LIFE Science Scope and Sequence

National Science Standards	Unit 1 (Life)	Unit 2 (Viruses, Bacteria, Archaea, Fungi, and Protists)	Unit 3 (Plants)	Unit 4 (Animals)	Unit 5 (Human Body)	Unit 6 (Genetics and Heredity)	Unit 7 (Ecology)
Unifying Concepts and Processes							
• Systems, order, and organization	•	•	•	•	•	•	•
• Evidence, models, and explanation	•	•	•	•	•	•	•
• Change, constancy, and measurement	•	•	•	•	•	•	•
• Form and function	•	•	•	•	•	•	•
Science as Inquiry							
Abilities Necessary to Do Scientific Inquiry							
• Identify questions that can be answered through scientific investigations.	•	•	•	•	•		•
• Design and conduct a scientific investigation.	•	•	•	•	•		
• Use appropriate tools and techniques to gather, analyze, and interpret data.	•	•	•	•	•	•	•
• Develop descriptions, explanations, predictions, and models using evidence.	•	•	•	•	•	•	•
• Think critically and logically to make the relationships between evidence and explanations.	•	•	•	•	•	•	•
• Recognize and analyze alternative explanations and predictions.	•	•	•		•	•	•
• Communicate scientific procedures and explanations.	•	•	•		•	•	•
• Use mathematics in all aspects of scientific inquiry.				•	•	•	•

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	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
Understandings About Scientific Inquiry							
• Different kinds of questions suggest different kinds of scientific investigations.	•	•	•	•	•	•	•
• Current scientific knowledge and understanding guide scientific investigations.	•	•		•	•	•	•
• Mathematics is important in all aspects of scientific inquiry.				•	•		•
• Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.	•	•				•	
• Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories.	•	•		•	•	•	•
• Science advances through legitimate skepticism. Asking questions and querying other scientists' explanations is part of scientific inquiry.	•				•		•
• Scientific investigations sometimes result in new ideas and phenomena for study, generate new methods or procedures for an investigation, or develop new technologies to improve the collections of data.	•				•	•	•
Grades 5 – 8 Life Science Content Standards							
Structure and Function in Living Systems							
• Living systems at all levels of organization demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, organs, tissues, organ systems, whole organisms, and ecosystems.	•			•	•		•
• All organisms are composed of cells – the fundamental unit of life. Most organisms are single cells; other organisms, including humans, are multicellular.	•	•		•	•		
• Cells carry on the many functions needed to sustain life. They grow and divide, thereby producing more cells. This requires that they take in nutrients, which they use to provide energy for the work that cells do and to make the materials that a cell or an organism needs.	•	•	•	•	•		
• Specialized cells perform specialized functions in multicellular organisms. Groups of specialized cells cooperate to form a tissue, such as a muscle. Different tissues are in turn grouped together to form larger functional units, called organs.			•		•	•	

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
• The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease. These systems interact with one another.					•		
• Disease is a breakdown in structures or functions of an organism. Some diseases are the result of intrinsic failures of the system. Others are the result of damage by infection by other organisms.		•		•	•	•	•
Reproduction and Heredity							
• 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.				•	•		
• In many species, including humans, females produce eggs and males produce sperm. Plants also reproduce sexually – the egg and sperm are produced in the flowers of flowering plants. An egg and sperm unite to begin development of a new individual.				•	•	•	
• Every organism requires a set of instructions for specifying its traits. Heredity is the passage of these instructions from one generation to another.						•	
• Hereditary information is contained in genes, located in the chromosomes of each cell. Each gene carries a single unit of information. An inherited trait of an individual can be determined by one or by many genes, and a single gene can influence more than one trait. A human cell contains many thousands of different genes.						•	
• The characteristics of an organism can be described in terms of a combination of traits. Some traits are inherited and others result from interactions with the environment.					•	•	
Regulation and Behavior							
• All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.				•	•		•
• Regulation of an organism's internal environment involves sensing the internal environment and changing physiological activities to keep conditions within the range required to survive.				•	•		•
• Behavior is one kind of response an organism can make to an internal or environmental stimulus. A behavioral response requires coordination and communication at many levels, including cells, organ systems, and whole organisms.				•			•
• An organism's behavior evolves through adaptation to its environment.				•			•

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	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
Populations and Ecosystems							
• A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.							•
• Populations of organisms can be categorized by the function they serve in an ecosystem. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.							•
• For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs.							•
• The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.							•
Diversity and Adaptation of Organisms							
• Millions of species of animals, plants, and microorganisms are alive today. Although different species might look dissimilar, the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry.	•						
• Biological evolution accounts for the diversity of species developed through gradual processes over many generations. Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations. Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.	•						
• Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its 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.							•

