Advanced Placement Biology
2011-2012 Syllabus

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Course Expectations

This course is designed to prepare students for the college level Advanced Placement Biology Examination and is based on the curriculum established by the College Board. Students will be provided the opportunity to experience laboratory skills comparable to introductory college level Biology courses, including inquiry based labs and computerized data acquisition and analysis. This class requires learning at an accelerated pace due to the amount and complexity of the required material. Material will be covered through daily class activities, lectures, discussions, laboratories, and independent projects. A student's success will depend on the time and effort that is invested into this course.

Students enrolling in the Advanced Placement Biology course should have a strong foundation in biology and chemistry. It is strongly suggested that students concurrently enroll in Level I Human Anatomy & Physiology. All students must take the AP exam.

Resources

Textbook: *Biology*, AP Edition, Neil A. Campbell and Jane B. Reece, 8th edition (2008)
Laboratory Manual: AP Biology Lab Manual for Students
Various AP Biology Review Books
Vernier LabQuest with LoggerPro Software for select labs
Articles from Various Scientific Journals

Follow the registration steps below to access your online textbook resources:

1. Register at http://www.phschool.com/access/
2. Click on Covered Titles, then click on your title from the list (Campbell, Biology 8th Edition)
3. Choose Student Registration
4. Click I Accept at the bottom of the License Agreement page
5. Access Information -
   - Enter or Create your username & password
   - Enter the appropriate access code below:
     SSNAST-JEDDA-OBEYS-SIDED-TAPIR-WIVES
6. Account Information - complete or verify your name & school information
7. Confirmation & Summary - list of websites where you can now login

Log in to the textbook resources at: http://wps.aw.com/bc_campbell_biology_8ap
Join Class ID: cm429765

Student Assessment

Grades are determined using the assignment weights to the right. All Advanced Placement Science classes at SBRHS use this weighted grading system.

Category	Weight
Tests & Quizzes	50%
Labs & Classwork	30%
Projects	15%
Homework	5%

Within each category, assignments will be given a point value (unique to this class) based on their length, complexity, involvement, and importance.

Unit Tests (200 points):
Tests are given at the end of most units. In order to prepare students for the AP exam in May, tests will consist of 25 multiple-choice questions and 1 free-response question.

Quizzes (30 points):
Quizzes are given to ensure that students are keeping up with their homework and reading assignments. Quizzes consist of 15 multiple-choice questions.

Laboratories (25-100 points):
Lab protocols are taken from the AP Laboratory Manual or alternate sources. Labs are designed to allow the students to apply their knowledge of the biological concepts discussed in class. Students are expected to prepare for laboratories by reading the protocols prior to lab. An assessment will be assigned for the lab (due dates depend on the difficulty/length of the assignment). Lab behavior and technique are also sometimes factored into the laboratory grade.

Laboratory Free-Response Questions (25-50 Points):
After each of the twelve AP labs, a free-response question will be assigned allowing students to practice for the lab-related free-response question on the AP Biology Exam.

Classwork (10-100 points):
Both individual and group work will be assigned to apply what is learned in class.

Homework (10-50 points):
In order to progress at an accelerated pace, students must prepare for each class prior to the next class meeting. This preparation includes both reading assignments and chapter reading guides. Written work will not always be graded.

Projects (200 points):
Students will be required to complete one project per term. These projects will be long-term and will require a great deal of effort.

Mid-Year Exam (400 points) **and Final Project** (300 points):
A Mid-Year Exam will be given at the end of Term 2 and will be half an AP Exam (50 multiple-choice and 2 free-response questions). The Final Project usually changes every year and will be presented according to the senior final exam schedule.

Summer Project (150 points):
Students enrolling in AP Biology are required to complete a summer project in order to prepare them for a challenging year. Project details are provided in June and the project is due on the first day of school.

Extra Credit:
Extra Credit is not offered for this class. Please keep up with the regular assignments!

