Glencoe

High School Science Content Expectations/Biology Essential Skills



# Biology



| STANDARDS | PAGE REFERENCES |
|---|---|
| **STANDARD B1: INQUIRY, REFLECTION, AND SOCIAL IMPLICATIONS**<br>*Students will understand the nature of science and demonstrate an ability to practice scientific reasoning by applying it to the design, execution, and evaluation of scientific investigations. Students will demonstrate their understanding that scientific knowledge is gathered through various forms of direct and indirect observations and the testing of this information by methods including, but not limited to, experimentation. They will be able to distinguish between types of scientific knowledge (e.g., hypotheses, laws, theories) and become aware of areas of active research in contrast to conclusions that are part of established scientific consensus. They will use their scientific knowledge to assess the costs, risks, and benefits of technological systems as they make personal choices and participate in public policy decisions. These insights will help them analyze the role science plays in society, technology, and potential career opportunities.* | |
| **S1 B1.1 Scientific Inquiry**<br>Science is a way of understanding nature. Scientific research may begin by generating new scientific questions that can be answered through replicable scientific investigations that are logically developed and conducted systematically. Scientific conclusions and explanations result from careful analysis of empirical evidence and the use of logical reasoning. Some questions in science are addressed through indirect rather than direct observation, evaluating the consistency of new evidence with results predicted by models of natural processes. Results from investigations are communicated in reports that are scrutinized through a peer review process. | |
| **B1.1A** Generate new questions that can be investigated in the laboratory or field. | **Student Edition:**<br>16, 18<br>*BioLab: Design Your Own* 23, 51, 173, 533, 567, 593, 925<br>*Section Assessment* 21 (#6)<br>**Teacher Wraparound Edition:**<br>CT 18 |

**Codes used for Teacher Wraparound Edition pages are the initial caps of headings on that page.**

| STANDARDS | | PAGE REFERENCES |
|---|---|---|
| **B1.1B** | Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables, accuracy of data analysis, logic of argument, logic of experimental design, and/or the dependence on underlying assumptions. | **Student Edition:**<br>xxxiii, 12-14, 20<br>*BioLab: Design Your Own* 173, 593, 925, 1035<br>*MiniLab* 19<br>**Teacher Wraparound Edition:**<br>DC 11, 13 |
| **B1.1C** | Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision). | **Student Edition:**<br>xxxiii-xli<br>*BioLab: Design Your Own* 173, 235, 593, 983<br>*Launch Lab* 181, 217<br>*MiniLab* 48, 154, 223<br>**Teacher Wraparound Edition:**<br>DE 14, 164; SP 14 |
| **B1.1D** | Identify patterns in data and relate them to theoretical models. | **Student Edition:**<br>20<br>*BioLab* 443, 1097<br>*BioLab: Design Your Own* 287<br>*Data Analysis Lab* 63<br>*Launch Lab* 31<br>*MiniLab* 314, 396<br>**Teacher Wraparound Edition:**<br>CB 433 |
| **B1.1E** | Describe a reason for a given conclusion using evidence from an investigation. | **Student Edition:**<br>20<br>*BioLab: Design Your Own* 173, 235, 593, 653, 925<br>*Data Analysis Lab* 1064, 1090 |

