Unit 2 Heredity: Inheritance and Variation of Traits (Life Science)

Content Area: **Science**
Course(s): **Science 8**
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Length: **50 Days & Grade 8**
Status: **Published**

Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Science, Grade 8

Unit 2: Heredity: Inheritance & Variation of Traits

Belleville Board of Education

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Unit Overview

- The theme of this unit is that all living things grow, develop, and reproduce, and that through this process various traits and characteristics are passed on from one generation to the next. It is the variation of these traits, that has facilitated the evolution of life into the present day diverse biosphere.

- The ideological direction of this unit is that the cell's ability to grow and develop and to pass on traits to its offspring,sets the stage for the evolution of the species.

- Topics that will be explored include:
    - Growth and Development of Organisms
    - Mitosis and Meiosis
    - Inheritance of Traits
    - Variation of Traits
    - Genotype and Phenotype
    - Reproduction -Sexual and Asexual
    - Plant Growth and Reproduction
    - Plant Structures that influence reproductive success
    - Animal Growth and Reproduction
    - Animal Behaviors that influence reproductive success

- Students can expect to learn:
    - How to develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteinsGene mutations may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
    - Why asexual reproduction results in offspring with identical genetic information and sexual

reproduction results in offspring with genetic variation.
- To 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.
- To use graphic organizers and models to describe mitosis and meiosis, Asexual and sexual reproduction.
- To use models to demonstrate how mutations can be passed to succeeding generations.
- Photosynthesis/cellular respiration
- Anatomy of plant reproductive structures
- Mating Behaviors/Rituals of various Animals

Enduring Understanding

- We are unique individuals as a direct result of DNA from prior generations.
- Organisms reproduce, develop, have predictable life cycles, and pass on some traits to their offspring.
- Sometimes differences between organisms of the same kind give advantages in surviving and reproducing in different environments.
- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.

Essential Questions

- How do living organisms pass traits from one generation to the next?
- How do organisms change as they go through their life cycles?
- In what ways are organisms of the same kind different from each other?
- How do mutations occur in genes?
- Why can mutations benefit, harm or be neutral to an organism?
- How do differences aid in survival?
- How are traits and organisms passed from one generation to another?

Exit Skills

By the end of Grade 8, Science Unit 2, the student should be able to:

- Define genetic terms
- Use models to describe ways gene mutations and sexual reproduction contribute to genetic variation
- Compare and contrast sexual and asexual reproduction
- Define heredity and explain the role of genes and chromosomes in the process of inheriting a specific trait.
- Describe how cells divide to increase their numbers through the process of mitosis, and sequence the steps of mitosis
- Contrast the processes of mitosis and meiosis in relation to growth, repair, reproduction, and heredity.
- Identify the phenotype of an organism based on its genotype
- Use Punnett square to predict the probability of traits passed from parents to offspring
- Use a Punnett Square and apply
- Use ideas of genetic variation in a population to make sense of organisms surviving and reproducing, hence passing on the traits of the species.
- Describe Gregor Mendel's experiments
- Distinguish dominant and recessive traits/alleles/ and phenotypes/genotypes
- Communicate a deeper understanding of how gene structure determines differences in the functioning of organisms.
- Explain heredity and connection to allele frequency
- Interpret heredity based on Sex linked traits
- Debate the value of Genetic engineering
- Use ideas of genetic variation in a population to make sense of organisms surviving and reproducing, hence passing on the traits of the species

New Jersey Student Learning Standards (NJSLS-S)

NextGen Science Standards

6-8.MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

6-8.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.
6-8.MS-LS1-4.LS1.B.1	Animals engage in characteristic behaviors that increase the odds of reproduction.
6-8.MS-LS1-5.LS1.B.1	Genetic factors as well as local conditions affect the growth of the adult plant.
6-8.MS-LS3-2.LS1.B.1	Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.
6-8.MS-LS1-4.LS1.B.2	Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.
6-8.MS-LS3-1.LS3.A.1	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.
6-8.MS-LS3-2.LS3.A.1	Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.
6-8.MS-LS3-2.LS3.B.1	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.
6-8.MS-LS3-1.LS3.B.1	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.

Interdisciplinary Connections

LA.SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
LA.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
LA.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 context relevant to grades 6-8 texts and topics.
LA.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).
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.
6-8.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.

