AP Biology

Curriculum Guide

Dunmore School District

Dunmore, PA

AP Biology

Prerequisite:

- Successful Completion of Biology

AP Biology is an introductory college-level biology course. Students cultivate their understanding of biology through inquiry-based investigations as they explore the following topics: evolution, cellular processes — energy and communication, genetics, information transfer, ecology, and interactions.

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Year-at-a-glance

Subject: AP Biology	**Grade Level: 11**	**Date Completed: 4/24/2018**

1st Quarter

Topic	**Resources**	**Standards/Enduring Understanding**
Introduction to Evolution and the Foundations of Biology	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 1	1.A.1, 1.A.2, 1.A.3,1.A.4, 1.B.1, 1.B.2, 1.C.3
Evolution: Descent with Modification	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 19	1.A.1, 1.A.3, 1.A.4, 1.B.2, 1.C.3,1.D.1, 1.D.2
Phylogeny	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 20	1.A.1, 1.A.2, 1.B.1, 1.B.2, 1.C.3,
The Evolution of Populations	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 21	1.A.1, 1.A.2, 1.A.3, 1.A.4, 1.B.1, 1.C.3

2nd Quarter

Topic	Resources	Standards/Enduring Understanding
The Chemical Context of Life	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 2	4.A.1, 1.C.3, 2.A.3,
Carbon and the Molecular Diversity of Life	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 3	4.A.1, 4.A.2, 4.B.1, 3.A.3, 2.A.3, 2.A.2
A Tour of the Cell	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 4	4.C.1, 1.B.1, 2.A.1, 2.A.2, 2.A.3, 2.B.1, 2.B.3, 2.C.1, 3.A.1, 3.D.2
The Internal Environment of Animals	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 32	1.A.1, 1.B.1, 2.A.3, 2.B.1, 2.B.2, 2.C.1, 2.C.2, 2.D.1, 2.D.2, 2.D.3, 2.E.1, 3.E.2, 4.A.3, 4.B.2

3rd Quarter

Topic	Resources	Standards/Enduring Understanding
Neurons, Synapses and Signaling	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 5, 37	1.A.2, 2.E.2, 3.D.1, 3.D.2, 3.E.2, 1.B.1, 2.B.1, 2.B.2
Introduction to Metabolism	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 6	2.A.1, 4.B.1
Cellular Respiration and Fermentation/Photosynthesis	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 7, 8	2.A.2
Cell Cycle, Meiosis, Mendel and the Gene Idea	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 9, 10, 11	3.A.1, 3.A.3, 3.A.4, 3.C.1, 3.C.2

4th Quarter

Topic	Resources	Standards/Enduring Understanding
Chromosomal Inheritance and Gene Expression	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 12, 13, 14	3.A.1, 3.A.3, 3.A.4, 3.B.1, 3.B.2, 3.C.1, 3.C.2, 3.C.3
Ecology, Ecosystems and Energy	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 40-43	1.C.2, 1.C.3, 2.A.1, 2.A.2, 2.A.3, 2.D.1, 2.D.2, 4.A.5, 4.A.6, 4.B.3, 4.B.4, 4.C.3, 4.C.4
AP Exam Review	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 1-15, 19-21, 32, 37, 40-43	
Animal Nutrition/Final Exam	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 33	2.C.1, 4.B.1, 4.B.2

General Topic	AP Standards	Learning Objective, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Big Idea 1: The Process of Evolution Drives the Diversity and Unity of Life **Enduring Understanding:** 1.A: Change in the genetic makeup of a population over time is evolution	**Essential Knowledge:** 1.A.1: Natural selection is a major mechanism of evolution. 1.A.2: Natural selection acts on phenotypic variations in populations. 1.A.3: Evolutionary change is also driven by random processes 1.A.4: Biological evolution is supported by scientific evidence from many disciplines, including mathematics.	**Learning Objective:** The student is able to evaluate evidence provided by data to qualitatively and quantitatively investigate the role of natural selection in evolution. The student is able to use data from mathematical models based on the Hardy-Weinberg equilibrium to analyze genetic drift and effects of selection in the evolution of specific populations. The student is able to make predictions about the effects of genetic drift, migration and artificial selection on the genetic makeup of a population. The student is able to connect scientific evidence from many scientific disciplines to support the modern concept of evolution.	**Approved textbook** Campbell: *Biology in Focus: AP 2nd Edition*, Chapters 1, 19, 20, 21	**Teacher prepared tests, quizzes, etc.** **Series available assessments online. (Optional)**	**35**