Laboratories

Laboratories are an essential component of the AP Biology Curriculum, and will occupy a great deal of time in this course (greater than 25% of the course). Twelve labs are required and may appear on the AP Biology Exam. For most of the twelve labs, we will have a pre-lab and post-lab. The goal of the pre-lab is to discuss the purpose of the lab, prepare the necessary materials, and to review the procedure so that students are prepared for the lab. During the post-lab, students will compare their results with the class data and begin to analyze the results of the lab. After each of the twelve labs, a free-response question will be assigned allowing students to practice for the lab-related free-response question on the AP Biology Exam.

Additional labs and activities will be done throughout the year to further apply the knowledge learned in class. See the course planner for more information.

Required AP Biology Labs:

1. Diffusion and Osmosis
2. Enzyme Catalysis
3. Mitosis and Meiosis
4. Plant Pigments and Photosynthesis
5. Cell Respiration
6. Molecular Biology
7. Genetics of Organisms
8. Population Genetics and Evolution
9. Transpiration
10. Physiology of the Circulatory System
11. Animal Behavior
12. Dissolved Oxygen and Aquatic Primary Productivity

Free-Response Questions

When possible, AP Scoring Guides are used to grade free-response questions on unit tests and laboratory quizzes. These scoring guides have been used to grade previous AP Exams.

The AP Biology Exam

- **Date:** Monday, May 14, 2012
- **Time:** Morning Session
- **Multiple-Choice Section:** 60%, 100 Questions, 80 minutes
- 25% from Area I, 25% from Area II, and 50% from Area III
  Score is based on # of questions answered correctly (no penalty for wrong answers)
- **Free-Response Section:** 40%, 4 Questions, 90 minutes, 10 minute reading period
  1 from Area I, 1 from Area II, and 2 from Area III
  Usually one question relates to one of the 12 AP Biology Labs
  Each of the four questions is weighted equally
- **AP Exam Grades:**
  5 = Extremely Well Qualified
  4 = Well Qualified
  3 = Qualified
  2 = Possibly Qualified
  1 = No Recommendation

Major Themes of AP Biology

There are eight Major Themes of AP Biology that we will continually discuss throughout the year. Most themes can be applied to each unit that we will study.

I. **Science as a Process**—Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing.
   Example: The theory of evolution was developed based on observation and experimentation.

II. **Evolution**—Evolution is the biological change of organisms that occurs over time and is driven by the process of natural selection. Evolution accounts for the diversity of life on Earth.
   Example: Widespread use of antibiotics has selected for antibiotic resistance in disease-causing bacteria.

III. **Energy Transfer**—Energy is the capacity to do work. All living organisms are active (living) because of their abilities to link energy reactions to the biochemical reactions that take place within their cells.
   Example: The energy of sunlight, along with carbon dioxide and water, allows plant cells to make organic materials, synthesize chemical energy molecules, and ultimately release oxygen to the environment.

IV. **Continuity and Change**—All species tend to maintain themselves from generation to generation using the same genetic code. However, there are genetic mechanisms that lead to change over time, or evolution.
   Example: Mitosis consistently replicates cells in an organism; meiosis (and hence sexual reproduction) results in genetic variability.

V. **Relationship of Structure to Function**—The structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems.
   Example: Aerodynamics of a bird's wing permits flight.

VI. **Regulation**—Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms.
   Example: Body temperature is regulated by the brain via feedback mechanisms.

VII. **Interdependence in Nature**—Living organisms rarely exist alone in nature.
   Example: Microscopic organisms can live in a symbiotic relationship in the intestinal tract of another organism; the host provides shelter and nutrients, and the microorganisms digest the food.

VIII. **Science, Technology, and Society**—Scientific research often leads to technological advances that can have positive and/or negative impacts upon society as a whole.
   Example: Biotechnology has allowed the development of genetically modified plants.

