Textbook Title: *Concepts of Biology*					
Knowledge and Skills		**OpenStax Location**	**Details**	**Comments**	**Additional Resources**
Scientific Investigation and Reasoning TEKS begin at row 48.					
(4) Science concepts. The student knows that cells are the basic structures of all living things with specialized parts that perform specific functions and that viruses are different from cells. The student is expected to:					
Bio.4A	compare and contrast prokaryotic and eukaryotic cells, including their complexity, and compare and contrast scientific explanations for cellular complexity;	Section 1.1 Themes and Concepts of Biology (PDF p. 10) Section 3.2 Comparing Prokaryotic and Eukaryotic Cells (PDF p. 59-60) Section 3.3 Eukaryotic Cells (PDF p. 61-73) Section 6.1 The Genome (PDF p. 136) Section 6.4 Prokaryotic Cell Division (PDF p.145-148) Section 9.2 DNA Replication (PDF p.204-209) Section 13.1 Prokaryotic Diversity (PDF p. 292-297) Section 13.2 Eukaryotic Origins (PDF p.302-304)	**Compare and Contrast:** 1.1 briefly defines each (p.10) 3.2 Identifies similarities and differences in cell size, complexity, and presence of organelles (PDF p. 59-60) 6.1 compares prokaryotic and eukaryotic genome (p. 136) 6.4 Table 6.1 directly compares the structure and division of genetic material in Prokaryotes and other eukaryotes (p. 147-148) 9.1 Figure 9.6 compares location of DNA in each (p. 202) 9.2 describes DNA Replication for both () **Complexity:** 3.3 discusses complexity differences in cell components (p. 61- 73) 3.3 *Table 3.1* directly compares (p. 72-73) **Prokaryotes:** 13.1 covers evolutionary history of prokaryotes, diversity, and their basic structure (p.292- 297) **Eukaryotes:** 3.3 covers structure, role of plasma membrane, function of major organelles, cytoskeleton, and extracellular matrix (p. 61-73) 13.2 highlights Eukaryotic origins, endosymbiotic theory (p. 302-304)	To address the second part of this standard, a direct comparison of scientific explanations for cellular complexity is needed.	**Review Questions:** Ch. 3, Question # 6-8 (compare) Ch. 6, Question #10 (cell division differences) Ch. 9, Question # 3 (prokaryotic vs. eukaryotic chromosomes) Ch. 13, Question #2 (which came first) Ch. 13, Question # 8 (eukaryote origins) **Critical Thinking Questions:** Ch. 3, Question # 16 (describe prokaryotic cell) Ch. 13, Question # 16 (eukaryote origins) Ch. 6, Question #16 (cell division components in both) **Amoeba Sisters:** Compare and contrast prokaryotes and eukaryotes (time stamp: 1:55): https://www.youtube.com/watch?v=8IlzKri08kk&feature=youtu.be
Bio.4B	investigate and explain cellular processes, including homeostasis and transport of molecules; and	**Cellular Processes:** Ch. 4 How Cells Obtain Energy (PDF p.91-112); Section 6.2 Cell Cycle (PDF p.137- 143) Ch. 5 Photosynthesis (PDF p. 117-131) **Homeostasis:** Section 1.1 Themes and Concepts of Biology (PDF p.8) Section 16.1 Homeostasis and Osmoregulation (PDF p. 404-407) Section 16.4 Endocrine System (PDF p.421-425) Chapter 16 Summary (PDF p. 444) **Molecular Transport:** Section 3.5 Passive transport (PDF p.77-80) Section 3.6 Active Transport (PDF p. 81-84)	**Cellular Processes:** 4.1 covers metabolism (p.92-93) and feedback inhibition (p. 101-102) 4.2 "Glycolysis" (p.102-104) 4.3 "The Citric Acid Cycle" covers citric acid cycle/aerobic respiration (p. 104-105) 4.4 "Anaerobic cellular respiriation" (p. 110-111**)** 4.4 *Concepts in Action* video show anerobic cellular respiration (p.111) **Homeostasis:** 1.1 provides definition and examples (p.8) 16.1 explains iin depth, including thermoregulation and osmoregulation (p. 404-407) 16.1 *Figure 16.2* explains body system responses in thermoregulation (p. 406) 16.1 *Concept in Action* Video provides examples in different animals (p. 405) 16.4 covers homeostasis and cellular communication via hormones (p.421-425) Ch. 16 Summary provides a developed definition of Homeostasis (p.444) **Molecular Transport:** 3.5 covers diffusion, facilitated transport, osmosis (p. 77-80) 3.5 *Concept in Action* has a video on passive transport (p. 78) 3.6 covers electrochemcial gradient, endocytosis, phagocytosis, pinocytosis, receptor-mediated endocytosis, and exocytosis (p. 81-84) 3.6 *Concepts in Action* video depicts receptor-mediated endocytosis (p.83)	The TEK here says "investigate" so a lab where cellular processes such as homeostasis and molecular transport are investigated will cover the standard. This link shows current availability on the OER Commons for high school homeostasis labs: https://www.oercommons.org/search?f.search=homeostasis	**Review Questions** Ch. 3, Question # 12 (osmosis) Ch. 3, Question # 13-14 (diffusion, active transport) **Critical Thinking Questions:** Ch. 3, Question # 19 (osmosis) Ch. 3, Question # 20 (active transport) Ch. 16, Question # 27 (maintaining homeostasis) **Texas Gateway:** Additional examples of homeostasis: https://www.texasgateway.org/resource/biological-systems-homeostasis
Bio.4C	compare the structures of viruses to cells, describe viral reproduction, and describe the role of viruses in causing diseases such as human immunodeficiency virus (HIV) and influenza.	**Structure, Replication, and Infection:** Section 17.1 Viruses (PDF p. 450-456) **Role in HIV** Section 3.4 The Cell Membrane (PDF p. 74) Section 17.1 Viruses (PDF p. 452) **Role in Influenza** Section 17.1 Viruses (PDF p. 452-4)	3.4 *Evolution Connection* - How Viruses Infect Specific Organs (p. 76) 17.1 *Figure 17.5* shows structure of viruses which can be compared to images of cells (p.452) 17.1 *Concept in Action* - visual explanation of how influenza attacks the body (p. 453) 17.1 *Figure 17.6* charts influenza virus infection (p. 454) 17.1 *Concept in Action* has a link to a Kahn Academy Virus tutorial for identifying structures, modes of transmission, and replication (p. 454)		**Visual Connection Questions:** Ch. 17, Question #1 (virus structure) **Review Questions:** Ch. 17, Question # 4 (virus vs. cell) Ch. 17, Question # 5 (virus structure) Ch. 17, Question, #6 (viral replication)
(5) Science concepts. The student knows how an organism grows and the importance of cell differentiation. The student is expected to:					

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Knowledge and Skills		**OpenStax Location**	**Details**	**Comments**	**Additional Resources**
Bio.5A	describe the stages of the cell cycle, including deoxyribonucleic acid (DNA) replication and mitosis, and the importance of the cell cycle to the growth of organisms;	Ch. 6 Introduction (PDF p.135) Section 6.2 Cell Cycle (PDF p. 137-148) Section 9.2 DNA Replication (PDF p. 204-209)	**DNA replication** 6.2 "S phase" discusses this directly (p.138); 6.2 *Figure 6.3* summarizes the cell cycle (p. 137) 9.2 is an overview of DNA Replication (p.204-209) **Mitosis** 6.2 "The Mitotic Phase" discusses this directly (p.138-141) 6.2 *Figure 6.4* depicts and describes stages of animal cell mitosis (p.139) 6.2 *Concepts in Action* is a video of mitosis phases (p.140) 6.2 *Figure 6.5* contrasts cytokinesis in plant and animal cells (p. 141) **Importance of cell cycle to the growth of organisms** Ch. 6 Introductions discusses this directly (p. 135)		**Visual Connection Questions** Ch. 6, Question #1 (mitosis steps) **Review Questions:** Ch.6, Question #4-7 (cell cycle steps)
