Medical Interventions (MI)

Next Generation Science Standards

Lesson 1.1

HS.LS1.1 - From Molecules to Organisms: Structures and Processes

Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1),(Note: This Disciplinary Core Idea is also addressed by HS-LS3- 1.)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

DCI - LS3.A - Heredity: Inheritance and Variation of Traits - Inheritance of Traits

Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA . The instructions for forming species' characteristics are carried in DNA . All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

DCI - LS4.A - Biological Evolution: Unity and Diversity - Evidence of Common Ancestry and Diversity

Genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Using Mathematics and Computational Thinking

Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3 , acre-feet, etc.)

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Scale, Proportion, and Quantity

Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models

Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 1.2

HS.LS1.1 - From Molecules to Organisms: Structures and Processes

Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS4.2 - Biological Evolution: Unity and Diversity

Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS.LS4.4 - Biological Evolution: Unity and Diversity

Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS.LS4.5 - Biological Evolution: Unity and Diversity

Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

DCI - LS4.B - Biological Evolution: Unity and Diversity - Natural Selection

Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-2), (HS-LS4-3)

DCI - LS4.B - Biological Evolution: Unity and Diversity - Natural Selection

The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3)

DCI - LS4.C - Biological Evolution: Unity and Diversity - Adaptation

Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (HS-LS4-2)

DCI - LS4.C - Biological Evolution: Unity and Diversity - Adaptation

Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3), (HS-LS4-4)

DCI - LS4.C - Biological Evolution: Unity and Diversity - Adaptation

Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3)

DCI - LS4.C - Biological Evolution: Unity and Diversity - Adaptation

Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-5), (HS-LS4-6)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Developing and Using Models

Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.

Science and Engineering Practice - Developing and Using Models

Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.

Science and Engineering Practice - Developing and Using Models

Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Analyzing and Interpreting Data

Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.

Science and Engineering Practice - Using Mathematics and Computational Thinking

Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of

development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Scale, Proportion, and Quantity

Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models

Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

Crosscutting Concepts - Systems and System Models

Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 1.3

HS.PS4.1 - Waves and Their Applications in Technologies for Information Transfer

Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

DCI - PS3.A - Energy - Definitions of Energy

At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy . (HSPS3-2), (HS-PS3-3)

DCI - PS3.A - Energy - Definitions of Energy

These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2)

DCI - PS3.B - Energy - Conservation of Energy and Energy Transfer

Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1), (HS-PS3-4)

DCI - PS4.A - Waves and Their Applications in Technologies for Information Transfer - Wave Properties

The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Developing and Using Models

Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.

Science and Engineering Practice - Developing and Using Models

Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.

Science and Engineering Practice - Developing and Using Models

Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models

Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

Crosscutting Concepts - Systems and System Models

Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

Crosscutting Concepts - Energy and Matter: Flows, Cycles, and Conservation

Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 1.4

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1), (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Developing and Using Models

Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.

Science and Engineering Practice - Developing and Using Models

Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.

Science and Engineering Practice - Developing and Using Models

Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Using Mathematics and Computational Thinking

Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models

Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

Crosscutting Concepts - Systems and System Models

Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 2.1

HS.LS1.1 - From Molecules to Organisms: Structures and Processes

Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS3.1 - Heredity: Inheritance and Variation of Traits

Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS.LS3.2 - Heredity: Inheritance and Variation of Traits

Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1), (Note: This Disciplinary Core Idea is also addressed by HS-LS3- 1.)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

DCI - LS3.A - Heredity: Inheritance and Variation of Traits - Inheritance of Traits

Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 2.2

HS.LS1.1 - From Molecules to Organisms: Structures and Processes

Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS3.1 - Heredity: Inheritance and Variation of Traits

Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1), (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

DCI - LS3.A - Heredity: Inheritance and Variation of Traits - Inheritance of Traits

Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA . The instructions for forming species' characteristics are carried in DNA . All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

DCI - LS3.B - Heredity: Inheritance and Variation of Traits - Variation of Traits

In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Scale, Proportion, and Quantity

Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 3.1

HS.LS1.1 - From Molecules to Organisms: Structures and Processes

Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS3.2 - Heredity: Inheritance and Variation of Traits

Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

DCI - PS4.C - Waves and Their Applications in Technologies for Information Transfer - Information Technologies and Instrumentation

Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them. (HS-PS4- 5)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1), (Note: This Disciplinary Core Idea is also addressed by HS-LS3- 1.)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

DCI - LS1.B - From Molecules to Organisms: Structures and Processes - Growth and Development of Organisms

In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)

DCI - LS3.A - Heredity: Inheritance and Variation of Traits - Inheritance of Traits

Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

DCI - LS3.B - Heredity: Inheritance and Variation of Traits - Variation of Traits

In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Developing and Using Models

Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Analyzing and Interpreting Data

Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.

