

**Summary Outline of the Topics in
the AP Biology Curriculum Framework
and *CAMPBELL BIOLOGY 9e AP* Edition***

<u>Summary Outline of Topics in Curriculum Framework</u>	<u>Correlation to <i>CAMPBELL BIOLOGY 9E AP* Edition</i></u>
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Big Idea 1: The process of evolution drives the diversity and unity of life

A. Evolution: Change over Time

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| 1. Natural selection as a mechanism | 22.2, 23.2 |
| 2. Natural selection acts on phenotypes | 23.1, 23.4 |
| 3. Evolutionary change is random | 23.3 |
| 4. Evolution is supported by scientific evidence | 21.2, 21.6, 22.3, 25.2 |

B. Descent from Common Ancestry

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| 1. Many essential processes and features are widely conserved | 25.1, 25.3 |
| 2. Phylogenetic trees and cladograms | 26.1-26.3 |

C. Evolution Continues in a Changing Environment

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| 1. Speciation and extinction (rates/adaptive radiation) | 24.3, 24.4, 25.4 |
| 2. Role of reproductive isolation | 24.1 |
| 3. Populations continue to evolve (e.g., herbicide resistance) | 24.2 |

D. Natural Processes and the Origin of Living Systems

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| 1. Hypotheses and evidence of these origins | 4.1, 25.1, 25.3 |
| 2. Scientific evidence from many disciplines | 26.6 |

Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis**A. Role of Free Energy and Matter for Life Processes**

1. Constant input of free energy is required 8.2, 40.1, 40.2, 40.3, 40.4,
 - a. Energy pathways, ecosystem effects 51.3, 53.3, 53.4, 55.2, 55.3
 - b. Laws of thermodynamics/coupled reactions/exergonic, endergonic 8.1, 8.2, 8.3
2. Role of autotrophs and heterotrophs in free energy capture 10.1
 - a. Light reactions/chemiosmosis/Calvin cycle 10.2, 10.3
 - b. Glycolysis, pyruvate oxidation, Krebs, ETC 9.1, 9.2, 9.3, 9.4, 9.5
3. Matter and exchange with environment
 - a. Role of carbon, nitrogen, and phosphorus in organic compounds 4.1, 4.2, 4.3
 - b. Properties of water 3.1, 3.2
 - c. Surface area/volume ratios and exchange 6.2
 - d. Role of apoptosis 11.5

B. Cell Maintenance of Internal Environment

1. Cell membrane structure and selective permeability 7.1, 7.2
2. Transport processes across membranes 7.3, 7.4, 7.5
3. Compartmentalization 6.3, 6.4, 6.5

C. Role of Feedback Mechanisms in Homeostasis

1. Positive and negative feedback and examples 40.2
2. How organisms respond to changes in external environment 40.3

D. Growth and Homeostasis are Influenced by Environmental Changes

1. Biotic and abiotic factors/effect on cells → ecosystems 52.2, 53.1, 53.2, 53.3, 53.4, 53.5, 54.1, 54.2, 54.3, 54.4, 54.5, 55.1, 55.2, 55.3, 55.4
2. Homeostatic mechanisms reflect evolution 40.2, 40.3
3. Effect of homeostatic disruption at various levels 40.2, 40.3, 56.1
4. Plant and animal defense systems against infection 39.5, 43.1, 43.2, 43.3, 43.4

E. Temporal Regulation and Coordination to Maintain Homeostasis

1. Regulation of timing and coordination in development
 - a. Cell differentiation 18.2, 18.4
 - b. Homeotic genes/induction 18.3, 18.4
 - c. Gene expression/microRNAs 18.3
2. Mechanism of control/coordination of timing
 - a. Plants: photoperiodism/tropisms/germination 38.1, 39.2, 39.3
 - b. Animals 24.1
 - c. Fungi/protists/bacteria 11.1
3. Mechanisms that time and coordinate behavior
 - a. Innate behaviors/learning 51.1, 51.2
 - b. Plant/animal behaviors 39.2, 39.3, 51.1
 - c. Cooperative behaviors 54.1