Bio.5B	describe the roles of DNA, ribonucleic acid (RNA), and environmental factors in cell differentiation; and	Section 18.1 How Animals Reproduce (PDF p. 481)	Cell differentiation is not defined and this topic is not discussed in depth, though passing references are made 18.1 "Sex Determination" briefly describes environmental sex determination via temperature for some species (PDF p. 481)	Texas Gateway supplement (column G) may address missing information	**Texas Gateway:** Defines cell differentiation, roles of DNA and RNA in differentiation, and environmental factors. Journal prompts are also provided https://www.texasgateway.org/resource/cell-specialization-and-differentiation
Bio.5C	recognize that disruptions of the cell cycle lead to diseases such as cancer.	Section 6.3 Cancer and the Cell Cycle (PDF p.143-144)	6.3 identifies "uncontrolled cell division" as the cause of cancer, and the section discusesses the role of proto-oncogenes and oncogenes. Specific examples of disruption to cell cycle are also provided. For example, "A cell that carries a mutated form of a negative regulator might not be able to halt the cell cycle if there is a problem." (p.143-144) 6.3 *Concepts in Action* has a Khan Academy video that is "an introduction to what cancer is and how it is the by-product of broken DNA replication" (p. 144).		**Critical Thinking Questions:** Ch. 6, Question # 14 (steps to becoming cancerous)
(6) Science concepts. The student knows the mechanisms of genetics such as the role of nucleic acids and the principles of Mendelian and non-Mendelian genetics. The student is expected to:					
Bio.6A	identify components of DNA, identify how information for specifying the traits of an organism is carried in the DNA, and examine scientific explanations for the origin of DNA;	Section 2.3 Biological Molecules (PDF p.39-50) Section 6.1 The Genome (PDF p.135-136) Section 9.1 The Structure of DNA (PDF p. 200 - 203)	**Components:** 2.3 "Nucleic Acids" explains how nucleotides combine to form DNA or RNA and *Figure* 2.22 shows the components of a nucleotide (p.49) 2.3 "DNA Double-Helical Structure" covers hydrogen bonds that form the shape of DNA and *Figure 2.23* shows the double helix structure (p.49-50) 9.1 covers 3 parts of nucleotides, 4 types of nitrogenous bases, double-helix structure, base-pairing; *Figure 9.4* shows the structure of a nucleotide, base pairing, and double helix structure (p.201). **Traits in DNA:** 6.1 "Genomic DNA" explains the connection between DNA and traits, providing an example (p.136).	To address "scientific explanations for the origin of DNA" a mini lesson supplement is needed. See Supplemental Activities column for a related Khan Academy video	**Review Questions:** Ch. 9, Question # 2 (base pairing) **Critical Thinking Questions** Ch. 9, Question # 13 (DNA structure and base pairing) Ch. 9, Question # 15 (transcription/translation practice) **Khan Academy:** RNA World Hypothesis: https://www.khanacademy.org/science/ap-biology/natural-selection/origins-of-life-on-earth/v/originoflife
Bio.6B	recognize that components that make up the genetic code are common to all organisms;	Section 9.4 Translation (PDF p. 213-214)	9.4 "The Protein Synthesis Machinery" states "The composition of each component may vary across species; for instance, ribosomes may consist of different numbers of ribosomal RNAs (rRNA) and polypeptides depending on the organism. However, the general structures and functions of the protein synthesis machinery are comparable from bacteria to human cells." (p.213) 9.4 "The Genetic Code" restates "The genetic code is universal. With a few exceptions, virtually all species use the same genetic code for protein synthesis, which is powerful evidence that all life on Earth shares a common origin." (p.214)		

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Bio.6C	explain the purpose and process of transcription and translation using models of DNA and RNA;	Section 9.3 Transcription (PDF p. 210-212) Section 9.4 Translation (PDF p. 213-215)	**Purpose:** 9.3 Introduction summarizes the purpose for transcription and translation (p. 210) **Process:** 9.4 "Genetic Code" summarizes: "...the cellular process of transcription generates messenger RNA (mRNA), a mobile molecular copy of one or more genes with an alphabet of A, C, G, and uracil (U). Translation of the mRNA template converts nucleotide-based genetic information into a protein product" (p.214). **Transcription Image** 9.3 *Figures 9.15, 9.16, 9.17, 9.18* **Translation Image** 9.4 *Figure 9.21* (p.215)	The Concepts in Action activity in 9.4 could serve as the "Model" of DNA and RNA (p.215)	**Concepts in Action:** 9.4 Practice the process of Transcribing and Translating a Gene (p.215) **Review Questions:** Ch. 9, Question #6 (promoter) **Critical Thinking Questions:** Ch. 9, Question #15 (transcribing and translating)
Bio.6D	recognize that gene expression is a regulated process;	Section 9.5 How Genes Are Regulated (PDF p. 216 - 219)	9.5 *Table 9.2* summarizes differences in regulation of gene expression in Prokaryotic and Eukaryotic Organisms (p.217-218)		**Review Questions:** Ch. 9, Question # 10-11 (gene expression) **Critical Thinking Questions:** Ch. 9, Question # 16 (gene expression and protein levels)
Bio.6E	identify and illustrate changes in DNA and evaluate the significance of these changes;	Section 2.3 Biological Molecule (PDF p.47) Section 6.3 Cancer and the Cell Cycle (PDF p. 143-144) Section 9.2 DNA Replication (PDF p.208-209) Section 11.1 Discovering how Populations Change (PDF p. 252-253) Section 11.2 Mechanisms of Evolution (PDF p.255-256)	2.3 "Protein Structure" mentions "In sickle cell anemia, the hemoglobin β chain has a single amino acid substitution, causing a change in both the structure and function of the protein" (p. 47) 6.3 Introduction specifically mentions that "changes in the DNA nucleotide sequence" create a mutation, which is at the root of all cancers (p. 143) 9.2 "DNA Repair" remarks that " If the dimer is not removed and repaired it will lead to a mutation. Individuals with flaws in their nucleotide excision repair genes show extreme sensitivity to sunlight and develop skin cancers early in life." (p.208) 11.1 "Variation and Adaptation" discusses the role of mutation for genetic variation (p.252-253) 11.2 "Mutation" discusses the role of mutation in evolution. (p.255-256)	To address "identify and illustrate" changes in DNA, a mini lesson and activity is needed as a supplement. The textbook makes references to the significance of changes in DNA but does not illustrate or define the types of changes that can occur (i.e., substitution, insertion/deletion, inversion, duplication). See column G for support with this standard.	**Texas Gateway:** Video and activity that can help "illustrate" changes in DNA (covers insertion, substitution, and deletion): https://www.texasgateway.org/resource/genetic-mutations