Topic Outline

As a result of the custom schedule developed for this high school, this syllabus is delivered over a series of approximately 200 57-minute time periods taking place between September and the AP Exam. The schedule consists of an eight-day 6 period rotating system, with Advanced Placement Biology scheduled twice per day on 6 out of 8 days of the rotating schedule. Therefore, students have 114 minutes of class time on 6 of the 8 days. According to the College Board recommendations, the required topics in Advanced Placement Biology are taught within the schedule as follows:

I. Molecules and Cells - 25% - 50 Periods

A. Chemistry of Life - 7% - 14 Periods
- Water
- Organic molecules in organisms
- Free energy changes
- Enzymes

B. Cells - 10% - 20 Periods
- Prokaryotic and eukaryotic cells
- Membranes
- Subcellular organization
- Cell cycle and its regulation

C. Cellular Energetics - 8% - 16 Periods
- Coupled reactions
- Fermentation and cellular respiration
- Photosynthesis

II. Heredity and Evolution - 25% - 50 Periods

A. Heredity - 8% - 16 Periods
- Meiosis and gametogenesis
- Eukaryotic chromosomes
- Inheritance patterns

B. Molecular Genetics - 9% - 18 Periods
- RNA and DNA structure and function
- Gene regulation
- Mutation
- Viral structure and replication
- Nucleic acid technology and applications

C. Evolutionary Biology - 8% - 16 Periods
- Early evolution of life
- Evidence for evolution
- Mechanisms of evolution

III. Organisms and Populations - 50% - 100 Periods

A. Diversity of Organisms - 8% - 16 Periods
- Evolutionary patterns
- Survey of the diversity of life
- Phylogenetic classification
- Evolutionary relationships

B. Structure and Function of Plants and Animals - 32% - 64 Periods
- Reproduction, growth, and development
- Structural, physiological, and behavioral adaptations
- Response to the environment

C. Ecology - 10% - 20 Periods
- Population dynamics
- Communities and ecosystems
- Global issues

Course Planner

The following is a list of topics, laboratories, and activities in the order in which they will be covered throughout the year. The chapters are divided into twelve units.

Topics	Laboratories & Activities
Chapter 1: Introduction- Themes in the Study of Life • Themes help connect the concepts of biology. • The Core Theme: Evolution accounts for the unity and diversity of life. • Scientists use two main forms of inquiry in their study of nature.	Scientific Method Lab
Unit 1: The Chemistry of Life **Chapter 2: The Chemical Context of Life** • Matter consists of chemical elements in pure form and in combinations called compounds. • An element's properties depend on the structure of its atoms. • The formation and function of molecules depend on chemical bonding between atoms. • Chemical reactions make and break chemical bonds. **Chapter 3: Water and the Fitness of the Environment** • The polarity of water molecules results in hydrogen bonding. • Four emergent properties of water make Earth fit for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent • Acidic and basic conditions affect living organisms. **Chapter 4: Carbon and the Molecular Diversity of Life** • Organic chemistry is the study of carbon compounds. • Carbon atoms can form diverse molecules by bonding to four other atoms. • Characteristic chemical groups help determine how biological molecules function. **Chapter 5: The Structure and Function of Macromolecules** • Most macromolecules are polymers, built from monomers. • Carbohydrates serve as fuel and building material. • Lipids are a diverse group of hydrophobic molecules.	Acids and Bases Vernier Lab Determining the Concentration of an Unknown Protein Solution Summer Project

