

## Unit 6: Inheritance and Variation of Traits

CONTENT AREA: General Physical Science	GRADES: 7	UNIT: 6 of 8
<b>Pacing: Approx. 1 Month (February)</b>		
<p style="text-align: center;"><u>Science and Engineering Practices</u></p> <p><b>Developing and Using Models -</b> Develop and use a model to describe phenomena. <b>(MS-LS3-1),(MS-LS3-2)</b></p>	<p style="text-align: center;"><u>Disciplinary Core Ideas</u></p> <p><u>LS1.B: Growth and Development of Organisms</u></p> <ul style="list-style-type: none"> <li>● Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS-LS3-2)</li> </ul> <p><u>LS3.A: Inheritance of Traits</u></p> <ul style="list-style-type: none"> <li>● 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. (MS-LS3-1)</li> <li>● Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)</li> </ul> <p><u>LS3.B: Variation of Traits</u></p> <ul style="list-style-type: none"> <li>● 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. (MS-LS3-2)</li> <li>● 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</li> </ul>	<p style="text-align: center;"><u>Crosscutting Concepts</u></p> <p><b>Structure and Function</b></p> <ul style="list-style-type: none"> <li>● Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1)</li> </ul> <p><b>Cause and Effect</b></p> <ul style="list-style-type: none"> <li>● Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)</li> </ul>

	beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)	
<b>Performance Expectations:</b> MS-LS3-1, MS-LS3-2		
<b>Evidence Statement(s):</b> MS-LS3-1, MS-LS3-2		
<b>Essential Question: Why do kids look similar to their parents?</b>		
<b>21<sup>st</sup> Century Skills:</b> 9.2.8.B.3, 9.2.8.B.4		
<b>Career Ready Practices:</b> CRP4, CRP6, CRP7		
<b>Technology:</b> HS-ETS1-1 HS-ETS1-3		
<b>Technical Terms (Suggested)</b>	<b>Core Instructional Materials</b>	<b>Assessment Statement</b>
Circulatory Excretory Digestive System Respiratory System Muscular System Nervous System Brain Nerve cells Cause and Effect Relationships Stimuli Genes Chromosomes Traits Variations Mutations Proteins Sexual Reproduction Asexual Reproduction Genetic Variation Alleles Punnett Squares  ** All terms should be taught in context rather than in isolation. These terms should be addressed after conceptual understanding.**	<u>MS-LS3-1</u> - Chromebook, internet access, smartboard, notebook, pen, pencil, whiteboard.  <u>MS-LS3-2</u> - Computer, Internet access, smartboard, notebook, pen, pencil, whiteboard.	Students who understand the concepts are able to: <ul style="list-style-type: none"> <li>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.</li> </ul>
<b>Modifications</b>		

<u>English Language Learners</u>	<u>Special Education</u>	<u>At Risk</u>	<u>Gifted &amp; Talented</u>
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair-share Visual aides Modeling Cognates	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication Modified assignments Counseling	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities

5E Model	
<b>Performance Expectation: MS-LS3-1</b> 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."	
<b>Engage:</b> Anticipatory Set	<u>Video and Discussion</u> Watch an embryo develop in this animation and study how mutations affect the expression of genes. <a href="http://www.ck12.org/life-science/Mutations-in-Life-Science/web/Regulating-Genes/">http://www.ck12.org/life-science/Mutations-in-Life-Science/web/Regulating-Genes/</a>
<b>Exploration:</b> Student Inquiry	<a href="https://www.brainpop.com/health/geneticsgrowthanddevelopment/geneticmutations/preview.weml">https://www.brainpop.com/health/geneticsgrowthanddevelopment/geneticmutations/preview.weml</a>  Video: Introduction to Chromosomes <a href="http://www.ck12.org/biology/Chromosomes/lecture/Chromosomes/?referrer=featured_content">http://www.ck12.org/biology/Chromosomes/lecture/Chromosomes/?referrer=featured_content</a>  <u>DNA Replication: Paper Clip Activity</u> <a href="http://www.tiemanbiology.com/uploads/6/3/2/3/6323843/dna_replication_paper_clip_activity.pdf">http://www.tiemanbiology.com/uploads/6/3/2/3/6323843/dna_replication_paper_clip_activity.pdf</a>
<b>Explanation:</b> Concepts & Practices	<u>In these lessons:</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.  <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> <a href="#">LS3.A: Inheritance of Traits</a> <a href="#">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</a>

	<p><u>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.</u></p> <p><u>LS3.B: Variation of Traits</u>  <u>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.</u></p>
<b>Elaboration:</b> Extension Activity	<p><u>Genetic Disorder Project:</u>  Purpose: To learn about and share information on an assigned  Problem: You are a researcher and you are ready to present information on a genetic disorder you have discovered. You want to get more funding in order to continue your research. Your job is to creatively present all of your findings to the Board of Directors. Your presentation needs to be in words in which all members of the Board of Directors can understand. (In other words – break down all the medical language into everyday speech, whenever possible...) The following website can be used as your main source of information: <a href="http://www.ghr.nlm.nih.gov">www.ghr.nlm.nih.gov</a>.</p> <p><u>Choice of two different projects:</u>  1. <u>Create and present a PowerPoint presentation of the genetic disorder.</u>  2. <u>Create a tissue box display that explains the genetic disorder</u>  Both projects must include the following criteria:  - <u>Facts or theories about the disorder</u>  - <u>Symptoms of the disorder</u>  - <u>Inheritance (which chromosome/gene is affected? How do you get it and can it be passed on to further generations?)</u>  - <u>Incidence (how often it occurs in male/female, ethnicity, age, etc...)</u>  - <u>Treatment of the disorder (therapy, medicines, future prospects)</u></p>
<b>Evaluation:</b> Assessment	