Grades 9 – 12 Life Science Content Standards	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
The Cell							
• Cells have particular structures that underlie their functions. Every cell is surrounded by a membrane that separates it from the outside world. Inside the cell is a concentrated mixture of thousands of different molecules, which form a variety of specialized structures that carry out such cell functions as energy production, transport of molecules, waste disposal, synthesis of new molecules, and the storage of genetic material.	•	•					
• Most cell functions involve chemical reactions. Food molecules taken into cells react to provide the chemical constituents needed to synthesize other molecules. Both breakdown and synthesis are made possible by a large set of protein catalysts, called enzymes.	•				•		
• Cells store and use information to guide their functions. The genetic information stored in DNA is used to direct the synthesis of the thousands of proteins that each cell requires.						•	
• Plant cells contain chloroplasts, the site of photosynthesis. Plants and many microorganisms use solar energy to combine molecules of carbon dioxide and water into complex, energy-rich organic compounds and release oxygen to the environment.			•				
• Cells can differentiate, and complex multicellular organisms are formed as a highly organized arrangement of differentiated cells. This differentiation is regulated through the expression of different genes.					•		
Molecular Basis of Heredity							
• In all organisms, the instructions for specifying the characteristics of the organism are carried in DNA. The chemical and structural properties of DNA explain how the genetic information that underlies heredity is both encoded in genes (as a string of molecular "letters") and replicated (by a templating mechanism). Each DNA molecule in a cell forms a single chromosome.						•	
• Most of the cells in a human contain two copies of each of 22 different chromosomes. In addition, there is a pair of chromosomes that determines sex: a female contains two X chromosomes and a male contains one X and one Y chromosome. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. An egg and sperm unite to form a new individual.						•	
• Changes in DNA (mutations) occur spontaneously at low rates. Some of these changes make no difference to the organism, whereas others can change cells and organisms. Only mutations in germ cells can create the variation that changes an organism's offspring.						•	

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Biological Evolution							
• Species evolve over time. Evolution is the consequence of the interactions of (1) the potential for a species 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 by the environment of those offspring better able to survive and leave offspring.	•						
• The millions of different species of plants, animals, and microorganisms that live on Earth today are related by descent from common ancestors.	•						
• Biological classifications are based on how organisms are related. Organisms are classified into a hierarchy of groups and subgroups based on similarities, which reflect their evolutionary relationships. Species is the most fundamental unit of classification.	•						
Interdependence of Organisms							
• The atoms and molecules on the earth cycle among the living and nonliving components of the biosphere.	•	•					•
• Energy flows through ecosystems in one direction, from photosynthetic organisms to herbivores to carnivores and decomposers.				•			•
• Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.							•
• Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite.							•
• Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.				•			•
Matter, Energy, and Organization in Living Systems							
• All matter tends toward more disorganized states. Living systems require a continuous input of energy to maintain their chemical and physical organizations. With death, and the cessation of energy input, living systems rapidly disintegrate.					•		•

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
• The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes.							•
• The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in phosphate bonds of a small high-energy compound called ATP.	•				•		
• The complexity and organization of organisms accommodates the need for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain the organism.					•		•
• The distribution and abundance of organisms and populations in ecosystems are limited by the availability of matter and energy and the ability of the ecosystem to recycle materials.							•
• As matter and energy flows through different levels of organization of living systems – cells, organs, organisms, 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.					•		•
Behavior of Organisms							
• Multicellular animals have nervous systems that generate behavior. Nervous systems are formed from specialized cells that conduct signals rapidly through the long cell extensions that make up nerves. The nerve cells communicate with each other by secreting specific excitatory and inhibitory molecules. In sense organs, specialized cells detect light, sound, and specific chemicals and enable animals to monitor what is going on in the world around them.					•		
• Organisms have behavioral responses to internal changes and to external stimuli. Responses to external stimuli can result from interactions with the organism's own species and others, as well as environmental changes; these responses can be either innate or learned.				•	•		•