• Proteins have many structures, resulting in a wide range of functions. • Nucleic acids store and transmit hereditary information.	
<u>Unit 2: Cells</u> **Chapter 6: A Tour of the Cell** • To study cells, biologists use microscopes and the tools of biochemistry. • Eukaryotic cells have internal membranes that compartmentalize their functions. • The eukaryotic cell's genetic instructions are housed in the nucleus and carried out by the ribosomes. • The endomembrane system regulates protein traffic and performs metabolic functions in the cell. • Mitochondria and chloroplasts change energy from one form to another. • The cytoskeleton is a network of fibers that organizes structures and activities in the cell. • Extracellular components and connections between cells help coordinate cellular activities. **Chapter 7: Membrane Structure and Function** • Cellular membranes are fluid mosaics of lipids and proteins. • Membrane structure results in selective permeability. • Passive transport is diffusion of a substance across a membrane with no energy investment. • Active transport uses energy to move solutes against their gradients. • Bulk transport across the plasma membrane occurs by exocytosis and endocytosis. **Chapter 11: Cell Communication** • External signals are converted to responses within the cell. • Reception: A signal molecule binds to a receptor protein, causing it to change shape. • Transduction: Cascades of molecular interactions relay signals from receptors to target molecules in the cell. • Response: Cell signaling leads to regulation of cytoplasmic activities or transcription. • Apoptosis (programmed cell death) integrates multiple cell-signaling pathways.	Microscope Labs: Introduction, Measurement, Cells, Osmosis, etc. Limits on Cell Size Vernier Lab **AP Biology Lab #1: Diffusion and Osmosis**

<u>Unit 3: Cellular Energetics</u> **Chapter 8: An Introduction to Metabolism** • An organism's metabolism transforms matter and energy, subject to the laws of thermodynamics. • The free-energy change of a reaction tells us whether the reaction occurs spontaneously. • ATP powers cellular work by coupling exergonic reactions to endergonic reactions. • Enzymes speed up metabolic reactions by lowering energy barriers. • Regulation of enzyme activity helps control metabolism. **Chapter 9: Cellular Respiration- Harvesting Chemical Energy** • Catabolic pathways yield energy by oxidizing organic fuels. • Glycolysis harvests chemical energy by oxidizing glucose to pyruvate. • The citric acid cycle completes the energy-yielding oxidation of organic molecules. • During oxidative phosphorylation, chemiosmosis couples electron transport to ATP synthesis. • Fermentation and anaerobic respiration enable some cells to produce ATP without the use of oxygen. • Glycolysis and the citric acid cycle connect to many other metabolic pathways. **Chapter 10: Photosynthesis** • Photosynthesis converts light energy to the chemical energy of food. • The light reactions convert solar energy to the chemical energy of ATP and NADPH. • The Calvin cycle uses ATP and NADPH to convert CO2 to sugar. • Alternative mechanisms of carbon fixation have evolved in hot, arid climates.	**AP Biology Lab #2: Enzyme Catalysis** Investigating Enzyme Reaction Rates Activity **AP Biology Lab #4: Plant Pigments and Photosynthesis** **AP Biology Lab #5: Cell Respiration**
<u>Unit 4: Heredity</u> **Chapter 12: The Cell Cycle** • Cell division results in genetically identical daughter cells. • The mitotic phase alternates with interphase in the cell cycle.	**AP Biology Lab #3: Mitosis and Meiosis** NOVA Cancer Warrior Video and Activity Genetics Problems

• The eukaryotic cell cycle is regulated by a molecular control system. **Chapter 13: Meiosis and Sexual Life Cycles** • Offspring acquire genes from their parents by inheriting chromosomes. • Fertilization and meiosis alternate in sexual life cycles. • Meiosis reduces the number of chromosome sets from diploid to haploid. • Genetic variation produced in sexual life cycles contributes to evolution. **Chapter 14: Mendel and the Gene Idea** • Mendel used the scientific approach to identify two laws of inheritance. • The laws of probability govern Mendelian inheritance. • Inheritance patterns are often more complex than predicted by simple Mendelian genetics. • Many human traits follow Mendelian patterns of inheritance. **Chapter 15: The Chromosomal Basis of Inheritance** • Mendelian inheritance has its physical basis in the behavior of chromosomes. • Sex-linked genes exhibit unique patterns of inheritance. • Linked genes tend to be inherited together because they are located near each other on the same chromosome. • Alterations of chromosome number or structure cause some genetic disorders. • Some inheritance patterns are exceptions to the standard chromosome theory.	Genetics & Inheritance Activity Heredity in Families Activity (Pedigrees) Chi Square Activities **AP Biology Lab #7: Genetics of Organisms**
<u>Unit 5: Molecular Genetics</u> **Chapter 16: The Molecular Basis of Inheritance** • DNA is the genetic material. • Many proteins work together in DNA replication and repair. • A chromosome consists of a DNA molecule packed together with proteins. **Chapter 17: From Gene to Protein** • Genes specify proteins via transcription and translation.	Genome Replication Activity Protein Synthesis Activity **AP Biology Lab #6: Molecular Biology – Part A** Gene Regulation Activity