1.B: Organisms are linked by lines of descent from common ancestry	1.B.1: Organisms share many conserved core processes and features that evolved and are widely distributed among organisms today. 1.B.2: Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested.	The student is able to describe specific examples of conserved core biological processes and features shared by all domains or within one domain of life, and how these shared, conserved core processes and features support the concept of common ancestry for all organisms. The student is able to evaluate evidence provided by a data set in conjunction with a phylogenetic tree or a simple cladogram to determine evolutionary history and speciation.			
1.C: Life continues to evolve within a changing environment	1.C.1: Speciation and extinction have occurred throughout the Earth's history. 1.C.2: Speciation may occur when two populations become reproductively isolated from each other. 1.C.3: Populations of organisms continue to evolve.	The student is able to analyze data related to questions of speciation and extinction throughout the Earth's history. The student is able to use data from a real or simulated population(s), based on graphs or models of types of selection, to predict what will happen to the population in the future. The student is able to			

1.D: The origin of living systems is explained by natural processes	1.D.1: There are several hypotheses about the natural origin of life on Earth, each with supporting scientific evidence. 1.D.2: Scientific evidence from many different disciplines supports models of the origin of life.	describe a model that represents evolution within a population. The student is able to evaluate the accuracy and legitimacy of data to answer scientific questions about the origin of life on Earth. The student is able to justify the selection of geological, physical, and chemical data that reveal early Earth conditions. **Vocabulary:** Evolution Biology Emergent properties Systems biology Biosphere Ecosystems Communities Population Organism Eukaryotic cell Prokaryotic cell Organs Tissue Cell Organelle Molecule DNA			

		Genes Gene expression Genome Genomics Proteomics Bioinformatics Climate change Bacteria Archaea Eukarya Inductive reasoning Deductive reasoning Hypothesis Experiment Controlled experiment Variables Independent variable Dependent variable Theory Paleontology Natural selection Artificial selection Homologous structures Vestigial structures Convergent evolution Analogous structures Endemic Phylogeny Systematics Binomial Genus Sister taxa Homoplasies Cladistics			

		Maximum parsimony Molecular clock Horizontal gene transfer Microevolution Genetic variation Gene pool Hardy-Weinberg Gene flow Genetic drift Founder effect Bottleneck Relative fitness Directional selection Disruptive selection Stabilizing selection Heterozygote advantage			

General Topic	AP Standards	Learning Objective, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis. **Enduring Understanding:** 2.A: Growth, reproduction and maintenance of the organization of living systems require free energy and matter.	**Essential Knowledge:** 2.A.1: All living systems require constant input of free energy. 2.A.2: Organisms capture and store free energy for use in biological processes. 2.A.3: Organisms must exchange matter with the environment to grow, reproduce and maintain organization.	**Learning Objective:** The student is able to explain how biological systems use free energy based on empirical data that all organisms require constant energy input to maintain organization, to grow and to reproduce. The student is able to predict how changes in free energy availability affect organisms, populations and ecosystems. The student is able to represent graphically or model quantitatively the exchange of molecules between an organism and its environment, and the subsequent use of these molecules to build new molecules that facilitate dynamic homeostasis, growth and reproduction.	Campbell: *Biology in Focus: AP 2nd Edition* Chapter 2, 3, 4, 32	**Teacher prepared tests, quizzes, etc.** **Series available assessments online. (Optional)**	**35**

2.B: Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.	2.B.1: Cell membranes are selectively permeable due to their structure. 2.B.2: Growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes. 2.B.3: Eukaryotic cells maintain internal membranes that partition the cell into specialized regions.	The student is able to use representations and models to pose scientific questions about the properties of cell membranes and selective permeability based on molecular structure. The student is able to use representations and models to analyze situations or solve problems qualitatively and quantitatively to investigate whether dynamic homeostasis is maintained by the active movement of molecules across membrane. The student is able to explain how internal membranes and organelles contribute to cell functions.			
2.C: Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis.	2.C.1: Organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes. 2.C.2: Organisms respond to changes in their external environments.	The student is able to connect how organisms use negative feedback to maintain their internal environments. The student is able to justify the selection of the kind of data needed to answer scientific questions about the			

