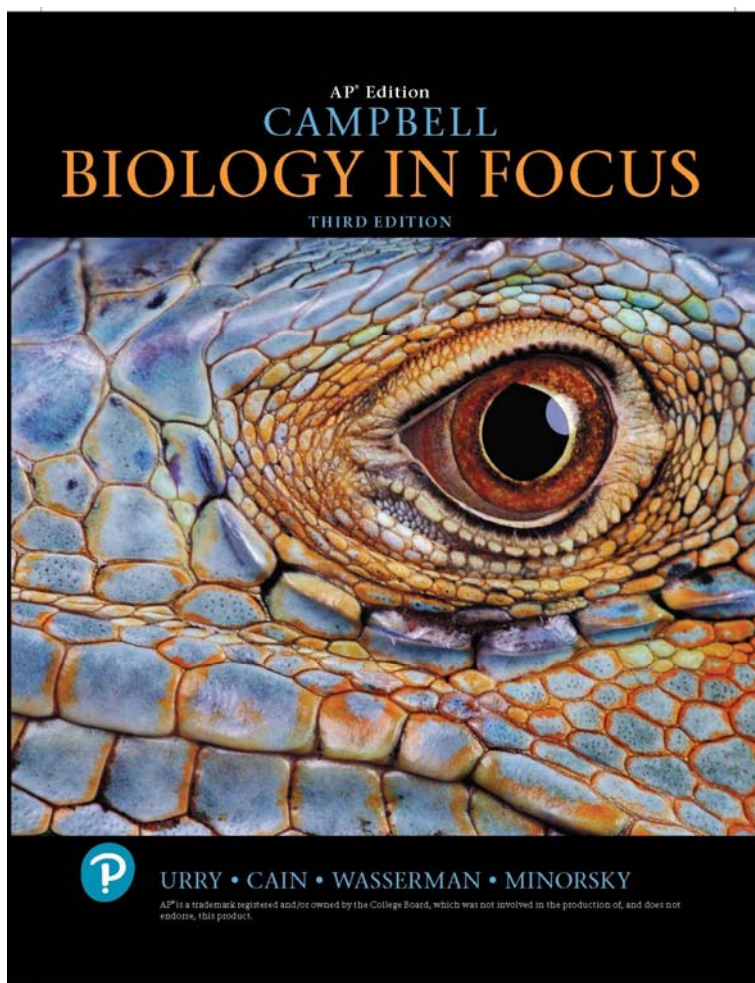


A Correlation of

# Campbell BIOLOGY in Focus

3<sup>rd</sup> Edition, AP<sup>®</sup> Edition ©2020



To the

## AP<sup>®</sup> Biology Curriculum Framework

Effective Fall 2019



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The units above reflect the College Board's AP<sup>®</sup> Biology Curriculum Framework.

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## **Big Idea Summary**

### **Big Idea 1: Evolution (EVO)**

**Description: The process of evolution drives the diversity and unity of life.**

Evolution is a change in the genetic makeup of a population over time, with natural selection as its major driving mechanism. Darwin's theory, which is supported by evidence from many scientific disciplines, states that inheritable variations occur in individuals in a population. Due to competition for limited resources, individuals with more favorable genetic variations are more likely to survive and produce more offspring, thus passing traits to future generations. A diverse gene pool is vital for the survival of species because environmental conditions change. The process of evolution explains the diversity and unity of life, but an explanation about the *origin* of life is less clear.

In addition to the process of natural selection, naturally occurring catastrophic and human-induced events, as well as random environmental changes can result in alteration in the gene pools of populations. Scientific evidence supports that speciation and extinction have occurred throughout Earth's history and that life continues to evolve within a changing environment, thus explaining the diversity of life.

