

MANCHESTER REGIONAL HIGH SCHOOL

ADVANCED PLACEMENT BIOLOGY



Adopted May, 2016

**Manchester Regional High School
District Mission Statement**

The mission of Manchester Regional High School is to produce respectful, responsible and well-rounded graduates who possess the knowledge and skills to become contributing members of society and life-long learners.

Highly qualified, collaborative and innovative staff address the needs of a diverse school community in a stimulating and nurturing environment.

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AP Biology

Course Syllabus

Personal Philosophy

I believe that biology is an ever-changing discipline. The instructor is both an educator and an infinite scholar who must study and stay abreast of new and innovative findings which change our perception of life and its processes. I believe that biology is learned and reinforced in the laboratory. Students utilize the material that is learned in the course of lecture and reading to work via experimentation with set laboratory procedures and also procedures produced by the students themselves to explore further scientific knowledge. AP students should be taught to separate themselves from instructor dependent learning, and incorporate a more collegiate, independent learning atmosphere. This involves diligent and precise note taking, independent reading assignments (both in and out of the textbook), AP test preparation exercises, and independent laboratory investigations. Through teaching AP biology, I hope to encourage my students that though the scientific community has made immense strides into the understandings of all aspects of life, that there is still far too much that we continue to be challenged and mystified by today.

Course Overview

My AP Biology class corresponds to the intensive standards brought forth by the College Board. Students who enter this course are high school juniors or seniors who have completed as a prerequisite the courses of general biology, chemistry, and in some cases physics. I believe that in order to complete the rigorous course load, students should begin their studies during the summer before they take AP Biology. Therefore the course begins when prospective students pick up their summer assignment before they are dismissed for summer vacation.

Special attention is paid to the subject of evolution. Evolution is often not incorporated into the other main units in biology. Throughout the year evolution will be built-in to all of the units (biochemistry, cells, heredity, microbiology, plant and animal physiology, and ecology) in order to display how all areas of life have evolved throughout time. The four major themes or big ideas for AP Biology are stressed throughout each of the various units during the course and they are as follows **(CR2)**:

Four Big Ideas of AP Biology *College Board

I. **Big Idea 1: EVOLUTION**

The process of evolution drives the diversity and unity of life.

II. **Big Idea 2: Cellular Processes: Energy and Communication**

Biological systems utilize free energy and molecular building blocks to grow, reproduce, and to maintain dynamic homeostasis.

III. **Big Idea 3**

Living systems store, retrieve, transmit, and respond to information essential to life processes.

IV. **Big Idea 4: Interactions**

Biological systems interact, and these systems and their interactions possess complex properties.

Course Planner

This AP Biology class is taught as the equivalent of a 2 semester collegiate course. The course is organized into 10 units that follow the layout given by the College Board. Units are taught on a timescale that correlates to the amount of focus demanded by the AP course guidelines. The course begins in June when prospective students pick up their summer work. This work is a collection of the first and last units to be covered throughout the year, chemistry and ecology respectfully. On average, each unit is taught for a period of 2 weeks, with the exception of plant and animal structure and function which require a longer unit schedule. The text book used by the students in my class is listed in the Course Texts section below.

Class meets 5 days a week at a fixed schedule. Two days a week the class meets for 43 minutes each, and on the other 3 days the class meets for a double lab period of 90 minutes each day. Total class time is roughly 6 hours a week for a period of 33-34 weeks before the AP exam. That measures up to about 200 hours of class/lab time until the AP exam is taken in May. All students are required to take the AP exam.

Weekly schedule is as follows:

Monday	Tuesday	Wednesday	Thursday	Friday
43 min	43 min	90 min	90 min	90 min

Course Texts

*****Main student text book**

Campbell, N.A. and J.B. Reece. *Biology 8th Edition*. (2008)
Pearson/Benjamin Cummings: San Francisco **(CR1)**

Campbell, N.A. and J.B. Reece. *Student Study Guide for Biology 8th Edition*. (2008) Pearson/Benjamin Cummings: San Francisco

Campbell, N.A. and J.B. Reece. *AP Test Prep Series: AP Biology*. (2008)
Pearson/Benjamin Cummings: San Francisco

College Board. AP Advanced Placement Program: *Biology Lab Manual*.
(2001)

College Board. *AP Biology Investigative Labs: An Inquiry-based Approach*.
(2012)