| STANDARDS | | PAGE REFERENCES |
|---|---|---|
| **B1.2 Scientific Reflection and Social Implications**<br>The integrity of the scientific process depends on scientists and citizens understanding and respecting the "nature of science." Openness to new ideas, skepticism, and honesty are attributes required for good scientific practice. Scientists must use logical reasoning during investigation design, analysis, conclusion, and communication. Science can produce critical insights on societal problems from a personal and local scale to a global scale. Science both aids in the development of technology and provides tools for assessing the costs, risks, and benefits of technological systems. Scientific conclusions and arguments play a role in personal choice and public policy decisions. New technology and scientific discoveries have had a major influence in shaping human history. Science and technology continue to offer diverse and significant career opportunities. | | |
| **B1.2A** | Critique whether or not specific questions can be answered through scientific investigations. | **Student Edition:**<br>16<br>*Biology & Society* 1066, 1096<br>*MiniLab* 77<br>**Teacher Wraparound Edition:**<br>CB 401; MI 11 |
| **B1.2B** | Identify and critique arguments about personal or societal issues based on scientific evidence. | **Student Edition:**<br>256-257, 363, 370-371<br>*Biology & Society* 258, 680, 1066, 1096<br>**Teacher Wraparound Edition:**<br>DC 257, 363; RS 370; WIB 258 |
| **B1.2C** | Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information. | **Student Edition:**<br>15<br>*BioLab: Internet* 783, 809, 899, 1011, 1067<br>*Debate in Biology* 1096<br>*Science Skill Handbook* 1111<br>*Writing in Biology* 172<br>**Teacher Wraparound Edition:**<br>DC 257; WS 257 |
| **B1.2D** | Evaluate scientific explanations in a peer review process or discussion format. | **Student Edition:**<br>14, 20<br>*BioLab: Design Your Own* 51, 173, 235, 593<br>**Teacher Wraparound Edition:**<br>DC 406, 407 |

| STANDARDS | | PAGE REFERENCES |
|---|---|---|
| **B1.2E** | Evaluate the future career and occupational prospects of science fields. | **Student Edition:**<br>5-6<br>*Careers in Biology* 9, 28, 150, 254, 274, 663, 970<br>*In the Field* 286, 316, 380, 622, 1038<br>*MiniLab* 314<br>**Teacher Wraparound Edition:**<br>AG 286; BA 316 |

**STANDARD B2: ORGANIZATION AND DEVELOPMENT OF LIVING SYSTEMS**

*Students describe the general structure and function of cells. They can explain that all living systems are composed of cells and that organisms may be unicellular or multicellular. They understand that cells are composed of biological macromolecules and that the complex processes of the cell allow it to maintain a stable internal environment necessary to maintain life. They make predictions based on these understandings.*

**S11. L2.p1 Cells *(prerequisite)***

All organisms are composed of cells, from just one cell to many cells. Water accounts for more than two-thirds of the weight of a cell, which gives cells many of their properties. In multicellular organisms, specialized cells perform specialized functions. Organs and organ systems are composed of cells and function to serve the needs of organisms for food, air, and waste removal. The way in which cells function is similar in all living organisms. *(prerequisite)*

**L2.p2 Cell Function *(prerequisite)***

Cells carry out the many functions needed to sustain life. They grow and divide, thereby producing more cells. Food is used to provide energy for the work that cells do and is a source of the molecular building blocks from which needed materials are assembled. *(prerequisite)*

**L2.p3 Plants as Producers *(prerequisite)***

Plants are producers; they use the energy from light to make sugar molecules from the atoms of carbon dioxide and water. Plants use these sugars, along with minerals from the soil, to form fats, proteins, and carbohydrates. This food can be used immediately, incorporated into the cells of a plant as the plant grows, or stored for later use. *(prerequisite)*

**L2.p4 Animals as Consumers *(prerequisite)***

All animals, including humans, are consumers; they obtain food by eating other organisms or their products. Consumers break down the structures of the organisms they eat to obtain the materials they need to grow and function. Decomposers, including bacteria and fungi, use dead organisms or their products for food. *(prerequisite)*

**L2.p5 Common Elements *(prerequisite)***

Living systems are made of complex molecules that consist mostly of a few elements, especially carbon, hydrogen, oxygen, nitrogen, and phosphorous. *(prerequisite)*

