

2012-2013 A.P. Biology Syllabus

Course Overview

My AP Biology course is designed to offer students a solid foundation in introductory college-level biology. By structuring the course around the four big ideas, enduring understandings, and science practices I assist students in developing an appreciation for the study of life and help them identify and understand unifying principles within a diversified biological world.

What we know today about biology is a result of inquiry. Science is a way of knowing. Therefore, the process of inquiry in science and developing critical thinking skills is the most important part of this course.

At the end of the course, students will have an awareness of the integration of other sciences in the study of biology, understand how the species to which we belong is similar to, yet different from, other species, and be knowledgeable and responsible citizens in understanding biological issues that could potentially impact their lives.

Instructional Context

I teach AP Biology to juniors and seniors at a high school that follows a 6 period day. Each class meets 5 days a week for 50 minutes.

Students must have completed both first year biology and chemistry prior to enrolling in AP Biology.

Instructional Resources

Reece, Jane, et al., *Campbell Biology*, 9th Edition, 2011, Pearson Benjamin Cummings.

<www.campbellbiology.com> (The website to accompany the main text provides animations, investigations, PowerPoint and other audio-visual sources to enhance instruction)

AP Biology Investigative Labs: an Inquiry Based Approach.

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

The Investigative Laboratory Component

The course is also structured around inquiry in the lab and the use of the seven science practices throughout the course.

Students are given the opportunity to engage in student-directed laboratory investigations throughout the course for a minimum of 25% of instructional time. Students will conduct a minimum of eight inquiry-based investigations (two per big idea throughout the course). Additional labs will be conducted to deepen students' conceptual understanding and to reinforce the application of science practices within a hands-on, discovery based environment. All levels of inquiry will be used and all seven science practice skills will be used by students on a regular basis in formal labs as well as activities outside of the lab experience. The course will provide opportunities for students to develop, record, and communicate the results of their laboratory investigations.

Science Practices

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.

Course Long Plan

Week	Readings	Lecture Topics	Labs or Alternative Activities
1	Intro to AP Biology Unit 1: The Chemistry of Life Ch.2- The Chemical Context of Life	<ul style="list-style-type: none"> The Nature of Atoms Bonding 	<p>Introduction of the 4 AP Big Ideas</p> <p>Practice with data collection, analysis, and presentation</p>
2	Ch.2- The Chemical Context of Life Ch.3- Water and Life	<ul style="list-style-type: none"> Properties of Water Acids & Bases 	<p>Properties of Water</p> <p>Acids and Bases</p>
3	Ch. 4 Carbon and the Molecular Diversity of Life Ch. 5 The Structure and Function of Large Biological Molecules	<ul style="list-style-type: none"> Properties of Carbon Carbohydrates, Nucleic Acids, Proteins, and Lipids 	<p>Organic Molecule Models</p> <p>Identification of Organic Compounds</p> <p>Using kits to build macromolecule models</p>
4	Unit 2: The Cell Ch.6- A Tour of The Cell Ch.7- Membrane Structure and Function	<ul style="list-style-type: none"> Cell Theory Prokaryotes vs. Eukaryotes Parts of the Cell Cell to Cell Interactions Cell Membrane Structure: Phospholipids & Proteins Passive vs. Active Transport Bulk Transport by Endocytosis & Exocytosis The Flow of Energy in Living Systems The Laws of Thermodynamics ATP, Enzymes, & Metabolism 	<p>Microscopy</p> <p>AP Lab #4: Diffusion & Osmosis</p> <p>Enzyme Catalysis Lab</p> <p>Models comparing cellular structures of 3 different cell types</p>
5	Ch.7- Membrane Structure and Function C. 8 - An Introduction to Metabolism	<ul style="list-style-type: none"> Overview of Cell Respiration Glycolysis, Krebs Cycle, ETC Energy Yield of Aerobic Respiration Regulation of Aerobic Respiration Anaerobic Respiration & Fermentation 	<p>AP Lab #6: Cellular Respiration</p>
6	Ch. 9-Cellular Respiration and Fermentation Ch. 10-Photosynthesis	<ul style="list-style-type: none"> Overview of Photosynthesis Pigments Light Dependent Reactions & The Calvin Cycle Photorespiration 	<p>AP Lab #5: Photosynthesis</p>
7	Ch.11- Cell Communication Ch. 12-The Cell Cycle	<ul style="list-style-type: none"> Overview of Cell Communication Receptor Types Intracellular Receptors Signal Transduction 	
8	Ch. 12-The Cell Cycle	<ul style="list-style-type: none"> Bacterial Cell Division Eukaryotic Chromosomes 	<p>AP Lab #7: Cell Division: Mitosis</p>