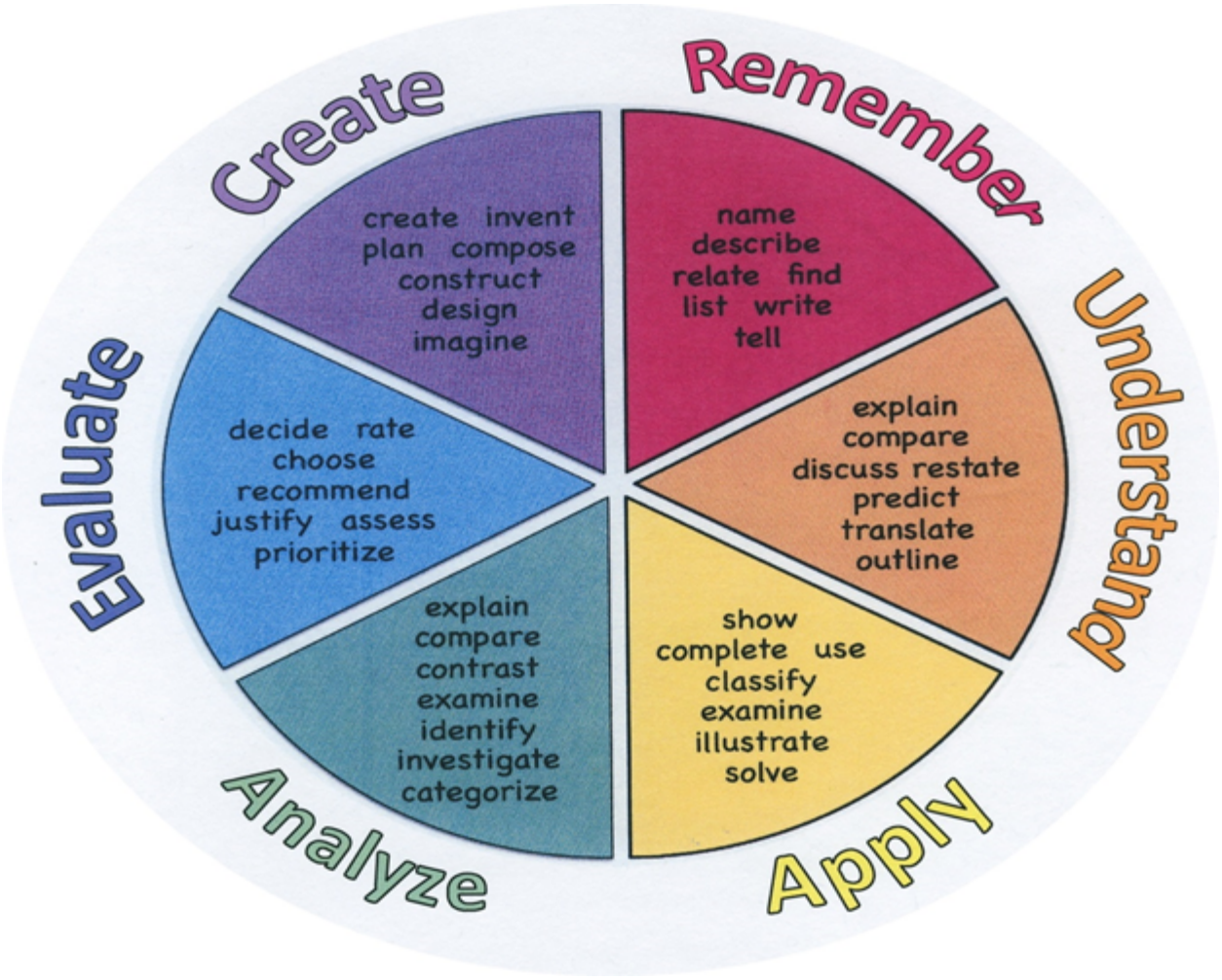
Learning Objectives

Effective Learning Objectives Used in Lesson Planning:

Students will develop the ability to:

- Explain how genetic factors influence an organisms traits.
- Familiarize themselves with the work of Gregor Menel on varying traits in pea plants.
- Analyze the cause and affect between dominant and recessive traits and the resulting characteristics of succeeding generations.
- Create models to describe the relationship between DNA, chromosomes, and genes.
- Develop models to show how genetic variation can be influenced by environmental factors.
- Create models to describe why asexual reproduction results in offspring that are genetically identical; while sexual reproduction results in genetic variation.
- Analyze how genetic and environmental factors affect the growth, survival, and reproductive success of an organism.
- Utilize Punnett Squares to calculate the probability of genotypes and phenotypes occurring in offspring.
- Develop and use models to further understand the variations of traits in organisms
- Explain how different structures of plants assist in their reproductive success.
- Analyze the cause and effect relationship between between certain animal behaviors and their reproductive success.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

Guidelines for Suggested Activities Include:

- HMH Hands on Lab Relating Genetic Structure to Traits
- Punnet Square worksheets and webquest.
- HMH Hands on Lab Model Asexual and Sexual Reproduction
- Flower Anatomy Diagram
- Flower Dissection and Sketches
- Bean Dissection and Sketches

Assessment Evidence - Checking for Understanding (CFU)