• Transcription is the DNA-directed synthesis of RNA: a closer look. • Eukaryotic cells modify RNA after transcription. • Translation is the RNA-directed synthesis of a polypeptide: a closer look. • Point mutations can affect protein structure and function. • While gene expression differs among the domains of life, the concept of a gene is universal. **Chapter 18: Regulation of Gene Expression** • Bacteria often respond to environmental change by regulating transcription. • Eukaryotic gene expression can be regulated at any stage. • Noncoding RNAs play multiple roles in controlling gene expression. • A program of differential gene expression leads to the different cell types in a multicellular organism. • Cancer results from genetic changes that affect cell cycle control.	
<u>Unit 6: Biotechnology</u> **Chapter 19: Viruses** • A virus consists of a nucleic acid surrounded by a protein coat. • Viruses reproduce only in host cells. • Viruses, viroids, and prions are formidable pathogens in animals and plants. **Chapter 20: Biotechnology** • DNA cloning yields multiple copies of a gene or other DNA segment. • DNA technology allows us to study the sequence, expression, and function of a gene. • Cloning organisms may lead to the production of stem cells for research and other applications. • The practical applications of DNA technology affect our lives in many ways. **Chapter 21: Genomes and Their Evolution** • New approaches have accelerated the pace of genome sequencing. • Scientists use bioinformatics to analyze genomes and their functions.	Sam Rhine Genetics Update Conference and Assignment (dependent on availability and funding) Restriction Enzyme Activities Sickle Cell Anemia Activity **AP Biology Lab #6: Molecular Biology – Part B**

• Genomes vary in size, number of genes, and gene density. • Multicellular eukaryotes have much noncoding DNA and many multigene families. • Duplication, rearrangement, and mutation of DNA contribute to genome evolution. • Comparing genome sequences provides clues to evolution and development.	
<u>Unit 7: Evolutionary Biology</u> **Chapter 22: Descent with Modification- A Darwinian View of Life** • The Darwinian revolution challenged traditional views of a young Earth inhabited by unchanging species. • Descent with modification by natural selection explains the adaptations of organisms and the unity and diversity of life. • Evolution is supported by an overwhelming amount of scientific evidence. **Chapter 23: The Evolution of Populations** • Mutation and sexual reproduction produce the genetic variation that makes evolution possible. • The Hardy-Weinberg equation can be used to test whether a population is evolving. • Natural selection, genetic drift, and gene flow can alter allele frequencies in a population. • Natural selection is the only mechanism that consistently causes adaptive evolution. **Chapter 24: The Origin of Species** • The biological species concept emphasizes reproductive isolation. • Speciation can take place with or without geographic separation. • Hybrid zones provide opportunities to study factors that cause reproductive isolation. • Speciation can occur rapidly or slowly and can result from changes in few or many genes. **Chapter 25: The History of Life on Earth** • Conditions on early Earth made the origin of life possible. • The fossil record documents the history of life. • Key events in life's history include the origins of single-	Biochemical Evidence Activity **AP Biology Lab #8: Population Genetics and Evolution** Hardy-Weinburg Problems Birth of the Earth Video and Activity Natural Selection Activity Phylogenetic Tree Activity