| STANDARDS | | PAGE REFERENCES |
|---|---|---|
| | **B2.1 Transformation of Matter and Energy in Cells**<br>In multicellular organisms, cells are specialized to carry out specific functions such as transport, reproduction, or energy transformation. | |
| **B2.1A** | Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis. | **Student Edition:**<br>41, 197, 220, 222-224, 226, 228-233<br>*MiniLab* 220<br>*National Geographic* 225<br>*Section Assessment* 227 (#1), 233 (#1)<br>**Teacher Wraparound Edition:**<br>CT 224; DC 232 |
| **B2.1B** | Compare and contrast the transformation of matter and energy during photosynthesis and respiration. | **Student Edition:**<br>41, 197, 220, 222-224, 226, 228-233<br>*Chapter Assessment* 229 (#43)<br>*MiniLab* 220<br>**Teacher Wraparound Edition:**<br>CT 224; DC 232 |
| **B2.1C** | Explain cell division, growth, and development as a consequence of an increase in cell number, cell size, and/or cell products. | **Student Edition:**<br>244-247, 248, 250-252, 253-256<br>*BioLab* 259<br>*MiniLab* 245<br>**Teacher Wraparound Edition:**<br>MI 253 |
| | **B2.1x Cell Differentiation**<br>Following fertilization, cell division produces a small cluster of cells that then differentiate by appearance and function to form the basic tissues of an embryo. | |
| | **B2.2 Organic Molecules**<br>There are four major categories of organic molecules that make up living systems: carbohydrates, fats, proteins, and nucleic acids. | |
| **B2.2A** | Explain how carbon can join to other carbon atoms in chains and rings to form large and complex molecules. | **Student Edition:**<br>166<br>**Teacher Wraparound Edition:**<br>MI 166 |
| **B2.2B** | Recognize the six most common elements in organic molecules (C, H, N, O, P, S). | **Teacher Wraparound Edition:**<br>DE 166; SP 167 |
| **B2.2C** | Describe the composition of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids). | **Student Edition:**<br>167-171<br>*Section Assessment* 171 (#2)<br>**Teacher Wraparound Edition:**<br>DE 170; RS 170; SP 167 |

| STANDARDS | | PAGE REFERENCES |
|---|---|---|
| **B2.2D** | Explain the general structure and primary functions of the major complex organic molecules that compose living organisms. | **Student Edition:**<br>167-171, 221, 226, 330-331, 336-338<br>*MiniLab* 331<br>*National Geographic* 339<br>*Section Assessment* 171 (#2), 221 (#4)<br>**Teacher Wraparound Edition:**<br>DE 170, 221; RS 170; SP 167 |
| **B2.2E** | Describe how dehydration and hydrolysis relate to organic molecules. | The following page references can be incorporated to meet this standard.<br>**Student Edition:**<br>156-157, 221, 224, 228 |
| | **B2.2x Proteins**<br>Protein molecules are long, usually folded chains composed mostly of amino acids and are made of C, H, O, and N.<br>Protein molecules assemble fats and carbohydrates; they function as enzymes, structural components, and hormones. The function of each protein molecule depends on its specific sequence of amino acids and the shape of the molecule. | |
| | **B2.3 Maintaining Environmental Stability**<br>The internal environment of living things must remain relatively constant. Many systems work together to maintain stability. Stability is challenged by changing physical, chemical, and environmental conditions as well as the presence of disease agents. | |
| **B2.3A** | Describe how cells function in a narrow range of physical conditions, such as temperature and pH (acidity), to perform life functions. | **Student Edition:**<br>160, 165, 187, 203-204<br>*BioLab: Design Your Own* 173<br>*MiniLab* 203<br>**Teacher Wraparound Edition:**<br>CT 158, 165 |
| **B2.3B** | Describe how the maintenance of a relatively stable internal environment is required for the continuation of life. | **Student Edition:**<br>7, 10, 160, 165, 203-204<br>**Teacher Wraparound Edition:**<br>CT 158, 165; RS 10 |
| **B2.3C** | Explain how stability is challenged by changing physical, chemical, and environmental conditions as well as the presence of disease agents. | **Student Edition:**<br>165, 938, 1007, 1032-1035, 1037, 1076<br>*Data Analysis Lab* 1007<br>*MiniLab* 1035<br>*Section Assessment* 1009 (#1), 1037 (#6)<br>**Teacher Wraparound Edition:**<br>DC 1032; SP 1032 |

