

7th Grade Unit 4 (~25 Days)	
Genetics and Inheritance of Traits	
Performance Expectations included in Unit 4	
7-MS-LS3-2: Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.	
7-MS-LS4-4: Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.	
7-MS-LS4-5: Gather, read, and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.	
Unit 4 Anchor Phenomenon: The Amazon Molly	
Unit 4 Anchor Phenomenon: Diversity in eyes	
7-MS-LS3-2 (Heredity:Inheritance and Variation of Traits) Investigative Phenomenon: Sexual vs. Asexual Reproduction	
7-MS-LS3-2 (Heredity:Inheritance and Variation of Traits) Investigative Phenomenon: How Animals and People see the World Differently	
7-MS-LS3-2 (Heredity:Inheritance and Variation of Traits)	Concepts
Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.	Organisms reproduce either sexually or asexually and transfer their genetic information to their offspring.
Clarification Statement	Asexual reproduction results in offspring with identical genetic information.
Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parents) to offspring and resulting genetic variation.	Sexual reproduction results in offspring with genetic variation. Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.
Science and Engineering Practice	Disciplinary Core Idea
Developing and using models: Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop and/or use a model to predict and/or describe phenomena.	GROWTH AND DEVELOPMENT OF ORGANISMS Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (MS.LS1B.a) Cells divide through the processes of mitosis and meiosis. (LS.MS.1B.b) INHERITANCE OF TRAITS Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS.LS3A.d) In sexually reproducing organisms, each parent contributes to the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS.LS3B.a)
Crosscutting Concepts	
	In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. Punnett squares, diagrams, and simulations can be used to describe the cause-and-effect relationship of gene transmission from parents) to offspring and resulting genetic variation. Sexual reproduction is the production of new living organisms by combining genetic information from two individuals of different types In asexual reproduction, the offspring results in identical genetic information. Sexual reproduction results in offspring that have greater genetic diversity than those resulting from asexual reproduction. Cells undergo a regular sequence of growth and division. There are two processes of cell division, mitosis and meiosis. Cell division occurs via a process called mitosis, when a cell divides in two.

<p>CAUSE AND EFFECT Cause and effect relationships may be used to predict phenomena in natural or designed systems.</p> <p>Students should be able to: Move beyond simple renderings or maps and begin to incorporate and make explicit the invisible features of a system, such as interactions, energy flows, or matter transfers. Mathematical ideas, such as ratios and simple graphs, should be seen as tools for making more definitive models; eventually, students' models should incorporate a range of mathematical relationships among variables and some analysis of the patterns of these</p>	<p>Mitosis produces two cells with identical genetic material.</p> <p>In sexual reproduction, a specialized type of cell division called meiosis occurs.</p> <p>Meiosis results in the production of sex cells, which contain only half the chromosomes from the parent cell.</p> <p>When the sex cells combine, one-half of the offspring's genetic information comes from the "male" parent and one-half comes from the</p>
<p align="center">Sample Guiding Questions</p>	<p>Variations of inherited traits between the parent and offspring arise from random genetic differences.</p>
<p>What is asexual reproduction? What is sexual reproduction? What factors determine genetic variation? What can be learned from a Punnett square? How is genetic information transmitted from parent to offspring?</p>	<p>Through inheritance, traits are passed from one generation to the next. Genetic differences help to ensure the survival of offspring in varied environments.</p> <p>Genetic information is transferred to the offspring through egg and sperm cells.</p> <p>The offspring have a combination of genetic information from each parent.</p>
<p align="center">Key Vocabulary</p>	<p>In species that reproduce sexually, each cell contains two variants of each chromosome, one inherited from each parent. These variants are</p>
<p>asexual reproduction, sexual reproduction, parent, offspring, chromosome, gene, gene transmission, genetic variation, cause and effect</p>	<p>An allele is defined as one of a pair of genes that appear at a particular location on a particular chromosome and control the same</p>
<p align="center">Sample 5E Lesson Plan</p>	<p>Each parent contributes half of the gene, or one allele, acquired at random by the offspring.</p>
<p>7-MS-LS3-2 Sample Lesson Plan</p>	<p>Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent.</p>
	<p>These alleles may be identical or may differ from each other</p>
<p align="center">Ways to check for understanding</p>	
	<p>Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information.</p>
	<p>Develop and use a model to describe why sexual reproduction results in offspring with genetic variation.</p>
	<p>Use models such as Punnett squares, diagrams, and simulations to describe the cause-and effect-relationship of gene transmission from parents) to offspring and resulting genetic variation.</p>
<p align="center">Additional Teacher Resources</p>	
	<p>LS3A Inheritance of Traits</p>
	<p>LS3B - Variation of Traits</p>
	<p>MS-LS3-2 NGSS Evidence Statement</p>
<p align="center">Sample Activities</p>	
	<p>Better Lesson: Mitosis Claymation Video</p>
	<p>Biracial Twins</p>
	<p>Pasta Genetics</p>