		<ul style="list-style-type: none"> Eukaryotic Cell Cycle Control of the Cell Cycle 	& Meiosis
9	Unit 3: Genetics Ch. 13-Meiosis and Sexual Life Cycles Ch. 14-Mendel and the Gene Idea	<ul style="list-style-type: none"> Meiosis Meiosis vs. Mitosis The Mystery of Heredity Monohybrid Crosses vs. Dihybrid Crosses Probability Extensions to Mendel 	
10	Ch. 15-The Chromosomal Basis of Inheritance	<ul style="list-style-type: none"> Sex Linkage and the Chromosomal Theory of Inheritance Sex Chromosomes and Sex Determination Genetic Mapping Genetic Disorders 	Identify and discuss Gene mapping, Gene linkage, and Genetic disorders Report on biotechnology advancements
11	Ch. 16-The Molecular Basis of Inheritance Ch. 17-From Gene to Protein	<ul style="list-style-type: none"> DNA Structure DNA Replication Prokaryotic vs. Eukaryotic Replication DNA Repair 	DNA Models of Replication
12	Ch. 18-Regulation of Gene Expression Ch. 19-Viruses	<ul style="list-style-type: none"> The Nature of Genes The Genetic Code Prokaryotic vs. Eukaryotic Transcription Eukaryotic pre-mRNA Splicing tRNA and Ribosomes Translation Gene Expression Mutations 	Protein Synthesis Simulation Activity
13	Ch. 20-Biotechnology Ch. 21-Genomes and Their Evolution	<ul style="list-style-type: none"> Regulatory Proteins Prokaryotic vs. Eukaryotic Regulation Protein Degradation DNA manipulation Molecular Cloning 	AP Lab #8: Biotechnology: Bacterial Transformation Research project: Should embryonic stem cell research be permitted?
14	Unit 4: Mechanisms of Evolution Ch. 22-Descent with Modification:A Darwinian View of Life	<ul style="list-style-type: none"> DNA Analysis Genetic Engineering Medical Applications Agricultural Applications Cell Division Cell Differentiation Nuclear Reprogramming Pattern Formation Morphogenesis 	AP Lab #9: Biotechnology: Restriction Enzyme Analysis of DNA DNA technology
15	Ch. 23-The Evolution of Populations Ch. 24-The Origin of Species	<ul style="list-style-type: none"> Genetic Variation and Evolution Changes in Allele Frequency Five Agents of Evolutionary Change Fitness and Its Measurement Interactions among Evolutionary Forces Selection on Traits affected by Multiple Genes Limits of Selection 	AP Lab #1: Artificial Selection Video: "What Darwin Never Knew" Analyze how molecular biology confirms Darwin's ideas.
16	Ch. 24-The Origin of Species Ch. 25-The History of Life on Earth	<ul style="list-style-type: none"> The Beaks of Darwin's Finches Peppered Moths Artificial Selection Fossil Evidence 	Model explaining the origins of life

		<ul style="list-style-type: none">• Anatomical Evidence• Convergent Evolution• Darwin's Critics	
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17	Unit 5: The Evolutionary History of Biological Diversity Ch. 26-Phylogeny and the Tree of Life Ch. 27-Bacteria and Archae	<ul style="list-style-type: none"> • The Nature of Species and the Biological Species Concept • Natural Selection & Reproductive Isolation • Genetic Drift • Adaptive Radiation • Speciation and Extinction Through Time 	AP Lab #2: Hardy- Weinberg
18	Unit 7: Animal Form and Function Ch 40-Basic Principles of Animal Form and Function	<ul style="list-style-type: none"> • Systematics • Cladistics • Systematics & Classification • Phylogenetics and Comparative Biology 	<p>AP Lab #3: Comparing DNA Sequences to Understand Evolutionary Relationships with BLAST</p> <p>Construct, interpret, and analyze cladograms</p> <p>Prior to lab students analyze a genetic database that allows them to use modern tools of science</p>
19	Ch.40-Basic Principles of Animal Form and Function Ch. 43-The Immune System	<ul style="list-style-type: none"> • Comparative Genomics • Whole Genome Duplications • Evolution within Genomes • Gene Function and Expression Patterns • Genome Size and Gene Number • Crop Improvement Through Genome Analysis 	
20	Ch. 48-Neurons, Synapses, and Signaling	<ul style="list-style-type: none"> • Origins of Life • Classification of Organisms • Grouping of Organisms • Making Sense of Protists • The Nature of Viruses • Bacteriophages • HIV • Other Viral Diseases • Prions & Viroids 	
21	Ch. 49.2-The Vertebrate Brain	<ul style="list-style-type: none"> • Prokaryotic Genetics • Organization of the Plant Body • Plant Tissues • Roots, Stems, & Leaves 	
22	Unit 6: Plant Form & Function Ch.38- Transport in Plants	<ul style="list-style-type: none"> • Transport Mechanisms • Water and Mineral Absorption • Xylem Transport • The Rate of Transportation • Phloem Transport 	AP Lab #11: Transpiration
23	Unit 6: Plant Form & Function Ch.40- Plant Defense Responses	<ul style="list-style-type: none"> • Physical Defenses • Chemical Defenses • Animals that Protect Plants • Systemic Responses to Invaders 	
24	Unit 6: Plant Form & Function Ch.42- Plant Reproduction Unit 7: Animal Form Ch.43- The Animal Body and Principles of Regulation	<ul style="list-style-type: none"> • Reproductive Development • Flower Production • Homeostasis • Regulating Body Temperature 	
25	Unit 7: Animal Form Ch.44- The Nervous System	<ul style="list-style-type: none"> • Nervous System Organization • Nerve Impulse • Synapse • CNS: The Brain & Spinal Cord 	