| | STANDARDS | PAGE REFERENCES |
|---|---|---|
| | **B2.3x Homeostasis**<br>The internal environment of living things must remain relatively constant. Many systems work together to maintain homeostasis. When homeostasis is lost, death occurs. | |
| | **B2.4 Cell Specialization**<br>In multicellular organisms, specialized cells perform specialized functions. Organs and organ systems are composed of cells and function to serve the needs of cells for food, air, and waste removal. The way in which cells function is similar in all living organisms. | |
| **B2.4A** | Explain that living things can be classified based on structural, embryological, and molecular (relatedness of DNA sequence) evidence. | **Student Edition:**<br>486, 490-496, 498<br>*Data Analysis Lab* 434<br>*MiniLab* 488<br>*Section Assessment* 498 (#3)<br>**Teacher Wraparound Edition:**<br>DC 493 |
| **B2.4B** | Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration). | **Student Edition:**<br>226-227, 440, 727, 739, 767, 795, 824-825, 836, 854, 865, 884-885<br>*BioLab* 753<br>*MiniLab* 672, 765, 773 |
| **B2.4C** | Explain how different organisms accomplish the same result using different structural specializations (gills vs. lungs vs. membranes). | **Student Edition:**<br>226-227, 440, 727, 739, 767, 795, 824-825, 836, 854, 865, 884-885<br>*BioLab* 753<br>*MiniLab* 672, 765, 773 |
| | **B2.5 Living Organism Composition**<br>All living or once-living organisms are composed of carbohydrates, lipids, proteins, and nucleic acids. Carbohydrates and lipids contain many carbon-hydrogen bonds that also store energy. | |
| **B2.5A** | Recognize and explain that macromolecules such as lipids contain high energy bonds. | **Student Edition:**<br>168-169, 221 |
| **B2.5B** | Explain how major systems and processes work together in animals and plants, including relationships between organelles, cells, tissues, organs, organ systems, and organisms. Relate these to molecular functions. | **Student Edition:**<br>634, 636-638, 639-645, 694, 948, 962-965, 967, 992-998, 1005-1007, 1020-1024<br>*MiniLab* 634, 1023<br>**Teacher Wraparound Edition:**<br>DC 948; WS 694 |

| STANDARDS | | PAGE REFERENCES |
|---|---|---|
| **B2.5C** | Describe how energy is transferred and transformed from the Sun to energy-rich molecules during photosynthesis. | **Student Edition:**<br>10, 41, 219-220, 222-224, 226-227<br>*MiniLab* 220<br>*National Geographic* 225<br>*Section Assessment* 221 (#1), 227 (#1)<br>**Teacher Wraparound Edition:**<br>MI 218 |
| **B2.5D** | Describe how individual cells break down energy-rich molecules to provide energy for cell functions. | **Student Edition:**<br>197, 220-221, 228-231<br>*Section Assessment* 233 (#1)<br>**Teacher Wraparound Edition:**<br>CT 221; DC 197; DE 220 |

**B2.5x Energy Transfer**

All living or once living organisms are composed of carbohydrates, lipids, proteins, and nucleic acids. Carbohydrates and lipids contain many carbon-hydrogen bonds that also store energy. However, that energy must be transferred to ATP (adenosine triphosphate) to be usable by the cell.

**B2.6x Internal/External Cell Regulation**

Cellular processes are regulated both internally and externally by environments in which cells exist, including local environments that lead to cell differentiation during the development of multicellular organisms. During the development of complex multicellular organisms, cell differentiation is regulated through the expression of different genes.

