# MIDLAND ISD
# ADVANCED PLACEMENT CURRICULUM STANDARDS

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| **(1) Scientific processes. The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:**<br>**(A)** demonstrate safe practices during laboratory and field investigations; and<br>**(B)** demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.<br><br>**(2) Scientific processes. The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:**<br>**(A)** know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;<br>**(B)** know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;<br>**(C)** know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and | **Science Practices**<br><br>**Standard SP.1: Scientific Questions and Predictions**<br>**Asking scientific questions that can be tested empirically and structuring these questions in the form of testable predictions**<br>**SP.1.1 Scientific Questions**<br>Students recognize, formulate, justify and revise scientific questions that can be addressed by science in order to construct explanations.<br>**SP.1.2 Predictions**<br>Students make and justify predictions concerning natural phenomena. Predictions and justifications are based on observations of the world, on knowledge of the discipline and on empirical evidence.<br><br>**Standard SP.2: Generation of Evidence: Collecting data to address scientific questions and to support predictions**<br>**SP.2.1 Data Collection**<br>Students select and use appropriate measurement methods and techniques for gathering data, and systematically record and organize observations and measurements. | **I. Nature of Science: Scientific Ways of Learning and Thinking**<br>**A. Cognitive skills in science**<br>**1.** Utilize skepticism, logic, and professional ethics in science.<br>**2.** Use creativity and insight to recognize and describe patterns in natural phenomena.<br>**3.** Formulate appropriate questions to test understanding of natural phenomena.<br>**4.** Rely on reproducible observations of empirical evidence when constructing, analyzing, and evaluating explanations of natural events and processes.<br>**B. Scientific inquiry**<br>**1.** Design and conduct scientific investigations In which hypotheses are formulated and tested.<br>**C. Collaborative and safe working practices**<br>**1.** Collaborate on joint projects.<br>**2**. Understand and apply safe procedures in the laboratory and field, including chemical, electrical, and fire safety and safe handling of live or preserved organisms.<br>**3**. Demonstrate skill in the safe use of a wide variety of apparatuses, equipment, techniques, and procedures.<br>**D. Current scientific technology**<br>**1.** Demonstrate literacy in computer use.<br>**2.** Use computer models, applications, and simulations.<br>**3.** Demonstrate appropriate use of a wide |

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| highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed;<br>**(D)** distinguish between scientific hypotheses and scientific theories;<br>**(E)** plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;<br>**(F)** collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;<br>**(G)** analyze, evaluate, make inferences, and predict trends from data; and<br>**(H)** communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, | **SP.2.2 Evaluating Data for Evidence**<br>Students determine which data from a specific investigation can be used as evidence to address a scientific question or to support a prediction or an explanation, and distinguish credible data from noncredible data in terms of quality.<br><br>**Standard SP.3: Data Analysis**<br>**Searching for regularities and patterns in observations and measurements (i.e., data analysis)**<br>**SP.3.1 Analyzing Data for Patterns**<br>Students analyze data to discover patterns.<br><br>**Standard SP.4:Evidence-Based Explanations and Models :**<br>**Using evidence and science knowledge to construct scientific explanations, models and representations**<br>**SP.4.1 Constructing Explanations**<br>Students construct explanations that are based on observations and measurements of the world, on empirical evidence and on reasoning grounded in the theories, principles and concepts of the discipline.<br>**SP.4.2 Models and Representations**<br>Students construct, use, re-express and revise models and representations of natural and designed objects, systems, | variety of apparatuses, equipment, techniques, and procedures for collecting quantitative and qualitative data.<br>**E. Effective communication of scientific information**<br>**1.** Use several modes of expression to describe or characterize natural patterns and phenomena. These modes of expression include narrative, numerical, graphical, pictorial, symbolic, and kinesthetic.<br>**2.** Use essential vocabulary of the discipline being studied.<br><br>**II. Foundation Skills: Scientific Applications of Mathematics**<br>**A. Basic mathematics conventions**<br>**1**. Understand the real number system and its properties.<br>**2.** Use exponents and scientific notation.<br>**3.** Understand ratios, proportions, percentages, and decimal fractions, and translate from any form to any other.<br>**4.** Use proportional reasoning to solve problems.<br>**5.** Simplify algebraic expressions.<br>**6.** Estimate results to evaluate whether a calculated result is reasonable.<br>**7**. Use calculators, spreadsheets, computers, etc., in data analysis.<br>**B. Mathematics as a symbolic language** |

