AVENTA LEARNING

Alignment Document
State of New York and Aventa Learning Biology

Biology
2005-2007 Benchmark Blueprint

Discipline	Standards	Key Ideas	Benchmarks	Unit Name	Course Topic Description
L Living Environment	**L.1** Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.	**L.1.1** The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing and creative process.	**L.1.1.1** Elaborate on basic scientific and personal explanations of natural phenomena, and develop extended visual models and mathematical formulations to represent one's thinking.	The Nature of Science and Biology	The Scientific Method Lab
			L.1.1.1.a Scientific explanations are built by combining evidence that can be observed with what people already know about the world.	The Nature of Science and Biology	Science and the Scientific Method
			L.1.1.1.b Learning about the historical development of scientific concepts or about individuals who have contributed to scientific knowledge provides a better understanding of scientific inquiry and the relationship between science and society.	Evolution Genetics	Descent With Modification Mendel and Heredity
			L.1.1.1.c Science provides knowledge, but values are also essential to making effective and ethical decisions about the application of scientific knowledge.		
			L.1.1.2 Hone ideas through reasoning, library research, and discussion with others, including experts.		
			L.1.1.2.a Inquiry involves asking questions and locating, interpreting, and	The Nature of Science and	Science and the Scientific Method

			processing information from a variety of sources.	Biology Animal Organization Population Ecology	 All Labs in this Unit fulfill this standard. Biomes Lab
			L.1.1.2.b Inquiry involves making judgments about the reliability of the source and relevance of information.	The Nature of Science and Biology	Science and the Scientific Method
			L.1.1.3 Work toward reconciling competing explanations; clarify points of agreement and disagreement.	Evolution History of Life on Earth	Descent With Modification Birth of a Planet and Establishment of Life
			L.1.1.3.a Scientific explanations are accepted when they are consistent with experimental and observational evidence and when they lead to accurate predictions.	The Nature of Science and Biology	The Scientific Method Lab
			L.1.1.3.b All scientific explanations are tentative and subject to change or improvement. Each new bit of evidence can create more questions than it answers. This leads to increasingly better understanding of how things work in the living world.	Genetics Evolution	Biotechnology and the Genetics Revolution Descent With Modification
			L.1.1.4 Coordinate explanations at different levels of scale, points of focus, and degrees of complexity and specificity, and recognize the need for such alternative representations of the natural world.	Cell Structure Plant Structure Plant Structure	Microscopes and Cell Features Plant Structure Lab Flower Fruit Seed Lab
			L.1.1.4.a Well-accepted theories are ones that are supported by different kinds of scientific investigations often involving the contributions of individuals	Genetics Genetics	Mendel and Heredity How Proteins are Made

			from different disciplines.		
		L.1.2 Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.	**L.1.2.1** Devise ways of making observations to test proposed explanations.		
			L.1.2.2 Refine research ideas through library investigations, including electronic information retrieval and reviews of the literature, and through peer feedback obtained from review and discussion.	Population Ecology The Nature of Science and Biology	Biomes Lab Characteristics of Life Discussion
			L.1.2.2.a Development of a research plan involves researching background information and understanding the major concepts in the area being investigated. Recommendations for methodologies, use of technologies, proper equipment, and safety precautions should also be included.		
			L.1.2.3 Develop and present proposals including formal hypotheses to test explanations; i.e., predict what should be observed under specific conditions if the explanation is true.	The Nature of Science and Biology	The Scientific Method Lab
			L.1.2.3.a Hypotheses are predictions based upon both research and observation.	The Nature of Science and Biology	The Scientific Method Lab
			L.1.2.3.b Hypotheses are widely used in science for determining what data to collect and as a guide for interpreting the data.	The Nature of Science and Biology The Nature of Science and Biology	The Scientific Method Lab Science and the Scientific Method
			L.1.2.3.c Development of a research plan for testing a hypothesis requires planning to avoid bias (e.g., repeated		

