

Course Title: AP Biology

Course Textbook: Campbell & Reece, et al, *AP Edition Biology 7th Edition*, Pearson Benjamin Cummings, 2005

Lab Manuals:

A.P. Biology Laboratory Manual for Students, College Board, 2001

Helms, Helms, Cummings, & Kosinski, *Biology in the Laboratory*, 3rd Edition, W. H. Freeman, 1998.

Course Objective:

To encourage the development of scientifically literate students who enjoy learning biology, who are confident in the laboratory, and who are ready to meet the future challenge of college-level science coursework. Take the AP Biology Exam in May.

Course Overview:

This AP Biology course follows the standards and recommendations as listed in the *AP Biology Course Description*. Every effort is made to insure that students are knowledgeable and develop mastery of the 8 major themes of biology which include: Science as Process; Evolution; Energy Transfer; Continuity and Change; Relationship of Structure To Function; Regulation; Interdependence in Nature; Science, Technology and Society. This course is also designed to cover the assigned topics which include biochemistry, cell structure and function, metabolism, genetics, molecular basis of inheritance, DNA technology, evolution, microbiology, classification, plants, animals, animal physiology, and ecology. Over 25% of this course is devoted to laboratory experience which includes few teacher demonstrations, the traditional hands-on 12 required laboratory exercises by the College Board, supplementary hands-on laboratory investigations not covered by the required labs, and expanded laboratory experience in inquiry-based activities to augment the use of scientific method, problem solving, high level thinking, formulating hypotheses, and designing testable questions. This course is open to all students that have completed college prep biology; completion or con-current enrollment in chemistry is recommended.

Syllabus

Unit link to Acorn Guide	Curricular Requirement	Theme (s)	Topics	Reading/ Lectures/ Example Videos/ Assessments	Activities/ Labs/ Assessment (Lab Days generally include introduction, lab setup, data analysis discussion) Additional information on other labs included below.
III. Organisms and Populations 50%	Ecology (10%) Organisms and Populations	Science as a Process, Interdependence in nature, STS, Energy Transfer	Population dynamics, communities and ecosystems Global issues	Independent Summer Reading: Chapters 50-55 Lecture: Climate and Ecosystems Population Biology Behavior Assessments: 1 Reading Quiz 1 Unit Test with FRQ	Safety and Scientific Method (teacher) 1. Slime Mold Inquiry (3 days) (hands on) AP Lab 11: Behavior (3 days) (hands on) Assessments: Semi-Formal and Formal Lab write-ups with rubrics for each lab Lab related questions or FRQ included with Unit Test
I. Molecules and Cells 25%	Chemistry of Life (7%) Cellular Energetics (8%) (split between two units)	Science as a Process, Energy Transfer, Structure/ Function (Enzymes-Digestion), Regulation	Water Biochemistry (organic molecules) Free Energy Energetics Enzymes Digestion (Ch 41)	Chapters 1-5, 8 Lecture: Properties of Water Functional Groups Macromolecules Gibbs Free Energy Thermodynamics Enzymes Video: Origins: How Life Began Assessments 3 Reading Quizzes 1 Unit Test with FRQ	AP Lab 2: Enzymes (3 days) (hands on) Toothpickase (1 day) (hands on) Inquiry Lab with Enzymes (3 days)(hands on) Assessments: Semi-Formal and Formal Lab write-ups with rubrics for each lab Lab related questions or FRQ included with Unit Test
	Cells (10%) Cellular Energetics (8%) (split between two units)	Energy Transfer, Structure/ Function (Membranes-Excretion), Regulation (Cell Cycle), Evolution	Prokaryotic and Eukaryotic Cells Membranes Subcellular organization Cellular Respiration Photosynthesis Cell Cycle and its	Chapter 6, 7,9-12 Lectures: Membrane structure, function, osmosis, diffusion, ports; also include Excretion (Chapter 44: Osmoregulation and Excretion) Cellular Respiration Photosynthesis,	AP Lab 1: Osmosis and Diffusion + inquiry extension (4 days) (hands on) AP Lab 5: Cellular Respiration (3 days) (hands on) AP Lab 4: Photosynthesis (includes Spec 20 activity) (3 days) (hands on) AP Lab 12: Dissolved Oxygen/Photosynthesis (3 days) (hands on) (covered here instead of ecology when

