

**RHINEBECK CENTRAL SCHOOL DISTRICT
PRIORITIZED CURRICULUM
AP BIOLOGY SYLLABUS**

PERSONAL PHILOSOPHY

Students have different ways of learning and bring to class a different set of personal experiences that can be used to help with knowledge accumulation. I try as much as possible to vary my teaching style so that all learners find success in my classes. A conscious effort is made to develop lessons that are successful in teaching students a solid knowledge base as well as facilitating their learning of the methods of science. I strive to stress the importance of science research in the fields of medicine and ecology because I feel that students who enter these fields can have a profound impact. Whenever possible I introduce and we discuss current science articles from the New York Times Science section or other science journals. By doing this we explore the ever changing and constantly expanding world of scientific research and knowledge.

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COURSE OVERVIEW

AP Biology is a one-year course that promotes in-depth learning of a vast body of related biological facts while at the same time encouraging the development of a broad, general understanding of the principles of science. The syllabus emphasizes and integrates eight central themes throughout the teaching of the course topics. These themes include Science as a Process, Evolution, Energy Transfer, Continuity and Change, Relationship of Structure to Function, Regulation, Interdependence in Nature and Science, and Science and Technology. Evolution is approached throughout the course as the unifying theme that connects all others. This theme of unity and the hierarchy of interdependence in nature are used to stress important medical, ecological and social concerns in our world today. Course topics for candidates include: The chemistry of Life, Cells, Energy Production and Transfer, Cell Reproduction, Genetics, Evolution and diversity, Taxonomy, Plants, Human Anatomy and Physiology, and Ecology. Classes meet 42 minutes on "A" and "C" days and 86 minutes on "B" and "D" days. This course is intended for the college-bound, science-oriented student who is ready for serious, self-motivated study.

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The Objectives of the AP Biology Course Are That Students:

1. Develop an appreciation for all forms of life through an understanding of the unifying fundamental life processes that link our biologically diverse world
2. Instill a respect for the uniqueness of all organisms and develop an understanding of their interactions
3. Understand that biological concepts can overlap and link together in association
4. Become scientifically minded by developing self-confidence, open-mindedness, inquisitiveness, and awareness of the natural environment and the unique positions humankind holds within it
5. Master the investigative approach to problem solving by gaining skills in argumentation, model-building, experimental design, data analysis, systemic/analytical reasoning, and interpretation of information
6. Develop an appreciation of the ethical, philosophical, and political impacts of biology from past to present
7. Develop the ability to evaluate biological knowledge with the goal of making informed decisions regarding problems facing humankind at the present and which will face humankind in the future
8. Understand the fluidity of science as a process

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CLASS FORMAT AND DESIGN

The typical format of the class is a mix of lecture, lab and review of study support material. Students receive a note packet using the textbook AP Edition - Biology, (2005), by Campbell and Reese. The note packets are designed differently depending on the material covered. Students are given lecture notes for some chapters, but for other chapters, students have the responsibility of summarizing and writing notes for an assigned topic. Jigsaw sessions accompany these assignments. Some note packets combine lecture notes with study guide questions. Oral report projects and lab work are assigned regularly. Note packet and chapter study guides from AP Edition - Biology, (2005), by Campbell and Reese, as well as study guides from Senior Biology 1 and Senior Biology 2, (Biozone - 2006) are assigned and reviewed. Vocabulary quizzes are given for most chapters and tests, which include 30 multiple-choice questions and 1 AP free response question, and are given, in most cases, every 1 - 2 chapters. A mid-term is also given.

During the year, The Howard Hughes Medical Institute's Holiday Lecture Series on Science Tapes or DVDs are made available for students to borrow. Students are required to summarize 8 one-hour lectures (2 per quarter). When applicable, sections of these lectures are shown and discussed in class. We also read and discuss articles from various scientific periodicals or journals.

Debates occur periodically in which 2 teams or individuals provide an argument pro or con regarding a controversial issue in Biology. In addition, I invite one or two guest speakers yearly to speak on topics such as the effects of invasive species, neurobiology, or genetic research currently being done.

After the AP exam, students are required to engage in a research project, which are then presented to the class. They also are required to read and summarize 3 current science articles from appropriate research journals or periodicals. These summaries as well as an opinion statement are presented and discussed with the class.