			trials, large sample size, and objective data-collection techniques).		
			L.1.2.4 Carry out a research plan for testing explanations, including selecting and developing techniques, acquiring and building apparatus, and recording observations as necessary.		
		L.1.3 The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into natural phenomena.	**L.1.3.1** Use various methods of representing and organizing observations (e.g., diagrams, tables, charts, graphs, equations, matrices) and insightfully interpret the organized data.	The Nature of Science and Biology Genetics History of Life on Earth	The Scientific Method Lab Mendel and Heredity History of Life Lab
			L.1.3.1.a Interpretation of data leads to development of additional hypotheses, the formulation of generalizations, or explanations of natural phenomena.	The Nature of Science and Biology The Nature of Science and Biology	The Scientific Method Lab Science and the Scientific Method
			L.1.3.2 Apply statistical analysis techniques when appropriate to test if chance alone explains the results.		
			L.1.3.3 Assess correspondence between the predicted result contained in the hypothesis and actual result, and reach a conclusion as to whether the explanation on which the prediction was based is supported.	The Nature of Science and Biology Photosynthesis and Cellular Respiration	The Scientific Method Lab Enzyme Lab
			L.1.3.4 Based on the results of the test and through public discussion, revise the explanation and contemplate additional research.		

			L.1.3.4.a Hypotheses are valuable, even if they turn out not to be true, because they may lead to further investigation.	The Nature of Science and Biology The Nature of Science and Biology	The Scientific Method Lab Science and the Scientific Method
			L.1.3.4.b Claims should be questioned if the data are based on samples that are very small, biased, or inadequately controlled or if the conclusions are based on the faulty, incomplete, or misleading use of numbers.	The Nature of Science and Biology	Science and the Scientific Method
			L.1.3.4.c Claims should be questioned if fact and opinion are intermingled, if adequate evidence is not cited, or if the conclusions do not follow logically from the evidence given.	History of Life on Earth	Birth of a Planet and Establishment of Life
			L.1.3.5 Develop a written report for public scrutiny that describes the proposed explanation, including a literature review, the research carried out, its result, and suggestions for further research.		
			L.1.3.5.a One assumption of science is that other individuals could arrive at the same explanation if they had access to similar evidence. Scientists make the results of their investigations public; they should describe the investigations in ways that enable others to repeat the investigations.		
			L.1.3.5.b Scientists use peer review to evaluate the results of scientific investigations and the explanations proposed by other scientists. They		

			analyze the experimental procedures, examine the evidence, identify faulty reasoning, point out statements that go beyond the evidence, and suggest alternative explanations for the same observations.		
	L.4 Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.	**L.4.1** Living things are both similar to and different from each other and from nonliving things.	**L.4.1.1** Explain how diversity of populations within ecosystems relates to the stability of ecosystems.	Population Ecology	Community and Ecosystem Dynamics
			L.4.1.1.a Populations can be categorized by the function they serve. Food webs identify the relationships among producers, consumers, and decomposers carrying out either autotropic or heterotropic nutrition.		
			L.4.1.1.b An ecosystem is shaped by the nonliving environment as well as its interacting species. The world contains a wide diversity of physical conditions, which creates a variety of environments.	Population Ecology	Community and Ecosystem Dynamics
			L.4.1.1.c In all environments, organisms compete for vital resources. The linked and changing interactions of populations and the environment compose the total ecosystem.	Population Ecology	Community and Ecosystem Dynamics
			L.4.1.1.d The interdependence of organisms in an established ecosystem often results in approximate stability over hundreds and thousands of years. For example, as one population increases, it is held in check by one or more environmental factors or another species.	Population Ecology	Community and Ecosystem Dynamics
			L.4.1.1.e Ecosystems, like many other complex systems, tend to show cyclic changes around a state of approximate	Population Ecology	Community and Ecosystem Dynamics