celled and multicelled organisms and the colonization of land. • The rise and fall of dominant groups reflect continental drift, mass extinctions, and adaptive radiations. • Major changes in body form can result from changes in the sequence and regulation of developmental genes. • Evolution is not goal oriented. **Chapter 26: Phylogeny and the Tree of Life** • Phylogenies show evolutionary relationships. • Phylogenies are inferred from morphological and molecular data. • Shared characters are used to construct phylogenetic trees. • An organism's evolutionary history is documented in its genome. • Molecular clocks help track evolutionary time. • New information continues to revise our understanding of the tree of life.	
<u>Unit 8: Diversity of Organisms</u> **Chapter 27: Bacteria and Archaea** • Structural and functional adaptations contribute to prokaryotic success. • Rapid reproduction, mutation, and genetic recombination promote genetic diversity in prokaryotes. • A great diversity of nutritional and metabolic adaptations have evolved in prokaryotes. • Molecular systematics is illuminating prokaryotic phylogeny. • Prokaryotes play crucial roles in the biosphere. • Prokaryotes have both harmful and beneficial impacts on humans. **Chapter 28: Protists** • Most eukaryotes are single-celled organisms. • Excavates include protists with modified mitochondria and protists with unique flagella. • Chromalveolates may have originated by secondary endosymbiosis. • Rhizaria are a diverse group of protists defined by DNA similarities. • Red algae and green algae are the closest relatives of	Term Project (Term 4)

land plants. • Unikonts include protists that are closely related to fungi and animals. • Protists play key roles in ecological relationships. **Chapter 31: Fungi** • Fungi are heterotrophs that feed by absorption. • Fungi produce spores through sexual or asexual life cycles. • Fungi descended from an aquatic, single-celled, flagellated protist. • Fungi have radiated into a diverse set of lineages. • Fungi play key roles in nutrient cycling, ecological interactions, and human welfare. **Chapter 32: An Introduction to Animal Diversity** • Animals are multicellular, heterotrophic eukaryotes with tissues that develop from embryonic layers. • The history of animals spans more than half a billion years. • Animals can be characterized by their “body plans.” • New views of animal phylogeny are emerging from molecular data. **Chapter 33: Invertebrates** • Sponges are basal animals that lack true tissues. • Cnidarians are an ancient phylum of eumetazoans. • Lophotrochozoans, a clade identified by molecular data, have the widest range of animal body forms. • Ecdysozoans are the most species-rich group. • Echinoderms and chordates are deuterostomes. **Chapter 34: Vertebrates** • Chordates have a notochord and a dorsal, hollow nerve cord. • Craniates are chordates that have a head. • Vertebrates are craniates that have a backbone. • Gnathostomes are vertebrates that have jaws. • Tetrapods are gnathostomes that have limbs. • Amniotes are tetrapods that have a terrestrially adapted egg. • Mammals are amniotes that have hair and produce milk. • Humans are mammals that have a large brain and bipedal locomotion.	

<u>Unit 9: Structure and Function of Plants</u> **Chapter 29: Plant Diversity I- How Plants Colonized Land** • Land plants evolved from green algae. • Mosses and other nonvascular plants have life cycles dominated by gametophytes. • Ferns and other seedless vascular plants were the first plants to grow tall. **Chapter 30: Plant Diversity II- The Evolution of Seed Plants** • Seeds and pollen grains are key adaptations for life on land. • Gymnosperms bear "naked" seeds, typically on cones. • The reproductive adaptations of angiosperms include flowers and fruits. Human welfare depends greatly on seed plants. **Chapter 35: Plant Structure, Growth, and Development** • The plant body has a hierarchy of organs, tissues, and cells. • Meristems generate cells for new organs. • Primary growth lengthens roots and shoots. • Secondary growth adds girth to stems and roots in woody plants. • Growth, morphogenesis, and differentiation produce the plant body. **Chapter 36: Resource Acquisition and Transport in Vascular Plants** • Land plants acquire resources from both above- and below-ground. • Transport occurs by short-distance diffusion or active transport and by long-distance bulk flow. • Water and minerals are transported from roots to shoots. • Stomata help regulate the rate of transpiration. • Sugars are transported from leaves and other sources to sites of use or storage. • The symplasm is highly dynamic. **Chapter 37: Soil and Plant Nutrition** • Soil is a living, finite resource. • Plants require essential elements to complete their life	Term Projects (Terms 1-3) **AP Biology Lab #9: Transpiration**

