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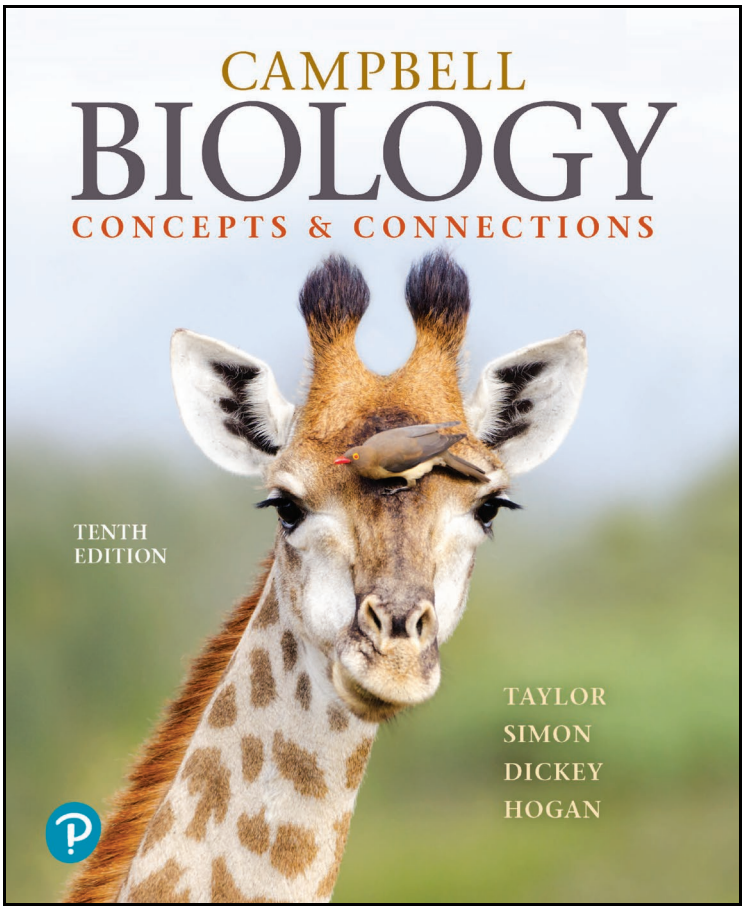

To the

Next Generation Science Standards
Performance Expectations
High School Life Science

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(HS-LS3-2) Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.	**SE/TE:** **Chapter 8: The Cellular Basis of Reproduction and Inheritance, pp. 146–172** Lesson 8.14: Mitosis and meiosis have important similarities and differences, p. 160 Lesson 8.15: Independent orientation of chromosomes in meiosis and random fertilization lead to varied offspring, p. 161 Lesson 8.16: Homologous chromosomes may carry different versions of genes, p. 162 Lesson 8.17: Crossing over further increases genetic variability, p. 163 Lesson 8.18: Accidents during meiosis can alter chromosome number, p. 164 Lesson 8.20: An extra copy of chromosome 21 causes Down syndrome, p. 166 Lesson 8.21: Abnormal numbers of sex chromosomes do not usually affect survival, p. 167 Lesson 8.22: New species can arise from errors in cell division, p. 168 Lesson 8.23: Alterations of chromosome structure can cause birth defects and cancer, p. 169 **Chapter 9: Patterns of Inheritance, pp. 173–199** Lesson 9.18: Crossing over produces new combinations of alleles, p. 191 Lesson 9.19: Geneticists use crossover data to map genes, p. 192 **Chapter 10: Molecular Biology of the Gene, pp. 200–226** Lesson 10.5: DNA replication proceeds in two directions at many sites simultaneously, p. 205 Lesson 10.16: Mutations can affect genes, p. 216 Lesson 10.22: Bacteria can transfer DNA in three ways, p. 222 Lesson 10.23: Bacterial plasmids can serve as carriers for gene transfer, p. 223 **Chapter 13: How Populations Evolve, pp. 275–296** Lesson 13.8: Mutation and sexual reproduction produce the genetic variation that makes evolution possible, p. 283