Assessment Evidence:

- Why It Matters charts (KWL) (Formative)
- Graphic Organizers (Formative)
- BrainPop quizzes - Genetics, Heredity, DNA (Summative)
- Newsela Article/Quz Facts about Genetics (Summative)
- Defined STEM - Geneological Research (Summative)
- HMH Workbook Module B Unit 3 - student highlights & completed questions (Formative)
- Punnet Square Worksheets (Alternate)
- HMH Hands on Activities and worksheets "Model Genes and Traits" and "Model Sexual Reproduction" (Alternate)
- Oncourse Assessment Tools (Formative)
- Unit Test/Quiz (Summative)
- "Do Now/Exit Ticket" Activity (Formative)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline

- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Primary Textbook and Dimensions materials are:

- Defined Stem
- Google Classroom
- HMH workbook and Website Module A and B
- HMH Laboratory Kits Module A and B
- Brainpop
- NewsELA
- YouTube
- School Tube
- Khan Academy

Ancillary Resources

Supplementary resources include:

- Legends of Learning website (teacher prepared web-based games and quizzes)
- Bill Nye - Genes Video
- Untamed Science - Gregor Mendel video, and Non-Mendelian Genetics video.
- BraipPOP Videos and Quizzes - "Genetics", Genetic Mutations", "Heredity", and "DNA"

- Amoeba Sisters tutorials - Chromosome, Genes, and Traits.
- Teacher prepared Powerpoint presentation

Technology Infusion

- Smart board/Interactive T.V.
- Student Chromebooks
- Google Classroom
- www.glencoe.com genetics virtual lab
- Document Camera
- Pod-casts video streams
- Discovery Education video streams
- You Tube video streams
- Brain-pop video streams
- Legends of Learning
- Quizlet
- Laptops
- Khan Academy
- Power Point presentation Meitosis and Meiosis
- MS Word

