**AP Biology Syllabus 2013-14 Text: Biology AP 8th Ed**

**Campbell/Reese 2008**

**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.

Campbell 8th Ed.

Ch 22, 23

Lab: Hardy Weinberg Lab

a. According to Darwin’s theory of natural selection, competition for limited resources results in differential survival. Individuals with more favorable phenotypes are more likely to survive and produce more offspring, thus passing traits to subsequent generations.

b. Evolutionary fitness is measured by reproductive success.

c. Genetic variation and mutation play roles in natural selection. A diverse gene pool is important for the survival of a species in a changing environment.

d. Environments can be more or less stable or fluctuating, and this affects evolutionary rate and direction; different genetic variations can be selected in each generation.

e. An adaptation is a genetic variation that is favored by selection and is manifested as a trait that provides an advantage to an organism in a particular environment.

f. In addition to natural selection, chance and random events can influence the evolutionary process, especially for small

g. Conditions for a population or an allele to be in Hardy-Weinberg equilibrium are: (1) a large population size, (2) absence of migration, (3) no net mutations, (4) random mating and (5) absence of selection. These conditions are seldom met.

h. Mathematical approaches are used to calculate changes in allele frequency, providing evidence for the occurrence of evolution in a population

**Essential knowledge 1.A.2**: Natural selection acts on

phenotypic variations in populations.

a. Environments change and act as selective mechanism on populations.

Campbell 8th Ed

Ch 23

Lab: Artificial Selecton

b. Phenotypic variations are not .

c. Some phenotypic variations significantly increase or

decrease fitness of the organism and the population.

d. Humans impact variation in other species.

**Essential knowledge 1.A.3**: Evolutionary change is also driven by random processes.

a. Genetic drift is a nonselective process occurring in small populations.

b. Reduction of genetic variation within a given population can increase the differences between populations of the same species.

**Essential knowledge 1.A.4:** Biological evolution is supported by scientific evidence from many disciplines, including mathematics.

Campbell 8th Ed

Ch 22, 25

a. Scientific evidence of biological evolution uses information from geographical, geological, physical, chemical and mathematical applications.

b. Molecular, morphological and genetic information of existing and extinct organisms add to our understanding of evolution.

**Enduring understanding 1.B**: Organisms are linked by lines of descent from common ancestry.

**Essential knowledge 1.B.1**: Organisms share many conserved core processes and features that evolved and are widely distributed among organisms today.

Campbell 8th Ed

Ch 25

a. DNA and RNA are carriers of genetic information through transcription, translation and replication.

b. . Major features of the genetic code are shared by all modern living systems.

c. Metabolic pathways are conserved across all currently recognized domains.

**Essential knowledge 1.B.2**: Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested.

a.. Phylogenetic trees and cladograms can represent traits that are either derived or lost due to evolution.

Campbell 8th Ed

Ch 26

Lab: BLAST

b. Phylogenetic trees and cladograms illustrate speciation that has occurred, in that relatedness of any two groups on the tree is shown by how recently two groups had a common ancestor.

c.. Phylogenetic trees and cladograms can be constructed from morphological similarities of living or fossil species, and from DNA and protein sequence similarities, by employing computer programs that have sophisticated ways of measuring and representing relatedness among organisms.

d. Phylogenetic trees and cladograms are dynamic (i.e., phylogenetic trees and cladograms are constantly being revised), based on the biological data used, new mathematical and computational ideas, and current and emerging knowledge.

**Enduring understanding 1.C**: Life continues to evolve within a changing environment.

**Essential knowledge 1.C.1**: Speciation and extinction have occurred throughout the Earth’s history.

Cambell 8th Ed

Ch 24, 25

a. Speciation rates can vary, especially when adaptive radiation occurs when new habitats become available.

b. Species extinction rates are rapid at times of ecological stress.

