Unit 4: Genetics
8th Grade Science

17 Class Meetings

Revised May 2025

Essential Questions

- Why are living things different from one another?

Enduring Understandings with Unit Goals

EU 1: Genes are located on the chromosomes of cells with each chromosome pair containing two variants of each of many genes. In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations.

- Develop a model in which students identify the relationship between mutations and the effects on an organism.
- Describe the relationships between the components in their models.
- Use the model to describe that mutations may result in observable effects at the level of the organism, including structural changes to the gene.
- Use the model to describe that mutations can be beneficial, harmful, or neutral.

EU 2: Organisms reproduce and transfer their genetic information to their offspring. Differences of inherited traits between parents and offspring arise from genetic differences that result from the subset of chromosomes. In sexually reproducing organisms, each parent contributes half of the genes acquired by the offspring.

- Develop a model involving the differences in genetic variation that arise from sexual and asexual reproduction.
- Describe the relationships and interactions between components.
- Use the model to describe a casual account for why sexual and asexual reproduction result in different amounts of genetic variation in offspring relevant to their parents.
- Predict that sexually reproducing organisms have more genetic variation compared to asexually reproducing ones by using cause-and-effect relationships from the model.

EU 3: In artificial selection (as opposed to natural 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 to offspring.

- Gather information about at least two technologies that have changed the way humans influence the inheritance of desired traits through artificial selection.
- Use at least two appropriate and reliable sources of information for investigating each technology.
- Assess the credibility, accuracy, and possible bias of each publication and method used in the information gathered.
- Determine how the information gathered is or is not supported by evidence.
- Synthesize the information from multiple sources to provide examples of how technologies have changed the ways that humans are able to influence the inheritance of desired traits in organisms.
- Identify and describe how a better understanding of cause-and-effect relationships in how traits occur in organisms has led to advances in technology that provide a higher probability of being able to influence the inheritance of desired traits in organisms.

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Standards

Next Generation Science Standards:

- **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.
- **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.
- **MS-LS4-5:** Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.

Common Core State Standards:

- **CCSS.ELA-LITERACY.RST.6-8.1:** Cite specific textual evidence to support analysis of science and technical texts.
- **CCSS.ELA-LITERACY.RST.6-8.4:** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical contect relevant to grades 6-8 texts and topics.
- **CCSS.ELA-LITERACY.WHST.6-8.8:** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
- **CCSS.ELA-LITERACY.RST.6-8.7:** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- **CCSS.MATH.CONTENT.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.
- **CCSS.MATH.CONTENT.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.
- **CCSS.MATH.CONTENT.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.
- **CCSS.MATH.CONTENT.7.RP.A.2:** Recognize and represent proportional relationships between quantities.

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ISAAC Vision of the Graduate Competencies

Competency 1: Write effectively for a variety of purposes.
Competency 2: Speak to diverse audiences in an accountable manner.
Competency 3: Develop the behaviors needed to interact and contribute with others on a team.
Competency 4: Analyze and solve problems independently and collaboratively.
Competency 5: Be responsible, creative, and empathetic members of the community.

Unit Content Overview

1. **Develop ideas about the inheritance of a mutation of a specific gene.**
   - Predict and explore possible causes for how animals can get extra-big muscles.
   - Investigate and model how animals can inherit this trait variation.
   - Apply the model we figured out about cattle muscles to explain selective breeding in offspring.

2. **Variations observed in other living things.**
   - Apply the model to explain the inheritance of traits in plants.
   - Investigate other examples of organisms whose trait variation is caused by multiple genetic and environmental factors.

Interdisciplinary Connection:

- Language Arts- Students gather, read, and synthesize information from multiple sources.
- Math – Students use mathematical models to help predict the probability of inheriting particular traits.
- Art – Students use models and develop models to make sense of and explain how traits are inherited and inheritance patterns.