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(HS-LS3-3) Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.	**SE/TE:** **Chapter 9: Patterns of Inheritance, pp. 173–199** Lesson 9.2: The science of genetics began in an abbey garden, p. 175 Lesson 9.3: Mendel's law of segregation describes the inheritance of a single character, p. 176 Lesson 9.4: Homologous chromosomes bear the alleles for each character, p. 177 Lesson 9.5: The law of independent assortment is revealed by tracking two characters at once, p. 178 Lesson 9.6: Geneticists can use a testcross to determine unknown genotypes, p. 179 Lesson 9.7: Mendel's laws reflect the rules of probability, p. 180 Lesson 9.8: Genetic traits in humans can be tracked through family pedigrees, p. 181 Lesson 9.9: Many inherited traits in humans are controlled by a single gene, p. 182 Lesson 9.11: Incomplete dominance results in intermediate phenotypes, p. 184 Lesson 9.12: Many genes have more than two alleles that may be codominant, p. 185 Lesson 9.13: A single gene may affect many phenotypic characters, p. 186 Lesson 9.14: A single character may be influenced by many genes, p. 187 Lesson 9.15: The environment affects many characters, p. 188 Lesson 9.17: Genes on the same chromosome tend to be inherited together, p. 190 Lesson 9.18: Crossing over produces new combinations of alleles, p. 191 **Chapter 13: How Populations Evolve, pp. 275–296** Lesson 13.10: The Hardy-Weinberg equation can test whether a population is evolving, p. 285 **Chapter 35: Behavioral Adaptations to the Environment, pp. 714–740** Lesson 35.3: Both genetics and environment influence behavior, p. 717 Lesson 35.23: Human behavior is the result of both genetic and environmental factors, p. 737

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(HS-LS4) Biological Evolution: Unity and Diversity	
(HS-LS4-1) Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.	**SE/TE:** **Chapter 1: Biology: Exploring Life, pp. 1–18** Lesson 1.6: Hypotheses can be tested using observational data, p. 7 Lesson 1.9: Theme: Evolution is the core theme of biology, p. 10 **Chapter 12: DNA Technology and Genomics, pp. 249–274** Lesson 12.21: Genomes hold clues to human evolution, p. 271 **Chapter 13: How Populations Evolve, pp. 275–296** Lesson 13.2: The study of fossils provides strong evidence for evolution, p. 277 Lesson 13.3: Fossils of transitional forms support Darwin's theory of evolution, p. 278 Lesson 13.4: Homologies provide strong evidence for evolution, p. 279 Lesson 13.5: Homologies indicate patterns of descent that can be shown on an evolutionary tree, p. 280 **Chapter 15: Tracing Evolutionary History, pp. 312–335** Lesson 15.15: Phylogenies based on homologies reflect evolutionary history, p. 327 Lesson 15.16: Shared characters are used to construct phylogenetic trees, p. 328 Lesson 15.17: An organism's evolutionary history is documented in its genome, p. 329 Lesson 15.18: Molecular clocks help track evolutionary time, p. 330 Lesson 15.19: Constructing the tree of life is a work in progress, p. 331 **Chapter 16: Microbial Life: Prokaryotes and Protists, pp. 336–358** Lesson 16.7: Bacteria and archaea are the two main branches of prokaryotic evolution, p. 343