		relevant mechanism that organisms use to respond to changes in their external environment.			
2.D: Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment	2.D.1: All biological systems from cells and organisms to populations, communities and ecosystems are affected by complex biotic and abiotic interactions involving exchange of matter and free energy. 2.D.2: Homeostatic mechanisms reflect both common ancestry and divergence due to adaptation in different environments. 2.D.3: Biological systems are affected by disruptions to their dynamic homeostasis. 2.D.4: Plants and animals have a variety of chemical defenses against infections that affect dynamic homeostasis.	The student is able to refine scientific models and questions about the effect of complex biotic and abiotic interactions on all biological systems, from cells and organisms to populations, communities and ecosystems. The student can construct explanations based on scientific evidence that homeostatic mechanisms reflect continuity due to common ancestry and/or divergence due to adaptation in different environments. The student is able to use representations or models to analyze quantitatively and qualitatively the effects of disruptions to dynamic homeostasis in biological systems. The student can create representations or models to			

		describe nonspecific immune defenses in plants and animals.			
2.E: Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.	2.E.1: Timing and coordination of specific events are necessary for the normal development of an organism, and these events are regulated by a variety of mechanisms. 2.E.2: Timing and coordination of physiological events are regulated by multiple mechanisms. 2.E.3: Timing and coordination of behavior are regulated by various mechanisms and are important in natural selection.	The student can connect concepts in and across domains to show that timing and coordination of specific events are necessary for normal development in an organism and that these events are regulated by multiple mechanisms. The student is able to design a plan for collecting data to support the scientific claim that the timing and coordination of physiological events involve regulation. The student is able to justify scientific claims, using evidence, to describe how timing and coordination of behavioral events in organisms are regulated by several mechanisms. **Vocabulary:** Matter Compound Element Atom Neutrons			

		Protons Electrons Atomic nucleus Atomic number Mass number Isotopes Potential energy Valence shell Covalent bond Molecule Electronegativity Non-polar Polar Ion Ionic compounds Hydrogen bond Reactants Products Cohesion Adhesion Specific heat Solvent solute Hydrophobic Hydrophilic pH Organic compound Hydrocarbons Isomer ATP Dehydration reaction Hydrolysis reaction Polymer Polysaccharides Cellulose			

		Chitin Lipids Steroids Catalyst Protein Denaturation Nucleic acids Organelles Chromosomes Endomembrane Phagocytosis Endosymbiont Motor proteins Physiology Endocrine system Hormone Hypothalamus Negative feedback Positive feedback Pituitary gland Adrenal glands Neuroendocrine signaling ADH TSH Conformer Osmoregulation Nephrons Glomerulus aquaporin			

General Topic	AP Standards	Learning Objective, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Big Idea 3: Living systems store, retrieve, transmit and respond to information essential to life processes. **Enduring Understanding:** 3.A: Heritable information provides for continuity of life.	**Essential Knowledge:** 3.A.1: DNA, and in some cases RNA, is the primary source of heritable information. 3.A.2: In eukaryotes, heritable information is passed to the next generation via processes that include the cell cycle and mitosis or meiosis plus fertilization. 3.A.3: The chromosomal basis of inheritance provides an understanding of the pattern of passage (transmission) of genes from parent to offspring. 3.A.4: The inheritance pattern of many traits cannot be explained by simple Mendelian genetics.	**Learning Objective:** The student is able to construct scientific explanations that use the structures and mechanisms of DNA and RNA to support the claim that DNA and, in some cases, that RNA are the primary sources of heritable information. The student is able to describe representations and models illustrating how genetic information is translated into polypeptides. The student is able to construct an explanation, using visual representations or narratives, as to how DNA in chromosomes is transmitted to the next generation via mitosis, or meiosis followed by fertilization. The student is able to apply mathematical routines to determine Mendelian patterns of inheritance provided by data sets.	**Approved textbook** Campbell: *Biology in Focus: AP 2nd Edition* Chapters 5,9-14	**Teacher prepared tests, quizzes, etc.** **Series available assessments online. (Optional)**	**35**