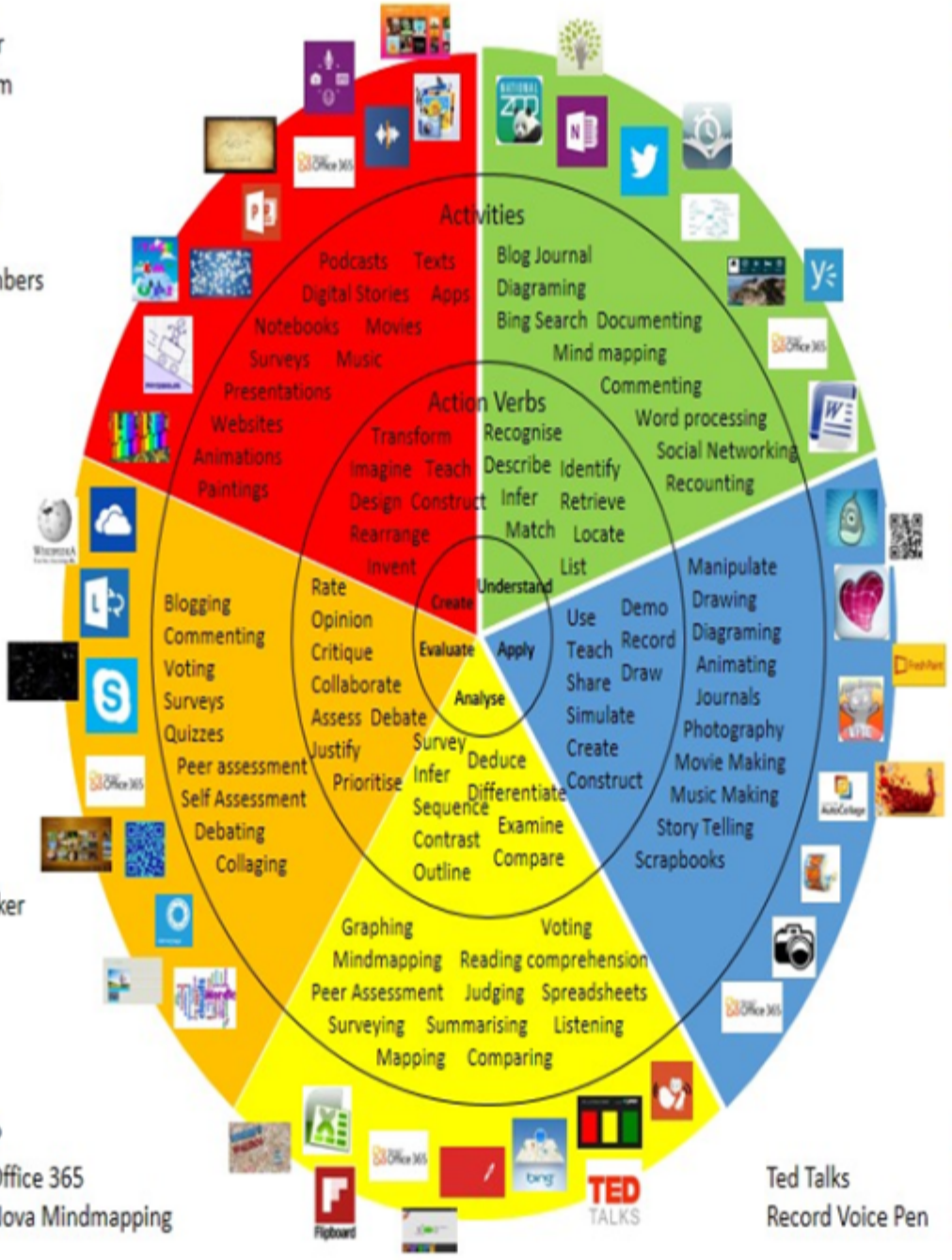
For example

- BraipPOP Videos and Quizzes - "Genetics", Genetic Mutations", "Heredity", and "DNA"
- Legends of Learning - Genes and Intheritance Games
- Glencoe Punnett Square inherited trait generator http://www.glencoe.com/sites/common_assets/science/virtual_labs/E09/E09.html

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel
Flipboard
Office 365
Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CAEP.9.2.8.B.1	Research careers within the 16 Career Clusters ® and determine attributes of career success.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
CAEP.9.2.8.B.4	Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
CAEP.9.2.8.B.7	Evaluate the impact of online activities and social media on employer decisions.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.A.CS1	Understand and use technology systems.
TECH.8.1.8.A.CS2	Select and use applications effectively and productively.
TECH.8.1.8.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.8.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.2.8.A.CS1	The characteristics and scope of technology.
TECH.8.2.8.A.CS2	The core concepts of technology.
TECH.8.2.8.A.CS3	The relationships among technologies and the connections between technology and other fields of study.

21st Century Skills/Interdisciplinary Themes

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century/Interdisciplinary Themes** that will be incorporated into this unit.

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills

- Media Literacy

21st Century Skills

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century Skills** that will be incorporated into this unit.

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

Multi-sensory presentation to reinforce Core and Cross Cutting Concepts

- Video streams on DNA, cellular reproduction, and sexual and asexual reproduction
- Powerpoint Presentation about Meiosis and Meiosis with teacher supplied guided notes
- Hands on Labs modeling genetics and inheritance probability

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation

- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

The following **Special Education Learning** adaptations will be employed in the unit:

- a student working with an assigned partner on Meitosis and Meiosis graphic organizer,
- Paired Partners work togethr on Punnett square webquest
- Unit 3 study guide for final assessment

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multiple test sessions
- multi-sensory presentation
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

The following **English Language Learners** adaptations will be employed in the unit:

- a student working with an assigned partner on graphic organizer,
- Paired partners collaborating on Punnett square webquest
- computer or electronic device quizzes and Punnett square webquest.
- modified test content on Module B UNit 3 Sumnative Test
- Study Guide to be given

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

The following adaptations will me made for **At Risk Students**

- Creating laboratory models to explain genetics. meiosis and mitosis, inheritance, reproduction.
- Use of math style manipulatiives (heads or tails of coins) to explain probbility, to model genetics and inheritnce.

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers

- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Talented and Gifted adaptations that will be employed in the unit include:

- Utilize project based learning - Defined STEM project - Geneological Reseaarch
- advanced problem solving using Punnett Squares predicting the probability of multiple triats being handed down to offspring
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- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Unit Name: Cells and Heredity

NJSLS: See link

Interdisciplinary Connection: See link

Statement of Objective: SWDAT develop and use models to describe the relationship between DNA, chromosomes, genes, and alleles.

Do Now: Question on Google: "What trait did the first generation of pea plants have, when Mendel crossbreed a purple true-breeding pea plant and white true-breeding pea plant?"

Anticipatory Set: a 3-minute video about inherited traits https://www.youtube.com/watch?v=Mehz7tCxjSE

Learning Activity:
1. Do Now
2. Anticipatory Set video
3. TW display eBook on the screen while students read aloud, highlight and complete questions on pages 128 and 129.
4. TW display Hands-on Lab activity street on Smart TV, while students read the introduction aloud. 5. Exit Ticket: Students work with a paired partner to complete Step 1 and 2 on the worksheet.
HMH Model Genes and Traits Lab.pdf

Student Assessment/CFU's: See link

Materials: Smart TV, laptops, Workbook, Lab Activity Worksheet. yellow and red beads,

21st Century Themes and Skills: See link

Differentiation: See link

Integration of Technology: HMH eBook, Google Classroom, YouTube video