			equilibrium.		
			L.4.1.1.f Every population is linked, directly or indirectly, with many others in an ecosystem. Disruptions in the numbers and types of species and environmental changes can upset ecosystem stability.	Population Ecology	Community and Ecosystem Dynamics
			L.4.1.2 Describe and explain the structures and functions of the human body at different organizational levels (e.g., systems, tissues, cells, organelles).	Cell Structure Animal Organization Animal Organization	Cell Features Animal Tissues Animal Organ Systems and Homeostasis
			L.4.1.2.a Important levels of organization for structure and function include organelles, cells, tissues, organs, organ systems, and whole organisms.	Cell Structure Animal Organization Animal Organization	Cell Features Animal Tissues Animal Organ Systems and Homeostasis
			L.4.1.2.b Humans are complex organisms. They require multiple systems for digestion, respiration, reproduction, circulation, excretion, movement, coordination, and immunity. The systems interact to perform the life functions.	Animal Organization Animal Organization Animal Organization Animal Organization Animal Organization	The Integumentary System The Circulatory System The Lymphatic System and Immunity The Digestive System The Nervous and Endocrine Systems

				Animal Organization Animal Organization	Muscular and Skeletal Systems The Reproductive System and Human Development
			L.4.1.2.c The components of the human body, from organ systems to cell organelles, interact to maintain a balanced internal environment. To successfully accomplish this, organisms possess a diversity of control mechanisms that detect deviations and make corrective actions.	Animal Development	Animal Organ Systems and Homeostasis
			L.4.1.2.d If there is a disruption in any human system, there may be a corresponding imbalance in homeostasis.	Animal Development	Animal Organ Systems and Homeostasis
			L.4.1.2.e The organs and systems of the body help to provide all the cells with their basic needs. The cells of the body are of different kinds and are grouped in ways that enhance how they function together.	Animal Development Animal Development	Animal Organ Systems and Homeostasis Animal Tissues
			L.4.1.2.f Cells have particular structures that perform specific jobs. These structures perform the actual work of the cell. Just as systems are coordinated and work together, cell parts must also be coordinated and work together.	Cell Structure	Cell Features
			L.4.1.2.g Each cell is covered by a membrane that performs a number of important functions for the cell. These include: separation from its outside environment, controlling which molecules enter and leave the cell, and recognition of chemical signals. The	Cell Structure	The Cell Membrane

			processes of diffusion and active transport are important in the movement of materials in and out of cells.		
			L.4.1.2.h Many organic and inorganic substances dissolved in cells allow necessary chemical reactions to take place in order to maintain life. Large organic food molecules such as proteins and starches must initially be broken down (digested to amino acids and simple sugars respectively), in order to enter cells. Once nutrients enter a cell, the cell will use them as building blocks in the synthesis of compounds necessary for life.		
			L.4.1.2.i Inside the cell a variety of specialized structures, formed from many different molecules, carry out the transport of materials (cytoplasm), extraction of energy from nutrients (mitochondria), protein building (ribosomes), waste disposal (cell membrane), storage (vacuole), and information storage (nucleus).	Cell Structure	Cell Features
			L.4.1.2.j Receptor molecules play an important role in the interactions between cells. Two primary agents of cellular communication are hormones and chemicals produced by nerve cells. If nerve or hormone signals are blocked, cellular communication is disrupted and the organism's stability is affected.	Animal Organization	The Nervous and Endocrine Systems
			L.4.1.3 Explain how a one-celled organism is able to function despite lacking the levels of organization present in more complex organisms.		

			L.4.1.3.a The structures present in some single-celled organisms act in a manner similar to the tissues and systems found in multicellular organisms, thus enabling them to perform all of the life processes needed to maintain homeostasis.		
		L.4.2 Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.	**L.4.2.1** Explain how the structure and replication of genetic material result in offspring that resemble their parents.	Cell Structure Genetics	Meiosis and Sexual Reproduction Mendel and Heredity
			L.4.2.1.a Genes are inherited, but their expression can be modified by interactions with the environment.	Genetics	The Chromosome Theory of Inheritance
			L.4.2.1.b Every organism requires a set of coded instructions for specifying its traits. For offspring to resemble their parents, there must be a reliable way to transfer information from one generation to the next. Heredity is the passage of these instructions from one generation to another.	Genetics Cell Structure	Mendel and Heredity Meiosis and Sexual Reproduction
			L.4.2.1.c Hereditary information is contained in genes, located in the chromosomes of each cell. 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 in its nucleus.	Genetics	The Chromosome Theory of Inheritance
			L.4.2.1.d In asexually reproducing organisms, all the genes come from a single parent. Asexually produced offspring are normally genetically identical to the parent.	Cell Structure	Chromosomes and Cell Reproduction
			L.4.2.1.e In sexually reproducing organisms, the new individual receives	Cell Structure	Meiosis and Sexual Reproduction