**Essential knowledge 1.C.2**: Speciation may occur when two populations become reproductively isolated from each other.

a. Speciation results in diversity of life forms.

b. . New species arise from reproductive isolation over time, which can involve scales of hundreds of thousands or even millions of years, or speciation can occur rapidly through mechanisms such as polyploidy in plants.

**Essential knowledge 1.C.3**: Populations of organisms

continue to evolve.

Campbell 8th Ed

Ch 24

a. Scientific evidence supports the idea that evolution has occurred in all species.

b. Scientific evidence supports the idea that evolution continues to occur.

**Enduring understanding 1.D**: The origin of living systems is explained by natural processes.

**Essential knowledge 1.D.1**: There are several hypotheses about the natural origin of life on Earth, each with supporting scientific evidence.

Campbell 8th Ed

Ch 4, 25,

a. Primitive Earth provided inorganic precursors from which organic molecules could have been synthesized due to the presence of available free energy and the absence of a significant quantity of oxygen.

b. In turn, these molecules served as monomers or building blocks for the formation of more complex molecules, including amino acids and nucleotides.

c. The joining of these monomers produced polymers with the ability to replicate, store and transfer information.

d. These complex reaction sets could have occurred in solution (organic soup model) or as reactions on solid reactive surfaces.

e. The RNA World hypothesis proposes that RNA could have been the earliest genetic material.

**Essential knowledge 1.D.2**: Scientific evidence from many different disciplines supports models of the origin of life.

Campbell 8th Ed

Ch 26

a. Geological evidence provides support for models of the origin of life on Earth.

b. Chemical experiments have shown that it is possible to form complex organic molecules from inorganic molecules in the absence of life.

c. Molecular and genetic evidence from extant and extinct organisms indicates that all organisms on Earth share a common ancestral origin of life.

**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.

Campbell 8th Ed

Ch 8, 9, 10, 40, 51, 53, 55

a. Life requires a highly ordered system.

b. Living systems do not violate the second law of thermodynamics, which states that entropy increases over time.

c. Energy-related pathways in biological systems are sequential and may be entered at multiple points in the pathway.

d. Organisms use free energy to maintain organization, grow and reproduce.

e. Changes in free energy availability can result in changes in population size.

f. Changes in free energy availability can result in disruptions to an ecosystem.

**Essential knowledge 2.A.2**: Organisms capture and store free energy for use in biological processes.

a. Autotrophs capture free energy from physical sources in the environment.

Campbell 8th Ed

Ch 9, 10

Lab: Photosynthesis

Lab: Cell Respiration

b. Heterotrophs capture free energy present in carbon compounds produced by other organisms.

c. Different energy-capturing processes use different types of electron acceptors.

d. The light-dependent reactions of photosynthesis in

eukaryotes involve a series of coordinated reaction pathways that capture free energy present in light to yield ATP and NADPH, which power the production of organic molecules.

e. Photosynthesis first evolved in prokaryotic organisms; scientific evidence supports that prokaryotic (bacterial) photosynthesis was responsible for the production of an oxygenated atmosphere; prokaryotic photosynthetic pathways were the foundation of eukaryotic photosynthesis.

f. Cellular respiration in eukaryotes involves a series of coordinated enzyme- catalyzed reactions that harvest free energy from simple carbohydrates.

g. The electron transport chain captures free energy from electrons in a series of coupled reactions that establish an electrochemical gradient across membranes.

h. Free energy becomes available for metabolism by the conversion of ATP→ADP, which is coupled to many steps in metabolic pathways.

**Essential knowledge 2.A.3**: Organisms must exchange matter with the environment to grow, reproduce and maintain organization.

Campbells 8th Ed

Ch 3, 4, 6

a. Molecules and atoms from the environment are necessary to build new molecules.

b. Surface area-to-volume ratios affect a biological system’s ability to obtain necessary resources or eliminate waste products.

**Enduring understanding 2.B**: Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.

**Essential knowledge 2.B.1**: Cell membranes are selectively permeable due to their structure.

a. Cell membranes separate the internal environment of the cell from the external environment.