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| journals, summaries, oral reports, and technology-based reports.<br>**(3) Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:**<br>**(A)** in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;<br>**(B)** communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;<br>**(C)** draw inferences based on data related to promotional materials for products and services;<br>**(D)** evaluate the impact of scientific research on society and the environment;<br>**(E)** evaluate models according to their limitations in representing biological objects or events; and<br>**(F)** research and describe the history of biology and contributions of scientists. | phenomena and scientific ideas in the appropriate context and in formulating their explanation.<br>**SP.4.3 Evaluating Explanations**<br>Students evaluate, compare and contrast explanations that are based on observations of the world, on empirical evidence and on reasoning grounded in the theories, principles and concepts of the discipline.<br><br>**Standard SP.5:Quantitative Applications**<br>**Using mathematical reasoning and quantitative applications to interpret and analyze data to solve problems**<br>**SP.5.1 Proportionality Between Variables**<br>Students reason about relationships between variables (e.g., data, representations, uncertainty, samples) through the lens of ratios, rates, percentages, probability or proportional relationships when approaching or solving problems or when interpreting results or situations.<br>**SP.5.2 Patterns of Bivariate Relationships**<br>Students apply, analyze and create algebraic representations, relationships and patterns of linear functions, systems of linear inequalities, and one- or two-dimensional changes to solve problems, interpret situations and address scientific questions. | **1**. Carry out formal operations using standard algebraic symbols and formulae.<br>**2.** Represent natural events, processes, and relationships with algebraic expressions and algorithms.<br>**C. Understand relationships among geometry, algebra, and trigonometry**<br>**1.** Understand simple vectors, vector notations, and vector diagrams, and carry out simple calculations involving vectors.<br>**2.** Understand that a curve drawn on a defined set of axes is fully equivalent to a set of algebraic equations.<br>**3.** Understand basic trigonometric principles, Including definitions of terms, such as sine, cosine, tangent, cotangent, and their relationship to triangles.<br>**4.** Understand basic geometric principles.<br>**D. Scientific problem solving**<br>**1.** Use dimensional analysis in problem solving.<br>**E. Scientific application of probability and statistics**<br>**1**. Understand descriptive statistics.<br>**F. Scientific measurement**<br>**1.** Select and use appropriate Standard International (SI) units and prefixes to express measurements for real world problems.<br>**2.** Use appropriate significant digits.<br>**3**. Understand and use logarithmic notation (base 10). |

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| **(4) Science concepts. The student knows that cells are the basic structures of all living things with specialized parts that perform specific functions and that viruses are different from cells. The student is expected to:**<br>**(A)** compare and contrast prokaryotic and eukaryotic cells;<br>**(B)** investigate and explain cellular processes, including homeostasis, energy conversions, transport of molecules, and synthesis of new molecules; and<br>**(C)** compare the structures of viruses to cells, describe viral reproduction, and describe the role of viruses in causing diseases such as human immunodeficiency virus (HIV) and influenza.<br><br>**(5) Science concepts. The student knows how an organism grows and the importance of cell differentiation. The student is expected to:**<br>**(A)** describe the stages of the cell cycle, including deoxyribonucleic acid (DNA) replication and mitosis, and the importance of the cell cycle to the growth of organisms;<br>**(B)** examine specialized cells, including roots, stems, and leaves of plants; and animal cells such as blood, muscle, and epithelium;<br>**(C)** describe the roles of DNA, ribonucleic acid (RNA), and environmental factors in cell differentiation; and | **Science, Technology and Society**<br><br>**Standard STS.1:Science, Technology and Society**<br>**A critical interdependence exists among science, technology and society.**<br>**STS.1.1 Interdependence of Science and Technology**<br>Students explain the interdependence of science and technology: how the ongoing development of technology relies on the advancements of science while scientific research relies on technological progress. Students understand how the evolution of various technologies (e.g., biotechnology, seismology, computational software, lasers) radically alters the practice of many science disciplines by affecting the quality and quantity of available data.<br>**STS.1.2 Advantages and Disadvantages to Society**<br>Students understand how science and technology together can be used for the benefit of society as well as their own lives (e.g., weather predictions, development of medications, creation of safety devices in cars), but that some technological capabilities (e.g., cloning, genetic recombination, nuclear energy studies, access to fossil fuels, chemical engineering) | **III. Foundation Skills: Scientific Applications of Communication**<br>**A. Scientific writing**<br>**1.** Use correct applications of writing practices in scientific communication.<br>**B. Scientific reading**<br>**1.** Read technical and scientific articles to gain understanding of interpretations, apparatuses, techniques or procedures, and data.<br>**2.** Set up apparatuses, carry out procedures, and collect specified data from a given set of appropriate instructions.<br>**3.** Recognize scientific and technical vocabulary In the field of study and use this vocabulary to enhance clarity of communication.<br>**4.** List, use, and give examples of specific strategies before, during, and after reading to improve comprehension.<br>**C. Presentation of scientific/technical information**<br>**1.** Prepare and present scientific/technical information in appropriate formats for various audiences.<br>**D. Research skills/information literacy**<br>**1.** Use search engines, databases, and other digital electronic tools effectively to locate information.<br>**2.** Evaluate quality, accuracy, completeness, reliability, and currency of information from any sources. |

