AP Biology Syllabus 2012-2013

In AP Biology, an emphasis is on students making connections between the big ideas within the AP Biology Curriculum Framework. The two main goals of AP Biology are to help students develop a conceptual framework for modern biology and an appreciation of science as a process.

Philosophy

My AP Biology course is designed to actively engage students in the process of science through class assignments and discussions which inform their laboratory experiences. I teach the equivalent of an introductory college-level biology course, and it is designed to prepare students for the AP Biology Exam. I believe the study of biology is important to the understanding of ourselves and the environment in which we live. Through new discoveries, biology is an ever changing course that allows the student to see how the acquisition of this knowledge can influence future generations. To emphasis this, journal article readings will be used in order to expose students to present day hypotheses in order to develop better designed experimental investigation. Students will be held to high expectations and mature responsibilities just like a college freshman taking Introduction to Biology.

Course Overview

This course is designed based on the three overarching topics of Molecules and Cells, Heredity and Evolution, and Organisms and Populations. The recurring thread throughout the text is evolution as the foundation of modern biological models and thought. The eight major themes are discussed and reemphasized through the course. The course is taught to constantly review the themes and relate the biological concepts to real world examples and explanations to the students and society. The 8 major themes put forth by the College Board are:

- Science as a Process
- Evolution
- Energy Transfer
- Continuity and Change
- Relationship of structure and function
- Regulation
- Interdependence in nature
- Science, Technology and Society

During the first semester, classes meet 5 days a week for 90 minutes. During second semester, classes meet 3 days a week for 45 minutes and 1 day for 90 minutes. The textbook for the course is the seventh edition of Neil A. Campbell and Jane B. Reece's *Biology*. The twelve inquiry-based, hands-on labs will be conducted in order to develop students' inquiry, higher-order thinking and laboratory skills and make up at least 25% of instructional time. The labs are from the *AP Biology Investigative Labs: An Inquiry-Based Approach* and *Advanced Placement Biology Lab Manual for Students*. The time spent in lab averages to one day out of four. During labs, analysis, reports, and discussion the process of science is emphasized. Student will get a copy of the big ideas and enduring understandings to self-mastery.

Big Ideas:

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

Online simulations are designed to be a way to actively engage students in technology as well as building inquiry skills. These simulations are found at http://phet.colorado.edu/. Most simulations will be assigned as homework to give more time for more meaningful face-to-face discussion as part of a "flipped" classroom.

Molecules, Cells & Energy

	Topics	Readings	Activity/Labs
UNIT 1	**I. Biochemistry** Polarity of water & its importance to biological systems Carbon's role in the molecular diversity of life Monomers, polymers & reactions involved in building & breaking them down considering polar/nonpolar interactions Various level of structures in protein & carbohydrates Enzyme structure as a special protein Cohesion, adhesion, specific heat of water & its importance to biological systems Acids, bases, and buffers	Chapters 2,4,5	PymoL Buffers and pH Acid-Base Solution Online Simulation pH scale simulation Eating & Exercise Online Lab: PhET
UNIT 2	**II. The Cell** Explain similarities, differences & evolutionary relationships between prokaryotic and eukaryotic cells Cell membrane structure and function (Fluid mosaic fluid) Subcellular organization Cell communication (signals, receptors, response, hormones) Methods of transport across membranes	Chapters 3,7,8 & 11	Diffusion & Osmosis **AP Lab 4** Membrane Channels Online Lab: PhET
UNIT 3	**III. Cell Energy & Metabolism** ATP structure and function Redox reactions in relation to cellular respiration Enzyme catalysis Activation energy and specificity Cellular respiration glycolysis, citric acid cycle,	Chapters 6,9,10	Photosynthesis **AP Lab 5** Cellular Respiration **AP Lab 6**

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	electron transport chain & chemiosmosis Mitochondria form and function Photosynthesis mechanisms; light/dark Compare/contrast to respiration Alternative mechanisms Understanding light energy		
Heredity, Genetics & Evolution			
UNIT 4	**IV. Molecular Basis of Inheritance & Molecular Genetics** DNA structure and replication RNA structure Protein synthesis, transcription & translation Mutations-basis for natural selection Viral structure and replication Biotechnology and applications to society Regulation of gene expression Gene expression in bacteria	Chapters 16-21 Watson & Cricks original Science article	Stretching DNA simulation: PhET Gene Machine: The Lac Operon simulation Gel Electrophoresis Biotechnology: Bacterial Transformation **Lab 8** Biotechnology: Restriction Enzyme Analysis of DNA **Lab 9**
UNIT 5	**V. Mitosis & Meiosis** Cell Cycle Chromosomes Stages of meiosis Asexual vs. Sexual reproduction and evolutionary advantages Genetic variation in offspring and impact on evolution Investigating genetics: environmental influences	Chapters 12-13 & 46-47	Cell Division: Mitosis and Meiosis **Lab 7**

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UNIT 6	**VI. Mendelian Genetics** Patterns of Inheritance Predicting genetic outcomes & genetic counseling Gene linking & mapping Mutations revisited	Chapters 14, 15	
UNIT 7	**VII. Evolutionary Biology** Darwin's explorations and theory of descent with modification & natural selection Galapagos Islands Overview Early evolution of life Evidence for evolution Phylogeny Evolution of populations Hardy-Weinberg Law	Chapters 22-25, 26 "Welcome to Evolution 101" Lamb, Trevor D., "Evolution of the Eye"	Natural Selection Online Simulation Artificial Selection **Lab 1** Mathematical Modeling: Hardy-Weinberg **Lab 2** BLAST **Lab 3**
Organisms & Populations			
UNIT 8	**VIII. Biological Diversity & Microbiology** Early life on earth Evolution of prokaryotes and eukaryotes Phylogenetic classification Evolutionary patterns Protists Fungi	Chapters 26-28, 31	Gram-Staining Culturing Bacteria
UNIT 9	**IX. Plants & their diversity** How plants colonized land Evolution of seed plants Structure, growth & development Plants responses to internal & external stimuli	Chapters 29, 30, 35-39	Transpiration **AP Lab 11**

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	Plant nutrition Angiosperm reproduction		
UNIT 10	**X. Animal Diversity** Characteristics of Invertebrates & Vertebrates Analysis of structure & function of body systems Body systems Response to the environment Reproduction, growth, and development	Chapters 32-34, 40-49	Pig Dissection Hands-on and virtual simulation Anatomy Online Lab Bioweb.wku.edu Fruit Fly Behavior **AP Lab 12**
UNIT 11	**XI. Ecology & Interactions** Population dynamics Communities and ecosystems Global issues	Chapters 50-55	Energy Dynamics **AP Lab 10** Brine Shrimp and Toxicity

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