Campbells 8th Ed

Ch 7

b. Selective permeability is a direct consequence of membrane structure, as described by the fluid mosaic model.

c. Cell walls provide a structural boundary, as well as a permeability barrier for some substances to the internal environments.

**Essential knowledge 2.B.2**: Growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes.

Campbells 8th Ed

Ch 7

Lab: Diffusion/Osmosis

a. Passive transport does not require the input of metabolic energy; the net movement of molecules is from high concentration to low concentration.

b. Active transport requires free energy to move molecules from regions of low concentration to regions of high concentration.

c. The processes of endocytosis and exocytosis move large molecules from the external environment to the internal environment and vice versa, respectively.

**Essential knowledge 2.B.3**: Eukaryotic cells maintain internal membranes that partition the cell into specialized regions.

Campbells 8th Ed

Ch 6

a. Internal membranes facilitate cellular processes by minimizing competing interactions and by increasing surface area where reactions can occur.

b. Membranes and membrane-bound organelles in eukaryotic cells localize (compartmentalize) intracellular metabolic processes and specific enzymatic reactions.

c. Archaea and Bacteria generally lack internal membranes and  **organelles and have a cell wall.**

**Enduring understanding 2.C**: Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis.

**Essential knowledge 2.C.1**: Organisms use feedback mechanisms to maintain their internal environments and

Campbells 8th Ed

Ch 40

respond to external environmental changes.

a. Negative feedback mechanisms maintain dynamic homeostasis for a particular condition (variable) by regulating physiological processes, returning the changing condition back to its target set point.

b. Positive feedback mechanisms amplify responses and processes in biological organisms. The variable initiating the response is moved farther away from the initial set-point. Amplification occurs when the stimulus is further activated which, in turn, initiates an additional response that produces system change.

c. Alteration in the mechanisms of feedback often results in deleterious consequences.

**Essential knowledge 2.C.2**: Organisms respond to changes in their external environments.

a. Organisms respond to changes in their environment through behavioral and physiological mechanisms.

Campbells 8th Ed

Ch 40

**Enduring understanding 2.D**: Growth and dynamic homeostasis of a biological system are influenced by changes in the system’s environment.

**Essential knowledge 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.

a. Cell activities are affected by interactions with biotic and abiotic factors.

Campbells 8th Ed

Ch 52, 53, 54, 55

b. Organism activities are affected by interactions with biotic and abiotic factors.

c. The stability of populations, communities and ecosystems is affected by interactions with biotic and abiotic factors

**Essential knowledge 2.D.2**: Homeostatic mechanisms reflect both common ancestry and divergence due to adaptation in different environments.

Campbells 8th Ed

Ch 40, 56

a. Continuity of homeostatic mechanisms reflects common ancestry, while changes may occur in response to different environmental conditions.

b. Organisms have various mechanisms for obtaining nutrients and eliminating wastes.

c. Homeostatic control systems in species of microbes, plants and animals support common ancestry.

**Essential knowledge 2.D.3**: Biological systems are affected by disruptions to their dynamic homeostasis.

a. Disruptions at the molecular and cellular levels affect the health of the organism

Campbells 8th Ed

Ch 40, 56

b. Disruptions to ecosystems impact the dynamic homeostasis or balance of the ecosystem.

**Essential knowledge 2.D.4**: Plants and animals have a variety of chemical defenses against infections that affect dynamic homeostasis.

Campbells 8th Ed

Ch 39, 43

a. Plants, invertebrates and vertebrates have multiple, nonspecific immune responses.

b. Mammals use specific immune responses triggered by natural or artificial agents that disrupt dynamic homeostasis.

**Enduring understanding 2.E**: Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.

**Essential knowledge 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.

Campbells 8th Ed

Ch 18, 38

a. Observable cell differentiation results from the expression of genes for tissue- specific proteins.

b. Induction of transcription factors during development results in sequential gene expression.

c. Programmed cell death (apoptosis) plays a role in the normal development and differentiation.