			half of the genetic information from its mother (via the egg) and half from its father (via the sperm). Sexually produced offspring often resemble, but are not identical to, either of their parents.		
			L.4.2.1.f In all organisms, the coded instructions for specifying the characteristics of the organism are carried in DNA, a large molecule formed from subunits arranged in a sequence with bases of four kinds (represented by A, G, C, and T). The chemical and structural properties of DNA are the basis for how the genetic information that underlies heredity is both encoded in genes (as a string of molecular "bases") and replicated by means of a template.	Cell Structure Genetics	Chromosomes and Cell Reproduction How Proteins are Made
			L.4.2.1.g Cells store and use coded information. The genetic information stored in DNA is used to direct the synthesis of the thousands of proteins that each cell requires.	Genetics Genetics	How Proteins are Made Protein Synthesis
			L.4.2.1.h Genes are segments of DNA molecules. Any alteration of the DNA sequence is a mutation. Usually, an altered gene will be passed on to every cell that develops from it.	Genetics Genetics	Mendel and Heredity RNA Lab
			L.4.2.1.i The work of the cell is carried out by the many different types of molecules it assembles, mostly proteins. Protein molecules are long, usually folded chains made from 20 different kinds of amino acids in a specific sequence. This sequence influences the	The Nature of Science and Biology Genetics	Chemistry of Life Protein Synthesis

			shape of the protein. The shape of the protein, in turn, determines its function.		
			L.4.2.1.j Offspring resemble their parents because they inherit similar genes that code for the production of proteins that form similar structures and perform similar functions.	Genetics	The Chromosome Theory of Inheritance
			L.4.2.1.k The many body cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions. This is because different parts of these instructions are used in different types of cells, and are influenced by the cell's environment and past history.		
			L.4.2.2 Explain how the technology of genetic engineering allows humans to alter genetic makeup of organisms.	Genetics Genetics	Biotechnology and the Genetics Revolution Biotechnology Lab
			L.4.2.2.a For thousands of years new varieties of cultivated plants and domestic animals have resulted from selective breeding for particular traits.	Evolution	Evolution and Genetics
			L.4.2.2.b In recent years new varieties of farm plants and animals have been engineered by manipulating their genetic instructions to produce new characteristics.	Genetics	Biotechnology and the Genetics Revolution
			L.4.2.2.c Different enzymes can be used to cut, copy, and move segments of DNA. Characteristics produced by the segments of DNA may be expressed when these segments are inserted into new organisms, such as bacteria.	Genetics	Biotechnology and the Genetics Revolution

			L.4.2.2.d Inserting, deleting, or substituting DNA segments can alter genes. An altered gene may be passed on to every cell that develops from it.	Genetics Genetics	RNA Lab Mendel and Heredity
			L.4.2.2.e Knowledge of genetics is making possible new fields of health care; for example, finding genes which may have mutations that can cause disease will aid in the development of preventive measures to fight disease. Substances, such as hormones and enzymes, from genetically engineered organisms may reduce the cost and side effects of replacing missing body chemicals.	Genetics Genetics	Biotechnology and the Genetics Revolution Biotechnology Lab
		L.4.3 Individual organisms and species change over time.	**L.4.3.1** Explain the mechanisms and patterns of evolution.	Evolution Evolution	Descent With Modification Evolution and Genetics
			L.4.3.1.a The basic theory of biological evolution states that the Earth's present-day species developed from earlier, distinctly different species.	Evolution	Descent With Modification
			L.4.3.1.b New inheritable characteristics can result from new combinations of existing genes or from mutations of genes in reproductive cells.	Evolution	Evolution and Genetics
			L.4.3.1.c Mutation and the sorting and recombining of genes during meiosis and fertilization result in a great variety of possible gene combinations.	Cell Structure	Meiosis and Sexual Reproduction
			L.4.3.1.d Mutations occur as random chance events. Gene mutations can also be caused by such agents as radiation and chemicals. When they occur in sex cells, the mutations can be passed on to offspring; if they occur in	Genetics Genetics	Mendel and Heredity RNA Lab

