



COLORADO
Content Standards Grades 9-12
***BSCS Biology: A Molecular Approach* © 2006**

STANDARDS	PAGE REFERENCES
STANDARD 1: Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. As students in grades 9-12 extend their knowledge, what they know and are able to do includes	
<ul style="list-style-type: none"> asking questions and stating hypotheses, using prior scientific knowledge to help guide their development; 	SE: <i>Extension</i> (#1) 19 <i>Investigations</i> 696-698, 714-716, 716-718, 720-723, 726-729, 737-739, 739-741 ATE: T92-T93
<ul style="list-style-type: none"> creating and defending a written plan of action for a scientific investigation; 	SE: <i>Extension</i> (#1) 19 <i>Investigations</i> 686-687, 714-716, 782-783
<ul style="list-style-type: none"> selecting and using appropriate technologies to gather, process, and analyze data and to report information related to an investigation; 	SE: <i>Investigations</i> 680-687, 691-694, 696-698, 702-704, 709-712, 716-718, 720-723 ATE: T66-T68, T76, T93-T94
<ul style="list-style-type: none"> identifying major sources of error or uncertainty within an investigation (<i>for example, particular measuring devices and experimental procedures</i>); 	SE: <i>Investigations</i> 690-691, 698-700, 700-702, 702-704, 714-715, 780-781, 782-783 ATE: T56-T57, T69, T75, T77
<ul style="list-style-type: none"> constructing and revising scientific explanations and models, using evidence, logic, and experiments that include identifying and controlling variables; 	SE: <i>Investigations</i> 704-707, 707-709, 714-716, 716-718, 729, 770-774
<ul style="list-style-type: none"> communicating and evaluating scientific thinking that leads to particular conclusions; 	SE: 14-17 <i>Focus On</i> 16 <i>Investigations</i> 686-687, 696-698, 700-702, 704-706, 758-760, 770-774, 774-777
<ul style="list-style-type: none"> recognizing and analyzing alternative explanations and models; and 	SE: 7-12, 15-17 <i>Focus On</i> 16 <i>Theory</i> 412, 676 <i>Investigations</i> 694-696, 719-720 ATE: 8
<ul style="list-style-type: none"> explaining the difference between a scientific theory and a scientific hypothesis. 	SE: 7-12, 14 <i>Theory</i> 13, 514, 676 <i>Check and Challenge</i> (#2) 14 ATE: 8
For students continuing their science education beyond the standards, what they know and are able to do may include	
<ul style="list-style-type: none"> designing and completing an advanced scientific investigation—either individually or as part of a student team—that extends over several days or weeks; and 	SE: <i>Investigation</i> 718-719, 739-741, 749-751, 782-783

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<ul style="list-style-type: none"> continuing to practice and apply inquiry skills as they extend their understanding of science content through further study. 	*Investigations can be used for further study. SE: <i>Extensions</i> 19, 99, 127, 313 * <i>Investigation</i> 782-783, 791-792, 793-794, 795-797
STANDARD 3: Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. (Focus: Biology – Anatomy, Physiology, Botany, Zoology, Ecology)	
3.1 Students know and understand the characteristics of living things, the diversity of life, and how living things interact with each other and with their environment. As students in grades 9-12 extend their knowledge, what they know and are able to do includes	
<ul style="list-style-type: none"> using and producing a variety of classification systems for organisms (<i>for example, the five-kingdom classification, classification based on behavior</i>); 	SE: 465-472, 474-480 <i>Biological Challenges: Research</i> 481 <i>A Brief Survey of Organisms</i> 483-497 <i>Investigations</i> 763-764, 764-767 ATE: T177-T181, 472
<ul style="list-style-type: none"> predicting and describing the interactions of populations and ecosystems; 	SE: 633-640, 643, 645-647, 664-668, 671-672 <i>Investigations</i> 791-792, 792-794 ATE: 645
<ul style="list-style-type: none"> explaining how adaptations (<i>for example, structure, behavior</i>) of an organism determine its niche (role) in the environment; 	SE: 631, 638-639, 654-655, 658, 665-666 <i>Focus On</i> 636 <i>Connections</i> 653 ATE: 655
<ul style="list-style-type: none"> explaining how changes in an ecosystem can affect biodiversity and how biodiversity contributes to an ecosystem's stability; and 	SE: 461, 664-668, 672 <i>Investigations</i> 794-797
<ul style="list-style-type: none"> analyzing the dynamic equilibrium of ecosystems, including interactions among living and nonliving components (<i>for example, tropical deforestation is linked to decreased global precipitation; Mount St. Helens' eruption had impact on the local ecosystem</i>). 	SE: 634-636, 638-643, 645-647, 663-668, 672, 674-675 <i>Biological Challenges: Research</i> 673 <i>Theory</i> 676 <i>Investigations</i> 791-792, 792-793 ATE: 675
3.2 Students know and understand interrelationships of matter and energy in living systems. As students in grades 9-12 extend their knowledge, what they know and are able to do includes	
<ul style="list-style-type: none"> comparing and contrasting the processes of photosynthesis and respiration (<i>for example, in terms of energy and products</i>); 	SE: 55, 103-106, 108-112, 130-142 <i>Check and Challenge (#2)</i> 144 <i>Investigations</i> 716-718, 720-723 ATE: 133
<ul style="list-style-type: none"> explaining how simple molecules can be built into larger molecules within organisms (<i>for example, amino acids serve as building blocks of proteins; carbon dioxide and water are the basic materials for building sugars through photosynthesis</i>); 	SE: 33-42, 54-55, 62-63, 105-106, 111-112, 234-236, 247-251 <i>Investigation</i> 733-736 ATE: 34
<ul style="list-style-type: none"> explaining how large molecules (<i>for example, starch, protein</i>) are broken down into smaller molecules, serving as an energy source or as basic building blocks in organisms; 	SE: 55, 62-64, 67-73, 130-133 <i>Investigations</i> 702-704, 707-709