		The student is able to explain how the inheritance patterns of many traits cannot be accounted for by Mendelian genetics.			
3.B: Expression of genetic information involves cellular and molecular mechanisms.	3.B.1: Gene regulation results in differential gene expression, leading to cell specialization. 3.B.2: A variety of intercellular and intracellular signal transmissions mediate gene expression.	The student is able to describe the connection between the regulation of gene expression and observed differences between different kinds of organisms. The student is able to explain how the regulation of gene expression is essential for the processes and structures that support efficient cell function. The student is able to explain how signal pathways mediate gene expression, including how this process can affect protein production.			
3.C: The processing of genetic information is imperfect and is a source of genetic variation.	3.C.1: Changes in genotype can result in changes in phenotype. 3.C.2: Biological systems have multiple processes that increase genetic variation. 3.C.3: Viral replication results in genetic variation, and viral	The student is able to predict how a change in genotype, when expressed as a phenotype, provides a variation that can be subject to natural selection. The student is able to			

	infection can introduce genetic variation into the hosts.	compare and contrast processes by which genetic variation is produced and maintained in organisms from multiple domains The student is able to use representations and appropriate models to describe how viral replication introduces genetic variation in the viral population.			
3.D: Cells communicate by generating, transmitting and receiving chemical signals.	3.D.1: Cell communication processes share common features that reflect a shared evolutionary history. 3.D.2: Cells communicate with each other through direct contact with other cells or from a distance via chemical signaling. 3.D.3: Signal transduction pathways link signal reception with cellular response.	The student is able to describe basic chemical processes for cell communication shared across evolutionary lines of descent. The student is able to create representation(s) that depict how cell-to-cell communication occurs by direct contact or from a distance through chemical signaling. The student is able to describe a model that expresses the key elements of signal transduction pathways by which a signal is converted to a cellular response. The student is able to			

3.E: Transmission of information results in changes within and between biological systems.	3.E.1: Individuals can act on information and communicate it to others. 3.E.2: Animals have nervous systems that detect external and internal signals, transmit and integrate information, and produce responses.	describe a model that expresses key elements to show how change in signal transduction can alter cellular response. The student is able to create a representation that describes how organisms exchange information in response to internal changes and external cues, and which can result in changes in behavior. The student is able to construct an explanation, based on scientific theories and models, about how nervous systems detect external and internal signals, transmit and integrate information, and produce responses. **Vocabulary:** Integral proteins Peripheral proteins Glycolipids Glycoproteins Diffusion Concentration gradient Hypertonic Hypotonic			

		Isotonic Ion channels Gated channels Membrane potential Proton pump Reception Transduction Ligand GPCR G protein Cyclic AMP cell cycle Chromatin Chromosome Gametes Sister chromatids Mitosis Cytokinesis Interphase G1 S G2 G0 Centrosome Kinetochore Aster Prophase Prometaphase Metaphase Anaphase Telophase Cleavage furrow Binary fission Cell plate PDGF Density-dependent inhibition Benign tumor			

		Malignant tumor Genetics Heredity Genes Somatic cells Locus Karyotype Homologs Sex chromosomes Autosomes Diploid Haploid Zygote Meiosis Crossing over Synapsis Recombinants True breeding Hybridization Alleles Segregation Dominant allele Recessive allele Homozygous Heterozygous Genotype Phenotype Testcross Independent assortment Addition rule Incomplete dominance Co-dominant Multiple allele Pleiotropy			

		Epistasis Polygenic Multifactorial Pedigree Chromosome Theory of Inheritance Sex-linked genes X-linked Barr body Hemophilia Linkage map Cytogenetic maps Nondisjunction Monosomic Trisomy Polyploidy Deletion Inversion Translocation Down Syndrome aneuploidy			

General Topic	AP Standards	Learning Objective, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties. **Enduring Understanding:** 4.A: Interactions within biological systems lead to complex properties.	**Essential Knowledge:** 4.A.1: The subcomponents of biological molecules and their sequence determine the properties of that molecule. 4.A.2: The structure and function of subcellular components, and their interactions, provide essential cellular processes. 4.A.3: Interactions between external stimuli and regulated gene expression result in specialization of cells, tissues and organs. 4.A.4: Organisms exhibit complex properties due to interactions between their constituent parts. 4.A.5: Communities are composed of populations of organisms that interact in complex ways. 4.A.6: Interactions among living systems and with their environment result in the movement of matter and energy.	**Learning Objective:** The student is able to explain the connection between the sequence and the subcomponents of a biological polymer and its properties. The student is able to use representations and models to analyze situations qualitatively to describe how interactions of subcellular structures, which possess specialized functions, provide essential functions. The student is able to evaluate scientific questions concerning organisms that exhibit complex properties due to the interaction of their constituent parts. The student is able to predict the effects of a change in a component(s) of a biological system on the functionality of an organism(s). The student is able to apply mathematical routines to	**Approved textbook** Campbell: *Biology in Focus: AP 2nd Edition* Chapters 2, 4, 32, 40-43	**Teacher prepared tests, quizzes, etc.** **Series available assessments online. (Optional)**	**35**