**Essential knowledge 2.E.2**: Timing and coordination of physiological events are regulated by multiple mechanisms.

a. In plants, physiological events involve interactions between environmental stimuli and internal molecular signals.

Campbells 8th Ed

Ch 11, 24, 38. 39

b. In animals, internal and external signals regulate a variety of physiological responses that synchronize with environmental cycles and cues.

c. In fungi, protists and bacteria, internal and external signals regulate a variety of physiological responses that synchronize with environmental cycles and cues.

**Essential knowledge 2.E.3**: Timing and coordination of behavior are regulated by various mechanisms and are important in natural selection.

a. Individuals can act on information and communicate it to others.

Campbells 8th Ed

Ch 39, 51, 54

b. Responses to information and communication of information are vital to natural selection.

**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. a. Genetic information is transmitted from one generation to the next through DNA or RNA.

Campbell’s 8th Ed

Ch 5, 16, 17. 19, 20, 27

b. DNA and RNA molecules have structural similarities and differences that define function.

c. Genetic information flows from a sequence of nucleotides in a gene to a sequence of amino acids in a protein.

d. Phenotypes are determined through protein activities.

e. Genetic engineering techniques can manipulate the heritable information of DNA and, in special cases, RNA.

**Essential knowledge 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.

Campbell’s 8th Ed

Ch 12, 13

Lab: Cell Division

a. The cell cycle is a complex set of stages that is highly regulated with checkpoints, which determine the ultimate fate of the cell.

b. Mitosis passes a complete genome from the parent cell to daughter cells.

c. Meiosis, a reduction division, followed by fertilization ensures genetic diversity in sexually reproducing organisms.

**Essential knowledge 3.A.3**: The chromosomal basis of inheritance provides an understanding of the pattern of passage (transmission) of genes from parent to offspring.

a. Rules of probability can be applied to analyze passage of single gene traits from parent to offspring.

Campbell’s 8th Ed

Ch 14

b. Segregation and independent assortment of chromosomes result in genetic variation.

c. Certain human genetic disorders can be attributed to the

inheritance of single gene traits or specific chromosomal changes, such as nondisjunction.

d. Many ethical, social and medical issues surround human genetic disorders.

**Essential knowledge 3.A.4**: The inheritance pattern of many

Campbell’s 8th Ed

Ch 15

traits cannot be explained by simple Mendelian genetics.

a. Many traits are the product of multiple genes and/or physiological processes.

b. Some traits are determined by genes on sex chromosomes.

c. Some traits result from nonnuclear inheritance.

**Enduring understanding 3.B**: Expression of genetic information involves cellular and molecular mechanisms.

**Essential knowledge 3.B.1**: Gene regulation results in differential gene expression, leading to cell specialization.

a. Both DNA regulatory sequences, regulatory genes, and small regulatory RNAs are involved in gene expression.

Campbell’s 8th Ed

Ch 18

b. Both positive and negative control mechanisms regulate gene expression in bacteria and viruses.

c. In eukaryotes, gene expression is complex and control involves regulatory genes, regulatory elements and transcription factors that act in concert.

d. Gene regulation accounts for some of the phenotypic differences between organisms with similar genes.

**Essential knowledge 3.B.2**: A variety of intercellular and intracellular signal transmissions mediate gene expression.

Campbell’s 8th Ed

Ch 11, 18

a. Signal transmission within and between cells mediates gene expression.

b. Signal transmission within and between cells mediates cell function.

**Enduring understanding 3.C**: The processing of genetic information is imperfect and is a source of genetic variation.

**Essential knowledge 3.C.1**: Changes in genotype can result in changes in phenotype.

a. Alterations in a DNA sequence can lead to changes in the type or amount of the protein produced and the consequent phenotype.

b. Errors in DNA replication or DNA repair mechanisms, and external factors, including radiation and reactive chemicals, can cause random changes, e.g., mutations in the DNA.