**STANDARD B3: INTERDEPENDENCE OF LIVING SYSTEMS AND THE ENVIRONMENT**

*Students describe the processes of photosynthesis and cellular respiration and how energy is transferred through food webs. They recognize and analyze the consequences of the dependence of organisms on environmental resources and the interdependence of organisms in ecosystems.*

**L3.p1 Populations, Communities, and Ecosystems *(prerequisite)***

Organisms of one species form a population. Populations of different organisms interact and form communities. Living communities and the nonliving factors that interact with them form ecosystems. *(prerequisite)*

**L3.p2 Relationships Among Organisms *(prerequisite)***

Two types of organisms may interact with one another in several ways; they may be in a producer/consumer, predator/prey, or parasite/host relationship. Or one organism may scavenge or decompose another. Relationships may be competitive or mutually beneficial. Some species have become so adapted to each other that neither could survive without the other. *(prerequisite)*

**L3.p3 Factors Influencing Ecosystems *(prerequisite)***

The number of organisms and populations an ecosystem can support depends on the biotic resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. *(prerequisite)*

| STANDARDS | | PAGE REFERENCES |
|---|---|---|
| **L3.p4 Human Impact on Ecosystems *(prerequisite)*** All organisms cause changes in their environments. Some of these changes are detrimental, whereas others are beneficial. *(prerequisite)* | | |
| **B3.1 Photosynthesis and Respiration** Organisms acquire their energy directly or indirectly from sunlight. Plants capture the Sun's energy and use it to convert carbon dioxide and water to sugar and oxygen through the process of photosynthesis. Through the process of cellular respiration, animals are able to release the energy stored in the molecules produced by plants and use it for cellular processes, producing carbon dioxide and water. | | |
| **B3.1A** | Describe how organisms acquire energy directly or indirectly from sunlight. | **Student Edition:**<br>10, 41, 219-220, 222<br>*MiniLab* 220<br>*Section Assessment* 221 (#1)<br>**Teacher Wraparound Edition:**<br>MI 218 |
| **B3.1B** | Illustrate and describe the energy conversions that occur during photosynthesis and respiration. | **Student Edition:**<br>157, 218-220, 222-224, 226, 228-231, 233<br>*MiniLab* 220<br>*National Geographic* 225<br>*Section Assessment* 227 (#1), 233 (#1)<br>**Teacher Wraparound Edition:**<br>CT 224; DC 157; WS 219, 224, 229 |
| **B3.1C** | Recognize the equations for photosynthesis and respiration and identify the reactants and products for both. | **Student Edition:**<br>157, 220, 222, 228<br>*Chapter Assessment* 237 (#18), 239 (#41)<br>*Section Assessment* 227 (#1), 233 (#1)<br>**Teacher Wraparound Edition:**<br>DC 157, 232; FA 227 |
| **B3.1D** | Explain how living organisms gain and use mass through the processes of photosynthesis and respiration. | The following page references can be incorporated to meet this standard.<br>**Student Edition:**<br>9, 10, 41, 218-221<br>**Teacher Wraparound Edition:**<br>DC 219; MI 218 |

| | STANDARDS | PAGE REFERENCES |
|---|---|---|
| | **B3.2 Ecosystems**<br>The chemical elements that make up the molecules of living things pass through food webs and are combined and recombined in different ways. At each link in an ecosystem, some energy is stored in newly made structures, but much is dissipated into the environment as heat. Continual input of energy from sunlight keeps the process going. | |
| **B3.2A** | Identify how energy is stored in an ecosystem. | The following page references can be incorporated to meet this standard.<br>**Student Edition:**<br>41-42, 197, 218-220<br>*Section Assessment* 221 (#1, #4)<br>**Teacher Wraparound Edition:**<br>DC 219 |
| **B3.2B** | Describe energy transfer through an ecosystem, accounting for energy lost to the environment as heat. | **Student Edition:**<br>44, 218-219<br>*Chapter Assessment* 54 (#25)<br>*Section Assessment* 44 (#6), 221 (#5)<br>**Teacher Wraparound Edition:**<br>WS 219 |
| **B3.2C** | Draw the flow of energy through an ecosystem. Predict changes in the food web when one or more organisms are removed. | **Student Edition:**<br>*Chapter Assessment* 54 (#23)<br>*MiniLab* 42<br>*Section Assessment* 44 (#2, #5) |
| | **B3.3 Element Recombination**<br>As matter cycles and energy flows through different levels of organization of living systems—cells, organs, organisms, and communities—and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change. | |
| **B3.3A** | Use a food web to identify and distinguish producers, consumers, and decomposers and explain the transfer of energy through trophic levels. | **Student Edition:**<br>42-44<br>*Chapter Assessment* 54 (#24-#26)<br>*MiniLab* 42<br>*Section Assessment* 44 (#2, #5)<br>**Teacher Wraparound Edition:**<br>FA 44 |