Masterman, D. and Redding, K. *Biology with Computers 3rd Edition*.
(2006) Vernier Software & Technology: Beaverton, OR

Lab Component

The lab component is made up largely of student driven, inquiry based laboratory assignments. Laboratory work is usually done over the course of 1 double lab period each week. A single 90 minute lab session for a week makes up 25% of that weeks total class time (356 min). Several times throughout the year there are 2 or 3 days per week committed to a lab assignment, while other weeks do not have any lab work. During the 2 months following the AP exam, the majority of class time (2-4 days per week) is spent in the laboratory. Consequently, students certainly spend a minimum of 25% of course time working on laboratory assignments **(CR7)**.

Students work in groups, pairs, and individually on different labs throughout the course depending on the needs on each specific lab. Pre-labs are given the day before the more complex laboratory investigations. Also students are to make predictions and write their hypotheses for each variable tested. Due to time constraints within the lab period, students are given the labs the day before so that they can quickly get to work on the lab day or days.

When needed, the AP Biology labs are modified to meet both time and budgetary limitations. Modifications to labs include the use of Vernier computer probe technology or teacher driven demos. Vernier probes available to the students include temperature, pH, conductivity, colorimeter, oxygen, carbon dioxide, gas pressure, heart-rate, blood pressure, and dynamometer probes.

Students hand in their own lab report or occasionally hand in group reports for each investigation. The report is either the completion of the data and questions from the AP manual or a formal typed lab report including an abstract, procedures, data reporting including graphs and/or tables, analysis of results, and conclusion. Lab reports are always due the following Wednesday for AP Biology labs. Formal lab reports are given a longer time for completion **(CR8)**.

After the AP exam in May, students begin the dissection component of the lab. Two animal dissections are completed, a shark for fish anatomy, and a cat for mammalian anatomy. Each dissection lasts several days with attention focused on different systems each day. Assessments include dissecting technique and identification of body parts including a final lab practicum which includes all specimens.

Teaching Strategies

I have prepared lectures aided with PowerPoint presentations for each chapter that is discussed during class time. The PowerPoints include many visual images, charts, graphs, and studies from the text and from various other materials. Within the lecture are several comprehension and analysis questions to gauge the students understanding of the topics. To accompany the lectures, students are given a guided lecture packet for them to fill out during the lecture if they desire. Some students could take notes in their binders rather than in the guided lecture packet. Students are responsible for reading the text book at home to accompany the lectures.

In addition to lectures, students also engage in group and independent work on sample problems, matching terms, labeling diagrams, and other review material. Review packets are provided before every unit exam. These packets include brief overviews of terms and topics and sample multiple choice problems. My exams are multiple choice problems (70-100) with a multi-part free response question in order to make them accustomed to the AP exam format. Periodically I show DVDs which deal with relevant topics being discussed in class.

Student Evaluation

Students are graded on their performance on unit tests, chapter quizzes, lab reports, homework, and activities. The students also complete a final exam and dissecting lab practical following the AP exam. Student report period averages are determined on a total points scale for each report period (total point attained ÷ total points possible). Their final grade is an average of their 4 report period grades and their final exam/practical grade. The points that I assign to each assessment is listed in the table below (next page).

Assessment	Points	Frequency
Unit Tests	100	Every 3-4 weeks
Chapter Quizzes	20-30	Weekly/biweekly
Homework	10-20	Weekly/biweekly
Labs	50	Every 1-2 weeks

Students also complete a final project in which they have a choice between various assignments. Each of the choices has an oral portion in which the students must provide a presentation for the class. Due to limited time for presentations, the students work in groups.

There are also opportunities to achieve extra credit points. Opportunities include but are not limited to writing a reflection to a scientific article (**CR5**), donating blood, and making donations to food or clothing shelters.