Campbell’s 8th Ed

Ch 15, 16, 16, 23

Lab: DNA Extraction

Lab: DNA Fingerprinting

c. Errors in mitosis or meiosis can result in changes in phenotype.

d. Changes in genotype may affect phenotypes that are subject to natural selection. Genetic changes that enhance survival and reproduction can be selected by environmental conditions.

**Essential knowledge 3.C.2**: Biological systems have multiple processes that increase genetic variation.

a. The imperfect nature of DNA replication and repair increases variation.

Campbell’s 8th Ed

Ch 13, 27

Lab: Transformation

b. The horizontal acquisitions of genetic information primarily in prokaryotes via transformation, transduction, conjugation, and transposition increase variation.

c. Sexual reproduction in eukaryotes involving gamete formation, including crossing-over during meiosis and the random assortment of chromosomes during meiosis, and random fertilization serve to increase variation.

**Essential knowledge 3.C.3**: Viral replication results in genetic variation, and viral infection can introduce genetic variation into the hosts.

a. Viral replication differs from other reproductive strategies and generates genetic variation via various mechanisms

Campbell’s 8th Ed.

Ch 19

b. The reproductive cycles of viruses facilitate transfer of genetic information.

**Enduring understanding 3.D**: Cells communicate by generating, transmitting and receiving chemical signals.

**Essential knowledge 3.D.1**: Cell communication processes share com mon features that reflect a shared evolutionary history.

Campbell’s 8th Ed

Ch

a. Communication involves transduction of stimulatory or inhibitory signals from other cells, organisms or the environment.

b. Correct and appropriate signal transduction processes are generally under strong selective pressure.

c. In single-celled organisms, signal transduction pathways influence how the cell responds to its environment.

d. In multicellular organisms, signal transduction pathways coordinate the activities within individual cells that support the function of the organism as a whole.

**Essential knowledge 3.D.2**: Cells communicate with each other through direct contact with other cells or from a distance via chemical signaling.

Campbell’s 8th Ed

Ch 11

a. Cells communicate by cell-to-cell contact.

b. Cells communicate over short distances by using local regulators that target cells in the vicinity of the emitting cell.

c. Signals released by one cell type can travel long distances to target cells of another cell type.

**Essential knowledge 3.D.3**: Signal transduction pathways link signal reception with cellular response.

Campbell’s 8th Ed

Ch 11

a. Signaling begins with the recognition of a chemical messenger, a ligand, by a receptor protein.

b. Signal transduction is the process by which a signal is converted to a cellular response.

**Essential knowledge 3.D.4**: Changes in signal transduction pathways can alter cellular response.

Campbell’s 8th Ed

Ch 11

a. Conditions where signal transduction is blocked or defective can be deleterious, preventative or prophylactic.

**Enduring understanding 3.E**: Transmission of information results in changes within and between biological systems.

**Essential knowledge 3.E.1**: Individuals can act on information and communicate it to others.

a. Organisms exchange information with each other in response to internal changes and external cues, which can change behavior.

Campbell’s 8th Ed

Ch 51

Lab: Animal Behavior

b. Communication occurs through various mechanisms.

c. Responses to information and communication of information are vital to natural selection and evolution.

**Essential knowledge 3.E.2**: Animals have nervous systems that detect external and internal signals, transmit and integrate information, and produce responses.

a. The neuron is the basic structure of the nervous system that reflects function.

Campbell’s 8th Ed

Ch 48, 49

b. Action potentials propagate impulses along neurons.  
 c. Transmission of information between neurons occurs across synapses.

d. Different regions of the vertebrate brain have different functions.

**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.

Campbell’s 8th Ed

Ch 5

a. Structure and function of polymers are derived from the way their monomers are assembled.

b. Directionality influences structure and function of the polymer.