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(HS-LS4-2) Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.	**SE/TE:** **Chapter 1: Biology: Exploring Life, pp. 1–18** Lesson 1.9: Theme: Evolution is the core theme of biology, p. 10 **Chapter 13: How Populations Evolve, pp. 275–296** Lesson 13.6: Darwin proposed natural selection as the mechanism of evolution, p. 281 Lesson 13.7: Scientists can observe natural selection in action, p. 282 Lesson 13.8: Mutation and sexual reproduction produce the genetic variation that makes evolution possible, p. 283 Lesson 13.12: Natural selection, genetic drift, and gene flow can cause microevolution, p. 287 Lesson 13.13: Natural selection is the only mechanism that consistently leads to adaptive evolution, p. 288 Lesson 13.15: Sexual selection may lead to phenotypic differences between males and females, p. 290 Lesson 13.16: The evolution of drug-resistant microorganisms is a serious public health concern, p. 291 Lesson 13.17: Diploidy and balancing selection preserve genetic variation, p. 292 Lesson 13.18: Natural selection cannot fashion perfect organisms, p. 293 **Chapter 14: The Origin of Species, pp. 297–311** Lesson 14.9: Long-term field studies document evolution in Darwin's finches, p. 306
(HS-LS4-3) Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.	**SE/TE:** **Chapter 1: Biology: Exploring Life, pp. 1–18** Lesson 1.5: Hypotheses can be tested using controlled experiments, p. 6 Lesson 1.9: Theme: Evolution is the core theme of biology, p. 10 Lesson 1.12: Theme: Structure and function are related, p. 13 **Chapter 3: The Molecules of Cells, pp. 40–59** Lesson 3.16: Lactose tolerance is a recent event in human evolution, p. 56 **Chapter 13: How Populations Evolve, pp. 275–296** Lesson 13.6: Darwin proposed natural selection as the mechanism of evolution, p. 281 Lesson 13.7: Scientists can observe natural selection in action, p. 282

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Continued: (HS-LS4-3) Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.	**Continued:** **Chapter 13: How Populations Evolve, pp. 275–296** Lesson 13.6: Darwin proposed natural selection as the mechanism of evolution, p. 281 Lesson 13.7: Scientists can observe natural selection in action, p. 282 Lesson 13.8: Mutation and sexual reproduction produce the genetic variation that makes evolution possible, p. 283 Lesson 13.9: Evolution occurs within populations, p. 284 Lesson 13.13: Natural selection is the only mechanism that consistently leads to adaptive evolution, p. 288 Lesson 13.14: Natural selection can alter variation in a population in three ways, p. 289 Lesson 13.15: Sexual selection may lead to phenotypic differences between males and females, p. 290 Lesson 13.16: The evolution of drug-resistant microorganisms is a serious public health concern, p. 291 Lesson 13.17: Diploidy and balancing selection preserve genetic variation, p. 292 **Chapter 14: The Origin of Species, pp. 297–311** Lesson 14.9: Long-term field studies document evolution in Darwin's finches, p. 306 **Chapter 15: Tracing Evolutionary History, pp. 312–335** Lesson 15.12: Novel traits may arise in several ways, p. 324 **Chapter 19: The Evolution of Vertebrate Diversity, pp. 402–423** Lesson 19.16: Human skin color reflects adaptations to varying amounts of sunlight, p. 418 **Chapter 34: The Biosphere: An Introduction to Earth's Diverse Environments, pp. 692–714** Lesson 34.4: Organisms are adapted to abiotic and biotic factors through natural selection, p. 696 **Chapter 37: Communities and Ecosystems, pp. 756–782** Lesson 37.5: Predation leads to diverse adaptations in prey species, p. 761 Lesson 37.6 Herbivory leads to diverse adaptations in plants, p. 762