Big Idea 3: Living systems store, retrieve, transmit, and respond to information essential to life processes

A. Heritable Information

1. DNA and RNA
 - a. Structure and function 5.5, 16.1
 - b. Replication 16.1, 16.2
 - c. Role of RNA and its processing 17.1, 17.2, 17.3, 17.4
 - d. Prokaryotic/viral differences 19.2, 27.1
 - e. Manipulation of DNA 20.1, 20.2
2. Cell cycle, Mitosis and Meiosis 12.1, 12.2, 12.3, 13.1, 13.2, 13.3
3. Chromosomal basis of inheritance 14.1, 14.2, 14.3, 14.4
4. Non-Mendelian inheritance 15.1, 15.2, 15.3, 15.5

B. Cellular and Molecular Mechanisms of Gene Expression

1. Gene regulation and differential gene expression 18.1, 18.2, 18.3
2. Signal transmission and gene expression 11.1, 11.4, 18.4

C. Genetic Variation can Result from Imperfect Processing

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| 1. Changes in genotype → phenotype changes | 15.4, 16.2, 17.5, 23.4 |
| 2. Mechanisms to increase variation | 27.2, 13.4 |
| 3. Role of viruses | 19.1, 19.2 |

D. How Cells Transmit and Receive Signals

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| 1. Processes reflect evolutionary history | 11.1 |
| 2. Local and long-distance signaling | 11.1, 11.2 |
| 3. Signal transduction pathways | 11.3 |
| 4. Effect of changes in pathways | 11.1, 11.2, 11.3, 11.4 |

E. How Information Transmission Results in Changes

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| 1. Organisms exchange information which changes behavior | 51.1 |
| 2. Role of the animal nervous system | 48.1, 48.2, 48.3, 48.4 |
| a. Neurons/synapses/signaling | 48.1, 48.2, 48.3, 48.4 |
| b. Mammalian brain | 49.2 |

Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties

A. Interactions within Biological Systems

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| 1. Properties of biological molecules and their components | 5.2, 5.3, 5.4, 5.5 |
| 1. Monomers and polymers | 5.1 |
| 2. Cellular organelles and their role in cell processes | 6.2, 6.3, 6.4, 6.5 |
| 3. Role of interaction between stimuli and gene expression in specialization | 18.4 |
| 4. Complex properties are due to interaction of constituent parts | 48.4 |
| 5. Populations and organisms interact in communities | |
| a. Ecological field data | 53.1, 53.2, 53.3, 54.1, 54.2 |
| b. Growth curves, demographics | 53.5, 53.6 |
| 6. Interactions and energy flow in the environment | 55.1, 55.3 |
| a. Human impact on ecosystems | 55.4, 55.5 |

B. Competition and Cooperation

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| 1. Interaction and structure/function of molecules | 5.4, 8.4, 8.5 |
| a. Enzymes and their action | |
| 2. Interactions within organisms and use of energy/matter | 6.4 |
| a. Compartments, e.g., digestion, excretion, circulation | 40.1 |
| 3. Interactions of populations and effect on species distribution/abundance | 54.1 |
| 4. Change in ecosystem distribution over time | 56.1, 56.4, 25.4 |

C. Diversity Affects Interactions within the Environment

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| 1. Variation in molecular units provides cells with a wide range of functions e.g., chlorophylls, antibodies, allelic variants | 5.1, 5.2, 5.3, 5.4, 5.5, 21.5 |
| 2. Gene expression of genotype is influenced by environment | 14.3 |
| 3. Variation affects cell structure and function | 21.5, 23.4, 26.4 |
| 4. Variation affects population dynamics | 23.1, 23.2, 23.3 |
| 5. Diversity affects ecosystem stability | 14.3, 23.2, 54.2, 56.1 |

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**** The Curriculum Framework includes Learning Objectives that incorporate both content and Science Practices. This outline summarizes the content of topics covered by the Learning Objectives.**