AP Bio Syllabus

Area	Chapters	Assessments	AP Labs	Target Completion Date
I. Molecules and Cells				
A. Chemistry of Life.....	3-5	Summer Work Unit Test	Lab#2	Sep
B. Cellular Metabolism.....	6-7	Chapter quizzes Unit Test	Lab#1 Inv#4	Sept
C. Cellular Energetics.....	8-10	Chapter quizzes Unit Test	Inv#4,5, and 13 Lab#4 Lab#5	Oct
D. Cell Signaling and Cycle.....	11-12	Chapter quizzes	Inv#7 Lab#3	Nov
Subtotal.....	2-12	Quizzes and 3 Unit Tests	5	

II. Evolutionary Biology				
A. Heredity.....	13-15	Chapter quizzes and Unit Test	Lab#7	Nov
B. Molecular Genetics.....	16-21	Chapter quizzes and Unit Test	Inv#3 & 8 Lab#6	Dec
C. Evolutionary Biology.....	22-24	Chapter quizzes and Unit Test	Inv# 1 & 2 Lab#8	Dec
Subtotal.....	13-20, 22- 24	Quizzes and 3 Unit Tests	3	

AP Bio Syllabus (continued)

Area	Chapters	Assessments	AP Labs	Target Completion Date
III. Organisms and Populations				
A. Diversity of Organisms.....	25-27	Chapter Quizzes Unit Test		Jan
B. Structure & Function of Plants.....	38-39	Chapter Quizzes Unit Test	Lab#9	Feb
C. Structure and Function of Animals...	40, 43, 45, 47-49, 51	Chapter Quizzes Unit Test	Inv#12 Lab#10 Lab#11	Mar
D. Ecology.....	52-56	Summer Work Chapter Quizzes Unit Test	Inv#10 Lab#12	Apr

AP Test Review		Review Packets, Sample multiple choice and free response questions, and Lab Reviews		Mid May (Exam date)
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Unit Topics

Each of the units in AP Biology is taught using guided lectures, laboratory assignments, and activities that follow the outline below. Unit exams are given at the end of each unit and are based on material from that unit only.

Unit	Lecture Topics	Activities/Labs
1A	<p>Chemistry of Life</p> <ul style="list-style-type: none"> • Chemical bonding determines function • Properties of water • Properties of carbon • Structure and function of macromolecules 	<p>AP Lab 2: Enzyme Catalysis Parts A-D</p> <p>pH Activity Students use H⁺ and OH⁻ concentrations to determine the pH of a given solution (CR4b)</p>
1B	<p>Cellular Structure</p> <ul style="list-style-type: none"> • Use of microscopes • Prokaryotic and eukaryotic cells • Functions of eukaryotic organelles • Components of the cytoskeleton • Fluid mosaic model of the cell membrane • Passive and active transport • Endocytosis and exocytosis 	<p>Investigation 4: Diffusion and Osmosis</p> <p>Cell Type Activity Students work in groups to explain the differences between plant, animal, and bacterial cells (CR4a) (CR4c)</p> <p>Organelles Report Student oral reports on specific organelles (CR4b) (CR4c) (CR4d)</p>

Unit Topics (continued)

Unit	Lecture Topics	Activities/Labs
1C	<p>Cellular Metabolism</p> <ul style="list-style-type: none"> • Thermodynamics and free energy changes • Structure and function of ATP • Enzyme properties and regulation • Catabolic and anabolic pathways and the use of Redox reactions • Cellular respiration and fermentation • Light reactions of photosynthesis • Calvin cycle and alternate mechanisms of carbon fixation 	<p>AP lab 4: Plant Pigments & Photosynthesis Parts A report (CR8)</p> <p>Investigation 5: Photosynthesis Report (CR6) (CR8)</p> <p>Investigation 6: Cellular Respiration Report (CR6) (CR8)</p> <p>Enzyme Activity Determining the rate changes on chemical equations due to varying conditions (CR3b) (CR4b) (CR4c)</p>
1D	<p>Cell Signaling and Cycle</p> <ul style="list-style-type: none"> • Reception and transduction of signals • Regulation and Apoptosis • Stages of interphase, mitosis, and cytokinesis • Regulation of the cell cycle 	<p>AP lab 3: Mitosis Parts 3A1-3A2 Report (CR8)</p> <p>Investigation 7: Cell Division: Mitosis and Meiosis Report (CR6) (CR8)</p>

Unit Topics (continued)

