Appendix to the Curriculum Framework: AP Biology Concepts at a Glance

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.
Essential knowledge 1.A.2: Natural selection acts on phenotypic variations in populations.
Essential knowledge 1.A.3: Evolutionary change is also driven by random processes.
Essential knowledge 1.A.4: Biological evolution is supported by scientific evidence from many disciplines, including mathematics.
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.
Essential knowledge 1.B.2: Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested.
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.
Essential knowledge 1.C.2: Speciation may occur when two populations become reproductively isolated from each other.
Essential knowledge 1.C.3: Populations of organisms continue to evolve.
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.
Essential knowledge 1.D.2: Scientific evidence from many different disciplines supports models of the 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.
Essential knowledge 2.A.2: Organisms capture and store free energy for use in biological processes.
Essential knowledge 2.A.3: Organisms must exchange matter with the environment to grow, reproduce and maintain organization.
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.
Essential knowledge 2.B.2: Growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes.
Essential knowledge 2.B.3: Eukaryotic cells maintain internal membranes that partition the cell into specialized regions.
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 respond to external environmental changes.
Essential knowledge 2.C.2: Organisms respond to changes in their external environments.
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.
Essential knowledge 2.D.2: Homeostatic mechanisms reflect both common ancestry and divergence due to adaptation in different environments.
Essential knowledge 2.D.3: Biological systems are affected by disruptions to their dynamic homeostasis.
Essential knowledge 2.D.4: Plants and animals have a variety of chemical defenses against infections that affect 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.
Essential knowledge 2.E.2: Timing and coordination of physiological events are regulated by multiple mechanisms.
Essential knowledge 2.E.3: Timing and coordination of behavior are regulated by various mechanisms and are

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.
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.
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.
Essential knowledge 3.A.4: The inheritance pattern of many traits cannot be explained by simple Mendelian genetics.
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.
Essential knowledge 3.B.2: A variety of intercellular and intracellular signal transmissions mediate gene expression.
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.
Essential knowledge 3.C.2: Biological systems have multiple processes that increase genetic variation.
Essential knowledge 3.C.3: Viral replication results in genetic variation, and viral infection can introduce genetic variation into the hosts.
Enduring understanding 3.D: Cells communicate by generating, transmitting and receiving chemical signals.
Essential knowledge 3.D.1: Cell communication processes share common features that reflect a shared evolutionary history.
Essential knowledge 3.D.2: Cells communicate with each other through direct contact with other cells or from a distance via chemical signaling.
Essential knowledge 3.D.3: Signal transduction pathways link signal reception with cellular response.
Essential knowledge 3.D.4: Changes in signal transduction pathways can alter cellular response.
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.
Essential knowledge 3.E.2: Animals have nervous systems that detect external and internal signals, transmit and integrate information, and produce responses.

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.

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

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

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

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

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

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.

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

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

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

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.

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

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

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