**Essential knowledge 4.A.2**: The structure and function of subcellular components, and their interactions, provide essential cellular processes.

a. Ribosomes are small, universal structures comprised of two interacting parts: ribosomal RNA and protein

Campbell’s 8th Ed

Ch 6

b. Endoplasmic reticulum (ER) occurs in two forms: smooth and rough.

c. The Golgi complex is a membrane-bound structure that consists a series of flattened membrane sacs (cisternae).

d. Mitochondria specialize in energy capture and transformation.

e. Lysosomes are membrane-enclosed sacs that contain hydrolytic enzymes, which are important in intracellular digestion, the recycling of a cell’s organic materials and programmed cell death (apoptosis).

f. A vacuole is a membrane-bound sac that plays roles in intracellular digestion and the release of cellular waste products

g. Chloroplasts are specialized organelles found in algae and higher plants that capture energy through photosynthesis.

**Essential knowledge 4.A.3**: Interactions between external stimuli and regulated gene expression result in specialization of cells, tissues and organs.

a. Differentiation in development is due to external and internal cues that trigger gene regulation by proteins that bind to DNA.

Campbell’s 8th Ed

Ch 18

b. Structural and functional divergence of cells in development is due to expression of genes specific to a particular tissue or organ type

c. Environmental stimuli can affect gene expression in a mature cell.

**Essential knowledge 4.A.4**: Organisms exhibit complex properties due to interactions between their constituent parts.

Campbell’s 8th Ed

Ch 48

a. Interactions and coordination between organs provide essential biological activities.

b. Interactions and coordination between organs provide essential biological activities.

**Essential knowledge 4.A.5**: Communities are composed of populations of organisms that interact in complex ways.

a. The structure of a community is measured and described in terms of species composition and species diversity.

Campbell’s 8th Ed

Ch 53, 54

b. Mathematical or computer models are used to illustrate and investigate population interactions within and environmental impacts on a community.

c. Mathematical models and graphical representations are used to illustrate population growth patterns and interactions.

**Essential knowledge 4.A.6**: Interactions among living systems and with their environment result in the movement of matter and energy.

a. Energy flows, but matter is recycled.

Campbell’s 8th Ed

Ch 54, 55, 56

Lab: Dissolved Oxygen and Primary Productivity

b. Changes in regional and global climates and in atmospheric composition influence patterns of primary productivity.   
 c. Organisms within food webs and food chains interact.

d. Food webs and food chains are dependent on primary productivity.

e. Models allow the prediction of the impact of change in biotic and abiotic factors.

f. Human activities impact ecosystems on local, regional and global scales.

g. Many adaptations of organisms are related to obtaining and using energy and matter in a particular environment.

**Enduring understanding 4.B**: Competition and cooperation are important aspects of biological systems.

**Essential knowledge 4.B.1**: Interactions between molecules affect their structure and function.

a. Change in the structure of a molecular system may result in a change of the function of the system.

Campbell’s 8th Ed

Ch 5, 8

Lab: Enzyme/Catalyst Lab

b. The shape of enzymes, active sites and interaction with specific molecules are essential for basic functioning of the enzyme.

c. Other molecules and the environment in which the enzyme acts can enhance or inhibit enzyme activity

d. The change in function of an enzyme can be interpreted from data regarding the concentrations of product or substrate as a function of time

**Essential knowledge 4.B.2**: Cooperative interactions within organisms promote efficiency in the use of energy and matter.

a. Organisms have areas or compartments that perform a subset of functions related to energy and matter, and these parts contribute to the whole.

Campbell’s 8th Ed

Ch 6, 40

b. Interactions among cells of a population of unicellular organisms can be similar to those of multicellular organisms, and these interactions lead to increased efficiency and utilization of energy and matter.

**Essential knowledge 4.B.3**: Interactions between and within populations influence patterns of species distribution and abundance.

a. Interactions between populations affect the distributions and abundance of populations.