Unit	Lecture Topics	Activities/Labs
2A	<p>Heredity</p> <ul style="list-style-type: none"> • Asexual and sexual life cycles • Stages of meiosis and comparison to mitosis • Role of genetic variation in evolution • Laws of inheritance and Mendelian genetics • Non-Mendelian genetics and autosomal disorders • Sex-linked inheritance and chromosomal caused genetic disorders 	<p>AP lab 3: Meiosis Parts 3B1-3B2 Report (CR8)</p> <p>Modeling Cell Division Groups act out the processes of Mitosis and Meiosis including mutations (CR4a) (CR4b)</p> <p>Genetics Problems Activity Packet of genetics based investigations and counseling problems (CR4a)</p> <p>AP lab 7: Genetics of Organisms Using live flies and plants. Also using computer simulations Report (CR8)</p> <p>Chi-square Statistical Lab (Teacher generated) using M&M color and sample corn cobs (CR8)</p> <p>Genetic Diseases Discussion Genetic disorders, their treatment both current and prospective, and their testing (CR5)</p>
2B	<p>Molecular Genetics</p> <ul style="list-style-type: none"> • DNA and chromosomal structure • DNA replication • Transcription and Translation • Mutations • Gene expression and regulation in different organisms • Virus structure, reproduction, and as pathogens • Influence of biotechnology and practical applications 	<p>AP lab 6: Molecular Biology Part A: week 1 Part B: week 2 Report (CR8)</p> <p>Investigation 3: Comparing DNA Sequences to Understand Evolutionary Relationships with BLAST(CR6)</p> <p>Investigation 8: Biotechnology: Bacterial Transformation(CR6)</p> <p>Virus Poster Students create a poster and short presentation on a viral agent (CR3c) (CR4a) (CR4c)</p> <p>Antibacterial & Antiviral Agent Discussion Reading followed by discussion (CR5) (CR8)</p>

Unit Topics (continued)

Unit	Lecture Topics	Activities/Labs
2C	Evolutionary Biology <ul style="list-style-type: none"> Darwin and evolution by natural selection Genetic variation in populations Hardy-Weinberg equation as evidence for evolution in populations Genetic drift and gene flow Biological species concept and speciation 	AP lab 8: Population Genetics and Evolution Parts A-C Report (CR8) Inv 1: Artificial Selection (CR6) Inv 2: Mathematical Modeling: Hardy-Weinberg Report (CR8) (CR6)
3A	Diversity of Organisms <ul style="list-style-type: none"> Classification, phylogeny and cladistics Bacteria and Archaea Plant diversity Animal Diversity 	Phylogeny and Cladistics Activity Teacher generated on creating and reading cladograms and phylogenetic trees (CR3a) (CR4a) (CR8)
3B	Structure and Function of Plants <ul style="list-style-type: none"> Flower structure and the production of fruits Sexual and asexual reproduction in angiosperms Crop breeding and genetic engineering Signal transduction Plant hormones Responses to light and other stimuli Plant defenses against pathogens and herbivores 	AP lab 9: Transpiration Part A: week 1 Part B: week 2 Formal Lab Report (CR8) Flower dissection (teacher designed) Examine the structures that make up the flower

Unit Topics *(continued)*

Unit	Lecture Topics	Activities/Labs
3C	<p>Structure and Function of Animals</p> <ul style="list-style-type: none"> • Basic principles of animal form and function • Immune system • Hormone classes and functions • Endocrine system • Reproduction and development in animals • Reproductive anatomy and patterns of meiosis • Fertilization and development • Neurons, synapse, and signaling • Central nervous system • Genetic and environmental impacts on behavior 	<p>AP lab 11: Animal Behavior Parts A & C Report (CR8)</p> <p>Investigation 12: Fruit Fly Behavior (CR6)</p> <p>Invertebrates & Vertebrates dissections Follow the AP exam</p> <p>Super Hero Project Groups design and explain the development of a superhero *post AP exam (CR4c) (CR4d) (CR8)</p>
3D	<p>Ecology</p> <ul style="list-style-type: none"> • Ecology and evolution and the distribution of species • Aquatic and terrestrial biomes • Population density, dispersion, and demographics • Population growth and regulation • Community interactions • Disturbances, biogeography and pathogens effect on communities • Physical laws of conservation and chemical cycling in ecosystems • Energy and production in ecosystems • Human impacts on ecosystems • Biodiversity and population approaches • Restoration ecology 	<p>AP lab 12: Dissolved Oxygen and Aquatic Primary Productivity Part A: week 1 Part B: week 2 Presentation (CR8)</p> <p>Investigation 10: Energy Dynamics Report (CR6)(CR8)</p> <p>Pollution Activity Students are to research current pollution articles and provide a presentation (CR3d) (CR4d) (CR5) (CR8)</p>