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Daily Learning Objectives with *TWPS*

Students will be able to…

- Develop and/or use a model to predict what is causing some animals to have extra-big muscles. Ask questions about why animals have different muscles by looking closely at pictures of them.
    - *Notice and wonder T-chart for animal pictures. Discuss your observations with a partner.*
- Obtain, evaluate, and communicate information about muscles in various media and visual displays.
    - *Feel muscles (through our own skin), observe photos of muscles, and discuss how muscle tissue can be described.*
- Obtain, evaluate, and communicate information to determine the effects of exercise and diet in the development of muscle tissue.
    - *Brainstorm ways muscle mass can be increased.*
- Develop and use a model to determine the inheritance patterns for a particular trait variation.
    - *Pedigree shapes and symbols practice. Discuss with a partner why you picked what shape and symbol to use for each person represented in the pedigree.*
- Develop and use a model to explain inheritance based on chromosome pairs. Critically read scientific texts to obtain evidence that a particular gene causes the production of a specific protein.
    - *Zoom in on a chromosome worksheet. Discuss with a partner why you labeled each part what you did.*
- Develop a model to show how the alleles an offspring gets determine the phenotype we see.
    - *Gotta-Have-It Checklist for consensus model*
- Use mathematics and computational thinking to find patterns about genotypic and phenotypic outcomes.
    - *Why are siblings not identical if they share the same genetic information from two of the same parents?*
- Investigate how chromosome pairs separate then recombine at fertilization.
    - *Tracking alleles through different levels of scale. How is the allele getting passed along at each step?*
- Obtain, evaluate, and communicate information regarding the effect of selective breeding.
    - *How can farmers make sure they get offspring from two specific parents?*
- Use mathematics and computational thinking to determine the benefits and harmful effects of selective breeding.
    - Take the first 5 minutes of class to explore the Bird Breeder Simulation
- Critically read scientific texts and construct an explanation using models and math to explain different trait variation in offspring.
    - *Read through the background information on offspring. Match the description to the pictures.*
- Investigate and collect data for evidence that plants have genetic material.
    - *Brainstorm (Jot Thoughts)- How can we get chromosomes out of the nucleus of a cell?*
- Construct an explanation for how plants reproduce.
    - *Why do plants make seeds?*
- Obtain, evaluate, and communicate information about how organisms reproduce asexually.
    - *How will you read closely and carefully on a screen? What tools or strategies can you*

use?

- Construct an explanation using a model to explain the influence of environmental and genetic factors on trait variation.
    - *Gallery walk of Planaria data*
- Develop a logical argument for how much of trait variation in a population is controlled by genes or by the environment
    - *Make observations about the wheat kernels in the image on the slide. Discuss your observations with a partner.*
- Demonstrate mastery of the unit goals.
    - *Answer one of the questions on the driving question board with claim, evidence, and reasoning. Share your response with your partner.*

Instructional Strategies/Differentiated Instruction

- Whole group instruction
- Guided notes
- Student-led instruction
- Independent problem-solving
- Collaborative problem-solving
- Graphic Organizer
- Cross-curricular problem solving (independent and collaborative)
- Accountable Talk
- Homework
- Word walls with visuals
- Small group instruction
- Investigations/labs
- Interactive Notebooks
- Pre, During, After Reading Strategies
- Annotating Text

EL Differentiated Instruction:

- Sentence starters
- Simplified directions
- Prompting and questioning
- Alternate responses when needed
- Explicit modeling
- Key vocabulary
- Visuals
- Graphic organizers
- KWL charts
- Venn diagram
- Glossary

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- Frayer Model
- Pre-teaching vocabulary
- Morphology Instruction (teaching roots, prefixes, and suffixes
- Context Clues Practice (using sentence-level meaning to infer unfamiliar words
- Pre reading strategies
- Close Reading (reading a text multiple times with different focuses)

Assessments

FORMATIVE ASSESSMENTS:

- Do Now
- Notebook checks
- Mid-class check-ins
- Exit Slips
- Accountable Talk Discussions- TWPS
- Homework
- NGSS Interim Assessment

SUMMATIVE ASSESSMENTS:

- Quiz – EU 1-2 & EU 3
- Performance Task- Offspring Unit Task
- Unit Test

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Unit Task

Unit Task Name: Designer Offspring Unit Task

Description: Students will read through scientific texts and develop a logical argument to describe how sexual reproduction results in offspring with genetic variation in the context of a designer offspring (EU 1). Students will use models and math (probability) in their constructed explanations (EU 2). Students will then use their understanding of the inheritance of traits to plan a designer breed of an offspring (EU 3).

Evaluation: Unit Task Teacher Created Rubric/Scoring Guide

Unit Resources

- Open Sci Ed unit resources
- Science notebooks
- Laptops
- NGSS Interim Assessments
- Pear Assessment
- NGSS Practice Items
- Newsela.com
- Diffit.com