		(Endosymbioses), STS	regulation Cell Communication	Cell Cycle, p53, apoptosis, RAS, oncogenes, Signal Transduction Assessments 5 Reading Quizzes 1 Unit Test with FRQ	students have not yet covered photosynthesis) AP Lab 3A: Mitosis (2 days) (hands on) Assessments: Semi-Formal and Formal Lab write-ups with rubrics for each lab Lab related questions or FRQ included with Unit Test
II. Heredity and Evolution (25%)	Heredity (8%) (split between two units) Molecular Genetics (9%)	Structure and Function, Evolution, Regulation, STS, Science as a Process, Continuity and Change	Meiosis and gametogenesis, Eukaryotic Chromosomes RNA and DNA Structure and Function, Gene Regulation, Mutation, Viral Structure and Replication, Nucleic Acid Technology and Application (also found in Evolution unit later) Development	Chapters 13, 16-21 Lectures: Gametogenesis, Structure Function of Nucleic Acids Gene Regulation in Prokaryotes and Eukaryotes, DNA Technology, Viral structure and function, Hox genes and development Videos: DNA Secret of Life (Hour 1) , DNA Interactive Intimate Universe: Everyday Miracle Assessments 4 Reading Quizzes 1 Unit Test with FRQ	AP Lab 3B: Meiosis and Sordaria (2 days) (hands on) AP Lab 7: Fruit Fly Genetics (on and off for 4 weeks) (hands on) AP Lab 6 (note: Bacterial Transformation done by all regular biology students prior to AP Biology, students who did not take biology at this high school are directed to Lab Bench at Biology.com) Restriction Digest Analysis with Mapping (hands on) 2. PV 92 Alu PCR, includes use of CSHL/ Allele Server exercises (hands on) Assessments: Semi-Formal and Formal Lab write-ups with rubrics for each lab Lab related questions or FRQ included with Unit Test
	Heredity (8%) (split between two units)	Science as a Process, Continuity and Change, Structure/ Function	Eukaryotic Chromosomes, Inheritance Patterns, Mutation	Ch 14,15 Patterns of inheritance Epistasis Video: HHMI: On Sex and Gender (Sexual Evolution from X to Y) Assessments 1 Reading Quiz Unit Test with FRQ included in 1 st Semester	3. Helms Lab 15: Human Genetics (hands-on) (2 days) 4. Jumping Genes and Epistasis: Corn Genetics (2 days)

1 st Semester Final Exam				Final Exam Assessment: 100 Multiple Choice Questions + 2 FRQ	
2nd Semester					
II. Heredity and Evolution (25%) III. Organisms and Populations (50%)	Evolutionary Biology (8%) Diversity of Organisms (8%) Structure and Function of Plants and Animals (32%)	Science as a Process, Evolution, Continuity and Change, STS	Early Evolution of Life, Evidence of Evolution, Mechanisms of evolution Evolutionary Patterns Structural, physiological and behavioral adaptations, Nucleic Acid Technology	Ch 22-25, + P. 697-707 Primate/Human Evolution Lecture: Population Genetics Mechanisms of Evolution <i>Wolbachia</i> Bacterial Agent of Evolution Taxonomy overview with Phylogenetics/systematics Human Evolution Videos: Journey of Man Evolution Series: Why Sex?, Mind's Big Bang Assessments: 2 Reading Quizzes Unit Test with FRQ	AP Lab 8 Hardy Weinberg/Population Genetics (hands-on) (1 day) 5. Comparative Proteomics (Fish Protein Lab) (hands-on) (4 days) Bioinformatics Activity: Extension of Comparative Proteomics (hands-on computer activity) (2 days) 6. Phylogenetics Activity (hands-on computer activity) (2 days) Assessments: Semi-Formal and Formal Lab write-ups with rubrics for each lab Lab related questions or FRQ included with Unit Test
III. Organisms and Populations (50%)	Evolutionary Biology (8%) Diversity of Organisms (8%) Structure and Function of Plants and Animals (32%)	Science as a Process, Structure/ Function, Evolution, Continuity and Change, Interdependence, STS	Reproduction, growth, development, Structural, physiological, behavioral adaptations, response to environment	Ch 26 -31 Lecture: Origin and Diversity of Life Asexual/ Sexual Reproduction Alteration of Generations (protists, fungi, plants) Videos: Private Life of Plants (Reproduction: Birds and Bees) Fungi: Rotten World Among Us Assessments:	7. Helms Labs 22-25 (Survey of Monera, Protists, Fungi and Plants) 5 days (hands- on) Assessments: Lab Practicum