cycles. • Plant nutrition often involves relationships with other organisms. **Chapter 38: Angiosperm Reproduction and Biotechnology** • Flowers, double fertilization, and fruits are unique features of the angiosperm life cycle. • Plant reproduce sexually, asexually, or both. • Humans modify crops by breeding and genetic engineering. **Chapter 39: Plant Responses to Internal and External Signals** • Signal transduction pathways link signal reception to response. • Plant hormones help coordinate growth, development, and responses to stimuli. • Responses to light are critical for plant success. • Plants respond to a wide variety of stimuli other than light. • Plants respond to attacks by herbivores and pathogens.	
<u>Unit 10: Animal Structure and Function – Part I</u> **Chapter 40: Basic Principles of Animal Form and Function** • Animal form and function are correlated at all levels of organization. • Feedback control loops maintain the internal environment in many animals. • Homeostatic processes for thermoregulation involve form, function, and behavior. • Energy requirements are related to animal size, activity, and environment. **Chapter 41: Animal Nutrition** • An animal's diet must supply chemical energy, organic molecules, and essential nutrients. • The main stages of food processing are ingestion, digestion, absorption, and elimination. • Organs specialized for successive stages of food processing form the mammalian digestive system. • Evolutionary adaptations of vertebrate digestive systems correlate with diet.	Sheep Heart & Kidney Dissection Fetal Pig Dissection **AP Biology Lab #10: Physiology of the Circulatory System**

• Homeostatic mechanisms contribute to an animal's energy balance. **Chapter 42: Circulation and Gas Exchange** • Circulatory systems enable exchange at a distance. • Coordinated cycles of heart contraction drive double circulation in mammals. • Blood pressure and flow reflect the structure and arrangement of blood vessels. • Blood components mediate exchange, transport, and defense. • Gas exchange occurs across specialized respiratory surfaces. • Breathing ventilates the lungs. • Adaptations for gas exchange include pigments that bind and transport gases. **Chapter 43: The Immune System** • In innate immunity, recognition and response rely on shared pathogen traits. • In acquired immunity, lymphocyte receptors provide pathogen-specific recognition. • Acquired immunity defends against infection of body cells and fluids. • Disruptions in immune system function can elicit or exacerbate disease. **Chapter 44: Osmoregulation and Excretion** • Osmoregulation balances uptake and loss of water and solutes. • An animal's nitrogenous wastes reflect its phylogeny and habitat. • Diverse excretory systems are variations on a tubular theme. • The nephron is organized for stepwise processing of blood filtrate. • Hormonal circuits link kidney function, water balance, and blood pressure. **Chapter 45: Hormones and the Endocrine System** • Hormones and other chemical signals bind to target receptors, triggering specific response pathways. • Negative feedback and antagonistic hormone pairs are common features of the endocrine system. • The endocrine and nervous systems act individually and together to regulate an animal's physiology.	

