

Textbook Title: *Biology 2e*

Knowledge and Skills		OpenStax Location	Details	Comments	Additional Resources
<p><i>Scientific Investigation and Reasoning TEKS begin at row 49.</i></p> <p>(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:</p>					
Bio.4A	compare and contrast prokaryotic and eukaryotic cells, including their complexity, and compare and contrast scientific explanations for cellular complexity;	Sections 4.2 and 4.3	<p>These sections describe the structures of both prokaryotic and eukaryotic cells and compare and contrast the two types of cells.</p>	<p>Although beyond the scope of this standard, the following have information concerning this topic: Section 10.5 discusses Prokaryotic Cell Division Sections 15.2 and 15.3 discuss P & E Transcription Sections 16.2-16.6 discuss P & E Gene Regulation Section 22.1 discusses Prokaryotic Diversity Section 22.3 discusses Prokaryotic Metabolism Section 22.5 discusses Beneficial Prokaryotes</p> <p>Scientific explanations for cellular complexity is not addressed.</p>	Career Connection - Microbiologist, Section 4.2
Bio.4B	investigate and explain cellular processes, including homeostasis and transport of molecules; and	Section 1.2 Section 2.2 Sections 5.1 - 5.4 Section 33.3	<p>Homeostasis is addressed briefly in section 1.2 under Properties of Life, and Section 2.2 discusses the role of acids, bases and buffers in homeostasis.</p> <p>Section 33.3 defines and describes factors affecting homeostasis, discusses positive and negative feedback mechanisms, and describes thermoregulation of endothermic and ectothermic animals.</p> <p>Chapter 5 describes the plasma membrane and all of the various types of transport of molecules such as active, passive, and facilitated. It also includes osmosis, diffusion and tonicity.</p> <p>Section 5.4 includes bulk transport such as endocytosis and exocytosis.</p>		
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.	Sections 21.1 - 21.4	<p>Chapter 21 discusses the structures of viruses, how viruses reproduce, and the role in causing diseases. It has graphics showing both the lytic and lysogenic cycles of viral reproduction. HIV and influenza are both discussed.</p>		<ol style="list-style-type: none"> 1. Visual Connection showing and discussing structure of influenza virus, Section 21.1 2. Visual Connection showing influenza virus infecting a cell and replicating, Section 21.2 3. Link to Learning video about viruses: https://www.khanacademy.org/science/biology/her/tree-of-life/v/viruses 4. Visual Connection showing Lytic Cycle of viral replication, Section 21.2 5. Link to Learning interactive animation showing various stages of the replicative cycles of animal viruses: http://openstaxcollege.org//animal_viruses
<p>(5) Science concepts. The student knows how an organism grows and the importance of cell differentiation. The student is expected to:</p>					
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;	Section 10.2	<p>Discusses each step in the cell cycle. Discusses DNA replication and mitosis.</p>	Growth of organisms is not mentioned.	<ol style="list-style-type: none"> 1. Laboratory provided has students determine the time spent in cell cycle stages. 2. Visual Connection has students place events in mitosis in correct order.
Bio.5B	describe the roles of DNA, ribonucleic acid (RNA), and environmental factors in cell differentiation; and			Cell differentiation is used in several paragraphs, but it is not discussed as a topic	