### **Big Idea 2: Energetics (ENE)**

**Description: Biological systems use energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.**

Cells and organisms must exchange matter with the environment. Organisms respond to changes in their environment at the molecular, cellular, physiological, and behavioral levels. Living systems require energy and matter to maintain order, to grow, and to reproduce. Organisms employ various strategies to capture, use, and store energy and other vital resources. Energy deficiencies are not only detrimental to individual organisms; they also can cause disruptions at the population and ecosystem levels. Homeostatic mechanisms that are conserved or divergent across related organisms reflect either continuity due to common ancestry or evolutionary change in response to distinct selective pressures.

### **Big Idea 3: Information Storage and Transmission (5 EUs)-IST**

**Description: Living systems store, retrieve, transmit, and respond to information essential to life processes.**

Genetic information provides for continuity of life and, in most cases, this information is passed from parent to offspring via DNA. Nonheritable information transmission influences behavior within and between cells, organisms, and populations. These behaviors are directed by underlying genetic information, and responses to information are vital to natural selection and evolution. Genetic information is a repository of instructions necessary for the survival, growth, and reproduction of the organism. Genetic variation can be advantageous for the long-term survival and evolution of a species.

### **Big Idea 4: Systems Interactions (3 EUs)-SYI**

**Description: Biological systems interact, and these systems and their interactions exhibit complex properties.**

All biological systems comprise parts that interact with one another. These interactions result in characteristics and emergent properties not found in the individual parts alone. All biological systems from the molecular level to the ecosystem level exhibit properties of biocomplexity and diversity. These two properties provide robustness to biological systems, enabling greater resiliency and flexibility to tolerate and respond to changes in the environment.

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<b>Unit 1: Chemistry of Life (6 topics) AP<sup>®</sup> Biology Curriculum Framework</b>		
<b>Big Ideas</b>	<b>Enduring Understandings</b>	<b>Campbell Biology in Focus Chapters and Key Concepts</b>
<b>Energetics (ENE)</b>	ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.	<p>Chapter 3, Carbon and the Molecular Diversity of Life, 44</p> <p>Concept 3.1, Carbon atoms can form diverse molecules by bonding to four other atoms, 45</p> <p>Concept 3.2, Macromolecules are polymers, built from monomers, 49</p> <p>Concept 3.3, Carbohydrates serve as fuel and building material, 50</p> <p>Concept 3.4, Lipids are a diverse group of hydrophobic molecules, 54</p> <p>Concept 3.5, Proteins include a diversity of structures, resulting in a wide range of functions, 57</p> <p>Chapter 4, A Tour of the Cell, 74</p> <p>Concept 4.5, Mitochondria and chloroplasts change energy from one form to another, 89</p> <p>Chapter 6, An Introduction to Metabolism, 126</p> <p>Concept 6.1, An organism's metabolism transforms matter and energy, 126</p> <p>Chapter 7, Cellular Respiration and Fermentation, 145</p> <p>Chapter 8, Photosynthesis, 165</p>

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<b>Systems Interactions (SYI)</b>	SYI-1: Living systems are organized in a hierarchy of structural levels that interact.	<p>Chapter 28, Vascular Plant Structure and Growth, 585 Concept 28.1, Plants have a hierarchical organization consisting of organs, tissues, and cells, 586</p> <p>Chapter 32, The Internal Environment of Animals: Organization and Regulation, 673 Concept 32.1, Animal Form and function are correlated at all levels of organization</p>

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<b>Unit 2: Cell Structure and Function (11 Topics) AP<sup>®</sup> Biology Curriculum Framework</b>		
<b>Big Ideas</b>	<b>Enduring Understandings</b>	<b>Campbell Biology in Focus Chapters and Key Concepts</b>
<b>Evolution (EVO)</b>	EVO-1: Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence.	<p>Chapter 19, Descent with Modification, 385            Concept 19.1, The Darwinian revolution challenged traditional views of a young Earth inhabited by unchanging species, 386            Concept 19.3, Evolution is supported by an overwhelming amount of scientific evidence, 393</p> <p>Chapter 21, The Evolution of Populations, 420            Concept 21.1, Genetic variation makes evolution possible, 421            Concept 21.3, Natural selection, genetic drift, and gene flow can alter allele frequencies in a population, 428</p> <p>Chapter 22, The Origin of Species, 440            Concept 22.4, Speciation can occur rapidly or slowly and can result from changes in few or many genes, 454</p> <p>Chapter 23, Broad Patterns of Evolution, 459            Concept 23.3, Major changes in body form can result from changes in the sequence and regulation of developmental genes, 473</p>