		<ul style="list-style-type: none"> • Peripheral Nervous System: Sensory & Motor Neurons 	
26	Unit 7: Animal Form Ch.45- Sensory Systems	<ul style="list-style-type: none"> • Overview of Sensory Receptors • Mechanoreceptors • Hearing, Vibration, and Detection of Body Position • Chemoreceptors • Sensory Experiences 	
27	Unit 7: Animal Form Ch.46- The Endocrine System	<ul style="list-style-type: none"> • Regulation of Body Processes by Chemical Messengers • Actions of Lipophilic vs. Hydrophilic Hormones • The Pituitary and Hypothalamus • Major Peripheral Endocrine Glands 	
28	Unit 7: Animal Form Ch.48- The Digestive System	<ul style="list-style-type: none"> • Types of Digestive Systems • The Mouth & Teeth • Esophagus & Stomach • Intestines • Variations in Vertebrate Digestive Systems 	
29	Unit 7: Animal Form Ch.49- The Respiratory System	<ul style="list-style-type: none"> • Gas exchange across respiratory surfaces • Gills, Cutaneous Respiration, & Tracheal Systems • Lungs • Structures & Mechanisms of Ventilation in Mammals 	
30	Unit 7: Animal Form Ch.50- The Circulatory System	<ul style="list-style-type: none"> • The Components of Blood • Invertebrate Circulatory Systems • Vertebrate Circulatory Systems • The Four-Chambered Heart & Blood Vessels 	
31	Unit 7: Animal Form Ch.51- Osmotic Regulation and the Urinary System	<ul style="list-style-type: none"> • Osmolarity and Osmotic Balance • Osmoregulatory Organs • Evolution of the Vertebrate Kidney • Nitrogenous Wastes • The Mammalian Kidney • Hormonal Control of Osmoregulatory Functions 	
32	Unit 7: Animal Form Ch.52- The Immune System	<ul style="list-style-type: none"> • Innate Immunity • Adaptive Immunity • Cell-Mediated Immunity • Humoral Immunity and Antibody Production • Autoimmunity & Hypersensitivity • Antibodies • Pathogens 	
33	Unit 7: Animal Form Ch.54- Animal Development	<ul style="list-style-type: none"> • Fertilization • Cleavage and the Blastula Stage • Gastrulation • Organogenesis • Vertebrate Axis Formation 	

		<ul style="list-style-type: none"> • Human Development 	
34	Unit 8: Ecology & Behavior Ch.55- Behavioral Ecology Ch.56- Ecology of Individuals & Populations	<ul style="list-style-type: none"> • The Natural History of Behavior • Nerve Cells, Neurotransmitters, Hormones, & Behavior • Behavioral Genetics • Learning • Animal Communication • Altruism • Population Demography and Dynamics • Life History & the Cost of Reproduction • Environmental Limits 	AP Lab #10: Energy Dynamics
35	Unit 8: Ecology & Behavior Ch.57- Community Ecology Ch.58- Dynamics of Ecosystems	<ul style="list-style-type: none"> • The Ecological Niche Concept • Predator- Prey Relationships • Species Interactions • Biogeochemical Cycles • Trophic Level Interactions 	AP Lab #12: Fruit Fly Behavior
36	Unit 8: Ecology & Behavior Ch.59- The Biosphere Ch.60- Conservation Biology	<ul style="list-style-type: none"> • Ecosystem Effects of Sun, Wind, and Water • Earth's Biomes • Freshwater & Marine Habitats • Human Impacts • Biodiversity Crisis • The Value of Biodiversity • Factors Responsible for Extinction 	Research Paper: Global Warming

