

Unit 3: Heredity: Inheritance and Variation of Traits

Content Area: **Science**
Course(s):
Time Period: **Marking Period 3**
Length: **6-7 weeks**
Status: **Published**

Unit 3: Heredity: Inheritance and Variation of Traits

Students develop and use models to describe how gene mutations and sexual reproduction contribute to genetic variation. Students understand how genetic factors determine the growth of an individual organism. They also demonstrate understanding of the genetic implications of sexual and asexual reproduction. Students will explore how genetic information can be altered by mutations and how these changes can negatively or positively effect an organism. The crosscutting concepts of *cause and effect* and *structure and function* provide a framework for understanding how gene structure determines differences in the functioning of organisms. Students are expected to demonstrate proficiency in *developing and using models*. Students use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

Revision Date: July 2020

STANDARDS:

MA.7.RP.A	Analyze proportional relationships and use them to solve real-world and mathematical problems.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
LA.RI.7	Reading Informational Text
LA.RI.7.1	Cite several pieces of textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.
LA.W.7.1	Write arguments to support claims with clear reasons and relevant evidence.
MA.7.SP	Statistics and Probability
MA.7.SP.A	Use random sampling to draw inferences about a population.
MA.7.SP.A.1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
MA.7.SP.A.2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.
MA.8.SP.A	Investigate patterns of association in bivariate data.
MA.7.SP.C	Investigate chance processes and develop, use, and evaluate probability models.
MA.7.SP.C.5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
MA.7.SP.C.6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the

	approximate relative frequency given the probability.
MA.8.SP.A.4	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.
MA.7.SP.C.7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
LA.SL.7.5	Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.
SCI.MS-LS1	From Molecules to Organisms: Structures and Processes
SCI.MS-LS1-2	Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. Structure and Function Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function.
SCI.MS-LS1-4	Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
SCI.MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
SCI.MS-LS1-8	Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. Cause and Effect Cause and effect relationships may be used to predict phenomena in natural systems.
SCI.MS-LS2	Ecosystems: Interactions, Energy, and Dynamics
SCI.MS-LS2-1	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems.
SCI.MS-LS3	Heredity: Inheritance and Variation of Traits
SCI.MS-LS3-1	Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. Developing and Using Models
SCI.MS.LS3.A	Inheritance of Traits Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes(mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.
SCI.MS.LS3.B	Variation of Traits In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the

	structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism.
SCI.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. Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.
SCI.MS.LS3.A	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.
SCI.MS.LS3.B	Variation of Traits 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. Cause and Effect Cause and effect relationships may be used to predict phenomena in natural systems.
SCI.MS.ETS1.B	Developing Possible Solutions
CS.6-8.8.1.8.AP.9	Document programs in order to make them easier to follow, test, and debug.
CS.6-8.8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
CS.6-8.8.1.8.DA.5	Test, analyze, and refine computational models.
CS.6-8.8.1.8.DA.6	Analyze climate change computational models and propose refinements.
CS.6-8.8.1.8.NI.2	Model the role of protocols in transmitting data across networks and the Internet and how they enable secure and errorless communication.
CS.6-8.8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
CS.6-8.8.2.8.ED.7	Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).
CS.6-8.8.2.8.NT.2	Analyze an existing technological product that has been repurposed for a different function.
CS.6-8.8.2.8.ETW.2	Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital).
CS.6-8.8.2.8.ETW.3	Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact.
CS.6-8.CS	Computing Systems
CS.6-8.DA	Data & Analysis
CS.6-8.ED	Engineering Design
CS.6-8.NI	Networks and the Internet
CS.6-8.NT	Nature of Technology
CS.6-8.ETW	Effects of Technology on the Natural World
WRK.9.2.8.CAP	Career Awareness and Planning
WRK.9.2.8.CAP.9	Analyze how a variety of activities related to career preparation (e.g., volunteering, apprenticeships, structured learning experiences, dual enrollment, job search,

	scholarships) impacts post-secondary options.
WRK.9.2.8.CAP.16	Research different ways workers/employees improve their earning power through education and the acquisition of new knowledge and skills.
WRK.9.2.8.CAP.19	Relate academic achievement, as represented by high school diplomas, college degrees, and industry credentials, to employability and to potential level.
TECH.9.4.8.CI	Creativity and Innovation
TECH.9.4.8.CT	Critical Thinking and Problem-solving

Essential Questions

Essential Questions:

How do chance combinations of genes which make you unique?

How do mutations lead to different traits being inherited?

How can the environment affect DNA and the expression of traits?

How does the inheritance of dominant and recessive alleles impact the expression of traits?

How are DNA, RNA, and proteins involved in the expression of traits?

Enduring Understandings:

Organisms reproduce, develop, have predictable life cycles, and pass on traits to their offspring.

The inheritance of traits is controlled by varying factors therefore no 2 people are truly identical.

Mutations in the DNA code can either be harmful, beneficial or benign and lead to variations.

Objectives

Students will know that organisms reproduce, develop, have predictable life cycles, and pass on traits to their offspring.

Students will know that DNA consists of sugars, phosphates and nitrogen bases in a double helix.

Students will know that if you change the DNA code, you change the protein that forms and alters the trait.

Students will know that the expression of traits can be determined through the inheritance of dominant and

recessive alleles.

Students will be skilled at using Punnett squares to show possible gene combinations.

Students will know that result of genetic crosses sometimes vary from Mendel's predictions.

Students will know that some traits are controlled by incomplete dominance, multiple alleles or polygenic inheritance.

Students will know that mutations can either be harmful, beneficial or benign.

Students will know that no two people are truly identical.

Students will know why sex-linked disorders are more common in males.

Students will know that through meiosis organisms that reproduce sexually get half their genetic material from each parent.

Students will be skilled at using pedigrees to help trace the occurrence of a trait within a family.

Learning Plan

Preview the essential questions and connect to learning throughout the unit.

View Teacher's Domain Virtual Meiosis

Participate in Meiosis by the Numbers Activity

Conduct DNA extraction lab.

Construct DNA models

Participate in role play in DNA Play Activity

View Video: The Secret of Photo 51

Explain how traits are inherited and explain Mendel's role in the history of genetics.

Use a Punnett squares to predict the results of a cross.

Explain the difference between genotype and phenotype.

Explain incomplete dominance.

Compare multiple allele and polygenic inheritance, and give examples of both.

Research two human genetic disorders.

Explain the inheritance of sex-linked traits and the importance of genetic engineering.

Project: Explain some advantages and disadvantages of genetic research.

Conduct Genetic Dice Lab.

Participate in Genetic taste test activity.

Participate in the A Quick Switch activity.

View The Power of Genes Video (by Discovery).

Perform Probability Lab.

Complete Incomplete dominance worksheet.

Participate in Dragon Genetics lab.

Perform The Genetics of Bloops lab.

View Video: Forensic Detectives.

View Video: Recovering the Romanovs.

Conduct Blood Type simulation.

Complete Baffling Baby Mix-Up Activity.

Complete Beautiful Baby Activity.

Perform Blood Compatibility lab.

Construct a pedigree in the A Family Puzzle Activity.

Materials

Prentice Hall Life Science - Science Explorer

newsela

Computer(s) .

Smartboard .

Powerpoints .

Relevant worksheets/notes .

Relevant videos .

Relevant virtual activities .

Relevant interactive programs .

Safety Equipment .

Dragon genetics chromosomes

Dragon Pictures

Colored Pencils/scissors

DNA Models

DNA Extraction lab supplies

Dry erase boards and markers/erasers

Protein synthesis magnet kit

Genetic Dice

Pennies

Red/White beans for probabilities