• Endocrine glands respond to diverse stimuli in regulating metabolism, homeostasis, development, and behavior. **Chapter 46: Animal Reproduction** • Both asexual and sexual reproduction occur in the animal kingdom. • Mechanisms for fertilization bring together sperm and eggs of the same species. • Reproductive organs produce and transport gametes. • The timing and pattern of meiosis in mammals differ for males and females. • The interplay of tropic and sex hormones regulates mammalian reproduction. • In placental mammals, an embryo develops fully within the mother's uterus. **Chapter 47: Animal Development** • After fertilization, embryonic development proceeds through cleavage, gastrulation, and organogenesis. • Morphogenesis in animals involves specific changes in cell shape, position, and adhesion. • The developmental fate of cells depends on their history and on inductive signals.	
<u>Unit 11: Animal Structure and Function – Part II</u> **Chapter 48: Neurons, Synapses, and Signaling** • Neuron organization and structure reflect function in information transfer. • Ion pumps and ion channels maintain the resting potential of a neuron. • Action potentials are the signals conducted by axons. • Neurons communicate with other cells at synapses. **Chapter 49: Nervous Systems** • Nervous systems consist of circuits of neurons and supporting cells. • The vertebrate brain is regionally specialized. • The cerebral cortex controls voluntary movement and cognitive functions. • Changes in synaptic connections underlie memory and learning. • Nervous system disorders can be understood in molecular terms.	Sheep Brain & Eye Dissection **AP Biology Lab #11: Animal Behavior**

Chapter 50: Sensory and Motor Mechanisms • Sensory receptors transduce stimulus energy and transmit signals to the central nervous system. • The mechanoreceptors responsible for hearing and equilibrium detect moving fluid or settling particles. • The senses of taste and smell rely on similar sets of sensory receptors. • Similar mechanisms underlie vision throughout the animal kingdom. • The physical interaction of protein filaments is required for muscle function. • Skeletal systems transform muscle contraction into locomotion. **Chapter 51: Animal Behavior** • A discrete sensory input is the stimulus for a wide range of animal behaviors. • Learning establishes specific links between experience and behavior. • Genetic makeup and environment both contribute to the development of behavior. • Selection for individual survival and reproductive success can explain most behaviors. • Inclusive fitness can account for the evolution of altruistic social behavior.	
<u>Unit 12: Ecology</u> **Chapter 52: An Introduction to Ecology and the Biosphere** • Ecology integrates all areas of biological research and informs environmental decision making. • Interactions between organisms and the environment limit the distribution of species. • Aquatic biomes are diverse and dynamic systems that cover most of Earth. • The structure and distribution of terrestrial biomes are controlled by climate and disturbance. **Chapter 53: Population Ecology** • Dynamic biological processes influence population density, dispersion, and demographics. • Life history traits are products of natural selection. • The exponential model describes population growth in an idealized, unlimited environment. • The logistic growth model describes how a population	Population Ecology Activity **AP Biology Lab # 12: Dissolved Oxygen and Aquatic Primary Productivity**

grows more slowly as it nears its carrying capacity. • Many factors that regulate population growth are density-dependent. • The human population is no longer growing exponentially, but it is still increasing rapidly. **Chapter 54: Community Ecology** • Community interactions are classified by whether they help, harm, or have no effect on the species involved. • Dominant and keystone species exert strong controls on community structure. • Disturbance influences species diversity and composition. • Biogeographic factors affect community biodiversity. • Community ecology is useful for understanding pathogen life cycles and controlling human disease. **Chapter 55: Ecosystems** • Physical laws govern energy flow and chemical cycling in ecosystems. • Energy and other limiting factors control primary production in ecosystems. • Energy transfer between trophic levels is typically only 10% efficient. • Biological and geologic processes cycle nutrients between organic and inorganic parts of an ecosystem. • Human activities now dominate most chemical cycles on Earth. **Chapter 56: Conservation Biology and Restoration Ecology** • Human activities threaten Earth's biodiversity. • Population conservation focuses on population size, genetic diversity, and critical habitat. • Landscape ecology and regional conservation aim to sustain entire biotas. • Restoration ecology attempts to restore degraded ecosystems to a more natural state. • Sustainable development seeks to improve the human condition while conserving biodiversity.	
Review for the Advanced Placement Biology Exam **Final Project**	