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<ul style="list-style-type: none"> explaining how energy is used in the maintenance, repair, growth, and development of tissues (<i>for example, the production of new skin cells requires energy</i>); and 	<p>*The following discuss the use of energy for biological processes. SE: 54, 59, 60, 64-66 <i>Focus On</i> 54</p>
<ul style="list-style-type: none"> describing the cycling of matter and the movement and change of energy through the ecosystem (<i>for example, some energy dissipates as heat as it is transferred through a food web</i>). 	<p>SE: 54-60, 636-638 <i>Investigations</i> 702-704 ATE: 59, 60</p>
<p>3.3 Students know and understand how the human body functions, factors that influence its structures and functions, and how these structures and functions compare with those of other organisms.</p>	
<p>As students in grades 9-12 extend their knowledge, what they know and are able to do includes</p>	
<ul style="list-style-type: none"> describing cellular organelles and their function (<i>for example, the relationship of ribosomes to protein synthesis; the relationship of mitochondria to energy transformation</i>); 	<p>SE: 104-105, 137, 163-171, 249-250 <i>Investigations</i> 723-725, 733-736 ATE: 166, 169</p>
<ul style="list-style-type: none"> differentiating among levels of organization (<i>cells, tissues, and organs</i>) and their roles within the whole organism; 	<p>SE: 94-95, 176-177, 179-181, 193-197, 548-551, 557</p>
<ul style="list-style-type: none"> explaining human body functions in terms of interacting organ systems composed of specialized structures that maintain or restore health (<i>for example, mechanisms involved in homeostasis [balance], such as feedback in the endocrine system</i>); 	<p>SE: 92-97, 146-147, 206-209, 552-553, 609-611, 619-624 <i>Connections</i> 553 <i>Investigations</i> 713-714 ATE: 209</p>
<ul style="list-style-type: none"> comparing and contrasting characteristics of and treatments for various types of medical problems (<i>for example, accidental, infectious, genetic</i>); 	<p>SE: 256, 410-411, 607-608 <i>Focus On</i> 208 ATE: 208, 410, 411</p>
<ul style="list-style-type: none"> using examples to explain the relationship of structure and function in organisms; and 	<p>SE: 38-40, 43-45, 47, 67-73, 89-92, 189-190, 191-197 <i>Connections</i> 39, 191 <i>Focus On</i> 110, 550 <i>Investigations</i> 723-725, 726-729</p>
<ul style="list-style-type: none"> describing the pattern and process of reproduction and development in several organisms (<i>for example, earthworm, chick, human</i>). 	<p>SE: 261-274, 292-300, 317-319, 324-332 <i>Investigations</i> 743-746, 746-748 ATE: 264, 267, 270, 293, 319, 325, 330</p>
<p>3.4 Students know and understand how organisms change over time in terms of biological evolution and genetics.</p>	
<p>As students in grades 9-12 extend their knowledge, what they know and are able to do includes</p>	
<ul style="list-style-type: none"> comparing and contrasting the purpose and process of cell division (mitosis) with the production of sex cells (meiosis); 	<p>SE: 214-215, 222-223, 320, 322-324 <i>Investigations</i> 731-732, 741-742</p>
<ul style="list-style-type: none"> giving examples to show how some traits can be inherited while others are due to the interaction of genes and the environment (<i>for example, skin cancer triggered by over-exposure to sunlight or contact with chemical carcinogens</i>); 	<p>SE: 221, 229, 344, 352-355, 358-360 <i>Focus On</i> 203, 228 <i>Investigations</i> 749-751, 751-755 ATE: 344</p>