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Bio.5C	recognize that disruptions of the cell cycle lead to diseases such as cancer.	Section 10.4	Discusses Cancer and the Cell Cycle .	Text goes beyond standard when it discusses cell-cycle regulators.	<p>1. Visual Connection that diagrams how DNA damage may cause cancer.</p> <p>2. Link to Learning has an animation that shows how cancer results from errors in the cell cycle: http://cnx.org/content/m66480/1.3/#eip-id1169995709332</p>
(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 14.2	Discusses the structure/ components of DNA .	Connection between DNA and traits isn't clearly stated, and scientific explanations for the origin of DNA are not covered.	Visual Connection that shows the five bases of DNA and RNA.
Bio.6B	recognize that components that make up the genetic code are common to all organisms;	Section 15.1	Discusses how the "central dogma" of DNA-protein synthesis is essential to life as we know it.	Although the ideas represented by the standard are present in this section, this specific TEKS wording and idea are not in the text.	
Bio.6C	explain the purpose and process of transcription and translation using models of DNA and RNA;	Sections 15.2, 15.3, and 15.5	Discusses transcription and translation in both prokaryotes and eukaryotes, along with ribosome and protein synthesis (translation).	The discussion of mRNA processing in Section 15.4 goes beyond the standard.	<p>Link to Learning options:</p> <p>1. Link to Learning shows the first part of transcription: http://openstaxcollege.org/l/transcription</p> <p>2. Link to Learning shows an animation of the process of prokaryotic transcription: http://openstaxcollege.org/l/transcription2</p> <p>3. Link to Learning shows protein synthesis in action: http://openstaxcollege.org/l/prokary_protein</p>
Bio.6D	recognize that gene expression is a regulated process;	Sections 16.1-16.7	Discusses regulation of gene expression in prokaryotes and eukaryotes.	Sections also include additional information on epigenetic, transcription and post-transcriptional gene regulation along with cancer and gene regulation.	
Bio.6E	identify and illustrate changes in DNA and evaluate the significance of these changes;	Section 14.6	Discusses different types of changes (mutations) in DNA , such as induced and spontaneous mutations.		Visual Connection shows DNA examples of Point Mutations and Frameshift Mutations.
Bio.6F	predict possible outcomes of various genetic combinations such as monohybrid crosses, dihybrid crosses, and non-Mendelian inheritance; and	Sections 12.2 and 12.3	Discusses Mendelian genetics, punnett square, and monohybrid crosses , along with how to calculate the probability of a trait appearing. Also highlights alternatives to dominance and recessiveness (non-Mendelian inheritance) such as incomplete dominance, codominance, multiple alleles, X-linked traits, and human sex-linked disorders. Discusses dihybrid crosses and probability.		Link to Learning has a video about sex-linked traits: https://youtu.be/-ROhfKyxgCo
Bio.6G	recognize the significance of meiosis to sexual reproduction.	Sections 11.1 and 11.2	Discusses the process of meiosis and sexual reproduction .		<p>1. Link to Learning has a video about meiosis: http://openstaxcollege.org/l/animal_meiosis</p> <p>2. Link to Learning has an interactive animation to compare meiosis and mitosis: http://openstaxcollege.org/l/how_cells_divide</p>
(7) Science concepts. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life. The student is expected to:					
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;	Section 18.1	Discusses evidence of evolution using the fossil record, anatomy and embryology (developmental homologies), biogeography, and molecular biology .	This chapter uses the term <i>evolution</i> , while Texas/the TEKS use <i>common ancestry</i> as a code for evolution.	Link to Learning offers an interactive site that allows students to guess which bone structures are homologous: http://openstaxcollege.org/l/bone_structures

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Bio.7B	examine scientific explanations of abrupt appearance and stasis in the fossil record;			These concepts aren't covered in the textbook.	
Bio.7C	analyze and evaluate how natural selection produces change in populations, not individuals;	Section 19.1	Discusses population genetics and describes how scientists use population genetics in studying population evolution.	The Hardy-Weinberg Principle of Equilibrium is explained.	1. Visual Connection illustrates the Hardy-Weinberg Principle. 2. Link to Learning has an online calculator to determine a population's genetic structure: http://openstaxcollege.org/l/hardy-weinberg
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 19.3	Discusses reproductive success in terms of frequency dependent selection.	The concepts are presented, without analysis or evaluation of the ideas, however.	
Bio.7E	analyze and evaluate the relationship of natural selection to adaptation and to the development of diversity in and among species; and	Section 18.2	Discusses how genetic variables (natural selection) lead to speciation and describes adaptive radiation.		Link to Learning in an interactive site that shows how island birds evolved in evolutionary increments: http://openstaxcollege.org/l/bird_evolution
Bio.7F	analyze other evolutionary mechanisms, including genetic drift, gene flow, mutation, and recombination.	Section 19.2	Discusses genetic drift , gene flow and mutation .	Recombination is not mentioned in terms of evolution	1. Link to Learning has an animation of random sampling and genetic drift in action at the site linked below: http://openstaxcollege.org/l/genetic_drift 2. Scientific Method Connection - Testing the Bottleneck Effect
(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 20.1	Discusses the need for classification system and the different levels of the taxonomic classification system.		
Bio.8B	categorize organisms using a hierarchical classification system based on similarities and differences shared among groups; and	Sections 20.1 and 20.2	Discusses phylogenetic trees and binomial nomenclature.		Link to Learning offers a game to classify three organisms available at link: http://openstaxcollege.org/l/classify_life
Bio.8C	compare characteristics of taxonomic groups, including archaea, bacteria, protists, fungi, plants, and animals.		Chapters 21-29 give information about each different group.	Few comparisons made between each group, but students can identify key characteristics from each chapter and then compare using graphic organizers or in their notebooks.	
(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:					
Bio.9A	compare the functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids;	Sections 3.1 - 3.5	Extensive discussions on each biomolecule in these sections, but they are referred to as macromolecules .		Link to Learning options: 1. Interactive animation on carbohydrates: http://openstaxcollege.org/l/carbohydrates 2. Interactive animation on lipids: http://openstaxcollege.org/l/lipids 3. Interactive tutorial on protein synthesis: http://openstaxcollege.org/l/protein_synth 4. Animation on proteins: http://openstaxcollege.org/l/proteins 5. Animation on DNA: http://openstaxcollege.org/l/DNA