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UNIT 1 - Chemistry of Life

Topics	Objectives	Labs	Assignments	Timeline
<ul style="list-style-type: none"> ▪ Water and the fitness of the environment ▪ Carbon and the molecular diversity of life ▪ Structure and function of organic molecules in organisms 	<p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ Discuss the structure, function and significance of water ▪ Explain the significance of carbon as the backbone atom in organic molecules and discuss the characteristics of common functional groups ▪ Describe the structure and function of the major macromolecules ▪ Discuss the significance of the location of our planet in terms of the evolution of life ▪ Discuss how nature's hierarchy of complexity starts with subatomic particles and culminates at the biosphere level ▪ Explain the interdependence of nature at these various levels 	<ul style="list-style-type: none"> ▪ Biological Shapes (CIBT) ▪ Organic Molecules (Helmes, D.) 	<ul style="list-style-type: none"> ▪ Read chapters 2 - 5 ▪ Book and note packet study guides 	<p>2 weeks</p>

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UNIT 2 - Cells

Topics	Objectives	Labs	Assignments	Timeline
<ul style="list-style-type: none"> ▪ Historical approach to the 'cell theory' ▪ Structure and function of cell organelles ▪ Prokaryotes vs. eukaryotes ▪ Heterotrophs vs. autotrophs ▪ Tools of a scientist ▪ Membrane structure and cell transport ▪ Cell specialization 	<p>The student will be able to:</p> <ul style="list-style-type: none"> ▪ Explain the historical development of the cell theory, relating the development of this theory to the scientific process and to technological advancement ▪ Identify the structure and function of cell organelles ▪ Distinguish between prokaryotic and eukaryotic cells and between autotroph and heterotroph cells ▪ Explain the function of various tools of a biologist ▪ Relate the structure of the cell membrane to the transport of materials through this membrane ▪ Compare and contrast methods of cell transport ▪ Relate cell structure to cell function 	<ul style="list-style-type: none"> ▪ Comparing Prokaryotes to Eukaryotes and Plant to Animal Cells (Helmes, D.) ▪ A Closer Look at Eukaryotes- Electron Micrographs (Helmes, D.) ▪ Diffusion and Osmosis (AP Lab #1) 	<ul style="list-style-type: none"> ▪ Read chapters 6-7 ▪ Book and note packet study guides ▪ Senior Biology Study Guides 	<p>2 weeks</p>

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UNIT 3 - Energetics of Life

Topics	Objectives	Labs	Assignments	Timeline
<ul style="list-style-type: none"> ▪ Free energy changes, metabolism and homeostasis ▪ Enzymes ▪ Cellular respiration and fermentation ▪ Photosynthesis-light dependent and light independent reactions 	<p>The student will be able to:</p> <ul style="list-style-type: none"> ▪ Relate free energy changes to metabolism and homeostasis ▪ Relate the structure of enzymes to their functions ▪ Investigate factors which control or alter the rate of enzyme activity ▪ Relate the structure of mitochondria and chloroplasts to their functions ▪ Discuss oxidation-reduction reactions ▪ Explain all processes involved in the various forms of cellular respiration ▪ Explain all processes involved in photosynthesis ▪ Discuss the cyclic nature of respiration and photosynthesis in terms of the interdependence of nature ▪ Explain how energy is captured, converted and stored or moved through an ecosystem 	<ul style="list-style-type: none"> ▪ Enzyme Catalysis (AP Lab #2) ▪ Cell Respiration (AP Lab #5) ▪ Plant Pigments and Photosynthesis (AP Lab #4) 	<ul style="list-style-type: none"> ▪ Read chapters 8-10 ▪ Book and note packet study guides ▪ Senior Biology Study Guides ▪ Jigsaw assignment- Introduction to Metabolism/Enzymes 	<p>3 weeks</p>

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UNIT 4 - Cell Reproduction

Topics	Objectives	Labs	Assignments	Timeline
<ul style="list-style-type: none"> ▪ Cell communication ▪ Mitosis and the asexual cell cycle ▪ Meiosis and sexual reproduction 	<p>The student will be able to:</p> <ul style="list-style-type: none"> ▪ Briefly describe the way cells communicate with each other ▪ Describe the process of mitosis and describe the various methods of asexual reproduction ▪ Describe the process of meiosis ▪ Describe how variation occurs and the benefits of variation to a species over time ▪ Compare and contrast mitosis with meiosis ▪ Discuss the evolution and interconnection of binary fission, mitosis and meiosis 	<ul style="list-style-type: none"> ▪ Mitosis and Meiosis (AP Lab #3) 	<ul style="list-style-type: none"> ▪ Read chapters 11-13 ▪ Book and note packet study guides ▪ Senior Biology Study Guides 	<p>2 weeks</p>