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	ENE-2: Cells have membranes that allow them to establish and maintain internal environments that are different from their external environments.	<p>Chapter 4, A Tour of the Cell, 74 Concept 4.7, Extracellular components and connections between cells help coordinate cellular activities, 96</p> <p>Chapter 5, Membrane Transport and Cell Signaling, 104 Concept 5.1, Cellular membranes are fluid mosaics of lipids and proteins, 104 Concept 5.2, Membrane structure results in selective permeability, 108 Concept 5.3, Passive transport is diffusion of a substance across a membrane with no energy investment, 109 Concept 5.4, Active transport uses energy to move solutes against their gradient, 113 Concept 5.5, Bulk transport across the plasma membrane occurs by exocytosis and endocytosis, 116 Concept 5.6, The plasma membrane plays a key role in most cell signaling, 118</p>
<b>Systems Interactions (SYI)</b>	SYI-1: Living systems are organized in a hierarchy of structural levels that interact.	<p>Chapter 28, Vascular Plant Structure and Growth, 585 Concept 28.1, Plants have a hierarchical organization consisting of organs, tissues, and cells, 586</p> <p>Chapter 32, The Internal Environment of Animals: Organization and Regulation, 673 Concept 32.1, Animal Form and function are correlated at all levels of organization</p>



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<b>Unit 3: Cellular Energetics (7 Topics) AP<sup>®</sup> Biology Curriculum Framework</b>		
<b>Big Ideas</b>	<b>Enduring Understandings</b>	<b>Campbell Biology in Focus Chapters and Key Concepts</b>
<b>Energetics (ENE)</b>	ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.	<p>Chapter 3, Carbon and the Molecular Diversity of Life, 44</p> <p>Concept 3.1, Carbon atoms can form diverse molecules by bonding to four other atoms, 45</p> <p>Concept 3.2, Macromolecules are polymers, built from monomers, 49</p> <p>Concept 3.3, Carbohydrates serve as fuel and building material, 50</p> <p>Concept 3.4, Lipids are a diverse group of hydrophobic molecules, 54</p> <p>Concept 3.5, Proteins include a diversity of structures, resulting in a wide range of functions, 57</p> <p>Chapter 4, A Tour of the Cell, 74</p> <p>Concept 4.5, Mitochondria and chloroplasts change energy from one form to another, 89</p> <p>Chapter 6, An Introduction to Metabolism, 126</p> <p>Concept 6.1, An organism's metabolism transforms matter and energy, 126</p> <p>Chapter 7, Cellular Respiration and Fermentation, 145</p> <p>Chapter 8, Photosynthesis, 165</p>
<b>Systems Interactions (SYI)</b>	SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.	<p>Chapter 41, Ecological Communities, 877</p> <p>Concept 41.2, Biological communities can be characterized by their diversity and trophic structure, 883</p> <p>Concept 41.3, Disturbance influences species diversity and composition, 888</p> <p>Concept 41.4, Biogeographic factors affect community diversity, 891</p>

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<b>Unit 4: Cell Communication and Cell Cycle (7 Topics) AP<sup>®</sup> Biology Curriculum Framework</b>		
<b>Big Ideas</b>	<b>Enduring Understandings</b>	<b>Campbell Biology in Focus Chapters and Key Concepts</b>
<b>Energetics (ENE)</b>	ENE-3: Timing and coordination of biological mechanisms involved in growth, reproduction, and homeostasis depend on organisms responding to environmental cues.	<p>Chapter 16, Development, Stem Cells, and Cancer, 327</p> <p>Concept 16.3, Abnormal regulation of genes that affect the cell cycle can lead to cancer, 340</p> <p>Chapter 31, Plant Responses to Internal and External Signals, 649</p> <p>Chapter 32, The Internal Environment of Animals: Organization and Regulation, 673</p>