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Bio.9B	compare the reactants and products of photosynthesis and cellular respiration in terms of energy, energy conversions, and matter; and	Chapters 7 and 8	Extensive discussions included in these chapters on photosynthesis and cellular respiration . The last topic in Section "The Energy Cycle" briefly compares the waste products of each process.	Energy conversions and matter are not discussed. The Visual Connection discusses the Calvin cycle with a question about the reactants and products of photosynthesis. This question is beyond the scope of this standard.	Link to Learning options: 1. Video to show anaerobic cellular respiration in action: https://www.youtube.com/watch?v=Cngt2HmJuSo 2. Animation of the electron transport chain and ATP synthesis: http://openstaxcollege.org//electron_transp 3. Site to learn more about photosynthesis: http://openstaxcollege.org//photosynthesis 4. Animation to view the process of photosynthesis: http://openstaxcollege.org//light_reactions
Bio.9C	identify and investigate the role of enzymes.	Section 6.5	Discusses role of enzymes .	<i>Investigation</i> not necessarily covered, through students can access the Link to Learning and Visual Connection for applications of enzyme discoveries. Investigation could be addressed through a hands-on lab like available through the OER Commons (see #3 in next column).	1. Link to Learning has an animation showing induced fit and other enzyme mechanisms: http://openstaxcollege.org//hexokinase 2. Everyday Connection discusses enzymes and drug discoveries. 3. Enzyme function lab from OER Commons: https://www.oercommons.org/authoring/53321-got-lactose-investigating-how-enzymes-function
(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;	Chapters 33-43	Each of the animal systems are discussed.	Interactions between the mentioned systems are not present.	
Bio.10B	describe the interactions that occur among systems that perform the functions of transport, reproduction, and response in plants; and	Chapters 30-32	Transport of water within plants and plant reproduction are discussed. Section 30.6 discusses plant responses to light and gravity along with growth responses from auxins, cytokinins, gibberellins, abscisic acid, and ethylene.	Interactions between the mentioned systems are not present.	
Bio.10C	analyze the levels of organization in biological systems and relate the levels to each other and to the whole system.	Section 1.2	Levels of organization and diversity of life are discussed.	No relationship is given between levels and the whole system.	Visual Connection shows the biological levels of organization.
(11) Science concepts. The student knows that biological systems work to achieve and maintain balance. The student is expected to:					
Bio.11A	summarize the role of microorganisms in both maintaining and disrupting the health of both organisms and ecosystems; and	Chapters 21-24 Section 46.1	Sections 21.2 and 21.3 discuss virus infections and prevention and treatment of those infections. Section 46.1 briefly mentions the role of microorganisms within ecosystems. Sections 22.4 and 22.5 discuss bacterial diseases in humans and beneficial prokaryotes. Section 23.3 discusses sleeping sickness caused by a protist , and 23.4 discusses the role protists play in the ecosystem along with the important pathogenic species of protists. Sections 24.4 and 24.5 discuss fungal parasites and pathogens and the importance of fungi in human life.		Link to Learning options: 1. <i>T. brucei</i> swimming: http://cnx.org/content/m66555/1.3/#eip-id1167232288213 2. Pathogenesis of <i>Plasmodium falciparum</i> , the causative agent of malaria: http://openstaxcollege.org//malaria
Bio.11B	describe how events and processes that occur during ecological succession can change populations and species diversity.	Section 45.6	Describes primary and secondary succession .	Text does not link primary/secondary succession to change in populations or species diversity.	
(12) Science concepts. The student knows that interdependence and interactions occur within an environmental system. The student is expected to:					