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(HS-LS4-4) Construct an explanation based on evidence for how natural selection leads to adaptation of populations.	**SE/TE:** **Chapter 13: How Populations Evolve, pp. 275–296** Lesson 13.6: Darwin proposed natural selection as the mechanism of evolution, p. 281 Lesson 13.7: Scientists can observe natural selection in action, p. 282 Lesson 13.8: Mutation and sexual reproduction produce the genetic variation that makes evolution possible, p. 283 Lesson 13.9: Evolution occurs within populations, p. 284 Lesson 13.13: Natural selection is the only mechanism that consistently leads to adaptive evolution, p. 288 Lesson 13.14: Natural selection can alter variation in a population in three ways, p. 289 Lesson 13.16: The evolution of drug-resistant microorganisms is a serious public health concern, p. 291 Lesson 13.17: Diploidy and balancing selection preserve genetic variation, p. 292 Lesson 13.18: Natural selection cannot fashion perfect organisms, p. 293 **Chapter 14: The Origin of Species, pp. 297–311** Lesson 14.9: Long-term field studies document evolution in Darwin's finches, p. 306 **Chapter 15: Tracing Evolutionary History, pp. 312–335** Lesson 15.12: Novel traits may arise in several ways, p. 324 **Chapter 19: The Evolution of Vertebrate Diversity, pp. 402–423** Lesson 19.16: Human skin color reflects adaptations to varying amounts of sunlight, p. 418 **Chapter 34: The Biosphere: An Introduction to Earth's Diverse Environments, pp. 692–714** Lesson 34.4: Organisms are adapted to abiotic and biotic factors through natural selection, p. 696 **Chapter 37: Communities and Ecosystems, pp. 756–782** Lesson 37.5: Predation leads to diverse adaptations in prey species, p. 761 Lesson 37.6 Herbivory leads to diverse adaptations in plants, p. 762

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(HS-LS4-5) Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.	**SE/TE:** **Chapter 14: The Origin of Species, pp. 297–311** Lesson 14.3: Reproductive barriers keep species separate, p. 300 Lesson 14.4: In allopatric speciation, geographic isolation leads to speciation, p. 301 Lesson 14.5: Reproductive barriers can evolve as populations diverge, p. 302 Lesson 14.6: Sympatric speciation takes place without geographic isolation, p. 303 Lesson 14.7: Sexual selection can lead to speciation, p. 304 Lesson 14.8: Isolated islands are often showcases of speciation, p. 305 Lesson 14.9: Long-term field studies document evolution in Darwin's finches, p. 306 Lesson 14.10: Hybrid zones provide opportunities to study reproductive isolation, p. 307 Lesson 14.11: Speciation can occur rapidly or slowly, p. 308 **Chapter 15: Tracing Evolutionary History, pp. 312–335** Lesson 15.7: Continental drift has played a major role in macroevolution, p. 319 Lesson 15.9: Five mass extinctions have altered the course of evolution, p. 321 Lesson 15.10: Adaptive radiations have increased the diversity of life, p. 322 Lesson 15.11: Genes that control development play a major role in evolution, p. 323 Lesson 15.13: Evolutionary trends do not mean that evolution is goal directed, p. 325

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(HS-LS4-6) Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.	For supporting content, please see: **SE/TE:** **Chapter 38: Conservation Biology, pp. 783–799** Lesson 38.2: Habitat loss, invasive species, overharvesting, pollution, and climate change are major threats to biodiversity, p. 785 Lesson 38.3: Rapid warming is changing the global climate, p. 786 Lesson 38.4: Human activities are responsible for rising concentrations of greenhouse gases, p. 787 Lesson 38.5: Climate change affects biomes, ecosystems, communities, and populations, p. 788 Lesson 38.6: Climate change is an agent of natural selection, p. 789 Lesson 38.7: Protecting endangered populations is one goal of conservation biology, p. 790 Lesson 38.8: Sustaining ecosystems and landscapes is a conservation priority, p. 791 Lesson 38.9: Establishing protected areas slows the loss of biodiversity, p. 792 Lesson 38.10: Zoned reserves are an attempt to reverse ecosystem disruption, p. 793 Lesson 38.11: The Yellowstone to Yukon Conservation Initiative seeks to preserve biodiversity by connecting protected areas, p. 794 Lesson 38.12: The study of how to restore degraded habitats is a developing science, p. 795 Lesson 38.13: Sustainable development is an ultimate goal, p. 796