			other cells, they can be passed on to other body cells only.		
			L.4.3.1.e Natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life-forms, as well as for the molecular and structural similarities observed among the diverse species of living organisms.	Evolution Evolution History of Life on Earth Biological Diversity	Descent With Modification Evolution and Genetics Fossils Prokaryotes
			L.4.3.1.f 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.	Evolution Evolution	Descent With Modification Evolution and Genetics
			L.4.3.1.g Some characteristics give individuals an advantage over others in surviving and reproducing, and the advantaged offspring, in turn, are more likely than others to survive and reproduce. The proportion of individuals that have advantageous characteristics will increase.	Evolution	Evolution and Genetics
			L.4.3.1.h The variation of organisms within a species increases the likelihood that at least some members of the species will survive under changed environmental conditions.	Evolution	Evolution and Genetics
			L.4.3.1.i Behaviors have evolved	Evolution	Evolution and Genetics

			through natural selection. The broad patterns of behavior exhibited by organisms are those that have resulted in greater reproductive success.		
			L.4.3.1.j Billions of years ago, life on Earth is thought by many scientists to have begun as simple, single-celled organisms. About a billion years ago, increasingly complex multi- cellular organisms began to evolve.	History of Life on Earth	Birth of a Planet and Establishment of Life
			L.4.3.1.k Evolution does not necessitate long-term progress in some set direction. Evolutionary changes appear to be like the growth of a bush: Some branches survive from the beginning with little or no change, many die out altogether, and others branch repeatedly, sometimes giving rise to more complex organisms.		
			L.4.3.1.l 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 Earth no longer exist.	Population Ecology	The Biosphere and Mass Extinctions
		L.4.4 The continuity of life is sustained through reproduction and development.	**L.4.4.1** Explain how organisms, including humans, reproduce their own kind.	Cell Structure	Meiosis and Sexual Reproduction
			L.4.4.1.a Reproduction and development are necessary for the continuation of any species.	Population Ecology	Population Growth
			L.4.4.1.b Some organisms reproduce asexually with all the genetic information coming from one parent. Other	Cell Structure	Chromosomes and Cell Reproduction

			organisms reproduce sexually with half the genetic information typically contributed by each parent. Cloning is the production of identical genetic copies.	Cell Structure	Meiosis and Sexual Reproduction
			L.4.4.1.c The processes of meiosis and fertilization are key to sexual reproduction in a wide variety of organisms. The process of meiosis results in the production of eggs and sperm which each contain half of the genetic information. During fertilization, gametes unite to form a zygote, which contains the complete genetic information for the offspring.	Cell Structure	Meiosis and Sexual Reproduction
			L.4.4.1.d The zygote may divide by mitosis and differentiate to form the specialized cells, tissues, and organs of multicellular organisms.	Animal Organization	The Reproductive System and Human Development
			L.4.4.1.e Human reproduction and development are influenced by factors such as gene expression, hormones, and the environment. The reproductive cycle in both males and females is regulated by hormones such as testosterone, estrogen, and progesterone.	Animal Organization	The Reproductive System and Human Development
			L.4.4.1.f The structures and functions of the human female reproductive system, as in almost all other mammals, are designed to produce gametes in ovaries, allow for internal fertilization, support the internal development of the embryo and fetus in the uterus, and provide essential materials through the placenta, and nutrition through milk for the newborn.	Animal Organization	The Reproductive System and Human Development