Bio.6F	predict possible outcomes of various genetic combinations such as monohybrid crosses, dihybrid crosses, and non-Mendelian inheritance; and	Ch. 8 Patterns of Inheritance (PDF p.173-193)	Ch. 8 provides context necessary to identify related vocabulary and predict outcomes of various genetic crosses 8.2 identifies phenotype, genotypes, law of dominance, monohybrid cross, law of segregation, law of independent assortment, dihybrid cross (p. 178-185) 8.3 covers non-Mendelian inheritance (p. 185-193)		**Visual Connection Questions:** Ch. 8, Question # 1 (predict parent plant) Ch. 8, Questions # 2, 3 (predict outcomes) **Review Questions:** Ch. 8, Questions # 4, 5 (predict outcomes) Ch. 8, Questin # 6 (phenotype, vocab) Ch. 8, Question # 8 (possible gametes for given genotype) Ch. 8, Question # 10 (vocab) Ch. 8, Quetstion # 12 (predict outcome) 12 **Critical Thinking Questions:** Ch. 8, Question # 15, 16, 18 (predict outcomes) **Kahn Academy:** Non-mendelian inheritance review: https://www.khanacademy.org/science/high-school-biology/hs-classical-genetics/hs-non-mendelian-inheritance/a/hs-non-mendelian-inheritance-review
Bio.6G	recognize the significance of meiosis to sexual reproduction.	Section: 7.1 Sexual Reproduction (PDF p. 153-157) Section 7.2 Meiosis (PDF p.157-163)	Both sections specifically connect meiosis with sexual reproduction		**Review Questions** Ch. 7, Question # 5-8 (meiosis process) **Critical Thinking Questions:** Ch. 7, Question # 13 (connects meiosis with fertilization/sexual reproduction) Ch. 7, Question #14-15 (meiosis process)
(7) Science concepts. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life. The student is expected to:					

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Knowledge and Skills		**OpenStax Location**	**Details**	**Comments**	**Additional Resources**
Bio.7A	analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental;	11.3 Evidence of Evolution (PDF p. 258-261)	**Fossil Record:** 11.3 "Fossils" provides a detailed example of how the fossil record marked common ancestry between species leading to the horse and also remarks of the influence of environmental changes, reference *Figure 11.10* (p. 258-259) **BioGeography:** 11.3 "Biogeography" discusses this directly, reference *Figure 11.13* (p. 260-261) **Anatomical:** 11.3 "Anatomy and Embryology" connects structural similarities to common ancestry 11.3 *Figure 11.11* shows homologous and vestigial structures (p. 259 - 260) **Molecular:** 11.3 "Molecular Biology" (p.261) discusses common ancestry as reflected in DNA and the 3 domains (3 Domains of life summarized in 1.1 "The Diversity of Life" p.12) **Developmental:** 11.3 "Anatomy and Embryology" provides description and examples (p. 260)	To address "analyze and evaluate" supplemental activities are needed to apply the textbook content to *all* these lines of evidence.	**Concepts in Action:** 11.3 Concepts in Action activity (identifing homologies - requires Adobe Flash) **Review Questions:** Ch. 11, Question # 8 (anatomical) Ch. 11, Question # 9 (molecular) **Critical Thinking Questions:** Ch. 11, Question # 18 (anatomical) Ch. 12, Question # 15 (homologous vs. analogous) **Berkley:** Examines developmental homology: https://evolution.berkeley.edu/evolibrary/article/0_0_0/lines_07 Examines molecular homology: https://evolution.berkeley.edu/evolibrary/article/0_0_0/lines_08 **Kahn Academy:** More examples on this topic: https://www.khanacademy.org/science/biology/her/evolution-and-natural-selection/a/lines-of-evidence-for-evolution Video on this topic: https://www.khanacademy.org/science/biology/her/evolution-and-natural-selection/v/evidence-for-evolution Multiple choice questions for identifying and interpreting evidence of common ancestry: https://www.khanacademy.org/science/biology/her/evolution-and-natural-selection/e/evidence-for-evolution
Bio.7B	examine scientific explanations of abrupt appearance and stasis in the fossil record;			Would need supplemental mini-lesson to address this standard	**Biology 2e** Link to Learning describes how stasis in populations (and the fossil record) using a snail speciation example: https://evolution.berkeley.edu/evolibrary/article/side_0_0/punctuated_01
Bio.7C	analyze and evaluate how natural selection produces change in populations, not individuals;	Section 11.1 Discovering How Populations Changes (PDF p. 250 - 255) Section 11.2 Mechanisms of Evolution (PDFp. 255 - 258) Section 11.5 Common Misconceptions about Evolution (PDF p. 266 -269)	11.1 "Charles Darwin and Natural Selection" discusses this mechanism in terms of *generational* change in Galapagos finches (p. 250 - 253) 11.1 "The Modern Synthesis" reiterates that "evolutionary pressures, such as natural selection, can affect a population's genetic makeup, and in turn, how this can result in the gradual evolution of populations and species" and defines microevolution and macroevolution (p. 253 - 254) 11.2 "Natural Selection" provides a helpful summary of the role of individuals in population change via Natural Selection (p. 255) 11.5 "Individuals Evolve" clarifies why natural selection does not produce change in individuals (p. 267)	To address "analyze and evaluate" supplemental activities are needed to apply textbook content to an example of natural selection. Could be addressed by expanding on the Critical Thinking Question #17 in Chapter 11	**Critical Thinking Questions:** Ch. 11, Question # 17 (describe natural selection within a population) **NASA:** Scavenger Hunt: Simulating Natural Selection: activity explores how adaptive structures, inherited variation, and limited resources (utensils collecting beans // bird beaks) impacts a species' ability to survive and how this can create population changes over time (rounds): https://pumas.jpl.nasa.gov/examples/index.php?id=73
Bio.7D	analyze and evaluate how the elements of natural selection, including inherited variation, the potential of a population to produce more offspring than can survive, and a finite supply of environmental resources, result in differential reproductive success;	Section 4.5 Connections to Other Metabolic Pathways (PDF p. 111-112) Section 11.1 Discovering How Populations Change (PDF p. 250-255)	**All 3 Factors:** 11.1 "Charles Darwin and Natural Selection" directly addresses these 3 factors (p.250-253) **Inherited Variation:** 11.1 "Variation and Adaptation" addresses the role of inherited variation in natural selection(p. 252-253) 11.1 "Population Genetics" covers genetic component of inherited variation more indepth, including Hardy-Weinberg equilibrium, nonrandom mating, sexual selection (p. 254-255) **Environmental Resources**: 4.5 Evolution Connection - hypothesis for the development of photosynthesis and cellular metabolism references natural selection and environmental resources (p. 112)	To address "analyze and evaluate" supplemental activities are needed to apply textbook content to an example of natural selection	**Review Questions:** Ch. 11, Question # 3 (elements of natural selection) **Critical Thinking Question:** Ch. 7, Question # 12 (inherited variation-requires knowledge of sexually vs. asexually reproducing organisms) Ch. 11, Question # 15 (natural selection) Ch. 11, Question # 17 (natural selection) ***See above activity under "NASA"***

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Knowledge and Skills		**OpenStax Location**	**Details**	**Comments**	**Additional Resources**