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UNIT 5 - Genetics

Topics	Objectives	Labs	Assignments	Timeline
<ul style="list-style-type: none"> ▪ DNA Structure and replication ▪ Protein synthesis ▪ Mendelian/non-mendelian genetics ▪ Inheritance patterns ▪ Biotechnology ▪ Genetic engineering ▪ Mutations ▪ Chromosome structure of prokaryotes and eukaryotes ▪ Gene regulation in prokaryotes and eukaryotes ▪ Applied genetics ▪ Theoretical genetics 	<p>The student will be able to:</p> <ul style="list-style-type: none"> ▪ Describe the structure and function of DNA ▪ Describe through a historical approach the experimentation that led to current understanding of the molecule ▪ Sequence DNA replication ▪ Describe RNA structure and sequence protein synthesis ▪ Investigate various techniques used in recombinant DNA research ▪ Discuss the benefits and hazards of genetic engineering ▪ Discuss the various types and causes of gene and chromosomal mutations and relate mutation to variation and evolution ▪ Describe eukaryotic chromosome structure in relation to gene linkage and chromosomal mapping ▪ Describe viral structure and replication patterns ▪ Investigate areas of applied genetics such as genetic screening and cloning ▪ Use the law of probability and statistical analysis to analyze various hereditary patterns 	<ul style="list-style-type: none"> ▪ Molecular Biology (AP Lab #6) Partially accomplished through a field trip to SUNY New Paltz ▪ Genetics of Drosophila-Statistical Analysis (AP Lab #7) ▪ Oral report project - DNA Technology and Genomics 	<ul style="list-style-type: none"> ▪ Read chapters 14-20 ▪ Book and note packet study guides ▪ Senior biology study guides ▪ Jig saw assignment - The Molecular Basis of Inheritance 	<p>5 weeks</p>

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UNIT 6 - Evolution and diversity

Topics	Objectives	Labs	Assignments	Timeline
<ul style="list-style-type: none"> ▪ Theories of evolution ▪ Evidences of evolution ▪ Natural selection ▪ Mechanisms of speciation/evolution ▪ Human evolution ▪ Hardy Weinberg 	<p>The students will be able to:</p> <ul style="list-style-type: none"> ▪ Compare theories of how species evolve, and understand the changing nature of evolutionary thought ▪ State Darwin's theory of natural selection ▪ Identify evidence that is used to support the modern theory of evolution ▪ Discuss other mechanisms involved in evolution and speciation ▪ Follow human evolution to the present ▪ Use the Hardy Weinberg equation ▪ Identify the principles of modern taxonomy and systematics ▪ Describe how evolution follows scientific processes in terms of observing, hypothesizing, experimenting, collecting data, and accepting or rejecting the hypothesis 	<ul style="list-style-type: none"> ▪ Population Genetics and Evolution (AP Lab #8) ▪ The Genetics Basis of Evolution and Dueling Alleles (Helmes, D.) ▪ Calculating Gene Frequency in a Population (Scott Foresman) 	<ul style="list-style-type: none"> ▪ Read chapters 22-25 ▪ Book and note packet study guides ▪ Senior biology study guides ▪ Jig saw assignment - Descent with Modification 	<p>2 weeks</p>

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UNIT 7 - Taxonomy and Classification

Topics	Objectives	Labs	Assignments	Timeline
<ul style="list-style-type: none"> ▪ Chemical evolution ▪ Principles of modern taxonomy ▪ 3 Domain System vs. 5 Kingdom Classification ▪ Characteristics of archae, eubacteria, protists and fungi 	<p>The student will be able to:</p> <ul style="list-style-type: none"> ▪ Discuss the various theories regarding how life originated on the earth ▪ Discuss the evolution of the major life forms (i.e., prokaryotes vs. eukaryotes, unicellular vs. multi-cellular, aquatic vs. terrestrial) ▪ Describe the classification and the characteristics of prokaryotes ▪ Discuss the classification and features of protists ▪ Discuss the classification and features of fungi 	<ul style="list-style-type: none"> ▪ Comparing prokaryotes, protists and fungi (teacher generated) 	<ul style="list-style-type: none"> ▪ Read chapters 26-28, 31 ▪ Senior biology study guides ▪ Note packet/lab 	<p>2 weeks</p>

