

# 3. Grade 07 : Inheritance and Variations of Traits

Content Area: **Science**  
Course(s):  
Time Period: **Generic Time Period**  
Length: **18**  
Status: **Published**

## Stage 1: Desired Results

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## Unit Overview/ Rationale

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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. 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.

## Standards & Indicators

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**Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect harmful, beneficial, or neutral effects to the structure and function of the organism.** [Clarification Statement: Emphasis is on changes in genetic material that may result in making different proteins.] [Assessment Boundary: Assessment does not include molecular level, mechanisms for protein synthesis, or specific types of mutations.] ([MS-LS3-1](#))

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**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.** [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and flowcharts to show the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.] ([MS-LS3-2](#))

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## Big Ideas - Students will understand that...

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Using models, such as electronic simulations, physical models, or drawings, students will learn that genes are located in the chromosomes of cells and each chromosome pair contains two variants of each gene. Students will need to make distinctions between chromosomes and genes and understand the connections between them. DNA will be introduced in high school. Students will learn that chromosomes are the genetic material that is found in the nucleus of the cell and that chromosomes are made up of genes. They will also learn that each gene chiefly controls the production of specific proteins, which in turn affect the traits of the individual.

Students should be given opportunities to use student-developed conceptual models to visualize how a mutation of genetic material could have positive, negative, or neutral impact on the expression of traits in organisms. Emphasis in this unit is on conceptual understanding that mutations of the genetic material may result in making different proteins; therefore, models and activities that focus on the expression of genetic traits, rather than on the molecular-level mechanisms for protein synthesis or specific types of mutations, are important for this unit of study. For example, models that assign genetic information to specific segments of model chromosomes could be used. Students could add, remove, or exchange genes located on the chromosomes and see that changing or altering a gene can result in a change in gene expression (proteins and therefore traits).

Students will continue this unit of study by describing two of the most common sources of genetic variation, sexual and asexual reproduction. Students will be able to show that in sexual reproduction, each parent contributes half of the genes acquired by offspring, whereas in asexual reproduction, a single parent contributes the genetic makeup of offspring. Using models such as Punnett squares, diagrams, and simulations, students will describe the cause-and-effect relationship between gene transmission from parent(s) to offspring and the resulting genetic variation. Using symbols to represent the two alleles of a gene, one acquired from each parent, students can use Punnett squares to model how sexual reproduction results in offspring that may or may not have a genetic makeup that is different from either parent. Students can observe the same mixing of genetic information using colored counters or electronic simulations. Using other models, students can show that asexual reproduction results in offspring with the same combination of genetic information as the parents.

Students can summarize the numerical data they collect during these activities as part of their description of why asexual reproduction results in offspring with identical genetic combinations and sexual reproduction results in offspring with genetic variations. As a culmination of this unit of study, students could make multimedia presentations to demonstrate their understanding of the key concepts. Students could participate in a short research project and cite the specific textual evidence used to support the analysis of any scientific information they gather. They could integrate quantitative or technical information as part of their presentation. For example, students can take data collected during investigations of genetic mutations and provide a narrative description of their results. They could use data collected during their investigation of sexual and asexual reproduction. They could also include diagrams, graphs, or tables to clarify their data.

## **Essential Questions - What provocative questions will foster inquiry and transfer of learning**

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How are traits passed from parent to offspring?

How can a Punnett square model inheritance?

How are traits passed from parent to offspring?

Why did Mendel perform cross-pollination experiments?

What did Mendel conclude about inherited traits?

How do dominant and recessive traits interact?

What determines the expression of traits?

### **Content - Students will understand that...**

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- Complex and microscopic structures and systems, such as genes located on chromosomes, can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among the parts of the system; therefore, complex natural structures/systems can be analyzed to determine how they function.
- 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 affect the traits of the individual.
- In addition to variations that arise from sexual reproduction, genetic information can be altered due to mutations.
- Some changes to genetic material are beneficial, others harmful, and some neutral to the organism.
- Changes in genetic material may result in the production of different proteins.
- Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.
- 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
- Though rare, mutations may result in changes to the structure and function of proteins.
- Organisms reproduce either sexually or asexually and transfer their genetic information to their offspring.
- Asexual reproduction results in offspring with identical genetic information.
- 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.

- 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 parent(s) to offspring and resulting genetic variation.

## **Skills - Students will be able to...**

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- Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information.
- Develop and use a model to describe why sexual reproduction results in offspring with genetic variation.
- Use models such as Punnett squares, diagrams, and simulations to describe the cause-and effect-relationship of gene transmission from parent(s) to offspring and resulting genetic variation.
- Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect offsprings and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

## **Stage 2: Assessment Evidence**

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### **Assessment**

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Chapter 5 assessments including tests and quizzes

Launch Labs

Punnett Square Practice Worksheet

MiniLabs

Inquiry Labs

Essential Question Responses

### **Stage 3: Learning Plan**

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#### **Learning Activities**

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##### **Accommodations for students with IEPs and learning difficulties:**

- Model how to perform specific roles when conducting experiments
- visual sentence frames using academic vocabulary for discussion
- use science "Reading Essentials" packets in place of textbook sections
- print lesson vocabulary in premade flashcard fashion to be used as a study guide
- allow verbal responses in place of written responses
- provide graphic organizers for comparing and contrasting science concepts
- modify graphic organizers/worksheets to reduce choices
- Use visuals to show important vocabulary for students to make connections
- Vocabulary word banks and strategies
- Think alouds and Think-Pair-Share

**For ELL students:**

- visuals for vocabulary
- word wall
- additional word work such as illustrating vocabulary and playing vocabulary games
- partner reading
- choral reading
- color-coded sticky notes for close reading to identify which sticky notes pertain to vocabulary
- questions about text, etc.
- When students make an error in speaking, answer or restate what they said using the correct form without drawing attention to the mistake.

**For gifted students:**

- additional self-selected science resources to explore the global impact of pollution created by fossil fuels
- offer bonus points for "Reaching Higher" critical thinking questions

**Resources**

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**McGraw Hill Earth Science Volume 2**

**Chapter 5**

**ConnectEd.Mcgraw-hill.com resources**

## **Unit Reflections & Teacher Notes**

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