Bio.7E	analyze and evaluate the relationship of natural selection to adaptation and to the development of diversity in and among species; and	Section 1.1 Themes and Concepts of Biology (PDF p. 5-16) Section 11.1 Discovering How Populations Change (PDF p. 250-255) Section 11.4 Speciation (PDF p.261-266)	**Natural Selection and Adaptation:** 1.1 "Adaptation" briefly summarizes the connection between adapation and natural selection; "adaptation" is identified as a "consequence of evolution by natural selection;" The examples briefly highlight diversity in adaptation (p. 7) 11.1 'Variation and Adaptation" defines adaptation and variation (p.252-253) **Natural Selection and Diversity:** 11.1 "Charles Darwin and Natural Selection" discusses the role natural selection played in producing difference in and among species, specifically discussing the beak shapes in Galapagos finches (p. 262-264) 11.4 "Speciation through Geographic Separation" points to the role natural selection has on the creation of new species and emphasizes the role of environmental influences (p. 262-264) 11.4 *Figure 11.16* illustrates different beak shapes and the diets of various species of honeycreepers related to 1 founder species and the text points to natural selection and adaptive radiation (p. 264)	To address "analyze and evaluate" supplemental activities are needed to apply textbook content to an example of natural selection	**Review Questions:** Ch. 11, Question # 3 (specifically, B) **Critical Thinking Questions:** Ch. 11, Question # 19 (adaptive radiation)
Bio.7F	analyze other evolutionary mechanisms, including genetic drift, gene flow, mutation, and recombination.	**Cellular Processes:** Chapter 4 How Cells Obtain Energy (PDF p.91-112); Section 6.2 Cell Cycle (PDF p.137- 143) Chapter 5 Photosynthesis (PDF p. 117-131) **Homeostasis:** Section 1.1 Themes and Concepts of Biology (PDF p.8) Section 16.1 Homeostasis and Osmoregulation (PDF p. 404-407) Section 16.4 Endocrine System (PDF p.421-425) Chapter 16 Summary (PDF p. 444) **Molecular Transport:** Section 3.5 Passive transport (PDF p.77-80) Section 3.6 Active Transport (PDF p. 81-84)	**Genetic Drift:** 11.2 "Genetic Drift" defines and describes genetic drift in relation to populations (p.256-257) 11.2 Visual Connection provides a visual for genetic drift (p. 256) 11.2 Concepts in Action site has a genetic drift review and simulation (p. 257) **Gene Flow:** 11.2 "Gene Flow" defines and discusses this concept (p. 257) 11.2 *Figure 11.9* demonstrates how gene flow might occur (p. 258) 11.4 "Speciation through Geographic Separation" discusses gene flow's role in speciation (p.262-264) **Mutation:** 11.1 "Variation and Adaptation" identifies mutation as a source of genetic diversity and lists its potential outcomes; mutations are connected to adaptation (p. 252-253) 11.2 "Mutation" defines and describes this concept in relation to evolution (p. 255-256) 11.4 "Speciation through Geographic Separation" remarks on the presence of new alleles through mutation and its role in speciation (p.262 -264) **Recombination:** 8.3 "Linked Genes Violate the Law of Independent Assortment" defines and describes recombination (p. 191) Ch. 8 Chapter Summary "Extensions of the Laws of Inheritance" provides a nice summary of recombination (p.195) 13.1 "Reproduction" discusses how recombination via transformation, transduction, and conjugation creates in the "rapid evolution of prokaryotes, allowing them to respond to environemtnal changes... very quickly" (p.296-297)	To address "analyze and evaluate" supplemental activities are needed to apply textbook content to an example of natural selection; Recombination specifically as an evolutionary mechanism could be discussed more in depth	**Visual Connection Questions:** Ch. 11, Question # 1 (genetic drift) **Review Questions:** Ch. 11, Question # 11 (genetic drift) Ch. 11, Question #6 (gene flow) Ch. 11, Question # 7 (mutation and gene flow) **Critical Thinking Questions:** Ch. 11, Question #19 (adaptive radiation/gene flow) **Amoeba Sisters:** Genetic Drift vs. Natural Selection (Founder Effect, Bottleneck Effect): https://www.youtube.com/watch?v=W0TM4LQmoZY
(8) Science concepts. The student knows that taxonomy is a branching classification based on the shared characteristics of organisms and can change as new discoveries are made. The student is expected to:					
Bio.8A	define taxonomy and recognize the importance of a standardized taxonomic system to the scientific community;	Section 1.1 Themes and Concepts of Biology (PDF p.5-16) Section 12.1 Organizing Life on Earth (PDF p. 275 - 280)	**Definition:** 12.1 "The Levels of Classification" defines taxonomy (p.276) **Importance:** 12.1 "Levels of Classification" paragraphs 3 & 4 specifically address how standardized taxonomy has impacted the scientific community (p.277) **Other:** 1.1 "The Diversity of Life" provides an overview of the taxonomic system (p. 12) *1.1 Figure 1.9* shows taxonomic hierarchy for a dog (p.12) *12.1 Figure 12.3* has an illustration of the taxonomic system (p. 278)		**Review Questions:** Ch. 12, Question #4 (importance) Ch. 12, Question # 5 (levels) **Critical Thinking Questions:** Ch. 12, Question # 14 (list levels) **Kahn Academy:** Importance of classifying living things video: https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-118 **Texas Gateway:** Video explains taxonomy with simple terminology: https://www.texasgateway.org/resource/taxonomy-standards

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Bio.8B	categorize organisms using a hierarchical classification system based on similarities and differences shared among groups; and			To address "categorize organisms using a hierarchical classification system," an activity is needed. See OER Commons website below: https://www.oercommons.org/search?f.search=hierarchical+classification+system&f.general_subject=life-science&f.sublevel=high-school&f.alignment_standard=	**Visual Connection** Ch. 11, Question #1 (identify which level cats and dogs are in the same group) **Texas Gateway:** https://www.texasgateway.org/resource/taxonomy-standards
Bio.8C	compare characteristics of taxonomic groups, including archaea, bacteria, protists, fungi, plants, and animals.	Section 1.1 Themes and Concepts of Biology (PDF p. 5-16) Section 3.2 Comparing Prokaryotic and Eukaryotic Cells (PDF p. 59 - 60) Chapter 13 Introduction (PDF p. 291-292) Section 13.1 Prokaryotic Diversity (PDF p. 292- 302) Section 13.3 Protists (PDF p. 304-310) Section 13.4 Fungi (PDF p. 311-318) Section 14.1 The Plant Kingdom (PDF p. 326-332) Section 15.1 Features of the Animal Kingdom (PDF p. 356-361)	**Archaea:** 1.1 "The Diversity of Life" (p.12-14) 1.1 Figure 1.11 show Phylogenetic Tree of Life with the three domains (p.14) **Bacteria:** 3.2 "Components of Prokaryotic Cells" distinguishes differences in bacteria cell wall compared to Archaea and eukaryotes (p.59-60) see Direct Comparisons **Protists:** 13.3 covers characteristics, structure, how they obtain energy, reproduction, and diversity **Fungi:** 13.4 covers cell structure and function, growth and reproduction, how they obtain nutrients, diversity, role as pathogens, and significance **Plants:** 14.1 covers Plant characteristics, adaptations on land and major divisions **Animals:** 15.1 covers complex tissue structure, animal reproduction and development, and