		Color Vision Genetics Dragon Genetics
7-MS-LS4-4 (Biological Evolution: Unity and Diversity) Investigative Phenomenon: How animals see the world		
7-MS-LS4-4 (Biological Evolution: Unity and Diversity)		Concepts
Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.		Genetic variations of traits in a population increase or decrease some individuals' probability of surviving and reproducing in a specific environment.
Clarification Statement		Natural selection leads to the predominance of certain traits in a population and the suppression of others.
Emphasis is on using simple probability statements and proportional reasoning to construct explanations about why some traits are suppressed and other traits become more prevalent for those individuals better at finding food, shelter, or avoiding predators.		Within every population, there are variations of organisms.
		Some of these variations exhibit traits that favor the chance to survive and reproduce, while others will decrease the likelihood to survive and reproduce.
Science and Engineering Practice	Disciplinary Core Idea	
Constructing explanations and designing solutions: Constructing explanations (science) and designing solutions (engineering) in 6–8 builds on K– 5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.	NATURAL SELECTION Natural selection leads to the predominance of certain traits in a population and the suppression of others. (MS.LS4B.a)	
		Natural selection leads to more organisms in a population with traits that favor the chance to survive and reproduce. Therefore, organisms with advantageous traits survive, reproduce, and pass those traits to offspring.
		Natural selection may have more than one cause, and some cause-and-effect relationships within natural selection can only be described using probability.
		Ways to check for understanding
		Construct an explanation that includes probability statements regarding variables and proportional reasoning of how genetic variations of traits in a population increase some individuals' probability surviving and reproducing in a specific environment.
		Use probability to describe some cause-and-effect relationships that can be used to explain why some individuals survive and reproduce in a specific environment.
Crosscutting Concepts		Additional Teacher Resources
CAUSE AND EFFECT Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.		LS4A - Evidence of Common Ancestry and Diversity LS4B - Natural Selection LS4C - Adaptation LS4D - Humans and Biodiversity
<i>Students should be able to: Develop arguments starting from students' own explanations of cause and effect. This can help them appreciate standard scientific theories that explain the causal mechanisms in the systems under study. Strategies for this type of instruction include asking students to argue from evidence when attributing an observed phenomenon to a specific cause. For example, students exploring why the population of a given species is shrinking will look for evidence in the ecosystem of factors that lead to food shortages, over predation, or other factors in the habitat related to survival; they will provide an argument for how these and other observed changes affect the species of interest.</i>		MS-LS4-4 NGSS Evidence Statement
		Sample Activities
		Better Lesson: Pocket Mouse - Natural Selection Stickleback Evolution Virtual Lab Natural Selection and the Development of Antibiotic Resistance - Middle School Sample Classroom Assessment
Sample Guiding Questions		