| | STANDARDS | PAGE REFERENCES |
|---|---|---|
| | **B3.4 Changes in Ecosystems**<br>Although the interrelationships and interdependence of organisms may generate biological communities in ecosystems that are stable for hundreds or thousands of years, ecosystems always change when climate changes or when one or more new species appear as a result of migration or local evolution. The impact of the human species has major consequences for other species. | |
| **B3.4A** | Describe ecosystem stability. Understand that if a disaster such as flood or fire occurs, the damaged ecosystem is likely to recover in stages of succession that eventually result in a system similar to the original one. | **Student Edition:**<br>62-64<br>*BioLab: Design Your Own* 83<br>*Section Assessment* 64 (#4)<br>**Teacher Wraparound Edition:**<br>CB 63; DC 62, 63; RS 64 |
| **B3.4B** | Recognize and describe that a great diversity of species increases the chance that at least some living organisms will survive in the face of cataclysmic changes in the environment. | The following page references can be incorporated to meet this standard.<br>**Student Edition:**<br>117, 122, 399, 400<br>**Teacher Wraparound Edition:**<br>DC 399 |
| **B3.4C** | Examine the negative impact of human activities. | **Student Edition:**<br>123-128<br>*Biology & Society* 50, 870, 1010<br>*Section Assessment* 128 (#1)<br>**Teacher Wraparound Edition:**<br>CB 124; DIB 50 |
| | **B3.4x Human Impact**<br>Humans can have tremendous impact on the environment. Sometimes their impact is beneficial, and sometimes it is detrimental. | |
| | **B3.5 Populations**<br>Populations of living things increase and decrease in size as they interact with other populations and with the environment. The rate of change is dependent upon relative birth and death rates. | |
| **B3.5A** | Graph changes in population growth, given a data table. | **Student Edition:**<br>*BioLab* 107<br>*Launch Lab* 31<br>**Teacher Wraparound Edition:**<br>DE 104; WS 103 |

| STANDARDS | | PAGE REFERENCES |
|---|---|---|
| **B3.5B** | Explain the influences that affect population growth. | **Student Edition:**<br>94-96<br>*BioLab* 107<br>*BioLab: Design Your Own* 593<br>*Data Analysis Lab* 39<br>*Section Assessment* 99 (#2, #6)<br>**Teacher Wraparound Edition:**<br>WS 95, 96 |
| **B3.5C** | Predict the consequences of an invading organism on the survival of other organisms. | **Student Edition:**<br>123, 128<br>Biology & Society 870<br>*Section Assessment* 99 (#4)<br>**Teacher Wraparound Edition:**<br>AG 870 |

**B3.5x Environmental Factors**

The shape of population growth curves vary with the type of organism and environmental conditions, such as availability of nutrients and space. As the population increases and resources become more scarce, the population usually stabilizes at the carrying capacity of that environment.

**STANDARD B4: GENETICS**

*Students recognize that the specific genetic instructions for any organism are contained within genes composed of DNA molecules located in chromosomes. They explain the mechanism for the direct production of specific proteins based on inherited DNA. Students diagram how occasional modifications in genes and the random distribution of genes from each parent provide genetic variation and become the raw material for evolution. Content Statements, Performances, and Boundaries*

**L4.p1 Reproduction *(prerequisite)***

Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms reproduce sexually. *(prerequisite)*