<b>5E Model</b>	
<b>Performance Expectation: MS-LS3-2</b>	
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. "	
<b>Engage:</b> Anticipatory Set	<p><a href="https://www.brainpop.com/science/cellularlifeandgenetics/asexualreproduction/preview.weml">https://www.brainpop.com/science/cellularlifeandgenetics/asexualreproduction/preview.weml</a></p> <p><a href="http://learn.genetics.utah.edu/content/variation/reproduction/">http://learn.genetics.utah.edu/content/variation/reproduction/</a></p>

	<a href="https://www.youtube.com/watch?v=jk2RJm5RBEk">https://www.youtube.com/watch?v=jk2RJm5RBEk</a>
<b>Exploration:</b> Student Inquiry	<p><u>Mitosis Claymation Videos</u>  <a href="http://betterlesson.com/lesson/639821/mitosis-claymation-videos">http://betterlesson.com/lesson/639821/mitosis-claymation-videos</a></p> <p><u>Monster Factory</u>  In this lesson, students will focus on the big idea that traits are inherited. Students will simulate the inheritance of alleles for physical traits and use those traits to create monster offspring.  <a href="http://betterlesson.com/lesson/633980/monster-factory">http://betterlesson.com/lesson/633980/monster-factory</a></p> <p><u>Punnett and the Rules</u>  Students will be able to set-up and complete a Punnett Square.  <a href="http://betterlesson.com/lesson/635051/punnett-and-the-rules">http://betterlesson.com/lesson/635051/punnett-and-the-rules</a></p>
<b>Explanation:</b> Concepts & Practices	<p><u>In these lessons:</u>  Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.  Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices.</p> <p><u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u>  <a href="#">LS1.B: Growth and Development of Organisms Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary)</a>  <a href="#">LS3.A: Inheritance of Traits</a>  <a href="#">Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.</a>  <a href="#">LS3.B: Variation of Traits</a>  <a href="#">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.</a></p>
<b>Elaboration:</b> Extension Activity	<p>Related Activities (Go to MS-LS3-2 section of page)  <a href="http://www.ck12.org/ngss/middle-school-life-sciences/heredity:-inheritance-and-variation-of-traits">http://www.ck12.org/ngss/middle-school-life-sciences/heredity:-inheritance-and-variation-of-traits</a></p>
<b>Evaluation:</b> Assessment	<p><u>Assessment Task A: Mitosis Video</u>  <a href="#">Develop and use a model to describe phenomena</a>  <a href="#">Teacher will assess student videos according to pre-established criteria.</a></p> <p><u>Assessment Task B: Punnett Practice</u>  <a href="#">Develop and use a model to describe phenomena</a>  <a href="http://betterlesson.com/lesson/resource/3174264/punnett-practice">http://betterlesson.com/lesson/resource/3174264/punnett-practice</a></p>

Students will use the Punnett Square model that they created for their to describe why genetic variation occurs in offspring of sexual reproduction.

Assessment Task C: Model Comparison

After creating models of both asexual and sexual reproduction, students will draft a written explanation to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

**Why do kids look similar to their parents?**

**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.**

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PEs and DCIs
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. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.] (MS-LS3-1)	LS3.1
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. [Clarification Statement: Emphasis is on using 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.] (MS-LS3-2)	LS3.2

The Student Learning Objectives above were developed using [the following elements from the NRC document A Framework for K-12 Science Education](#):

<p>Evidence Statements: MS-LS3-1  <b>Developing and Using Models</b>                      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.</p> <p>Develop and use a model to describe phenomena.</p>	<p><b>LS3.A: Inheritance of Traits</b>  <a href="#">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.</a></p> <p><b>LS3.B: Variation of Traits</b></p>	<p style="text-align: center;"><b>Crosscutting Concepts</b></p> <p>LS3.1  <b>Structure and Function</b>  <a href="#">Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex</a></p>
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<p>Evidence Statements: MS-LS3-2  <b>Developing and Using Models</b>  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.</p> <p>Develop and use a model to describe phenomena.</p>	<p><u>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.</u></p> <p><u>LS1.B: Growth and Development of Organisms</u>  <u>Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary)</u></p> <p><u>LS3.A: Inheritance of Traits</u>  <u>Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.</u></p> <p><u>LS3.B: Variation of Traits</u>  <u>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.</u></p>	<p><u>natural structures/systems can be analyzed to determine how they function.</u></p> <p>LS3.2</p> <p><b><u>Cause and Effect</u></b></p> <p><u>Cause and effect relationships may be used to predict phenomena in natural systems.</u></p>
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<p><i>Connections to other DCIs in this grade-band:</i>  MS.LS1.A ; MS.LS4.A ;</p>
<p><i>Articulation of DCIs across grade-bands:</i>  MS.LS1.A ; MS.LS4.A ; 3.LS3.A ; 3.LS3.B ; HS.LS1.B ; HS.LS3.A ; HS.LS3.B</p>
<p><i>Common Core State Standards Connections:</i>  ELA/Literacy -</p>

**RST.6-8.1,**  
**RST.6-8.4,**  
**RST.6-8.7,**  
**SL.8.5**

*Mathematics -*

**MP.4, 6.SP.B.5**