What evidence supports the theory of survival of the fittest?		
How does genetic variation of traits increase the probability of surviving?		
How does genetic variation of traits increase the probability of reproducing?		7-MS-LS4-4 Sample Lesson Plan
What are some benefits to genetic variation in a population?		
What are some factors influencing a population's ability to survive and reproduce?		
Key Vocabulary		
traits, natural selection, organism, population, genetic variation, survival, reproduction, environment, cause and effect		
7-MS-LS4-5 (Biological Evolution:Unity and Diversity) Investigative Phenomenon: Selective breeding		
7-MS-LS4-5 (Biological Evolution:Unity and Diversity) Investigative Phenomenon: Selective breeding image		
7-MS-LS4-5 (Biological Evolution:Unity and Diversity)		Concepts
Gather, read, and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.		Natural selection, which over generations leads to adaptations, is one important process through which species change over time in response to changes in environmental conditions.
Clarification Statement		The distribution of traits in a population changes.
Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy) and on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.		Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common
		Natural selection may have more than one cause, and some cause-and-effect relationships in natural selection can only be described using probability
Science and Engineering Practice	Disciplinary Core Idea	
Obtaining, evaluating, and communicating information: Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences and progresses to evaluating the merit and validity of ideas and methods.	NATURAL SELECTION Genetic engineering techniques can manipulate the DNA within various organisms. Technology has changed the way humans influence the inheritance of desired traits in organisms. (e.g., selective breeding, gene modification, gene therapy, or other methods) (MS.LS4B.b)	
• Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.	Mathematical representations can be used to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	
	In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring.	
	Through the use of biotechnology, scientists engineer plants and manipulate growing conditions to meet human needs and wants.	
	Genetic engineering manipulates the DNA within organisms.	
	Through technology, humans have found ways to enhance the rate at which some beneficial traits in some organisms occur.	
	These technologies may include concepts such as genetic modification, animal husbandry, and gene therapy.	
Crosscutting Concepts		
CAUSE AND EFFECT Phenomena may have more than one cause, and some cause and effect relationships in		Selective breeding is used to cultivate plants and domesticated animals with desirable traits.

systems can only be described using probability.

Students should be able to: Own argumentative explanations of cause and effect to help them appreciate standard scientific theories that explain the causal mechanisms in the systems under study. Strategies for this type of instruction include asking students to argue from evidence when attributing an observed phenomenon to a specific cause. For example, students exploring why the population of a given species is shrinking will look for evidence in the ecosystem of factors that lead to food shortages, over predation, or other factors in the habitat related to survival; they will provide an argument for how these and other observed changes affect the species of interest.

Sample Guiding Questions

- What are some characteristics of biotechnology?
- How can humans influence the inheritance of traits in organisms?
- What is artificial selection?
- What is natural selection?
- What are some characteristics of genetic modification?
- What are some characteristics of animal husbandry?
- What are some characteristics of gene therapy?
- What are some impacts of biotechnology on society?
- What kinds of technologies have led to scientific discoveries in artificial selection?

Key Vocabulary

artificial selection (e.g. genetic modification, animal husbandry, gene therapy), organisms (plants and animals), inheritance, technology, cause and effect

Ways to check for understanding

- Explain some causes of natural selection and the effect it has on the increase or decrease of specific traits in populations over time.
- Use mathematical representations to support conclusions about how natural selection may lead to increases and decreases of genetic traits in populations over time.

Additional Teacher Resources

- [LS4A - Evidence of Common Ancestry and Diversity](#)
- [LS4B - Natural Selection](#)
- [LS4C - Adaptation](#)
- [LS4D - Humans and Biodiversity](#)

MS-LS4-5 NGSS Evidence Statement

Sample Activities

- [Better Lesson: Genetic Technology](#)
- [Genetic Engineering & Genetically Modified Organisms: Forming Informal](#)
- [Cloning](#)
- [Catch up on tomatoe technology](#)

Sample 5E Lesson Plan

- [7-MS-LS4-5 Sample Lesson Plan](#)