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Bio.12A	interpret relationships, including predation, parasitism, commensalism, mutualism, and competition, among organisms;	Section 45.6	All relationships discussed, including mimicry.		
Bio.12B	compare variations and adaptations of organisms in different ecosystems;	Sections 18.2 and 18.3	Adaptations of various animals and plants are compared and discussed, as are variations as they pertain to the formation of new species.		Link to Learning in Section 18.1 is an interactive site that allows students to see examples of evolutionary adaptations.
Bio.12C	analyze the flow of matter and energy through trophic levels using various models, including food chains, food webs, and ecological pyramids;	Sections 46.1 and 46.2	Discusses flow of energy in ecosystems through food chains and food webs along with trophic levels and ecological pyramids .		Link to Learning has an online simulator to investigate food web function: http://openstaxcollege.org//food_web Visual Connections (in both sections) shows various types of food pyramids and asks students to analyze them.
Bio.12D	describe the flow of matter through the carbon and nitrogen cycles and explain the consequences of disrupting these cycles; and	Section 46.3	Discusses water, carbon, nitrogen , phosphorus, and sulfur cycles and explains how human activities have impacted them, along with the consequences for the Earth.		Link to Learning links to a website that then links to various other websites explaining and illustrating the different biogeochemical cycles: http://openstaxcollege.org//biogeochemical
Bio.12E	describe how environmental change can impact ecosystem stability.	Section 47.1	The effects of different environmental changes and their impacts on ecosystems are presented.	Various mass extinctions and the impacts on the ecosystems are discussed, as well as other threats to ecosystem stability, such as habitat loss, overharvesting, exotic species, and climate change.	Link to Learning options: 1. Video that discusses declining fish stocks: http://openstaxcollege.org//declining_fish 2. Interactive map of critical habitat for endangered and threatened species in the US: http://openstaxcollege.org//habitat_map 3. Interactive global data base to explore exotic or invasive species: http://openstaxcollege.org//exotic_invasive
Scientific Investigation and Reasoning TEKS					
(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 discussed			
Bio.1B	demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.	not discussed			
(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;	Section 1.1	Definition of science is explained but idea of limitations is not mentioned		
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;	Section 1.1	Hypotheses being testable and supported by evidence is discussed but that they are tentative is alluded to but not discussed in that language.		
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;	Section 1.1	Scientific theories discussed and the difference between them and hypotheses are discussed.		
Bio.2D	distinguish between scientific hypotheses and scientific theories;	Section 1.1	The two ideas, hypotheses and theories , are discussed but students are not asked to distinguish between the two.		

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Bio.2E	plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;	not discussed			
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;	not present			
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.	Section 1.1	Concept of valid conclusions discussed but students are not asked to communicate or make them		
(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;	not discussed	Students not asked to analyze, evaluate or critique scientific explanations.		
Bio.3B	communicate and apply scientific information extracted from various sources such as current events, published journal articles, and marketing materials;	not present			
Bio.3C	draw inferences based on data related to promotional materials for products and services;	not present			
Bio.3D	evaluate the impact of scientific research on society and the environment;	Throughout entire text	Everyday Connection features tie biological concepts to emerging issues and discuss science in terms of everyday life. (per Preface)	Link to <i>Everyday Connection</i> index forthcoming.	
Bio.3E	evaluate models according to their limitations in representing biological objects or events; and	not present			
Bio.3F	research and describe the history of biology and contributions of scientists.	Throughout entire text	Career Connection introduces students to information on a variety of careers (per Preface)	Link to <i>Career Connection</i> index forthcoming.	