Campbell’s 8th Ed

Ch 54

b. A population of organisms has properties that are different from individuals that make up the population. The cooperation and competition between individuals contributes to these different properties.

c. Species-specific and environmental catastrophes, geological events, the sudden influx/ depletion of abiotic resources or increased human activities affect species distribution and abundance

**Essential knowledge 4.B.4**: Distribution of local and global ecosystems changes over time.

Campbell’s 8th Ed

Ch 25, 55, 56

a. Human impact accelerates change at local and global levels.

b. Geological and meteorological events impact ecosystem distribution.

**Enduring understanding 4.C**: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

**Essential knowledge 4.C.1**: Variation in molecular units provides cells with a wider range of functions.

Campbell’s 8th Ed

Ch 5, 21

a. Variations within molecular classes provide cells and organisms with a wider range of functions.

b. Multiple copies of alleles or genes (gene duplication) may provide new phenotypes.

**Essential knowledge 4.C.2**: Environmental factors influence the expression of the genotype in an organism.

Campbell’s 8th Ed

Ch 14

Lab: Transpiration

a. Environmental factors influence many traits both directly and indirectly.

b. An organism’s adaptation to the local environment reflects a flexible response of its genome.

**Essential knowledge 4.C.3**: The level of variation in a population affects population dynamics.

a. Population ability to respond to changes in the environment is affected by genetic diversity. Species and populations with little genetic diversity are at risk for extinction.

Campbell’s 8th Ed

Ch 23

b. Genetic diversity allows individuals in a population to respond differently to the same changes in environmental conditions.

c. Allelic variation within a population can be modeled by the Hardy-Weinberg equation(s).

**Essential knowledge 4.C.4**: The diversity of species within an ecosystem may influence the stability of the ecosystem.

a. Natural and artificial ecosystems with fewer component parts and with little diversity among the parts are often less resilient to changes in the environment.

Campbell’s 8th Ed

Ch 14, 23, 54, 56

b. Keystone species, producers, and essential abiotic and biotic factors contribute to maintaining the diversity of an ecosystem.

**Advanced Placement Biology Course Outline & Syllabus**

**2014-2015**

\*Time frame is an approximation. Revisions may be made do to time.

**(Approximately 40 – 45 days spent in lab/ 25-28% of class time)**

**FIRST SEMESTER Big Ideas and Enduring Understandings**

**Unit 1 Biochemistry Ch. 1- 5** (3 weeks)

Introduction: Themes in the Study of Life (Ch 1)

1D1, 2A3, 3A1, 4A1, 4B1, 4C1

The Chemical Context of Life (Ch 2)

Water and the Fitness of the Environment (Ch 3)

Carbon and the Molecular Diversity of Life (Ch 4)

The Structure and Function of Macromolecules (Ch 5)

**UNIT TEST #1: Ch. 1- 5. Essay: Discuss chemical**

**composition of proteins and the**

**structural levels, role of DNA and**

**RNA in protein synthesis, and**

**role of proteins in membrane**

**structure and transport.**

**Unit 2 Cell Biology Ch. 6-7** (2 weeks)

2A3, 2B1, 2B2, 2B3, 4A2, 4B2,

A Tour of the Cell (Ch 6)

Membrane Structure and Function (Ch 7)

**Lab: Diffusion and Osmosis (3 days)**

**Essay: Draw a model of the three mechanisms of membrane tranport.**

**UNIT TEST #2:** Ch. 6-7

**Unit 3 Cell Processes Ch. 8, 9 and 10** (4 weeks)

2A1, 2A2, 4B1

Introduction to Metabolism (Ch 8)

Cellular Respiration: Harvesting Chemical Energy (Ch 9)

Photosynthesis (Ch 10)

