Unit Closing

How can we design a healthy school in terms of reducing mismatches between our bodies and our environment?

Performance Expectations
HS-LS1-1, HS-ETS1-2, HS-ETS1-3, HS-LS3-1, HS-LS4-1

Anchor Phenomenon
A high school student who recently arrived in New York City is unable to drink milk at lunch like her peers without getting sick.

Time
2-3 days

Based on the investigations and learning throughout the unit, students generate a design solution that addresses mismatch concerns in the school environment.

Anchor Phenomenon	Why are mismatch problems occuring, and why is this a problem we may need to address?	Students generate more ideas that explain mismatch diseases.
Driving Question Board	What questions about mismatch diseases have we not answered yet?	Based on the investigations and learning throughout the unit, students return to the Driving Question Board to reflect on questions generated throughout the unit.
Performance Task	How can we design a healthy school in terms of reducing mismatches between our bodies and our environment?	Based on the investigations and learning throughout the unit, students generate a design solution that addresses mismatch concerns in the school environment.
Unit Reflection	How can we evaluate our progress on using a design process to solve a problem?	Students reflect on their learning and use of a design process throughout the unit.

Science & Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts

Anchor Phenomenon

Why are mismatch problems occuring, and why is this a problem we may need to address?

Students generate more ideas that explain mismatch diseases.

Preparation

Student Grouping	Routines	Literacy Strategies
None	None	None

Materials

Handouts	Lab Supplies	Other Resources
None	None	

Generating Ideas about Anchor Phenomenon

1. Students return to the anchor phenomenon of Kanna, and recall the other mismatches presented across the unit. They review their ideas on the mismatch hypothesis, why mismatch problems are occuring, and why this might be a problem we need to address.

Driving Question Board

What questions about mismatch diseases have we not answered yet?

Based on the investigations and learning throughout the unit, students return to the Driving Question Board to reflect on questions generated throughout the unit.

Preparation

Student Grouping	Routines	Literacy Strategies
None	None	None

Materials

Handouts	Lab Supplies	Other Resources
None	None	❑ Driving Question Board

Revisit the Driving Question Board

1. Students return to the questions generated throughout the unit and reflect. What questions have been answered? Are there questions that we still need to investigate?

2. Note that not all of the students' questions will be answered at the end of the unit, and students may have generated entirely new questions. Depending on student interest and instructional time, prompt students to explore some of the unanswered questions independently.

Performance Task

How can we design a healthy school in terms of reducing mismatches between our bodies and our environment?

Based on the investigations and learning throughout the unit, students generate a design solution that addresses mismatch concerns in the school environment.

Preparation

Student Grouping	Routines	Literacy Strategies
None	None	None

Materials

Handouts	Lab Supplies	Other Resources
❑ Final Design Task ❑ Final Design Rubric	None	

Generate a Design Solution

1. Prompt students to review all of the mismatch problems and design elements that they have investigated and evaluated throughout the unit.
2. Students will decide on which design elements are the best supported, using scientific reasoning, outside research, and the collaborative design process they have iterated on throughout the unit.
3. Provide students with the *Final Design Task*, the *Final Design Rubric*, and the opportunity to review all of the initial designs and associated feedback from throughout the unit.

Integrating Three Dimensions

Throughout this unit, students have used both **CCC#2 Cause and Effect** and **CCC#6 Structure and Function** to both understand the phenomena and to design solutions to the mismatch problem. In the final

4. Students individually develop their final design and rationale.

design task, students may choose to explain how they use one or both of these cross-cutting concepts in the rationale for their design.

Unit Reflection

How can we evaluate our progress on using a design process to solve a problem?

Students reflect on their learning and use of a design process throughout the unit.

Preparation

Student Grouping	Routines	Literacy Strategies
None	None	None

Materials

Handouts	Lab Supplies	Other Resources
❑ Argument Evaluation ❑ Final Design Rubric	None	

Reflecting on the Engineering Design Process

1. Remind students that they started the unit by generating an initial set of design ideas and ideas about how engineers and scientists work together to solve problems.

2. Prompt students to identify how their thinking has changed on the work of engineers and how an iterative design process can be used to solve societal problems. Support the generation of student ideas by showing examples of initial designs or initial ideas on the design process.

3. Provide students with the *Argument Evaluation* to complete individually.

4. Use the *Final Design Rubric* to provide feedback as students are working.

Standards in Unit Closing

Performance Expectations

HS-LS1-1 **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.**
Clarification Statement: None
Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.

In NYS the following clarification statement has been added: Emphasis should be on how the DNA code is transcribed and translated in the synthesis of proteins. Types of proteins involved in performing life functions include enzymes, structural proteins, cell receptors, hormones, and antibodies.

HS-LS3-1 **Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.**
Clarification Statement: None
Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.

In NYS the assessment boundary was removed and the following clarification statement has been added: Emphasis should be on the distinction between coding and non-coding regions of DNA.

HS-LS4-1 **Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.**
Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.
Assessment Boundary: None

HS-ETS1-2 * **Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.**
Clarification Statement: None
Assessment Boundary: None

HS-ETS1-3 * **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.**
Clarification Statement: None
Assessment Boundary: None

The performance expectations marked with an asterisk (*) integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Aspects of Three-Dimensional Learning

Science and Engineering Practices

Asking Questions and Defining Problems

- Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships. SEP1(2)

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. SEP4(1)

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. SEP6(2)
- 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. SEP6(5)

Obtaining, Evaluating, and Communicating Information

- Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of

Disciplinary Core Ideas

ETS1.B Developing Possible Solutions

- When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability, and aesthetics and to consider social, cultural, and environmental impacts. ETS1.B(1)

ETS1.C Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. ETS1.C(1)

LS1.A Structure and Function

- Systems of specialized cells within organisms help them perform the essential functions of life. LS1.A(1)
- 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. LS1.A(2)

LS3.A 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

Crosscutting Concepts

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. CCC2(1)

Structure and Function

- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. CCC6(1)

development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). SEP8(5)

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. LS3.A(1)

LS4.A 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. LS4.A(1)

LS4.C 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. LS4.C(1)
- 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

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
	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. LS4.C(2)	

Assessment Matrix

	Anchor Phenomenon	Driving Question Board	Performance Task	Unit Reflection
Asking Questions and Defining Problems			*Final Design Task*	
Analyzing and Interpreting Data			*Final Design Task*	
Constructing Explanations and Designing Solutions			*Final Design Task*	*Argument Evaluation*
Obtaining, Evaluating, and Communicating Information			*Final Design Task*	
ETS1.B Developing Possible Solutions			*Final Design Task*	*Argument Evaluation*
ETS1.C Optimizing the Design Solution			*Final Design Task*	*Argument Evaluation*
LS1.A Structure and Function	Student generated ideas		*Final Design Task*	
LS3.A Inheritance of Traits			*Final Design Task*	

	Anchor Phenomenon	Driving Question Board	Performance Task	Unit Reflection
LS4.A Evidence of Common Ancestry and Diversity	Student generated ideas		*Final Design Task*	
LS4.C Adaptation			*Final Design Task*	
Cause and Effect			*Final Design Task*	
Structure and Function			*Final Design Task*	

Common Core State Standards Connections

	Anchor Phenomenon	Driving Question Board	Performance Task	Unit Reflection
Mathematics				
ELA/Literacy				