classification of animal features Ch.15 also covers Sponges and Cnidarians, Flatworms Nematodes and Arthropods, Mollusks and Annelids, Echinoderm, Chordates, and Vertebrates **Direct Comparisons:** 1.1 "The Diversity of Life" provides an overview of the 3 domains (Eukarya, Archaea, and Bacteria) and briefly compares Archaea and Bacteria (p.12-14) 3.2 Compares Prokaryotic and Eukaryotic cells and identifies which kingdoms belong to each Ch. 13 Introduction describes the development of domains and describes some characteristics 13.1 "Early LIfe on Earth" discusses bacteria and archaea as extremophiles (p.292-294) 13.4 "Cell Structure and Function" directly compares plant and fungal cells (p. 312-314) 15.1 Introductory paragraph distinguishes how animals acquire energy differently from plants and fungi (p.356) 15.1 "Sexual Reproduction and Embryonic Development" remarks that Animals' inability to reproduce asexually distinguishes them from fungi, protists, and bacteria (p.357)	While the book addresses each group, a direct comparison is not highlighted in terms of taxonomy. Domains are mentioned and compared, but there is not a dedicated section in the book; To better address the standard, a chart, mini lesson, and/or activity may be helpful (For example, compare against Prokaryote/Eukaryote, Unicellular/Multicellular, Autotroph/Heterotroph)	**Review Questions:** Ch. 13, Question # 4 (compare bacteria and archaea) Ch. 15, Question # 4 (animal characteristic) **Critical Thinking Questions:** Ch. 13, Question # 16 (relationship between Archaea and other eukaryotes) **Texas Gateway:** Provides an overview of Major Groups in Taxonomy, including the 3 domains, and 6 Kingdoms: https://www.texasgateway.org/resource/taxonomy-major-groups **Crash Course:** Video of Archaea, Bacteria, and Protists: https://www.youtube.com/watch?v=vAR47-g6tlA (12 min 16 s) - compares and contrasts **Amoeba Sisters:** Overview of Archaea characteristics https://www.youtube.com/watch?v=VGcT1-XaWgk&feature=youtu.be Autotrophs and Heterotrophs (mentions groups in each category) https://www.youtube.com/watch?v=f8G7IulYxiA&feature=youtu.be Overview of Bacteria https://www.youtube.com/watch?v=ORB866QSGv8&list=PLwL0Myd7Dk1F0iQPGrjehze3eDpco1eVz&t=0s
(9) Science concepts. The student knows the significance of various molecules involved in metabolic processes and energy conversions that occur in living organisms. The student is expected to:					

Textbook Title: *Concepts of Biology*					
Knowledge and Skills		**OpenStax Location**	**Details**	**Comments**	**Additional Resources**
Bio.9A	compare the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids;	Section 2.3 Biological Molecules (PDF p. 39-50) Section 3.3 Eukaryotic Cells (PDF p.61-73) Section 3.4 The Cell Membrane(PDF p.74-76) Section 3.5 Passive Transport (PDF p.77-80) Section 4.5 Connections to Other Metabolic Pathways(PDF p.111-112) Section 9.1 The Structure of DNA (PDF p.200-203) Section 15.6 Vertebrates (PDF p.385-394) Section 16.6 Nervous System (PDF p.431-439) Section 17.1 Viruses (PDF p.450-456)	**Overview:** 2.3 addresses each type of biomolecule in turn and provides images of each that can be compared 2.3 *Figure 2.15, Figure 2.16, Figure 2.18, , FIgure 2.20, Figure 2.21,, Figure 2.22, Figure 2.23* Ch. 2 Chapter Summary "Biological Molecules also provides a succinct summary of the 4 biomolecules (p.53-54) **Carbohydrates:** 2.3 "Carbohydrates" examines function through monosaccharides, disaccharides, starch, glycogen, and cellulose (p.40-42) 3.4 "Fluid Mosaic Model" last paragraph discusses the role carbohydrate chains play in plasma membranes (p.74-76) 3.5 "Selective Permeability discusses the role carbohydrates play in selective permeability (p.77) See Bio. 9B for a more indepth look at glucose in respect to Energy and Metabolism **Lipids:** 2.3 "Lipids" examines fats, oils, waves, phospholipids, and steroids (p.42-45) 3.3 "The Plasma Membrane" identifies and diagrams the phospholipid bilayer for the plasma membrane(p.63) 4.5 "Connections of Lipids to Glucose Metabolism" talks about cholesterol and triglycerides (p.112) 15.6 "Mammals second paragraph talks about lipids in sebum 16.6 "Neurons and Glial Cells" paragraph 4 mentions the role the lipid membrane around a neuron plays **Proteins:** 2.3 "Proteins" examines enzymes and hormones 2.3 "Protein Structure" *Concepts in Action* link has an interactive animation and overview function, structure 4.5 "Connections of Proteins to Glucose Metabolism (p.111) See Bio. 9C for an indepth look at enzymes throughout this book **Nucleic Acids:** 2.3 "Nucleic Acids" examines DNA and RNA 9.1 focuses on the structure of DNA and RNA and how DNA is arranged in eukaryotic and prokaryotic cells *9.1 Concepts in Action* has an animation of DNA packaging 17.1 discuss the role of nucleic acid in virus replication	A diagram directly comparing biomolecules would be helpful (For example, Biomolecular structure, monomer(s), function, food source, and examples)	**Review Questions:** Ch.2, Question # 10 (lipids) Ch. 3, Question # 10 (protein, plasma membrane) Ch. 6, Question #11 (protein, cellular reproduction) **Critical Thinking Questions:** Ch.2, Question #15 (lipids) Ch. 2, Question # 16 (nucleic acids) Ch. 9, Question # 12 (nucleic acid and proteins, organization of eukaryotic chromosome) **Amoeba Sisters:** Biomolecules overview video: https://www.youtube.com/watch?v=YO244P1e9QM **OER Commons:** https://www.oercommons.org/authoring/57448-structure-of-biomolecules

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Knowledge and Skills		**OpenStax Location**	**Details**	**Comments**	**Additional Resources**
Bio.9B	compare the reactants and products of photosynthesis and cellular respiration in terms of energy, energy conversions, and matter; and	Section 2.3 Biological Molecules (PDF p.39-50) Section 3.3 Eukaryotic Cells (PDF p.61-73) Section 4.1 Energy and Metabolism (PDF p.92-102) Chapter 5 (PDF p.117-131)	**Photosynthesis:** 3.3 "Chloroplasts" provides an overview of photosynthesis in respect to the chloroplast (p.69) 5.1 provides overview of Photosynthesis, including reactant and product energy, energy conversion, and matter (p.117-121) 5.2 covers light dependent reactions and discusses light energy and energy conversion from sunlight to ATP and NADPH (p.122-126) 5.3 covers the Calvin Cycle and mentions cellular respiration in "The Energy Cycle" (p.126-131) **Cellular Respiration:** **Direction Comparison:** 2.3 "Carbohydrates" summarizes the role of glucose in cellular respiration and photosynthesis (p.40-42) 5.3 "The Energy Cycle" (p.130-131)	Cellular Respiration is referenced but not discussed in depth/explained. A mini lesson is needed to allow for more direct comparison	**Review Questions:** Ch. 5, Question #2 (photosynthesis products) Ch. 5, Question# 5 (light energy) Ch. 5, Question #6 (photosynthesis reactant) Ch. 5, Question # 7 (photosynthesis products) Ch.5, Question#9-11 (Calvin Cycle) **Critical Thinking Questions:** Ch.5, Question # 12 (photosynthesis products and reactants) Ch. 5, Question # 16 (comparison) **Amoeba Sisters:** Cellular Respiration Video specifically covers reactant and product comparisons https://www.youtube.com/watch?v=4Eo7JtRA7lg&feature=youtu.be&list=PLwL0Myd7Dk1F0iQPGrjehze3eDpco1eVz **Texas Gateway:** https://www.texasgateway.org/resource/cell-processes-photosynthesis Photosynthesis - videos, fill in the blank exercise, leaf cross section labelling activity https://www.texasgateway.org/resource/cell-processes-respiration Cellular Respiration - energyconsumption video, fill in the blank exercise, equation, glycolysis video an fill in the blank activity, citric acid cycle video and self-quiz, electron transport chain video, and ATP synthase video **Ck12:** Cellular Respiration- videos, readings, exercises: https://www.ck12.org/assessment/ui/?test/detail/practice/life-science/cellular-respiration-practice&collectionHandle=life-science&collectionCreatorID=3&conceptCollectionHandle=life-science-::-cellular-respiration&mode=tunnel&testType=practice&referrer=practice_details&isPageView=true&ep=https://www.ck12.org/assessment/ui/browse/practice/life-science?topicHandle=cell-biology