Science and Engineering Practice - Using Mathematics and Computational Thinking

Apply techniques of algebra and functions to represent and solve scientific and engineering problems.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Scale, Proportion, and Quantity

Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models

Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

Crosscutting Concepts - Systems and System Models

Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 3.2

HS.LS1.1 - From Molecules to Organisms: Structures and Processes

Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS3.1 - Heredity: Inheritance and Variation of Traits

Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS.LS3.2 - Heredity: Inheritance and Variation of Traits

Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

DCI - PS4.B - Waves and Their Applications in Technologies for Information Transfer - Electromagnetic Radiation

When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. (HS-PS4-4)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1), (Note: This Disciplinary Core Idea is also addressed by HS-LS3- 1.)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

DCI - LS3.A - Heredity: Inheritance and Variation of Traits - Inheritance of Traits

Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA . The instructions for forming species' characteristics are carried in DNA . All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

DCI - LS3.B - Heredity: Inheritance and Variation of Traits - Variation of Traits

In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2)

DCI - LS4.C - Biological Evolution: Unity and Diversity - Adaptation

Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-5), (HS-LS4-6)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Evaluate a question to determine if it is testable and relevant.

Science and Engineering Practice - Asking questions and defining problems

Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Developing and Using Models

Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.

Science and Engineering Practice - Developing and Using Models

Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.

Science and Engineering Practice - Developing and Using Models

Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Science and Engineering Practice - Planning and Carrying Out Investigations

Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.

Science and Engineering Practice - Planning and Carrying Out Investigations

Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Science and Engineering Practice - Planning and Carrying Out Investigations

Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.

Science and Engineering Practice - Planning and Carrying Out Investigations

Select appropriate tools to collect, record, analyze, and evaluate data. Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Analyzing and Interpreting Data

Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Scale, Proportion, and Quantity

Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models

Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

Crosscutting Concepts - Systems and System Models

Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 3.3

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Evaluate a question to determine if it is testable and relevant.

Science and Engineering Practice - Asking questions and defining problems

Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Asking questions and defining problems

Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.

Science and Engineering Practice - Developing and Using Models

Design a test of a model to ascertain its reliability.

Science and Engineering Practice - Developing and Using Models

Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.

Science and Engineering Practice - Developing and Using Models

Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.

Science and Engineering Practice - Developing and Using Models

Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Science and Engineering Practice - Planning and Carrying Out Investigations

Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.

Science and Engineering Practice - Planning and Carrying Out Investigations

Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Science and Engineering Practice - Planning and Carrying Out Investigations

Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.

Science and Engineering Practice - Planning and Carrying Out Investigations

Select appropriate tools to collect, record, analyze, and evaluate data. Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Analyzing and Interpreting Data

Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical

information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models

Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

Crosscutting Concepts - Systems and System Models

Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 3.4

HS.PS2.6 - Motion and Stability: Forces and Interactions

Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.ETS1.2 - Engineering Design

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS.ETS1.3 - Engineering Design

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

DCI - ETS1.A - Engineering Design - Defining and Delimiting Engineering Problems

Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (secondary to HS-PS2- 3)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1), (Note: This Disciplinary Core Idea is also addressed by HS-LS3- 1.)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

DCI - LS3.B - Heredity: Inheritance and Variation of Traits - Variation of Traits

In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Asking questions and defining problems

Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models

Systems can be designed to do specific tasks.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 4.1

HS.LS1.1 - From Molecules to Organisms: Structures and Processes

Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1), (Note: This Disciplinary Core Idea is also addressed by HS-LS3- 1.)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)

DCI - LS3.A - Heredity: Inheritance and Variation of Traits - Inheritance of Traits

Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have

the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Analyzing and Interpreting Data

Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Scale, Proportion, and Quantity

Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Crosscutting Concepts - Stability and Change

Feedback (negative or positive) can stabilize or destabilize a system.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 4.2

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations,

models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 4.3

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS3.1 - Heredity: Inheritance and Variation of Traits

Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1), (Note: This Disciplinary Core Idea is also addressed by HS-LS3- 1.)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

DCI - LS3.A - Heredity: Inheritance and Variation of Traits - Inheritance of Traits

Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Developing and Using Models

Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.

Science and Engineering Practice - Developing and Using Models

Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.

Science and Engineering Practice - Developing and Using Models

Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models

Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

Crosscutting Concepts - Systems and System Models

Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Medical Interventions (MI)

Next Generation Science Standards

Lesson 4.4

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.ETS1.2 - Engineering Design

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS.ETS1.3 - Engineering Design

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

DCI - ETS1.A - Engineering Design - Defining and Delimiting Engineering Problems

Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (secondary to HS-PS2- 3)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

Science and Engineering Practice - Asking questions and defining problems

Ask questions

- that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

- that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

- to determine relationships, including quantitative relationships, between independent and dependent variables.

- to clarify and refine a model, an explanation, or an engineering problem.

Science and Engineering Practice - Asking questions and defining problems

Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

Science and Engineering Practice - Asking questions and defining problems

Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.

Science and Engineering Practice - Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

Science and Engineering Practice - Constructing Explanations and Designing Solutions

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Science and Engineering Practice - Engaging in Argument from Evidence

Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

Science and Engineering Practice - Engaging in Argument from Evidence

Construct, use, and/or present an oral and written argument or counterarguments based on data and evidence.

Science and Engineering Practice - Engaging in Argument from Evidence

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Science and Engineering Practice - Obtaining, Evaluating, and Communicating Information

Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Crosscutting Concepts - Patterns

Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Systems can be designed to cause a desired effect.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Crosscutting Concepts - Systems and System Models

Systems can be designed to do specific tasks.

Crosscutting Concepts - Structure and Function

The way an object is shaped or structured determines many of its properties and functions.

Crosscutting Concepts - Structure and Function

The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Crosscutting Concepts - Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.