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<b>Information Storage and Transmission (IST)</b>	IST-1: Heritable information provides for continuity of life.	<p>Chapter 3, Carbon and the Molecular Diversity of Life, 44 Concept 3.6, Nucleic Acids store, transmit, and help express hereditary information, 66</p> <p>Chapter 9, The Cell Cycle, 186 Concept 9.1, Most cell division results in genetically identical daughter cells, 187</p> <p>Chapter 10, Meiosis and Sexual Life Cycles, 204 Concept 10.1, Offspring acquiring genes from parents by inheriting chromosomes, 205 Concept 10.4, Genetic variation produced in sexual life cycles contribute to evolution, 214</p> <p>Chapter 12, The Chromosomal Basis of Inheritance, 240 Concept 12.1, Morgan showed that Mendelian inheritance has its physical basis in the behavior of chromosomes, 242</p> <p>Chapter 13, The Molecular Basis of Inheritance, 257 Concept 13.1, DNA is the genetic material, 258</p>
	IST-3: Cells communicate by generating, transmitting, receiving, and responding to chemical signals.	<p>Chapter 5, Membrane Transport and Cell Signaling, 104 Concept 5.1, Cellular membranes are fluid mosaics of lipids and proteins, 104 Concept 5.2, Membrane structure results in selective permeability, 108 Concept 5.3, Passive transport is diffusion of a substance across a membrane with no energy investment, 109 Concept 5.4, Active transport uses energy to move solutes against their gradient, 113 Concept 5.5, Bulk transport across the plasma membrane occurs by exocytosis and endocytosis, 116 Concept 5.6, The plasma membrane plays a key role in most cell signaling, 118</p>

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<b>Unit 5: Heredity (8 Topics) AP<sup>®</sup> Biology Curriculum Framework</b>		
<b>Big Ideas</b>	<b>Enduring Understandings</b>	<b>Campbell Biology in Focus Chapters and Key Concepts</b>
<b>Evolution (EVO)</b>	EVO-2: Organisms are linked by lines of descent from common ancestry.	<p>Chapter 19, Decent with Modification, 385            Concept 19.1, The Darwinian revolution challenged traditional views of a young Earth inhabited by unchanging species, 386            Concept 19.2, Decent with modification by natural selection explains adaptations of organisms and the unity and diversity of life, 388            Concept 19.3, Evolution is supported by an overwhelming amount of scientific evidence, 393</p> <p>Chapter 20, Phylogeny, 401            Concept 20-1, Phylogenies show evolutionary relationships, 402            Concept 20.2, Phylogenies are inferred from morphological and molecular data, 406            Concept 20.3, Shared characters are used to construct phylogenetic trees, 407            Concept 20.4, Molecular clocks help track evolutionary time, 413</p>

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<b>Systems Interactions (SYI)</b>	SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.	<p>Chapter 41, Ecological Communities, 877 Concept 41.2, Biological communities can be characterized by their diversity and trophic structure, 883 Concept 41.3, Disturbance influences species diversity and composition, 888 Concept 41.4, Biogeographic factors affect community diversity, 891</p>

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<b>Unit 6: Gene Expression and Regulation (9 Topics) AP<sup>®</sup> Biology Curriculum Framework</b>		
<b>Big Ideas</b>	<b>Enduring Understandings</b>	<b>Campbell Biology in Focus Chapters and Key Concepts</b>
<b>Information Storage and Transmission (IST)</b>	IST-1: Heritable information provides for continuity of life.	<p>Chapter 3, Carbon and the Molecular Diversity of Life, 44 Concept 3.6, Nucleic Acids store, transmit, and help express hereditary information, 66</p> <p>Chapter 9, The Cell Cycle, 186 Concept 9.1, Most cell division results in genetically identical daughter cells, 187</p> <p>Chapter 10, Meiosis and Sexual Life Cycles, 204 Concept 10.1, Offspring acquiring genes from parents by inheriting chromosomes, 205 Concept 10.4, Genetic variation produced in sexual life cycles contribute to evolution, 214</p> <p>Chapter 12, The Chromosomal Basis of Inheritance, 240 Concept 12.1, Morgan showed that Mendelian inheritance has its physical basis in the behavior of chromosomes, 242</p> <p>Chapter 13, The Molecular Basis of Inheritance, 257 Concept 13.1, DNA is the genetic material, 258</p>