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<ul style="list-style-type: none"> describing how DNA serves as the vehicle for genetic continuity and the source of genetic diversity upon which natural selection can act; 	SE: 40-42, 44, 47, 216-219, 221, 234-236, 425, 505-506 <i>Investigation 758-760, 760-762</i>
<ul style="list-style-type: none"> describing how mutation, natural selection, and reproductive isolation can lead to new species and explain the planet's biodiversity; 	SE: 462-463, 507-510 ATE: 509
<ul style="list-style-type: none"> explaining why variation within a population improves the chances that the species will survive under new environmental conditions; 	SE: 9-12, 423-425
<ul style="list-style-type: none"> describing the general structure and function of the gene (DNA) and its role in heredity and protein synthesis (<i>for example, replication of DNA and the role of RNA in protein synthesis</i>); and 	SE: 44-45, 216-219, 234-237, 240-251 <i>Theory 412</i> <i>Investigations 730-731, 732-733, 733-736</i> ATE: 234, 235
<ul style="list-style-type: none"> calculating the probability that an individual will inherit a particular single gene trait (<i>for example, calculating the probability of offspring inheriting cystic fibrosis when both parents are carriers for the disease</i>). 	SE: 351-355 <i>Using Concepts (#4) 367</i> <i>Investigations 748-749, 749-751, 751-754</i>
For students continuing their science education beyond the standards, what they know and are able to may include	
<ul style="list-style-type: none"> describing how, over long periods of time, ecosystems can remain stable and, if altered by factors such as climatic change, return to stability; 	SE: 654, 664-668 ATE: 667
<ul style="list-style-type: none"> explaining specializations that allow different types of cells to perform different functions; 	SE: 87-88, 91-92, 176-177, 188-190, 197-198, 204, 264-265, 557
<ul style="list-style-type: none"> describing how balance (homeostasis) is maintained within an organism when its environment is altered (<i>for example, the relationship between blood glucose level and insulin production; carbon dioxide and oxygen balance in the body</i>); 	SE: 92-97, 146-147, 209, 238 <i>Focus On 147</i> <i>Investigations 713-714</i> ATE: 147, 209
<ul style="list-style-type: none"> describing the role of gene mutations that result in uncontrolled cell division (<i>for example, cancer</i>); 	SE: 229, 408, 409, 625-626 <i>Focus On 228</i>
<ul style="list-style-type: none"> explaining the role of exposure to certain factors (<i>for example, chemical, biological, radiation</i>) that may increase the rate of mutation, and therefore the incidence of cancer and other diseases; 	SE: 221, 406
<ul style="list-style-type: none"> determining the degree of kinship between organisms or species from estimations of the similarity of their nucleic acid sequences, which often closely match classifications based on anatomical similarities; and 	SE: 466, 468, 476, 479 <i>Focus On 467</i> <i>Biological Challenges: Research 473</i> ATE: 468
<ul style="list-style-type: none"> explaining how the rate of environmental change may exceed the capacity of organisms to respond to change, leading to the extinction of species. 	SE: 503 <i>Biological Challenges: Research 512</i> ATE: 503