**L4.p2 Heredity and Environment *(prerequisite)***

The characteristics of organisms are influenced by heredity and environment. For some characteristics, inheritance is more important. For other characteristics, interactions with the environment are more important. *(prerequisite)*

| | STANDARDS | PAGE REFERENCES |
|---|---|---|
| | **B4.1 Genetics and Inherited Traits**<br>Hereditary information is contained in genes, located in the chromosomes of each cell. Cells contain many thousands of different genes. One or many genes can determine an inherited trait of an individual, and a single gene can influence more than one trait. Before a cell divides, this genetic information must be copied and apportioned evenly into the daughter cells. | |
| **B4.1A** | Draw and label a homologous chromosome pair with heterozygous alleles highlighting a particular gene location. | The following page references can be incorporated to meet this standard.<br>**Student Edition:**<br>272, 278<br>**Teacher Wraparound Edition:**<br>RC 278 |
| **B4.1B** | Explain that the information passed from parents to offspring is transmitted by means of genes that are coded in DNA molecules. These genes contain the information for the production of proteins. | **Student Edition:**<br>270-271, 277-280, 283, 336-338<br>*National Geographic* 339<br>**Teacher Wraparound Edition:**<br>WS 336 |
| | **B4.2 DNA**<br>The genetic information encoded in DNA molecules provides instructions for assembling protein molecules. Genes are segments of DNA molecules. Inserting, deleting, or substituting DNA segments can alter genes. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment. | |
| **B4.2A** | Show that when mutations occur in sex cells, they can be passed on to offspring (inherited mutations), but if they occur in other cells, they can be passed on to descendant cells only (noninherited mutations). | **Student Edition:**<br>254-255, 345-349, 434<br>**Teacher Wraparound Edition:**<br>CT 349 |
| **B4.2B** | Recognize that every species has its own characteristic DNA sequence. | The following page references can be incorporated to meet this standard.<br>**Student Edition:**<br>427, 493-495<br>*Data Analysis Lab* 494 |
| **B4.2C** | Describe the structure and function of DNA. | **Student Edition:**<br>329-331, 336-338, 340-341<br>*MiniLab* 331<br>*National Geographic* 339<br>*Section Assessment* 341 (#1)<br>**Teacher Wraparound Edition:**<br>DE 330; WS 336 |

| STANDARDS | | PAGE REFERENCES |
|---|---|---|
| **B4.2D** | Predict the consequences that changes in the DNA composition of particular genes may have on an organism (e.g., sickle cell anemia, other). | **Student Edition:**<br>345-349<br>*Section Assessment* 349 (#4)<br>**Teacher Wraparound Edition:**<br>CT 349; DC 347 |
| **B4.2E** | Propose possible effects (on the genes) of exposing an organism to radiation and toxic chemicals. | **Student Edition:**<br>254-255, 348-349<br>*Data Analysis Lab* 348<br>*Section Assessment* 349 (#2)<br>**Teacher Wraparound Edition:**<br>WS 346 |
| | **B4.2x DNA, RNA, and Protein Synthesis**<br>Protein synthesis begins with the information in a sequence of DNA bases being copied onto messenger RNA. This molecule moves from the nucleus to the ribosome in the cytoplasm where it is "read." Transfer RNA brings amino acids to the ribosome, where they are connected in the correct sequence to form a specific protein. | |
| | **B4.3 Cell Division — Mitosis and Meiosis**<br>Sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations from the offspring of any two parents. | |
| **B4.3A** | Compare and contrast the processes of cell division (mitosis and meiosis), particularly as those processes relate to production of new cells and to passing on genetic information between generations. | **Student Edition:**<br>246-247, 248, 250-251, 270-272, 274<br>*National Geographic* 249, 273<br>*Section Assessment* 276 (#2, #5, #6)<br>**Teacher Wraparound Edition:**<br>DC 272 |
| **B4.3B** | Explain why only mutations occurring in gametes (sex cells) can be passed on to offspring. | **Student Edition:**<br>345-349, 434<br>**Teacher Wraparound Edition:**<br>CT 349 |
| **B4.3C** | Explain how it might be possible to identify genetic defects from just a karyotype of a few cells. | **Student Edition:**<br>311, 313<br>*Chapter Assessment* 321 (#26, #28)<br>*Section Assessment* 315 (#1, #3, #5)<br>**Teacher Wraparound Edition:**<br>FA 315 |