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Knowledge and Skills		**OpenStax Location**	**Details**	**Comments**	**Additional Resources**
Bio.9C	identify and investigate the role of enzymes.	Section 2.3 Biological Molecules (PDF p.39-50) Section 3.3 Eukaryotic Cells (PDF p.61-73) Section 4.1 Energy and Metabolism(PDF p.92-102) Section 4.4 Fermentation (PDF p.107-111) Section 5.3 The Calvin Cycle (PDF p.126-131) Section 9.2 DNA Replication (PDF p.204-209) Section 9.3 Transcription (PDF p.210-212) Section 10.1 Cloning and Genetic Engineering (PDF p.225-232) Section 16.2 Digestive System (PDF p.408-414)	**Overview**: 2.3 "Proteins" second paragraph provides a brief description of enzymes (p. 45) 4.1 "Enzymes" provides a definition and overview of their role (p.97-102) *Figure* 4.7 demonstrates the role they play in lowering activation energy (p. 98) Concepts in Action provides an animation of induced fit (p.99) *Figure* 4.8 models induced fit (p.99) **Role:** 3.3 "Lysosomes" discusses the role of digestive and hydrolytic enzymes in lysosomes (p.66-67) 4.1 "Metabolic Pathways" last paragraph remarks on the role enzymes make for each step in chemical reactions of metabolic pathways (p.93) 4.4 "Lactic Acid Fermentation" identifies lactate dehydrogenase as the enzyme catalyst (p.108) 5.3 "The Interworkings of the Calvin Cycle" identifies the role RuBisCO plays in initiating the Calvin Cycle (p.127-129) 5.3 *Concept in Action* link has an interactive model of the Calvin cycle and the role of RuBisCO (requires Adobe Flash player) (p.128) *Figure* 5.15 denotes RuBisCo in the Calvin Cycle image (p.128) 9.2 "DNA Replication in Eukaryotes" discusses the role of the enzyme helicase, DNA polymerase, and DNA ligase in replication (p.205-208) 9.2 "Telomere Replication" discusses the role of the enzyme telomerase, Figure 9.11 illustrates the role of telomerase (p.206-208) 9.2 *Concepts in Action* link walks through the steps of DNA replication, highlighting the role of enzymes (p.208) 9.3 "Elongation" discusses the role of RNA polymerase (p.211) *Figure* 9.16 illustrates the role of RNA polymerase (p.211) 10.1 "Polymerase Chain Reaction" covers the role DNA polymerase in "Polymerase Chain Reaction" (p.227-228) 10.1 "Molecular Cloning" discusses role of restriction enzymes and sticky ends (p.228-230) *Figure* 10.6 illustrates molecular cloning and identifies enzymes (p.230) 16.2 "Oral Cavity" covers the role amylase and lipase play in digestion, "Stomach" covers pepsin, last paragraph in "Nutrition" describes the role minerals play as enzyme cofactors (p.409-410)	To better address "investigate" supplemental activities are needed to examine the role of enzymes. From OER Commons: https://www.oercommons.org/authoring/53321-got-lactose-investigating-how-enzymes-function	**Review Questions:** Ch. 4, Question # 5 **Critical Thinking Questions:** Ch. 4, Question #16 Ch. 5, Question #15 **Texas Gateway:** Provides introduction video, enzyme-substrate complex, some examples of the specific enzymes and the roles they play; enzyme activity lab https://www.texasgateway.org/resource/enzymes
(10) Science concepts. The student knows that biological systems are composed of multiple levels. The student is expected to:					
Bio.10A	describe the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals;	Section 16.1 Homeostasis and Osmoregulation (PDF p.404-408) Section 16.2 Digestive System (PDF p.408-414) Section 16.4 Endocrine System (PDF p.420-425) Chapter 17 The Immune System and Disease (PDF p. 449-471) Chapter 18 Animal Reproduction and Development (PDF p. 477-494)	**Regulation:** 16.1 covers homeostasis, thermoregulation, osmoregulation, excretory system 16.1 Thermoregulation *Concepts in Action* link illustrates thermoregulation in several animals (p.405) **Nutrient Absorption:** 16.1 covers the human digestive system, oral cavity, esophagus, stomach, small intestine, large intestine, and accessory organs **Reproduction:** 18.1 covers asexual reproduction, sexual reproduction, external and internal fertilization (p.478-482) 18.2 covers early embryonic development and organogensis (p.482-484) 18.3 covers human reproductive anatomy, gametogenesis, hormonal control of reproduction, and gestation (p.484-494) (16.4 Endocrine system may also be helpful as it covers hormones, which are discussed in reproduction and development) **Defense from Injury/Illness:** 17.1 covers cirus replication, steps of virus infection, viruses and disease, vaccines (p.450-456) 17.2 covers Innate immunity, extenral and chemcial barriers, internal defenses, inflammatory response and phagocytosis, natural killer cells, and complement system (p.456-459) 17.3 covers Adaptive Immunity, B and T Cells, humoral immune response, cell-mediated immunity, immunological memory, the lymphatic system, mucosal immune system, and immune intolerance (p.459-468)		**Visual Connection Questions:** Ch. 16, Question #1 (regulation) Ch. 16, Question #2 (nutrient absorption) Ch. 18, Question# 1-2 (reproduction) **Review Questions:** Ch. 16, Question # 6-8 (regulation) Ch. 16, Question #9-11 (nutrient absorption) Ch. 17, Question #7-12, 14 (defense) Ch. 18, Question # 8-12 (reproduction) **Critical Thinking Questions:** Ch. 16, Question # 27-28 (regulation) Ch. 16, Question # 29 (nutrient absorption) Ch. 17, Question # 18-22 (defense) Ch. 18, Question # 15-18 (reproduction) **Texas Gateway:** Provides an overview of human body systems as well as an activity where students are shown a picture and they have to describe what body systems are involved. https://www.texasgateway.org/resource/animal-system-interactions

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Knowledge and Skills		**OpenStax Location**	**Details**	**Comments**	**Additional Resources**