			L.4.4.1.g The structures and functions of the human male reproductive system, as in other mammals, are designed to produce gametes in testes and make possible the delivery of these gametes for fertilization.	Animal Organization	The Reproductive System and Human Development
			L.4.4.1.h In humans, the embryonic development of essential organs occurs in early stages of pregnancy. The embryo may encounter risks from faults in its genes and from its mother's exposure to environmental factors such as inadequate diet, use of alcohol/drugs/tobacco, other toxins, or infections throughout her pregnancy.	Animal Organization	The Reproductive System and Human Development
		L.4.5 Organisms maintain a dynamic equilibrium that sustains life.	**L.4.5.1** Explain the basic biochemical processes in living organisms and their importance in maintaining dynamic equilibrium.	Photosynthesis and Cellular Respiration Photosynthesis and Cellular Respiration	Photosynthesis: Food Production Cellular Respiration
			L.4.5.1.a The energy for life comes primarily from the Sun. Photosynthesis provides a vital connection between the Sun and the energy needs of living systems.	Photosynthesis and Cellular Respiration	Photosynthesis: Food Production
			L.4.5.1.b Plant cells and some one-celled organisms contain chloroplasts, the site of photosynthesis. The process of photosynthesis uses solar energy to combine the inorganic molecules carbon dioxide and water into energy-rich organic compounds (e.g., glucose) and release oxygen to the environment.	Photosynthesis and Cellular Respiration	Photosynthesis: Food Production
			L.4.5.1.c In all organisms, organic	The Nature of	Chemistry of Life

			compounds can be used to assemble other molecules such as proteins, DNA, starch, and fats. The chemical energy stored in bonds can be used as a source of energy for life processes.	Science and Biology	
			L.4.5.1.d In all organisms, the energy stored in organic molecules may be released during cellular respiration. This energy is temporarily stored in ATP molecules. In many organisms, the process of cellular respiration is concluded in mitochondria, in which ATP is produced more efficiently, oxygen is used, and carbon dioxide and water are released as wastes.	Photosynthesis and Cellular Respiration	Cellular Respiration
			L.4.5.1.e The energy from ATP is used by the organism to obtain, transform, and transport materials, and to eliminate wastes.	Photosynthesis and Cellular Respiration	Cellular Respiration
			L.4.5.1.f Biochemical processes, both breakdown and synthesis, are made possible by a large set of biological catalysts called enzymes. Enzymes can affect the rates of chemical change. The rate at which enzymes work can be influenced by internal environmental factors such as pH and temperature.	Photosynthesis and Cellular Respiration	Enzymes
			L.4.5.1.g Enzymes and other molecules, such as hormones, receptor molecules, and antibodies, have specific shapes that influence both how they function and how they interact with other molecules.	The Nature of Science and Biology Photosynthesis and Cellular Respiration	Chemistry of Life Enzymes
			L.4.5.2 Explain disease as a failure of homeostasis.		

			L.4.5.2.a Homeostasis in an organism is constantly threatened. Failure to respond effectively can result in disease or death.	Animal Organization	Animal Organ Systems and Homeostasis
			L.4.5.2.b Viruses, bacteria, fungi, and other parasites may infect plants and animals and interfere with normal life functions.	Animal Organization Plant Structure	The Lymphatic System and Immunity Plant Hormones, Nutrition, and Transport
			L.4.5.2.c The immune system protects against antigens associated with pathogenic organisms or foreign substances and some cancer cells.	Animal Organization	The Lymphatic System and Immunity
			L.4.5.2.d Some white blood cells engulf invaders. Others produce antibodies that attack them or mark them for killing. Some specialized white blood cells will remain, able to fight off subsequent invaders of the same kind.	Animal Organization	The Lymphatic System and Immunity
			L.4.5.2.e Vaccinations use weakened microbes (or parts of them) to stimulate the immune system to react. This reaction prepares the body to fight subsequent invasions by the same microbes.	Animal Organization	The Lymphatic System and Immunity
			L.4.5.2.f Some viral diseases, such as AIDS, damage the immune system, leaving the body unable to deal with multiple infectious agents and cancerous cells.	Animal Organization	The Lymphatic System and Immunity
			L.4.5.2.g Some allergic reactions are caused by the body's immune responses to usually harmless environmental substances. Sometimes the immune system may attack some of the body's own cells or transplanted	Animal Organization	The Lymphatic System and Immunity