| STANDARDS | | PAGE REFERENCES |
|---|---|---|
| **B4.4x Genetic Variation**<br>Genetic variation is essential to biodiversity and the stability of a population. Genetic variation is ensured by the formation of gametes and their combination to form a zygote. Opportunities for genetic variation also occur during cell division when chromosomes exchange genetic material causing permanent changes in the DNA sequences of the chromosomes. Random mutations in DNA structure caused by the environment are another source of genetic variation. | | |
| **B4.r5x Recombinant DNA**<br>Recombinant DNA technology allows scientists in the laboratory to combine the genes from different sources, sometimes different species, into a single DNA molecule. This manipulation of genes using bacterial plasmids has been used for many practical purposes including the mass production of chemicals and drugs. *(recommended)* | | |
| **STANDARD B5: EVOLUTION AND BIODIVERSITY**<br>*Students recognize that evolution is the result of genetic changes that occur in constantly changing environments. They can explain that modern evolution includes both the concepts of common descent and natural selection. They illustrate how the consequences of natural selection and differential reproduction have led to the great biodiversity on Earth.* | | |
| **L5.p1 Survival and Extinction *(prerequisite)***<br>Individual organisms with certain traits in particular environments are more likely than others to survive and have offspring. When an environment changes, the advantage or disadvantage of characteristics can change. Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of species is common; most of the species that have lived on the Earth no longer exist. *(prerequisite)* | | |
| **L5.p2 Classification *(prerequisite)***<br>Similarities among organisms are found in anatomical features, which can be used to infer the degree of relatedness among organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance. *(prerequisite)* | | |
| **B5.1 Theory of Evolution**<br>The theory of evolution provides a scientific explanation for the history of life on Earth as depicted in the fossil record and in the similarities evident within the diversity of existing organisms. | | |
| **B5.1A** | Summarize the major concepts of natural selection (differential survival and reproduction of chance inherited variants, depending on environmental conditions). | **Student Edition:**<br>420, 434-436<br>*National Geographic* 421<br>*Section Assessment* 422 (#3)<br>**Teacher Wraparound Edition:**<br>DC 421 |

| STANDARDS | | PAGE REFERENCES |
|---|---|---|
| **B5.1B** | Describe how natural selection provides a mechanism for evolution. | **Student Edition:**<br>420, 434-436<br>*BioLab* 443<br>*Data Analysis Lab* 435<br>**Teacher Wraparound Edition:**<br>AC 421; DE 420 |
| | **B5.2x Molecular Evidence**<br>Molecular evidence substantiates the anatomical evidence for evolution and provides additional detail about the sequence in which various lines of descents branched. | |
| | **B5.3 Natural Selection**<br>Evolution is the consequence of natural selection, the interactions of (1) the potential for a population to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection from environmental pressure of those organisms better able to survive and leave offspring. | |
| **B5.3A** | Explain how natural selection acts on individuals, but it is populations that evolve. Relate genetic mutations and genetic variety produced by sexual reproduction to diversity within a given population. | **Student Edition:**<br>275-276, 420, 434-436<br>*BioLab* 443<br>*National Geographic* 421<br>**Teacher Wraparound Edition:**<br>CT 436; DC 421, 434 |
| **B5.3B** | Describe the role of geographic isolation in speciation. | **Student Edition:**<br>437, 438<br>*Section Assessment* 441 (#3, #5)<br>**Teacher Wraparound Edition:**<br>DE 138; SP 437 |
| **B4.3C** | Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms. | **Student Edition:**<br>275-276, 420, 428-429, 434-436<br>*BioLab* 443<br>*Launch Lab* 417<br>*National Geographic* 421<br>**Teacher Wraparound Edition:**<br>DC 276, 434 |