Bio.10B	describe the interactions that occur among systems that perform the functions of transport, reproduction, and response in plants; and	Chapter 14 The Plant Kingdom (PDF p.325-350)	**Transport:** 14.1 "Additional Land Plant Adaptations" briefly describes plant's vascular system, including the role of xylem, phloem, and roots (p.329-331) 14.2 "Vascular Plants" provides a more in depth look at xylem, phloem, roots as well as describe difference between plant transport systems (p.334-335) **Reproduction:** 14.2 "Bryophytes" third paragraph discusses reproduction (p.333) 14.3 covers reproduction in gymnosperms (p.338-343) 14.3 Figure 14.19 shows conifer life cycle (p.340) 14.3 Concepts in Action video models the process of seed production in gymnosperms (p.340) 14.4 covers reproduction in Angiosperms (p.343-350) 14.4 *Figure 14.25* shows male and female floral organs (p.345) 14.4 *Figure 14.26* covers the lifecycle of an angiosperm (p.346) 14.4 *Figure 14.27* shows double fertilization in angiosperms (p.347)	To address "response in plants" a mini lesson is needed. More information on the transport system would also be useful. See "Book Practice Resources" Biology 2e for supplements	**Visual Connection Questions:** Ch. 14, Question # 1-2 (reproduction) **Review Questions:** Ch. 14, Question # 4 (reproduction) Ch. 14, Question # 9-11 (reproduction) **Critical Thinking Questions:** Ch. 14, Question # 13 (reproduction) Ch. 14, Question # 15 (transport- vascular system) **Biology 2e** 30.6 "Plant Sensory Systems and Responses" Supplement for response in plants criteria - covers response to light, gravity, wind/touch, growth response, and defense against herbivores and pathogens https://openstax.org/books/biology-2e/pages/30-6-plant-sensory-systems-and-responses Chapter 30 "Plant Form and Physiology" Provides a more indepth look at the plant body, stems, roots, leaves, and transport of water and solutes https://openstax.org/books/biology-2e/pages/30-introduction
Bio.10C	analyze the levels of organization in biological systems and relate the levels to each other and to the whole system.	Section 1.1 Themes and Concepts of Biology (PDF p.5-16) Section 3.1 How Cells are Studied (PDF p. 55-59)	1.1 "Levels of Organization of Living Things" outlines the hierarchy of organization in biological systems from atoms to the biosphere (p.9-12) 1.1 *Visual Connection* provides visuals for this hierarchy and T/F question (p. 11) 3.1 Introduction describes the hierarchy again, providing examples from the human biological system (p.56)	To best address "analyze" a supplemental activity would be helpful - see Supplemental Activities	**Visual Connection Questions:** Ch. 1, Question # 1 (order levels) **Review Questions:** Ch. 1, Question # 4 (order levels) **Critical Thinking Questions:** Ch. 1, Question # 7 (relate levels of organization) **Amoeba Sisiters:** Biological Levels in Biology: The World Tour (cells -> biosphere) overview and relating them https://www.youtube.com/watch?v=ORB866QSGv8&list=PLwL0Myd7Dk1F0iQPGrjehze3eDpco1eVz&t=0s **Texas Gateway:** Provides a video for levels of organization from atom-biosphere, a vocabulary matching exercise, slideshow demonstrating organzation in the human circulatory system, identification exercise, and an overview of population, community, and ecosystem in a salt marsh and understanding check activity https://www.texasgateway.org/resource/biological-systems-system-organization Describes levels of organization with a community - country model to explain cell-organism organization https://www.texasgateway.org/resource/organisms-and-environments—levels-organization.
(11) Science concepts. The student knows that biological systems work to achieve and maintain balance. The student is expected to:					

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Knowledge and Skills		**OpenStax Location**	**Details**	**Comments**	**Additional Resources**
Bio.11A	summarize the role of microorganisms in both maintaining and disrupting the health of both organisms and ecosystems; and	Section 3.3 Eukaryotic Cells (PDF p. 61-73) Section 13.1 Prokaryotic Diversity (PDF p. 292-297) Section 13.4 Fungi (PDF p. 311-318) Section 17.1 Viruses (PDF p. 450-456) 19.4 Community Ecology (PDF p.514-524) Section 20.1 Waterford's Energy Flow through Ecosystems (PDF p.530-537) Section 20.2 Biogeochemical Cycles (PDF p.537-547)	**Fungi:** 13.4 "Pathogenic Fungi" (p.314-316) 13.4 "Beneficial Fungi" include importance to ecoysystems and humans (p. 316-318) **Viruses:** 17.1 "How Viruses Replicate" covers *E. coli*, polio, plantar warts, hepatitis A, HIV (p.450-454) 17.1 "Viruses and Disease" (p.454-456) 17.1 *Figure 17.6* shows Influneza virus infection (p.454) **Bacteria:** 20.2 "The Nitrogen Cycle" describes the role bacteria play (p.541-542) 20.2 *Figure 20.12* diagrams nitrogen cycle and highlights role of bacteria (p. 542) **Other** 13.1 "Prokaryotes in and on the Body" covers commensalism, gut flora, prokaryotes on skin (p.302) 20.1 *Figure 20.6* describes and depicts the role microorganisms play in the food web (p.534) 3.3 *Evolution Connection* describes symbiosis in relation to microbes and other organisms (p.70) 19.4 "Mutualism" describes the benefical role protists play in an insect's gut (p.519)		**Critical Thinking Questions:** Ch. 13, Question # 15 (organisms, positive)
Bio.11B	describe how events and processes that occur during ecological succession can change populations and species diversity.	Section 11.4 Speciation (PDF p. 261-266) Section 19.4 Community Ecology (PDF p.514-524)	11.4 "Speciation through Geographic Separation" covers allopatric speciation, adaptive radiation, and identifies events such as "a river forming a new branch, erosion forming a new valley, or a group of organisms traveling to a new location" (p. 262-264) 19.4 "Community Dynamics" remarks on the impact environmental disturbances such as volcanoes, earthquakes, storms, fires, and climate change can impact communities and covers primary and secondary succession (provides a look at population change and species diversity examining oak and hickory forest fires) (p.523-524)	For context, it may also be helpful to look at 19.4 "Characteristics of Communities" which covers species richness, foundation species, and keystone species (p.520-523)	**Review Questions:** Ch. 11, Question # 10 (allopatric speciation) Ch. 11, Question # 11 (dispersal and vicariance) Ch. 11, Question #12 (allopatric speciation) **Critical Thinking Questions:** Ch. 11, Question # 19 (adaptive radiation) Ch. 19, Question # 23 (removal of a keystone species) - this question could be expanded to describe an event that would *cause* this removal and then describe its impact **Crash Course:** Ecological Succession: Covers primary succession, secondary succession, climax community model, adn intermediate disturbance hypothesis https://www.youtube.com/watch?v=jZKIHe2LDP8
(12) Science concepts. The student knows that interdependence and interactions occur within an environmental system. The student is expected to:					
Bio.12A	interpret relationships, including predation, parasitism, commensalism, mutualism, and competition, among organisms;	Section 19.4 Community Ecology (PDF p.514-524)	19.4 covers predation, commensalism, mutualism, and parasitism	Competition not covered in depth; A mini lesson is needed to address this principle adequately- the textbook assumes prior knowledge (See Book Practice Resources)	**Review Questions:** Ch. 19, Question # 16 (mutualism) Ch. 19, Question # 17 (predation - along with extinction and invasive species) **Biology 2e:** 46.1 Ecology of Ecosystem Provides an overview of ecological competition in the introductory paragraph https://openstax.org/books/biology-2e/pages/46-1-ecology-of-ecosystems **Crash Course:** Predation: Covers herbivory and parasitism, predatory adaptation, cryptic coloration, mullerian mimicry, batesian mimicry https://www.youtube.com/watch?v=mFDiiSqGB7M

