

# Unit 2: Inheritance and Variation of Traits

Content Area: **Science**  
Course(s): **Biology/Lab**  
Time Period: **2nd Marking Period**  
Length: **10 Weeks**  
Status: **Published**

## Unit Overview

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DNA, in the form of chromosomes, passes genetic information from one generation to the next. Environmental and genetic causes of mutation result in variation within a population.

## Transfer

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Students will be able to independently use their learning to...

- Identify types of mutations.
- Predict the effect of a mutation on an organism.
- Predict the genotypic and phenotypic ratios of offspring given the parent genotypes.

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For more information, read the following article by Grant Wiggins.

[http://www.authenticeducation.org/ae\\_bigideas/article.lasso?artid=60](http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60)

## Meaning

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## Understandings

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Students will understand that...

- Genetic information is passed on to new cells during cell division.
- Cell division is essential to the development, growth and maintenance of an organism.
- Mutations may cause variation within a population.
- Traits are inherited from one generation to the next.

## **Essential Questions**

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Students will keep considering...

- How do cells know what to do?
- Are you a mutant? How do you know?

## **Application of Knowledge and Skill**

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### **Students will know...**

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Students will know...

- Genetic information is passed on to new cells during cell division.
- Cell division is essential to the development, growth and maintenance of an organism.
- Mutations may cause variation within a population.
- Traits are inherited from one generation to the next.

## **Students will be skilled at...**

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Students will be skilled at...

- Identifying the phases of cell division.
- Recognizing types of mutations.
- Predicting the genotypes and phenotypes of offspring.

## **Academic Vocabulary**

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Chromosome  
Chromatid  
Centromere  
Histone  
Homologous pair  
Sex chromosome  
Autosome  
Haploid  
Diploid  
Karyotype  
Cell cycle  
Binary fission  
Mitosis  
Meiosis  
Interphase  
Cleavage furrow  
Cell plate  
Cytokinesis

Heredity  
Genetics  
Dominant factor  
Recessive factor  
Gene Allele  
Genotype  
Phenotype  
Homozygous  
Heterozygous  
Probability  
Monohybrid cross  
Dihybrid cross  
Punnett square  
Complete dominance  
Incomplete dominance  
Codominance  
Sex linkage

Linkage groups  
Crossing over  
Germ cell mutations  
Somatic cell mutations  
Lethal mutations  
Chromosome mutations  
Deletion  
Inversion  
Translocation  
Nondisjunction  
Gene mutation  
Point mutations  
Frame shift mutations  
Patterns of inheritance  
Carrier  
Single-allele traits  
Multiple-allele traits  
Polygenic traits  
Sex-influenced traits

## **Learning Goal 1**

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Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

### Proficiency Scale

SCI.HS-LS1-4

Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

## **Target 1**

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SWBAT:

- Compare chromosomes and chromatin.
- Differentiate between sex chromosomes and autosomes.
- Identify steps of mitosis.
- Model the activities at each step in mitosis.

-Describe how genes control mitosis.

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- Identify steps of mitosis.
- Model the activities at each step in mitosis.

## **Learning Goal 2**

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Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

### Proficiency Scale

MA.K-12.2

Reason abstractly and quantitatively.

SCI.HS-LS3-1

Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

## **Target 1**

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SWBAT:

-Identify steps of meiosis.

-Differentiate between haploid and diploid cells and their roles in multicellular organisms.

-Describe how meiosis results in genetic variability.

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- Describe how meiosis results in genetic variability.
  - Differentiate between haploid and diploid cells and their roles in multicellular organisms.
  - Identify steps of meiosis.

## **Learning Goal 3**

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Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

## Proficiency Scale

LA.RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
SCI.HS-LS3-2	Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

### **Target 1**

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#### SWBAT:

- Define genotypes and phenotypes and provide examples.
- Predict the genotypes and phenotypes of offspring.
- Identify types of dominance and the effects on phenotypes.
- Determine gametes for dihybrid crosses.

- Define genotypes and phenotypes and provide examples.
- Identify types of dominance and the effects on phenotypes.
- Predict the genotypes and phenotypes of offspring.

### **Target 2**

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#### SWBAT:

- Identify different types of inheritance patterns.
- Differentiate between gene and chromosome mutations.
- Explain sex-determination and sex-linkage.
- Predict the genotypes and phenotypes of sex-linked traits.
- Analyze a pedigree to identify genotypes, phenotypes and patterns of inheritance.

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- Differentiate between gene and chromosome mutations.

- Explain sex-determination and sex-linkage.
- Identify different types of inheritance patterns.
- Predict the genotypes and phenotypes of sex-linked traits.

## **Learning Goal 4**

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Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

### Proficiency Scale

SCI.HS-LS3-3

Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

## **Target 1**

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SWBAT:

-Predict the genotypic and phenotypic frequencies within a gene pool.

-Describe factors that can affect gene pools.

- Describe factors that can affect gene pools.
- Predict the genotypic and phenotypic frequencies within a gene pool.

## **Formative Assessment and Performance Opportunities**

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-Science notebook

-Homework assignments

-Classwork assignments

-Lab activities/explorations

-Quizzes, Tests, Projects

## **Summative Assessment**

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Common unit assessment aligned to the NJSLs and differentiated for varied learners.

## **Accommodations/Modifications**

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- 504 accommodations
- IEP modifications
- Adaptations to science notebook entries
- Alternate form of assessment: Genetics Project - student driven research and application of curriculum vocabulary
- Additional resources such as videos, models, posters

Ex:

- model the effects of mutation; from start to finish
- students are supplied with amino acid chart

## **Unit Resources**

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- Textbook
- Supplemental textbook materials
- Online resources
- Laptops
- Student Response Systems
- Lab materials

## **21st Century Life and Careers**

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CRP.K-12.CRP1.1

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.



CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP9.1	Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

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## **Interdisciplinary Connections**

LA.SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence
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and to add interest.

LA.RST.11-12.1

Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.

LA.RST.11-12.9

Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

LA.WHST.11-12.1

Write arguments focused on discipline-specific content.

MA.F-BF.A.1

Write a function that describes a relationship between two quantities.

MA.F-IF.C.7

Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

MA.K-12.2

Reason abstractly and quantitatively.

MA.K-12.4

Model with mathematics.