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| **(D)** recognize that disruptions of the cell cycle lead to diseases such as cancer.<br><br>**(6) Science concepts. The student knows the mechanisms of genetics, including the role of nucleic acids and the principles of Mendelian Genetics. The student is expected to:**<br>**(A)** identify components of DNA, and describe how information for specifying the traits of an organism is carried in the DNA;<br>**(B)** recognize that components that make up the genetic code are common to all organisms;<br>**(C)** explain the purpose and process of transcription and translation using models of DNA and RNA;<br>**(D)** recognize that gene expression is a regulated process;<br>**(E)** identify and illustrate changes in DNA and evaluate the significance of these changes;<br>**(F)** predict possible outcomes of various genetic combinations such as monohybrid crosses, dihybrid crosses and non-Mendelian inheritance;<br>**(G)** recognize the significance of meiosis to sexual reproduction; and<br>**(H)** describe how techniques such as DNA fingerprinting, genetic modifications, and chromosomal analysis are used to study the genomes of organisms. | create ethical and economic dilemmas for society.<br>**STS.1.3 Evaluating Online Information**<br>Students recognize that the amount of information, as well as access to information, has exploded since the creation of the Internet. Online information should be judged using the same science practices and critical and skeptical views that reflect the way science is conducted and evaluated. Students also recognize the relationship between digital technology and the **fact** that social networking is a source of information generation and of the determination of "truths" in our current society. Students understand that this information presents a specific perspective that is not backed by research; therefore, the information and the perspective do not represent the empirical reality of science.<br><br>**Life Science**<br>**Standard LS.1: Evolution**<br>**The diversity and unity of life can be explained by the process of evolution.**<br>**LS.1.1 Evidence of Common Ancestry and Divergence**<br>Students understand that an analysis over time of both the anatomical structures and the DNA compositions of organisms can | **IV. Science, Technology, and Society**<br>**A. Interactions between innovations and science**<br>**1.** Recognize how scientific discoveries are connected to technological innovations.<br>**B. Social ethics**<br>**1.** Understand how scientific research and technology have an impact on ethical and legal practices.<br>**2.** Understand how commonly held ethical beliefs impact scientific research.<br>**C. History of science**<br>**1.** Understand the historical development of major theories in science.<br>**2.** Recognize the role of people in important contributions to scientific knowledge.<br><br>**V. Cross-Disciplinary Themes**<br>**A. Matter/states of matter**<br>**1.** Know modern theories of atomic structure.<br>**2.** Understand the typical states of matter (solid, liquid, gas) and phase changes among these.<br>**B. Energy (thermodynamics, kinetic, potential, energy transfers)**<br>**1.** Understand the Laws of Thermodynamics.<br>**2.** Know the processes of energy transfer.<br>**C. Change over time/equilibrium**<br>**1.** Recognize patterns of change.<br>**D. Classification** |