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<p>STANDARD 5: Students know and understand interrelationships among science, technology, and human activity and how they can affect the world. As students in grades 9-12 extend their knowledge, what they know and are able to do includes</p>	
<ul style="list-style-type: none"> analyzing benefits, limitations, costs, and consequences involved in using technology or resources (<i>for example, X-rays, agricultural chemicals, natural gas reserves</i>); 	SE: 2, 4, 411, 413, 668-672, 674-675 <i>Biological Challenges: Careers</i> 5 <i>Biological Challenges: Research</i> 321, 350, 673
<ul style="list-style-type: none"> analyzing how the introduction of a new technology has affected or could affect human activity (<i>for example, invention of the telescope, applications of modern telecommunications</i>); 	SE: 157-158, 338-339, 410-411, 413 <i>Biological Challenges: Technology</i> 46 <i>Focus On</i> 120, 280, 404 <i>Biological Challenges: Research</i> 321, 350 <i>Investigations</i> 689-690 ATE: 410
<ul style="list-style-type: none"> demonstrating the interrelationships between science and technology (<i>for example, building a bridge, designing a better running shoe</i>); and 	SE: 4, 17, 156-158, 398-400, 402-405 <i>Biological Challenges: Technology</i> 46, 401, 644 <i>Biological Challenges: Research</i> 53 <i>Biological Challenges: Discoveries</i> 156, 239
<ul style="list-style-type: none"> explaining the use of technology in an occupation. 	SE: <i>Biological Challenges: Technology</i> 46, 442, 644 <i>Focus On</i> 280, 404
<p>For students continuing their science education beyond the standards, what they know and are able to do may include</p>	
<ul style="list-style-type: none"> applying their knowledge and understanding of chemical and physical interactions to explain present and anticipated technologies (<i>for example, lasers, ultrasound, superconducting materials, photocopy machines</i>); and 	SE: 156-158, 398-400, 402-405 <i>Biological Challenges: Technology</i> 46, 401 <i>Focus On</i> 396 <i>Appendix</i> 798
<ul style="list-style-type: none"> exploring the scientific and technological aspects of contemporary problems (<i>for example, issues related to nutrition, air quality, natural resources</i>). 	SE: 2-4, 668-672, 674-675 <i>Biological Challenges: Careers</i> 5 <i>Biological Challenges: Research</i> 149, 673 <i>Focus On</i> 280 <i>Investigations</i> 688-690
<p>STANDARD 6: Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines. As students in grades 9-12 extend their knowledge, what they know and are able to do includes</p>	
<ul style="list-style-type: none"> evaluating print and visual media for scientific evidence, bias, or opinion; 	SE: 16-17 ATE: 16
<ul style="list-style-type: none"> explaining that the scientific way of knowing uses a critique and consensus process (<i>for example, peer review, openness to criticism, logical arguments, skepticism</i>); 	SE: 7-12, 14-17 <i>Focus On</i> 16 <i>Theory</i> 276, 594, 676 ATE: 3, 8, 14
<ul style="list-style-type: none"> using graphs, equations, or other models to analyze systems involving change and constancy (<i>for example, comparing the geologic time scale to shorter time frames</i>); 	SE: 61, 421-422, 441, 645-646, 671, 674-675 <i>Focus On</i> 500 <i>Investigations</i> 748-749, 758-760, 767-768, 768-770 ATE: 422, 645, 675

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<ul style="list-style-type: none"> analyzing and comparing models of cyclic change as used within and among scientific disciplines (<i>for example, water cycle, circular motion, sound waves, weather cycles</i>); 	SE: 640-642, 646-674 <i>Investigation 791-792</i>
<ul style="list-style-type: none"> identifying and predicting cause-effect relationships within a system (<i>for example, the effect of temperature on gas volume, effect of carbon dioxide level on the greenhouse effect, effects of changing nutrients at the base of a food pyramid</i>); 	SE: 113, 115-117, 663-668, 674-675 <i>Investigations 716-717, 719-720, 720-723, 792-793</i> ATE: 675
<ul style="list-style-type: none"> identifying and describing the dynamics of natural systems (<i>for example, weather systems, ecological systems, body systems, systems at dynamic equilibrium</i>); 	SE: 81-85, 92-97, 548-557, 640-642, 645-647 <i>Investigations 709-713, 713-714, 791-792</i> ATE: 645
<ul style="list-style-type: none"> identifying and testing a model to analyze systems involving change and constancy (<i>for example, a mathematical expression for gas behavior; constructing a closed ecosystem such as an aquarium</i>); 	SE: <i>Investigations 709-712, 712-713, 716-718, 720-723, 791-792, 792-794</i>
<ul style="list-style-type: none"> explaining an exponential model (<i>for example, pH scale, population growth, Richter scale</i>); and 	SE: 32, 645-646 <i>Investigations 696-698</i> ATE: 32, 645
<ul style="list-style-type: none"> refining a hypothesis based on an accumulation of data over time (<i>for example, Alvarez's theory on dinosaur extinction</i>). 	SE: 7-12, 439-441, 443-453, 479-480, 503 <i>Theory 13, 114, 514</i> <i>Biological Challenges: Discoveries 199</i> <i>Biological Challenges: Research 481</i>
For students continuing their science education beyond the standards, what they know and are able to do may include	
<ul style="list-style-type: none"> relating small-scale phenomena to large-scale properties (<i>for example, intermolecular forces related to physical properties</i>); and 	SE: 29-32, 221, 406-409, 423-428 <i>Investigations 760-762</i> ATE: 30, 32
<ul style="list-style-type: none"> tracing the development of an invention, theory, or discovery to demonstrate the dynamic nature of science. 	SE: 6-12, 156-157, 468-472, 474 <i>Biological Challenges: Discoveries 107, 159, 199, 239, 528</i> <i>Theory 114, 514, 594</i> ATE: 8