				2 Reading Quizzies Unit Test with FRQ	
III. Organisms and Populations (50%)	Evolutionary Biology (8%) Diversity of Organisms (8%) Structure and Function of Plants and Animals (32%)	Science as a Process, Evolution, Structure/ Function, Regulation, Continuity and Change, STS	Reproduction, growth, development, Structural, physiological, behavioral adaptations, response to environment	Ch 35-39 Lecture: Plant Morphology Plant Evolution Plant Hormones/ Cell Signaling Assessments: Take Home Unit Test with FRQ	AP Lab 9: Transpiration (3 days) 8. GMO PCR Lab (4 days) Assessments: Lab Practicum Formal lab write ups
III. Organisms and Populations (50%)	Structure and Function of Plants and Animals (32%) Evolutionary Biology (8%)	Science as a Process, Structure/ Function, Evolution, Continuity and Change	Reproduction, growth, development, Structural, physiological, behavioral adaptations, response to environment	Ch 32-34 Lecture: Animal Phylogeny and Evolution Videos: Shape of Life: Survival Game & Bones, Brawn, Brains Assessments: Unit Test with FRQ	9. Helms Labs 25-27 (Survey of Animal Kingdom: Porifera- Chordata) 5 days Assessment: Lab Practicum
III. Organisms and Populations (50%)	Structure and Function of Plants and Animals (32%)	Science as a Process, Structure/ Function, Evolution, Regulation, Continuity and Change, Energy Transfer	Reproduction, growth, development, Structural, physiological, behavioral adaptations, response to environment	Ch 40 -49 (many parts integrated into earlier units in the year) Lecture: (Student developed PowerPoint)	AP Lab 10 Physiology (Lab Bench/ Biology.com) 10. Helms 32: Animal Tissues (2 days) (hands-on) 11. Helms Lab 34-37 Fetal Pig Dissection (4 days) (Hands-on) Assessments: Lab write-up Lab Practicum
		Science as a Process, Evolution, STS		Final Project/ Group Presentation of current research (free choice by students) covered during course.	

				Videos: Story of AIDS, Evolution Series, What about God? DNA: Pandora's Box Assessment: Oral Presentation and PowerPoint	
2 nd Semester Final Exam				100 multiple choice questions and 4 FRQ	

Additional Information on Laboratory Activities outside the Required 12:

1. Slime Mold Inquiry Activity: Adapted from Bozzone & Martin (1998). "Chemotaxis in the Plasmodial Slime Mold *Physarum polycephalum*. An Experimental System for Student Exploration and Investigation." *The American Biology Teacher*. 60:1. Page 60.
2. Biotechnology Explorer: Chromosome 16: PV92 PCR/Informatics Kit Catalog #166-2100EDU, extension includes use of <http://www.geneticorigins.org/geneticorigins/pv92/aluframeset.htm>
3. Helms Lab 15: Human Genetic Traits (includes karyotyping, Barr bodies, non-disjunction, pedigrees).
4. Jumping Genes in Corn. Andrews, Baptist, Elwell, Kennedy, and Thompson. *A Sourcebook of biotechnology Activities*. National Association of Biology Teachers and the North Carolina Biotechnology Center.
5. Biotechnology Explorer: Comparative Proteomics Kit 1: Protein Profiler Module Catalog# **166-2700EDU**
6. Phylogenetics Activity: Investigating Polar Bear and Giant Panda Ancestry (Adapted from Maier, C.A. (2001) "Building Phylogenetic Trees from DNA Sequence Data: Investigating Polar Bear & Giant Panda Ancestry." *The American Biology Teacher*. 63:9, Pages642-646.) OR something similar using BLAST and other bioinformatics tools
7. Helms Labs 22-25 (Survey of Monera, Protists, Fungi and Plants)
8. Biotechnology Explorer GMO Investigator Kit Catalog #166-2500EDU
9. Helms Labs 25-27 (Survey of Animal Kingdom: Porifera- Chordata)
10. Helms 32 (Animal Tissues)
11. Helms 34-37 (Guide for dissection of fetal pigs)