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Knowledge and Skills		**OpenStax Location**	**Details**	**Comments**	**Additional Resources**
Bio.12B	compare variations and adaptations of organisms in different ecosystems;	Section 20.3 Terrestrial Biomes (PDF p. 547-554) Section 20.4 Aquatic and Marine Biomes (PDF p. 554-562)	Section 20.3 provides an overview of Tropical Forests, Savannas, Deserts, Chaparral, Temperate Grasslands, Temperate Forests, Boreal Forests, and Arctic Tundra; examples of plant and animal adaptations are scattered throughout 20.3 *Concepts in Action* Biome Video does describe some plant adaptations (p.554) Section 20.4 Covers Marine Biomes, Estuaries, Freshwater Biomes, and Wetlands and provides examples of plant and animal adaptations throughout		**Visual Connection Questions:** Ch. 20, Question # 2 (marine biomes, photosynthesizers) **Critical Thinking Questions:** Ch. 20, Question # 16 (subtropical desert, Arctic tundra comparison) - could be extended to include adaptations Ch. 20, Question # 17 (intertidal zone)
Bio.12C	analyze the flow of matter and energy through trophic levels using various models, including food chains, food webs, and ecological pyramids;	20.1 Waterford's Energy Flow through Ecosystems (PDF p. 530-537)	20.1 covers food chains, food webs, and trophic levels 20.1 *Figure 20.4* shows trophic levels in a food chain (p.532) 20.1 *Figure 20.6* shows food web (p.534)	Ecological pyramids are not covered; A mini lesson is needed to address this topic (See Book Practice Resources)	**Review Questions:** Ch. 20, Question #3-4 (food web) **Critical Thinking Questions:** Ch. 20, Question # 13 (food web) **Biology 2e**: 46.2 "Modeling Ecosystems Energy Flow: Ecological Pyramids" covers this topic and can be used as a resource: https://openstax.org/books/biology-2e/pages/46-2-energy-flow-through-ecosystems
Bio.12D	describe the flow of matter through the carbon and nitrogen cycles and explain the consequences of disrupting these cycles; and	20.2 Biogeochemical Cycles (PDF p.537-547)	**Overview:** 20.2 covers carbon and nitrogen cycles **Consequences:** 20.2 "The Biogeochemical Carbon Cycle" last paragraph remarks on the impact of human activity on this process through animal husbandry (p.540-541) 20.2 "The Nitrogen Cycle" last 2nd to last paragraph discusses the impact of combustion of fossil fuels and artificial fertilizers on this cycle (p.541)		**Visual Connection Questions:** Ch. 20, Question # 1 (Nitrogen cycle) **Amoeba Sisters:** Carbon adn Nitrogen Cycles video: Covers Carbon Importance, Carbon Cycle, Nitrogen importance, and Nitrogen Cycle https://www.youtube.com/watch?v=NHqEthRCqQ4&feature=youtu.be&list=PLwL0Myd7Dk1F0iQPGrjehze3eDpco1eVz **Biology 2e** 46.3 Link to learning**:** Provides an indepth look at climate change: https://www.exploratorium.edu/climate/atmosphere#Introduction:Atmosphere
Bio.12E	describe how environmental change can impact ecosystem stability.	19.4 Community Ecology (PDF p.514-524) 21.2 Threats to Biodiversity (PDF p.537-547)	19.4 "Community Dynamics" remarks on the impact environmental disturbances such as volcanoes, earthquakes, storms, fires, and climate change can impact communities; It also covers primary and secondary succession (p.523-524) 21.2 covers habitat loss, overharvesting, the introduction of exotic species, and climate change		**Review Questions:** Ch. 21, Question # 5 (habitat loss) Ch. 21, Question # 7 (invasive species) **Critical Thinking Questions:** Ch. 21, Question #10 (impact of biodiversity loss) Ch. 21, Queston # 12 (habitat loss) Ch. 21, Question # 15 (loss of keystone species)
(1) Scientific processes. The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:					
Bio.1A	demonstrate safe practices during laboratory and field investigations; and	Not covered			
Bio.1B	demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.	Not covered			
(2) Scientific processes. The student uses scientific practices to solve investigative questions. The student is expected to:					
Bio.2A	know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;	PDF p. 26, PDF 21 highlights supported/not supported.	The term **science** is defined and limitations are provided.		
Bio.2B	know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories;		A **hypothesis** is defined as a "tentative explanation" and the following sentence connects hypotheses with theories. Hypothesis testing covered on book pages 23-24, but a graphic on book page 25 actually uses terms "supported" and "not supported" in reference to the hypothesis.		Graphic on page 25 incorporates an activity where students look at a list of 6 potential hypotheses and state which are actual hypotheses and which aren't.

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Knowledge and Skills		**OpenStax Location**	**Details**	**Comments**	**Additional Resources**
Bio.2C	know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but may be subject to change as new areas of science and new technologies are developed;		Theories are defined on book p. 24, but there's not as much elaboration as there is in the standard.	Any additional information would need to highlight that theories are established among multiple researchers and are subject to change.	**TEA Gateway:** "On Track" resource binder with 17 components, covering most scientific process TEKS: https://www.texasgateway.org/binder/ontrack-scientific-process-skills
Bio.2D	distinguish between scientific hypotheses and scientific theories;	PDF p. 18	Definitions of each provided.		
Bio.2E	plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;		Components of the scientific process are elaborated on, but there isn't an opportunity for students to "plan" and "implement" an investigation of their own. Also, the types of investigations (descriptive, comparative, and experimental) aren't defined.	To address these process standards, a "Scientific Process" supplement should be developed that would cover each type of investigation and would include each type of equipment in the following standard.	
Bio.2F	collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as data-collecting probes, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, balances, gel electrophoresis apparatuses, micropipettes, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;				
Bio.2G	analyze, evaluate, make inferences, and predict trends from data; and				
Bio.2H	communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.				
(3) Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:					
Bio.3A	analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;				
Bio.3B	communicate and apply scientific information extracted from various sources such as current events, published journal articles, and marketing materials;				
Bio.3C	draw inferences based on data related to promotional materials for products and services;				
Bio.3D	evaluate the impact of scientific research on society and the environment;				
Bio.3E	evaluate models according to their limitations in representing biological objects or events; and				
Bio.3F	research and describe the history of biology and contributions of scientists.				