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| **(7) Science concepts. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life. The student is expected to:**<br>**(A)** analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental;<br>**(B)** analyze and evaluate scientific explanations concerning any data of sudden appearance, stasis, and sequential nature of groups in the fossil record;<br>**(C)** analyze and evaluate how natural selection produces change in populations, not individuals;<br>**(D)** analyze and evaluate how the elements of natural selection, including inherited variation, the potential of a population to produce more offspring than can survive, and a finite supply of environmental resources, result in differential reproductive success;<br>**(E)** analyze and evaluate the relationship of natural selection to adaptation and to the development of diversity in and among species;<br>**(F)** analyze and evaluate the effects of other evolutionary mechanisms, including genetic drift, gene flow, mutation, and recombination; and<br>**(G)** analyze and evaluate scientific explanations | be used to infer lines of descent back to a common ancestor.<br>**LS.1.2 Natural Selection**<br>Students understand that when a trait is favorable to an organism, the number of organisms with that trait will increase over time; and that when a trait is unfavorable, the number of organisms with that trait will decrease over time. Students understand that as a result, there is an increase in the proportion of individuals with the advantageous trait in a population. Over time, the process of natural selection leads to both the extinction of existing species and the evolution of new species.<br>**LS.1.3 Genetic Variation Within Populations**<br>Students understand that genetic variation within a population is essential for natural selection. Mutations, as well as random assortment of existing genes, can produce genetic variation in a population.<br><br>**Standard LS.2: Cells as a System: Cells are a fundamental structural and functional unit of life.**<br>**LS.2.1 Cell Function**<br>Students understand that cells perform the essential functions of life, such as energy transfer and transformation, exchange of gas, disposal of waste, growth, reproduction, | **1.** Understand that scientists categorize things according to similarities and differences.<br>**E. Measurements and models**<br>**1.** Use models to make predictions.<br>**2.** Use scale to relate models and structures.<br>**3.** Demonstrate familiarity with length scales from sub-atomic particles through macroscopic objects.<br><br>**VI. Biology**<br>**A. Structure and function of cells**<br>**1.** Know that although all cells share basic features, cells differentiate to carry out specialized functions.<br>**2.** Explain how cells can be categorized into two major types: prokaryotic and eukaryotic, and describe major features that distinguish one from the other.<br>**3.** Describe the structure and function of major sub-cellular organelles.<br>**4.** Describe the major features of mitosis and relate this process to growth and asexual reproduction.<br>**5.** Understand the process of cytokinesis in plant and animal cells and how this process is related to growth.<br>**6.** Know the structure of membranes and how this relates to permeability.<br>**B. Biochemistry**<br>**1.** Understand the major categories of biological |

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| concerning the complexity of the cell.<br><br>**(8) Science concepts. The student knows that taxonomy is a branching classification based on the shared characteristics of organisms and can change as new discoveries are made. The student is expected to:**<br>**(A)** define taxonomy and recognize the importance of a standardized taxonomic system to the scientific community;<br>**(B)** categorize organisms using a hierarchical classification system based on similarities and differences shared among groups; and<br>**(C)** compare characteristics of taxonomic groups, including archaea, bacteria, protists, fungi, plants, and animals.<br><br>**(9) Science concepts. The student knows the significance of various molecules involved in metabolic processes and energy conversions that occur in living organisms. The student is expected to:**<br>**(A)** compare the structures and functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids;<br>**(B)** compare the reactants and products of photosynthesis and cellular respiration in terms of energy and matter;<br>**(C)** identify and investigate the role of | and interaction with the environment.<br>**LS.2.2 Cell Structure**<br>Students understand that cells have internal structures that carry out specialized life functions, and that these internal structures vary depending on a cell's function.<br>**LS.2.3 Cell Growth and Repair**<br>Students understand that cells of multicellular organisms repeatedly divide to make more cells for growth and repair.<br>**LS.2.4 Cell Differentiation**<br>Students understand that in multicellular organisms, the single cell (zygote) ultimately divides and differentiates into specialized cells that form the various tissues and organs of the organism.<br><br>**Standard LS.3: Interdependent Relationships**<br>**Interdependent relationships characterize biological ecosystems.**<br>**LS.3.1 Living Systems and the Physical Environment**<br>Students understand that in all ecosystems, living organisms interact with and depend on the physical (abiotic) conditions of their environment for survival.<br>**LS.3.2 Interactions of Living Systems**<br>Students understand that organisms in all | molecules: lipids, carbohydrates, proteins, and nucleic acids.<br>**2.** Describe the structure and function of enzymes.<br>**3.** Describe the major features and chemical events of photosynthesis.<br>**4.** Describe the major features and chemical events of cellular respiration.<br>**5.** Know how organisms respond to presence or absence of oxygen, including mechanisms of Fermentation.<br>**6.** Understand coupled reaction processes and describe the role of ATP in energy coupling and transfer.<br>**C. Evolution and populations**<br>**1.** Know multiple categories of evidence for evolutionary change and how this evidence is used to infer evolutionary relationships among organisms.<br>**2.** Recognize variations in population sizes, including extinction, and describe mechanisms and conditions that produce these variations.<br>**D. Molecular genetics and heredity**<br>**1.** Understand Mendel's laws of inheritance.<br>**2.** Know modifications to Mendel's laws.<br>**3.** Understand the molecular structures and functions of nucleic acids.<br>**4.** Understand simple principles of population genetics and describe characteristics of a Hardy-Weinberg population. |