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UNIT 8 - Taxonomy of Plants and Animals

Topics	Objectives	Labs	Assignments	Timeline
<ul style="list-style-type: none"> ▪ Origin of plants ▪ Plant diversity ▪ Origin of animals ▪ Animal diversity 	<p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ Discuss the evolutionary trends that led to the various plant divisions on earth today ▪ Describe adaptations that allowed for the movement of plants onto land ▪ Distinguish and identify the major divisions in the plant kingdom ▪ Explain alternation of generations and compare and contrast the various life cycles plants exhibit ▪ Compare the life cycles of the major taxonomic groups of plants ▪ Discuss the evolution of animals and the major organs within them ▪ Distinguish between and indentify the major phyla in the animal kingdom 	<ul style="list-style-type: none"> ▪ Hydra (teacher generated) ▪ Planarians (teacher generated) ▪ Segmented worms (Helses, D.) 	<ul style="list-style-type: none"> ▪ Read chapters 29-30, 32-34 ▪ Senior biology study guides ▪ Oral report project - Taxonomy of Animals ▪ Guest Speaker - Genetic Research Today 	<p>1 ½ weeks</p>

MIDTERM

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UNIT 9 - Plants

Topics	Objectives	Labs	Assignments	Timeline
<ul style="list-style-type: none"> ▪ Dicotyledonous plant structure and life function ▪ Organs, tissues and cells ▪ Structure and function of roots, stems and leaves ▪ Transport ▪ Seed germination ▪ Plant reproduction ▪ Plants and people 	<p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ Relate the structure of dicotyledonous plant organs, tissues, and cells to their function ▪ Diagram the distribution of tissues in dicot roots, stems and leaves ▪ Discuss the process of transport in plants ▪ Compare and contrast structural adaptations of xerophytes and hydrophytes ▪ Explain the nutritional requirements of plants in terms of soil fertility ▪ Describe reproduction in a flowering plant ▪ Discuss the evolutionary trends in angiosperm reproduction ▪ Describe the process of seed germination and discuss factors that control it ▪ Discuss hormonal control in plants ▪ Relate the importance of plants to humankind 	<ul style="list-style-type: none"> ▪ Transpiration (AP Lab #9) ▪ Angiosperm reproduction (teacher generated) ▪ Plant anatomy (Morgan/Carter) 	<ul style="list-style-type: none"> ▪ Read chapters 35-39 ▪ Senior biology study guides 	<p>4 weeks</p>

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UNIT 10 - Human Anatomy and Physiology

Topics	Objectives	Labs	Assignments	Timeline
<ul style="list-style-type: none"> ▪ Structure and function of various cells and tissues ▪ Metabolism and homeostasis ▪ Thermoregulation ▪ Digestion and nutrition ▪ Transport ▪ Gas exchange ▪ Excretion and osmoregulation ▪ Immunity ▪ Regulation ▪ Locomotion ▪ Behavior ▪ Reproduction and animal development 	<p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ Relate the structure and function of animal cells, tissues and organs ▪ Investigate the anatomy an physiology of human digestion, thermoregulation, transport, gas exchange, excretion, immune response, locomotion, regulation, behavior and reproduction ▪ Investigate and describe methods of maintaining homeostasis including feedback mechanisms ▪ Describe the evolutionary steps involved in the development of major organs found in humans 	<ul style="list-style-type: none"> ▪ Physiology of the circulatory system (AP Lab #10) ▪ Anatomy of the mammalian kidney (Helmes, D.) ▪ Control-The nervous system (Helmes, D.) ▪ Dissection of a bovine uterus and associated ovaries (CIBT) ▪ Histology of ovaries and testes (Scott Foresman) ▪ Some aspects of the male reproductive system (CIBT) ▪ The fetal pig (after the AP exam, teacher generated) 	<ul style="list-style-type: none"> ▪ Read chapters 40-49 ▪ Senior biology study guides ▪ Oral report project - Hormonal Control in Humans ▪ Debate - Diseases that Deserve Funding ▪ Guest speaker - Neurology 	<p>7 weeks</p>