		quantities that describe communities composed of populations of organisms that interact in complex ways. The student is able to use visual representations to analyze situations or solve problems qualitatively to illustrate how interactions among living systems and with their environment result in the movement of matter and energy.			
4.B: Competition and cooperation are important aspects of biological systems.	4.B.1: Interactions between molecules affect their structure and function. 4.B.2: Cooperative interactions within organisms promote efficiency in the use of energy and matter. 4.B.3: Interactions between and within populations influence patterns of species distribution and abundance. 4.B.4: Distribution of local and global ecosystems changes over time.	The student is able to analyze data to identify how molecular interactions affect structure and function. The student is able to use representations and models to analyze how cooperative interactions within organisms promote efficiency in the use of energy and matter. The student is able to use data analysis to refine observations and measurements regarding the effect of population interactions on patterns of species distribution and abundance.			

4.C: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.	4.C.1: Variation in molecular units provides cells with a wider range of functions. 4.C.2: Environmental factors influence the expression of the genotype in an organism. 4.C.3: The level of variation in a population affects population dynamics. 4.C.4: The diversity of species within an ecosystem may influence the stability of the ecosystem.	The student is able to construct explanations based on evidence of how variation in molecular units provides cells with a wider range of functions. The student is able to construct explanations of the influence of environmental factors on the phenotype of an organism. The student is able to use theories and models to make scientific claims and/ or predictions about the effects of variation within populations on survival and fitness. The student is able to make scientific claims and predictions about how species diversity within an ecosystem influences ecosystem stability. **Vocabulary:** Mutualistic adaptations Metabolic rate Insulin glucagon Ecology Abiotic Biotic Community			

		Biomes Climograph Photic zone Pelagic zone Oligotrophic Eutrophic Salinity Dispersion Immigration Emigration Survivorship curve Exponential growth Logistic growth Carrying capacity Population dynamics Interspecific Intraspecific Niche Character displacement Exploitation Predation Mimicry Herbivory Parasitism Mutualism Commensalism Species diversity Invasive species Trophic structure Food web Keystone species Ecological succession Limiting nutrient Nutrient cycling			

General Topic	AP Standards	Learning Objective, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Review for AP Exam	**Essential Knowledge:** All topics	**Learning Objective:** Pass AP exam	**Approved textbook** Campbell: *Biology in Focus: AP 2nd Edition* Chapter 1-15, 19-21, 32, 37, 40-43	**Teacher prepared tests, quizzes, etc.** **Series available assessments online. (Optional)**	**25**

General Topic	AP Standards	Learning Objective, Skills & Vocabulary	Resources & Activities	Assessments	Suggested Time (In Days)
Animal Nutrition and Final Exam	**Essential Knowledge:** 2.C.1: Organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes.	**Learning Objective:** The student is able to evaluate data that show the effect(s) of changes in concentrations of key molecules on negative feedback mechanisms. The student is able to justify the selection of the kind of data needed to answer scientific questions about the relevant mechanism that organisms use to respond to changes in their external environment.	**Approved textbook** Campbell: *Biology in Focus: AP 2nd Edition* Chapter 33	**Teacher prepared tests, quizzes, etc.** **Series available assessments online. (Optional)**	**15**
	4.B.1: Interactions between molecules affect their structure and function.	The student is able to analyze data to identify how molecular interactions affect structure and function.			
	4.B.2: Cooperative interactions within organisms promote efficiency in the use of energy and matter.	The student is able to use representations and models to analyze how cooperative interactions within organisms promote efficiency in the use of energy and matter.			

		Vocabulary: Herbivores Carnivores Nutrition Omnivores Essential nutrients Vitamins Minerals Deficiencies Ingestion Digestion Absorption Elimination Enzymatic hydrolysis Gastrovascular cavity Alimentary canal Mucus Esophagus Bolus Pepsin protease Bile Feces			