			organs.		
			L.4.5.2.h Disease may also be caused by inheritance, toxic substances, poor nutrition, organ malfunction, and some personal behavior. Some effects show up right away; others may not show up for many years.	Animal Organization Animal Organization Animal Organization Animal Organization Animal Organization Animal Organization Animal Organization	The Integumentary System The Circulatory System The Digestive System The Nervous and Endocrine Systems Muscular and Skeletal Systems Respiration and Excretion The Reproductive System and Human Development
			L.4.5.2.i Gene mutations in a cell can result in uncontrolled cell division, called cancer. Exposure of cells to certain chemicals and radiation increases mutations and thus increases the chance of cancer.	Animal Organization	The Integumentary System
			L.4.5.2.j Biological research generates knowledge used to design ways of diagnosing, preventing, treating, controlling, or curing diseases of plants and animals.		
			L.4.5.3 Relate processes at the system level to the cellular level in order to explain dynamic equilibrium in multicelled organisms.	Animal Organization	The Lymphatic System and Immunity

			L.4.5.3.a Dynamic equilibrium results from detection of and response to stimuli. Organisms detect and respond to change in a variety of ways both at the cellular level and at the organismal level.	Plant Structure	Plant Hormones, Nutrition, and Transport
			L.4.5.3.b Feedback mechanisms have evolved that maintain homeostasis. Examples include the changes in heart rate or respiratory rate in response to increased activity in muscle cells, the maintenance of blood sugar levels by insulin from the pancreas, and the changes in openings in the leaves of plants by guard cells to regulate water loss and gas exchange.	Animal Organization	Animal Organ Systems and Homeostasis
		L.4.6 Plants and animals depend on each other and their physical environment.	**L.4.6.1** Explain factors that limit growth of individuals and populations.	Population Ecology	Population Growth
			L.4.6.1.a Energy flows through ecosystems in one direction, typically from the Sun, through photosynthetic organisms including green plants and algae, to herbivores to carnivores and decomposers.	Photosynthesis and Cellular Respiration	Energy
			L.4.6.1.b The atoms and molecules on the Earth cycle among the living and nonliving components of the biosphere. For example, carbon dioxide and water molecules used in photosynthesis to form energy-rich organic compounds are returned to the environment when the energy in these compounds is eventually released by cells. Continual input of energy from sunlight keeps the process going. This concept may be illustrated with an energy pyramid.	Population Ecology	The Biosphere and Mass Extinctions

			L.4.6.1.c The chemical elements, such as carbon, hydrogen, nitrogen, and oxygen, that make up the molecules of living things pass through food webs and are combined and recombined in different ways. At each link in a food web, some energy is stored in newly made structures but much is dissipated into the environment as heat.		
			L.4.6.1.d The number of organisms any habitat can support (carrying capacity) is limited by the available energy, water, oxygen, and minerals, and by the ability of ecosystems to recycle the residue of dead organisms through the activities of bacteria and fungi.	Population Ecology	Population Growth
			L.4.6.1.e In any particular environment, the growth and survival of organisms depend on the physical conditions including light intensity, temperature range, mineral availability, soil/rock type, and relative acidity (pH).	Population Ecology Population Ecology	Population Growth Community and Ecosystem Dynamics
			L.4.6.1.f Living organisms have the capacity to produce populations of unlimited size, but environments and resources are finite. This has profound effects on the interactions among organisms.	Population Ecology	Population Growth
			L.4.6.1.g Relationships between organisms may be negative, neutral, or positive. Some 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 cause disease in, scavenge, or decompose	Population Ecology Population Ecology	Population Growth Community and Ecosystem Dynamics