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| enzymes; and<br>**(D)** analyze and evaluate the evidence regarding formation of simple organic molecules and their organization into long complex molecules having information such as the DNA molecule for self-replicating life.<br><br>**(10) Science concepts. The student knows that biological systems are composed of multiple levels. The student is expected to:**<br>**(A)** describe the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals;<br>**(B)** describe the interactions that occur among systems that perform the functions of transport, reproduction, and response in plants; and<br>**(C)** analyze the levels of organization in biological systems and relate the levels to each other and to the whole system.<br><br>**(11) Science concepts. The student knows that biological systems work to achieve and maintain balance. The student is expected to:**<br>**(A)** describe the role of internal feedback mechanisms in the maintenance of homeostasis;<br>**(B)** investigate and analyze how organisms, populations, and communities respond to | ecosystems interact with and depend on each other, and that organisms with similar needs compete for limited resources.<br>**LS.3.3 Ecosystem Stability**<br>Students understand that a complex set of interactions within an ecosystem can maintain the number and types of organisms in an ecosystem that is relatively constant over long periods of time.<br><br>**Standard LS.4: Matter and Energy**<br>**Biological systems utilize energy and molecular building blocks to carry out life's essential functions.**<br>**LS.4.1 Matter Cycling**<br>Students understand that matter is continuously recycled within the biological system and between the biological (biotic) and physical (abiotic) components of an ecosystem.<br>**LS.4.2 Energy Transfer**<br>Students understand that all of the processes that take place within organisms require energy. In most ecosystems, the energy is derived from the Sun and transferred into chemical energy in photosynthetic organisms of that ecosystem. | **5**. Describe the major features of meiosis and relate this process to Mendel's laws of inheritance.<br>**E. Classification and taxonomy**<br>**1.** Know ways in which living things can be classified based on each organism's internal and external structure, development, and relatedness of DNA sequences.<br>**F. Systems and homeostasis**<br>**1.** Know that organisms possess various structures and processes (feedback loops) that maintain steady internal conditions.<br>**2.** Describe, compare, and contrast structures and processes that allow gas exchange, nutrient uptake and processing, waste excretion, nervous and hormonal regulation, and reproduction in plants, animals, and fungi; give examples of each.<br>**G. Ecology**<br>**1.** Identify Earth's major biomes, giving their locations, typical climate conditions, and characteristic organisms.<br>**2.** Know patterns of energy flow and material cycling in Earth's ecosystems.<br>**3.** Understand typical forms of organismal behavior.<br>**4.** Know the process of succession. |

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| external factors;<br>**(C)** summarize the role of microorganisms in both maintaining and disrupting the health of both organisms and ecosystems; and<br>**(D)** describe how events and processes that occur during ecological succession can change populations and species diversity.<br><br>**(12) Science concepts. The student knows that interdependence and interactions occur within an environmental system. The student is expected to:**<br>**(A)** interpret relationships, including predation, parasitism, commensalism, mutualism, and competition among organisms;<br>**(B)** compare variations and adaptations of organisms in different ecosystems;<br>**(C)** analyze the flow of matter and energy through trophic levels using various models, including food chains, food webs, and ecological pyramids;<br>**(D)** recognize that long-term survival of species is dependent on changing resource bases that are limited;<br>**(E)** describe the flow of matter through the carbon and nitrogen cycles and explain the consequences of disrupting these cycles; and<br>**(F)** describe how environmental change can impact ecosystem stability. | **Standard LS.5: Information Transmission, Storage and Retrieval**<br>**Living systems have multiple mechanisms that are used to store, retrieve and transmit information.**<br>**LS.5.1 Changing Model of Inheritance**<br>Students describe the historic ideas that led to the identification of DNA as the molecule that contains and transmits genetic information.<br>**LS.5.2 Genetic Information Transmission**<br>Students understand that during reproduction, genetic information (DNA) is transmitted between parent and offspring. In asexual reproduction the lone parent contributes DNA to the offspring, and in sexual reproduction both parents contribute DNA to the offspring.<br>**LS.5.3 DNA to Trait**<br>Students understand that genetic information (DNA) is used to produce proteins that largely determine the traits of an organism. These traits often result from the interactions and expression of many genes.<br>**LS.5.4 Imperfect Transmission of Genetic Information**<br>Students understand that there are various ways in which the transmission of genetic information can be imperfect, and that | |

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| | these imperfections may have positive, negative or no consequences to the organism.<br>**LS.5.5 Nongenetic Information Transmission**<br>Students understand that nongenetic transmission of information within and among organisms involves specialized molecules, cell structures and cell systems. | |