine how various reproductive processes evolved and write a paper outlining this evolution. ACTIVITY: Hardy-Weinberg - Students will examine how environmental changes can impact Hardy-Weinberg equilibrium.	26 - Phylogeny and the Tree of Life 27 - Bacteria and Archaea 28 - Protists 29 - Plant Diversity I 30 - Plant Diversity II 31 - Fungi 32 - Animal Diversity 33 - Invertebrates 34 - Vertebrates
Structure and Function of Plants (Big Ideas 1, 2, 3, & 4)	Reproduction, growth, development, structural & physiological adaptations, and response to environment LAB: Transpiration (AP Lab 11) [SP 2, 3, & 5] LAB: Dissection of a Flower [SP 3 & 7] LAB: Dissection of a Fruit [SP 3 & 7] LAB: Seed Sandwiches [SP 1] LAB: Plant in a Box [SP 3, 4, 5, 6, & 7]	35 - Plant Structure 36 - Transport in Vascular Plants 37 - Plant Nutrition 38 - Angiosperm Reproduction 39 - Plant Responses to Internal and External Signals
Structure and Function of Animals (Big Ideas 1, 2, 3, & 4)	Reproduction, growth, development, structural & physiological adaptations, and response to environment LAB: Physiology of the Circulatory System [SP 2, 3, & 5] LAB: Fish Respiration [SP 1] LAB: Dissection of an Animal [SP 3 & 7] LAB: Fruit Fly Behavior (AP Lab 12) [SP 3 & 4] LAB: Termite Behavior [SP 3, 4, & 5] LAB: Endosymbiosis in Termites [SP 2 & 7] ACTIVITY: Vitamin Study - Students will research various vitamins and present how those vitamins are required for survival. FOCUS TOPIC: Genetically Modified Foods - Students will examine how GMOs are developed and why controversy exists about them.	40 - Animal Form and Function 41 - Animal Nutrition 42 - Circulation and Gas Exchange 43 - Immune System 44 - Osmoregulation and Excretion 45 - Hormones and Endocrine System 46 - Animal Reproduction 47 - Animal Development 48 - Neurons, Synapses, and Signaling 49 - Nervous Systems 50 - Sensory and Motor Mechanisms 51 - Animal Behavior