			another.		
			L.4.6.2 Explain the importance of preserving diversity of species and habitats.	Population Ecology	The Biosphere and Mass Extinctions
			L.4.6.2.a As a result of evolutionary processes, there is a diversity of organisms and roles in ecosystems. This diversity of species increases the chance that at least some will survive in the face of large environmental changes. Biodiversity increases the stability of the ecosystem.	Evolution Population Ecology	Descent With Modification Community and Ecosystem Dynamics
			L.4.6.2.b Biodiversity also ensures the availability of a rich variety of genetic material that may lead to future agricultural or medical discoveries with significant value to humankind. As diversity is lost, potential sources of these materials may be lost with it.		
			L.4.6.3 Explain how the living and nonliving environments change over time and respond to disturbances.	Population Ecology	The Biosphere and Mass Extinctions
			L.4.6.3.a The interrelationships and interdependencies of organisms affect the development of stable ecosystems.	Population Ecology	Community and Ecosystem Dynamics
			L.4.6.3.b Through ecological succession, all ecosystems progress through a sequence of changes during which one ecological community modifies the environment, making it more suitable for another community. These long-term gradual changes result in the community reaching a point of stability that can last for hundreds or thousands of years.	Population Ecology	The Biosphere and Mass Extinctions
			L.4.6.3.c A stable ecosystem can be	Population	The Biosphere and Mass

			altered, either rapidly or slowly, through the activities of organisms (including humans), or through climatic changes or natural disasters. The altered ecosystem can usually recover through gradual changes back to a point of long- term stability.	Ecology	Extinctions
		L.4.7 Human decisions and activities have had a profound impact on the physical and living environment.	**L.4.7.1** Describe the range of interrelationships of humans with the living and nonliving environment.	Population Ecology	The Biosphere and Mass Extinctions
			L.4.7.1.a The Earth has finite resources; increasing human consumption of resources places stress on the natural processes that renew some resources and deplete those resources that cannot be renewed.	Population Ecology	The Biosphere and Mass Extinctions
			L.4.7.1.b Natural ecosystems provide an array of basic processes that affect humans. Those processes include but are not limited to: maintenance of the quality of the atmosphere, generation of soils, control of the water cycle, removal of wastes, energy flow, and recycling of nutrients. Humans are changing many of these basic processes and the changes may be detrimental.	Population Ecology	The Biosphere and Mass Extinctions
			L.4.7.1.c Human beings are part of the Earth's ecosystems. Human activities can, deliberately or inadvertently, alter the equilibrium in ecosystems. Humans modify ecosystems as a result of population growth, consumption, and technology. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current	Population Ecology	The Biosphere and Mass Extinctions

			global stability, and if not addressed, ecosystems may be irreversibly affected.		
			L.4.7.2 Explain the impact of technological development and growth in the human population on the living and nonliving environment.	Population Ecology	The Biosphere and Mass Extinctions
			L.4.7.2.a Human activities that degrade ecosystems result in a loss of diversity of the living and nonliving environment. For example, the influence of humans on other organisms occurs through land use and pollution. Land use decreases the space and resources available to other species, and pollution changes the chemical composition of air, soil, and water.	Population Ecology	The Biosphere and Mass Extinctions
			L.4.7.2.b When humans alter ecosystems either by adding or removing specific organisms, serious consequences may result. For example, planting large expanses of one crop reduces the biodiversity of the area.	Population Ecology	The Biosphere and Mass Extinctions
			L.4.7.2.c Industrialization brings an increased demand for and use of energy and other resources including fossil and nuclear fuels. This usage can have positive and negative effects on humans and ecosystems.	Population Ecology	The Biosphere and Mass Extinctions
			L.4.7.3 Explain how individual choices and societal actions can contribute to improving the environment.		
			L.4.7.3.a Societies must decide on proposals which involve the introduction of new technologies. Individuals need to make decisions which will assess risks,	Population Ecology	The Biosphere and Mass Extinctions

			costs, benefits, and trade-offs.		
			L.4.7.3.b The decisions of one generation both provide and limit the range of possibilities open to the next generation.		