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	<p>IST-2: Differences in the expression of genes account for some of the phenotypic differences between organisms.</p>	<p>Chapter 11, Mendel and the Gene Idea, 218 Concept 11.3, Inheritance patterns are often more complex than predicted by simple Mendelian genetics, 227</p> <p>Chapter 14, Gene Expression: From Gene to Protein, 283</p> <p>Chapter 15, Regulation of Gene Expression, 309 Concept 15.4, Researchers can monitor expression of specific genes, 322</p>
	<p>IST-4: The processing of genetic information is imperfect and is a source of genetic variation.</p>	<p>Chapter 10. Meiosis and Sexual Life Cycles, 204 Concept 10.4, Genetic variation produced in sexual life cycles contributes to evolution</p> <p>Chapter 12, The Chromosomal Basis of Inheritance, 240 Concept 12.4, Alterations of chromosome number or structure cause some genetic disorders, 252</p> <p>Chapter 14, Gene Expression: From Gene to Protein, 283 Concept 14.5, Mutations of one or a few nucleotides can affect protein structure and function, 303</p> <p>Chapter 21, The Evolution of Populations, 420 Concept 21.2, Genetic variation makes evolution possible, 421</p>

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<b>Unit 7: Natural Selection (13 Topics) AP<sup>®</sup> Biology Curriculum Framework</b>		
<b>Big Ideas</b>	<b>Enduring Understandings</b>	<b>Campbell Biology in Focus Chapters and Key Concepts</b>
<b>Evolution (EVO)</b>	EVO-1: Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence.	<p>Chapter 19, Descent with Modification, 385            Concept 19.1, The Darwinian revolution challenged traditional views of a young Earth inhabited by unchanging species, 386            Concept 19.3, Evolution is supported by an overwhelming amount of scientific evidence, 393</p> <p>Chapter 21, The Evolution of Populations, 420            Concept 21.1, Genetic variation makes evolution possible, 421            Concept 21.3, Natural selection, genetic drift, and gene flow can alter allele frequencies in a population, 428</p> <p>Chapter 22, The Origin of Species, 440            Concept 22.4, Speciation can occur rapidly or slowly and can result from changes in few or many genes, 454</p> <p>Chapter 23, Broad Patterns of Evolution, 459            Concept 23.3, Major changes in body form can result from changes in the sequence and regulation of developmental genes, 473</p>



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	EVO-2: Organisms are linked by lines of descent from common ancestry.	<p>Chapter 19, Decent with Modification, 385  Concept 19.1, The Darwinian revolution challenged traditional views of a young Earth inhabited by unchanging species, 386  Concept 19.2, Decent with modification by natural selection explains adaptations of organisms and the unity and diversity of life, 388  Concept 19.3, Evolution is supported by an overwhelming amount of scientific evidence, 393</p> <p>Chapter 20, Phylogeny, 401  Concept 20-1, Phylogenies show evolutionary relationships, 402  Concept 20.2, Phylogenies are inferred from morphological and molecular data, 406  Concept 20.3, Shared characters are used to construct phylogenetic trees, 407  Concept 20.4, Molecular clocks help track evolutionary time, 413</p>
	EVO-3: Life continues to evolve within a changing environment.	<p>Chapter 22, The Origin of Species, 440</p> <p>Chapter 23, Broad Patterns of Evolution, 459</p> <p>Chapter 26, The Colonization of Land, 528</p> <p>Chapter 27, The Rise of Animal Diversity, 553</p>
<b>Systems and Interactions (SYI)</b>	SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.	<p>Chapter 41, Ecological Communities, 877  Concept 41.2, Biological communities can be characterized by their diversity and trophic structure, 883  Concept 41.3, Disturbance influences species diversity and composition, 888  Concept 41.4, Biogeographic factors affect community diversity, 891</p>