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UNIT 11 - Ecology

Topics	Objectives	Labs	Assignments	Timeline
<ul style="list-style-type: none"> ▪ Ecology of ecosystems <ul style="list-style-type: none"> - abiotic factors - biomes - energy relationships - chemical cycles - succession ▪ Species and populations ▪ Communities <ul style="list-style-type: none"> - competition - symbiosis ▪ Animal behavior ▪ Population dynamics ▪ Biodiversity and conservation ▪ Microbial ecology ▪ Global issues and human impact ▪ Reducing harmful impacts ▪ Ecological techniques 	<p>Students will be able to:</p> <ul style="list-style-type: none"> ▪ List and describe how these abiotic factors in an ecosystem effect the distribution of species ▪ Discuss and explain how biotic relationships within an ecosystem, including competition, symbiosis and predation effect species distribution ▪ Compare and contrast the features of terrestrial and aquatic biomes ▪ Describe and analyze energy relationships and productivity in an ecosystem ▪ Discuss the importance of detritivores to any ecosystem in terms of nutrient recycling and the interdependence of organisms ▪ Explain how and why populations fluctuate ▪ Describe and analyze the biochemical cycles found in an ecosystem, including the microbial biotic components and abiotic components ▪ Explain succession and discuss the factors that determine the rate and direction of succession in an ecosystem ▪ Discuss the significance and the evolution of the various types of animal behavior ▪ Describe the factors that effect biodiversity in various biomes ▪ Discuss the impact humans have had on the earth in terms of political, ethical, economical and ecological issues associated with the maintenance of biodiversity, ozone depletion, global warming, acid deposition and resource management ▪ Debate and develop alternative solutions to ecological issues ▪ Use appropriate ecological techniques to investigate abiotic and biotic factors in an ecosystem 	<ul style="list-style-type: none"> ▪ Animal behavior (AP Lab#11) ▪ Local human population study (teacher generated) ▪ Dissolved O₂ in aquatic primary production (AP Lab #12) 	<ul style="list-style-type: none"> ▪ Read chapters 51-55 ▪ Senior biology study guides ▪ Jig saw - Community Ecology ▪ Oral report projects <ul style="list-style-type: none"> - biomes - human impacts ▪ Debate - Ecological Problems: Which One is Top Priority? ▪ Guest speaker - Invasive Species 	<p>2 ½ weeks</p>

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FIELD TRIP OPTIONS:

- SUNY at New Paltz provides field trip access to electron microscopy labs and gel electrophoresis labs
- The proximity of the Bronx Zoo provides field trip access for evolution studies of primates
- The Taconic State Park and the Hudson River provides field trip access for ecological studies
- In-vitro fertilization Institute in Albany

LAB COMPONENT:

Working in small groups, we accomplish all 12 of the AP labs in the *AP Biology Lab Manual for Students*, as well as many others. About 25% of instructional time is devoted to lab work. When lab reports are assigned, the following elements must be included:

- Background information
- Purpose/hypothesis
- Procedure
- Identification of variables and controls
- Analysis
- Conclusion
- Error analysis and suggestions for improvement

Generally, students have one week to complete a lab. Lab reports are only assigned for labs that follow the scientific method, not for labs that focus on a learning a skill.

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STUDENT EVALUATION

Grading		1 ST , 3 RD , 4 TH Marking Period	2 ND Marking Period
	LABS	30%	20%
	HOMEWORK	20%	20%
	TESTS	50%	40%
	MIDTERM	20%	

REVIEW OF PRIMARY RESOURCES

Textbook, Study Guide and other Teacher Resources

Campbell, Neil A., Reece, J. AP Edition Biology 7th Edition, San Francisco: Pearson Education, Inc., 2005

Laboratory Manuals:

Advanced Placement Biology Laboratory Manual (ETS: newest edition)

Helmes, Doris R. Biology in the Laboratory (Worth Publishing)

Morgan, J. G., Carter, M. Investigating Biology 3rd Edition (Addison, Wesley Longman, Inc.)

Laboratory Experiences written at the Cornell Institute for Biology Teachers

Study Guides:

Richard Allen. Senior Biology 1 and 2. New Zealand: Biozone International Ltd, 2005

The Howard Hughes Medical Institute's Holiday Lectures on Science, 1995 - 2006