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	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
Science and Technology							
Abilities of Technological Design							
• Identify appropriate problems for technologic design		•	•	•		•	•
• Design a solution or product		•	•				•
• Evaluate completed technological designs or products			•	•			
• Communicate the process of technological design			•	•			
Understandings About Science and Technology							
• Scientific inquiry and technological design have similarities and differences.					•		
• Many different people in different cultures have made and continue to make contributions to science and technology.	•	•	•	•	•	•	•
• Science and technology are reciprocal.	•	•	•		•	•	•
• Perfectly designed solutions do not exist.					•		
• Technological designs have constraints.					•		
• Technological solutions have intended benefits and unintended consequences.	•	•		•		•	
Science in Personal and Social Perspectives							
Personal Health							
• Natural environments may contain substances (for example, radon and lead) that are harmful to human beings. Maintaining environmental health involves establishing or monitoring quality standards related to use of soil, water, and air.		•					•
Populations, Resources, and Environments							
• When an area becomes overpopulated, the environment will become degraded due to the increased use of resources.	•						•
• Causes of environmental degradation and resource depletion vary from region to region and from country to country.							•

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	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
Natural Hazards							
• Internal and external processes of the earth system cause natural hazards, events that change or destroy human and wildlife habitats, damage property, and harm or kill humans.							•
• Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal.							•
• Natural hazards can present personal and societal challenges.		•					•
Risks and Benefits							
• Students should understand the risks associated with natural hazards, chemical hazards, biological hazards, social hazards, and personal hazards.		•		•	•		•
• Individuals can use a systematic approach to thinking critically about risks and benefits.		•		•	•		•
Science and Technology in Society							
• Science influences society through its knowledge and world view.	•				•	•	•
• Societal challenges often inspire questions for scientific research, and social priorities often influence research.	•	•	•		•	•	•
• Technology influences society through its products and processes.	•	•	•	•	•	•	
• Science and technology have advanced through contributions of many different people, in different cultures, at different times in history.	•	•	•		•	•	•
• Scientists and engineers work in many different settings.	•	•	•	•	•	•	•
• Scientists and engineers have ethical codes.				•		•	•
• Science cannot answer all questions and technology cannot solve all human problems.	•					•	
History and Nature of Science							
Science as a Human Endeavor							
• Women and men of various social and ethnic backgrounds engage in the activities of science, engineering, and related fields.	•	•	•	•	•	•	•
• Science requires different abilities.	•	•	•	•	•	•	•

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
Nature of Science							
• Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models.	•	•		•	•	•	•
• It is normal for scientists to differ with one another about the interpretation of the evidence or theory being considered.	•	•				•	•
• It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists.	•			•			•
History of Science							
• Many individuals have contributed to the traditions of science.	•			•	•	•	•
• In historical perspective, science has been practiced by different individuals in different cultures.	•	•	•	•	•	•	•
• Tracing the history of science can show how difficult it was for scientific innovators to break through the accepted ideas of their time to reach the conclusions that we currently take for granted.	•	•					

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Skills	Unit 1 Life	Unit 2 Viruses, Bacteria, Archaea, Fungi, and Protists	Unit 3 Plants	Unit 4 Animals	Unit 5 Human Body	Unit 6 Genetics and Heredity	Unit 7 Ecology
Science Process Skills							
• Observing	•	•	•	•	•	•	•
• Inferring	•	•	•	•	•	•	•
• Predicting	•	•	•		•	•	•
• Measuring	•	•	•	•	•	•	•
• Calculating	•		•	•	•	•	•
• Classifying	•	•	•	•	•	•	•
• Using tables and graphs	•	•		•	•	•	•
• Developing and using models	•	•	•	•	•	•	•
• Posing questions	•	•	•	•			
• Designing experiments (investigations)	•	•	•	•			
• Formulating hypotheses	•	•	•	•	•		•
• Forming operational definitions	•	•	•	•	•		•
• Controlling variables	•	•	•	•			
• Analyzing data	•	•	•		•	•	•
• Making conclusions	•	•	•	•	•	•	•
• Communicating results	•	•	•	•	•	•	•
◦ Construct and present arguments using evidence to support the claim	•	•	•	•	•	•	•
◦ Integrate qualitative scientific and technical information to support the claim	•	•	•	•	•	•	

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	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
Critical Thinking Skills							
• Comparing and contrasting	•	•	•	•	•	•	•
• Interpreting data, diagrams, and photographs	•	•	•	•		•	•
• Making judgments	•	•		•	•	•	•
• Problem solving	•		•			•	•
• Using analogies	•	•			•		•
• Relating cause and effect	•	•	•		•	•	•
• Making generalizations	•	•	•	•		•	•
• Using mathematical representations						•	•
Graphic Organizers							
• Concept maps and web diagrams	•	•	•			•	
• Compare and contrast tables					•	•	
• Venn diagrams		•				•	•
• Flow charts	•	•					•
• Cycle diagrams		•	•	•			•
• Tables	•	•			•	•	•