**Lab: Enzymes/Catalyst Lab (5 days)**

**Lab: Plant Pigments and Photosynthesis (3 days)**

**Lab: Cell Respiration (3 days)**

**UNIT TEST #3:** Ch. 8,9 and 10 **Essay: Trace a molecule**

**of carbon through a food web**

**(carbon cycle). Explain the role of**

**carbon in the greenhouse effect**

**Unit 4 Cell Reproduction Ch. 11-15** (4 weeks)

2E2, 3A2, 3A3, 3A4, 3B2, 3C1, 3C2, 3D1, 3D2, 3D3, 4C2, 4C4, 3D4

Cell Communication (Ch 11)

The Cell Cycle (Ch 12)

Meiosis and Sexual Life Cycles (Ch 13)

Mendel and the Gene Idea (Ch 14)

The Chromosomal Basis of Inheritance (Ch 15)

**Lab: Mitosis and Meiosis** **(2 days)**

**UNIT TEST #4:** Ch. 11-15

**Unit 5 DNA, Genetics, and Biotechnology Ch. 16-21** (4 weeks)

3A1, 2E1, 3A1, 3B1, 3B2, 3C1, 3C3, 4A3, 4C1

The Molecular Basis of Inheritance (Ch 16)

From Gene to Protein (Ch 17)

Regulation of Gene Expression (Ch 18)

Viruses (Ch 19)

Biotechnology (Ch 20)

Genomes and Their Evolution (Ch 21)

**Lab: DNA Extration (1 day)**

**Lab: Protein Purification (4 days)**

**Lab: Transformation Lab (4 days)**

**UNIT TEST # 5** Ch. 16-21

**MIDTERM EXAM CH 1- 21 AND ALL LABORATORY EXERCISES**

**Second Semester**

**Unit 6 Evolution Ch. 22-27**(4 weeks)

Descent with Modification: A Darwinian View of Life (Ch 22)

The Evolution of Populations (Ch 23)

1A1, 1A2, 1A3, 1A4, 1B1, 1B2, 1C1, 1C2, 1C3, 1D1, 1D2, 2E2, 3A1, 3C1, 3C2, 4B4, 4C3, 4C4

The Origin of Species (Ch 24)

The History of Life on Earth (Ch 25)

Phylogeny and the Tree of LIfe (Ch 26)

Bacteria and Archea (Ch 27)

**Lab: Hardy Weinberg (2 days)**

**Lab: Blast (3 days)**

**Lab: Artificial Selection (3 days)**

**UNIT TEST #6** Ch. 22-27 Essay: Compare artificial selection and natural selection of dogs.

**Unit 7 Plants Ch. 38-39** (4 weeks)

2D4, 2E1, 2E2, 2E3

Angiosperm Reproduction and Biotechnology (Ch 38)

Plant Responses to Internal and External Signals (Ch 39)

**Transpiration (3 days)**

**UNIT TEST #7: Ch 38-39**,

**Unit 8 Animals Ch. 40, 43, 48, 49** (4 weeks)

2A1, 2C1, 2C2, 2D2, 2D3, 2D4, 3E2, 4A4, 4B3

Basic Principles of Animal Form and Function (Ch 40)

The Immune System (Ch 43)

Neurons, Synapses, and Signaling (Ch 48)

Nervous Systems (Ch 49)

**Laboratory 10: Physiology of the Circulatory System (2 days)**

**UNIT TEST #8: Ch 40, 43, 48, 49**

**Unit 9 Ecology Ch. 51-56** (4 weeks)

An Introduction to Ecology and the Biosphere (Ch 52)

Animal Behavior (Ch 51)

2A1, 2D1, 2D2, 2D3, 2E3, 3E1, 4A5, 4A6, 4B3, 4B4, 4C4

Population Ecology (Ch 53)

Community Ecology (Ch 54)

Ecosystems (Ch 55)

Conservation Biology (Ch 56)

**Animal Behavior (2 days)**

**Dissolved Oxygen and Primary Productivity (3 days)**

**REVIEW**

**AP EXAMINATION: May 11, 2015**

Textbook

AP Edition Biology 8th Edition, Campbell and Reece, 2008