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<b>Unit 8: Ecology (7 Topics) AP<sup>®</sup> Biology Curriculum Framework</b>		
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<b>Evolution (EVO)</b>	EVO-1: Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence.	<p>Chapter 19, Descent with Modification, 385            Concept 19.1, The Darwinian revolution challenged traditional views of a young Earth inhabited by unchanging species, 386            Concept 19.3, Evolution is supported by an overwhelming amount of scientific evidence, 393</p> <p>Chapter 21, The Evolution of Populations, 420            Concept 21.1, Genetic variation makes evolution possible, 421            Concept 21.3, Natural selection, genetic drift, and gene flow can alter allele frequencies in a population, 428</p> <p>Chapter 22, The Origin of Species, 440            Concept 22.4, Speciation can occur rapidly or slowly and can result from changes in few or many genes, 454</p> <p>Chapter 23, Broad Patterns of Evolution, 459            Concept 23.3, Major changes in body form can result from changes in the sequence and regulation of developmental genes, 473</p>

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	<p>ENE-3: Timing and coordination of biological mechanisms involved in growth, reproduction, and homeostasis depend on organisms responding to environmental cues.</p>	<p>Chapter 16, Development, Stem Cells, and Cancer, 327            Concept 16.3, Abnormal regulation of genes that affect the cell cycle can lead to cancer, 340</p> <p>Chapter 31, Plant Responses to Internal and External Signals, 649</p> <p>Chapter 32, The Internal Environment of Animals: Organization and Regulation, 673</p>

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	ENE-4: Communities and ecosystems change on the basis of interactions among populations and disruptions to the environment.	<p>Chapter 40, Population Ecology and the Distribution of Organisms, 850  Concept 40.1, Earth's climate influences the distribution of terrestrial biomes, 853  Concept 40.3, Interactions between organisms and the environment limit the distribution of species, 862  Concept 40.4, Biotic and abiotic factors affect population density, dispersion, and demographics, 864  Concept 40.5, The exponential and logistical models describe the growth of populations, 867  Concept 40.6, Population dynamics are influenced strongly by life history traits and population density, 871</p> <p>Chapter 41, Ecological Communities, 877  Concept 41.1, Interactions between species may help, harm, or have no effect on the individuals involved, 878  Concept 41.3, Disturbance influences species diversity and composition, 888  Concept 41.4, Biogeographic factors affect community diversity, 891  Concept 41.5, Pathogens alter community structure locally and globally, 892</p>
<b>Information Storage and Transmission (IST)</b>	IST-5: Transmission of information results in changes within and between biological systems.	<p>Chapter 31, Plant Responses to Internal and External Signals, 649</p> <p>Chapter 37, Neurons, Synapses, and Signaling, 782</p> <p>Chapter 38, Nervous and Sensory Systems 800  Concept 38.4, Sensory receptors transduce stimulus energy and transmit signals to the central nervous system, 811</p>

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<b>Systems Interactions (SYI)</b>	SYI-1: Living systems are organized in a hierarchy of structural levels that interact.	Chapter 28, Vascular Plant Structure and Growth, 585 Concept 28.1, Plants have a hierarchical organization consisting of organs, tissues, and cells, 586  Chapter 32, The Internal Environment of Animals: Organization and Regulation, 673 Concept 32.1, Animal Form and function are correlated at all levels of organization
	SYI-2: Competition and cooperation are important aspects of biological systems.	Chapter 41, Ecological Communities, 877 Concept 41.1, Interactions between species may help, harm, or have no effect on the individuals involved, 878
	SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.	Chapter 41, Ecological Communities, 877 Concept 41.2, Biological communities can be characterized by their diversity and trophic structure, 883 Concept 41.3, Disturbance influences species diversity and composition, 888 Concept 41.4, Biogeographic factors affect community diversity, 891