Additional Information on Videos:

1. Shape of Life The Complete Journey: Slingshot Entertainment: Live on the Move, Survival Game, Bones, Brawn & Brains, 2002
2. Origins: Fourteen Billion Years of Cosmic Evolution, NOVA, WGBH, Earth is Born, How Life Began, 2004
3. Frontline: PBS Influenza
4. DNA: FFH Home Video: Secret of Life, Pandora's Box
5. HHMI 2001 Holiday Lectures: On Sex and Gender: Sexual Evolution from X to Y
6. Journey of Man by Spencer Wells, PBS Home Video, 2003
7. Evolution: WGBH Boston: Why Sex? The Mind's Big Bang, What About God? 2001
8. Fungi: The Rotten World Around Us, BBC, 1981
9. Private Life of Plants: David Attenborough, The Birds and the Bees, Turner Home Entertainment & BBC, 1995
10. Intimate Universe, BBC Video: An Everyday Miracle 1998
11. History of HIV/AIDS: NOVA and Frontline series, 2006
12. DNA Interactive (Dolan DNA Learning Center, CSHL) 2003

Laboratory Write-ups:

(Semi-Formal laboratory write-ups are usually modified from the formal requirements)

Title: The title is a statement (not a question) reflecting the independent and dependent variables. Example: The Effect of Various Concentrations of Sucrose on Carrot Slices.

Abstract: 4-8 sentences. Includes 1-2 sentences of introductory information, 1-2 sentences regarding the purpose/hypothesis of the activity, 1-2 sentences regarding the result trends and 1-2 sentences regarding the analysis/conclusions of the activity.

Introduction: 1-2 paragraphs. The introduction/ background includes prior knowledge and important information regarding the activity. Also includes explanation of the key concepts and/or vocabulary. Make sure references used are credited in the following format. (Author's Last Name, Date of publication). Also make sure the full reference is found in the references section.

Hypotheses, Variables and Control. Please use the "if...then...because" format for the null and regular hypotheses. Make sure the independent, dependent and standardized variables are sentences. Also make sure the control includes an explanation of "why" this is a control for the experiment.

Materials/Methods/Procedure: Briefly describe in a paragraph what materials, methods and procedure used in the activity.

Results/Trends: Data tables and graphs must have descriptive titles, see the title section for information. The data tables must be computer generated with appropriate reference to the units of the measurements taken during the activity. The graphs must be computer generated with both axes labeled and if more than one line is shown, a key must be provided. Include statistical calculations (ex. Chi Square, Means, Q10, etc.) The third requirement is a trend/results paragraph, describing in words the graph and/or data table contents.

Analysis/Conclusion/Lab Review Questions: In general the requirements of this section of the report are to provide an explanation of "why" of the results/data section supports or doesn't support any hypotheses. Use appropriate statistics to support inferences that

can be drawn from data collected. What information in the data section and the introduction help explain the results found? This might include the answers to the questions at the end of an activity.

References: (2 minimum) Use APA format

Other Curricular Activities:

- 1. Summer Assignment: Ecology Unit Reading**
- 2. Extra Credit: Summer Reading Book Review**
- 3. Research Article Reviews: using primary research articles from Nature or Science. (Required topics: photosynthesis, genes, evolution mechanisms, bioethics, extra credit topics: cell reproduction, and prokaryotes).**
- 4. Speakers: ranging from returning students talking about undergraduate research, professors from nearby universities, emergency room doctor, practicing researchers from industry.**
- 5. Field trip visit to nearby gene sequencing Federal lab.**