Unit #7 Genetics and DNA

Content Area: **Science**
Course(s):
Time Period:
Length: **28 days**
Status: **Published**

State Mandated Topics Addressed in this Unit

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N/A	N/A

Genetics and DNA

Learning Objectives

- Objective 1 - Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
- Objective 2 - Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
- Objective 3 - Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
- Objective 4 - 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.
- Objective 5 - Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
- Objective 6 - Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
- Objective 7 - Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

Essential Skills

- Essential Skill 1 - Account for the appearance of a novel trait that arose in a given population.
- Essential Skill 2 - Reflect on and revise observations as new evidence emerges

- Essential Skill 3 - Apply data representations and new models to revise predictions and explanations
- Essential Skill 4 - Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences
- Essential Skill 5 - Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams
- Essential Skill 6 - Predict the potential impact on an organism given a change in a specific DNA code, and provide specific real world examples of conditions caused by mutations.
- Essential Skill 7 - Describe how a disease is the result of a malfunctioning system, organ, and cell, and relate this to possible treatment interventions.
- Essential Skill 8 - Demonstrate through modeling how sorting and recombination of genes during sexual reproduction has an effect on variation in offspring.

Standards

SCI.HS-LS3-3	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
SCI.HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
SCI.HS-LS1-6	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
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.
SCI.HS-LS4-3	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
SCI.HS-LS4-2	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
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.

Instructional Tasks/Activities

- Blood Type Problems: Students practice creating and interpreting Punnett squares given various blood type scenarios
- Classroom Survey: students hypothesize about predominance of several traits, survey classmates for phenotypes and record in data table, total results, determine percentages of each trait. Students predict which traits are determined by dominant and recessive alleles and explain their reasoning.
- Clues from the Karyotype – cut-out: Students cut out chromosomes and arrange in a karyotype. Then interpret karyotype to determine any chromosomal disorders .
- Codon Worksheet: Students use codon wheel to determine amino acids that correspond to codons.
- Coloring Transcription and Translation Worksheet: Students color and label parts of the transcription and translation processes

- Construct a Family Pedigree: students choose a trait, record this trait in their family members, design a pedigree diagram to indicate how the trait was passed from parents to offspring according to the pattern of inheritance they determine.
- Design a Dragon Activity: individually, students use genetic information provided about genotype and phenotype for various traits of a dragon. Then assemble the various parts to create a dragon model with the proper traits. Students explain how they determined the traits for their dragon.
- DNA cut and paste reproduction add-on: Students use manipulatives to display the structure of DNA. Then use these manipulatives to demonstrate the process of DNA reproduction.
- DNA Structure Activities: in each activity listed, students use manipulatives to demonstrate the structure of DNA, including base pairing, 5' to 3' arrangement of sugars and phosphates, etc. Cut and paste Jewelry, Origami, plastic models
- DNA, RNA, and Snorks: Students use codons to determine amino acids, protein, and trait. Students then use this information to draw an example of these hypothetical alien organisms.
- Foldables – organization of material
- Gene of Fortune – Codons and Amino Acids with Dice: Students in groups roll amino acid dice to create codon then determine the corresponding amino acid.
- Gene of Fortune Game – Bingo Base Pairing: Students practice base pairing using bingo game format.
- Genetics and Chance – Coin Flip: students, in groups, predict the outcome for varying numbers of coin tosses. Students observe and record actual coin tosses. Students compare results with other groups. Then offer reasoning using probability concepts for the observed outcomes. Then relate to outcomes of monohybrid crosses and predict outcomes for dihybrid and other crosses.
- Group discussion
- Inquiry Based lab: Segregation and Fertilization Lab: in partners, students create paper chromosomes, each designated with a different trait. Students determine their genotype for each trait and add it to the chromosomes. Pairs of students throw their chromosomes together to simulate fertilization then record the genotypes of their hypothetical children and explain the process of fertilization.
- Meiosis Clay Model Creation: Students use clay to demonstrate the organelles involved in each phase of meiosis and describe what occurs during each phase
- Meiosis Flip Book: students create a flipbook indicating a step-by-step knowledge of what occurs during each phase of meiosis
- Meiosis Internet Activity: Students observe animation of meiosis and answer analysis questions
- Meiosis Plates: students draw and label each organelle present in the proper location in each phase on a different plate
- Meiosis Worksheet: Label phase and indicate organelles involved in meiosis
- Monster CHNOPS: students determine traits of a monster using base pairing, transcription and translation concepts.
- Oompa Loompa problems: Students practice creating and interpreting Punnett squares given various scenarios using characteristics oompa loompas may have.
- Pedigree Analysis Problems: Students analyze various pedigrees to determine inheritance pattern of several phenotypes.
- Pedigree Analysis: Students are given several scenarios of pedigrees for different traits. They are to determine dominance of the trait, which individuals are affected, and where trait originated in the family, etc.
- PowerPoint presentation of material
- Reindeer problems: Students practice creating and interpreting Punnett squares given various scenarios using reindeer characters.
- Research into a specific genetic disorder and the effects on the individual

- Review game
- RNA diagram: Students draw and label the processes of transcription and translation, then explain steps of each process with a partner/group.
- SpongeBob problems: Students practice creating and interpreting Punnett squares given various scenarios using spongebob characters.
- Study a genetically inherited disease of your choice
- Think, pair, share (read assigned section of text individually, discuss with a partner, present material in pairs to class – use PowerPoint as a reference)
- Transcription & Translation – cut-out add-on: students use cut and past manipulatives from DNA activity to demonstrate transcription and translation processes.

Assessment Procedure

- Classroom Total Participation Technique
- Classwork
- DBQ
- Essay
- Exit Ticket/Entrance Ticket/Do Now
- Journal / Student Reflection
- Kahoot
- Other named in lesson
- Peer Review
- Performance
- Problem Correction
- Project
- Quiz
- Rubric
- Teacher Collected Data
- Test
- Worksheet

Recommended Technology Activities

- Appropriate Content Specific Online Resource
- Appropriate Content Specific Online Resource
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Gimkit
- GoGuardian

- Google Classroom
- Google Docs
- Google Slides
- Google Slides
- Kahoot
- MagicSchool AI
- Other- Specified in Lesson
- Quiziz
- Screencastify

Accommodations & Modifications & Differentiation

Accommodations and Modifications should be used to meet individual needs. Their IEP and 504 plans should be used in addition to the following suggestions.

Gifted and Talented

- Compare & Contrast
- Conferencing
- Debates
- Jigsaw
- Peer Partner Learning
- Problem Solving
- Structured Controversy
- Think, Pair, Share
- Tutorial Groups

Instruction/Materials

- alter format of materials (type/highlight, etc.)
- color code materials
- eliminate answers
- extended time
- extended time
- large print
- modified quiz
- modified test
- Modify Assignments as Needed

- Modify/Repeat/Model directions
- necessary assignments only
- Other (specify in plans)
- other- named in lesson
- provide assistance and cues for transitions
- provide daily assignment list
- read class materials orally
- reduce work load
- shorten assignments
- study guide/outline
- utilize multi-sensory modes to reinforce instruction

Environment

- alter physical room environment
- assign peer tutors/work buddies/note takers
- assign preferential seating
- individualized instruction/small group
- modify student schedule (Describe)
- other- please specify in plans
- provide desktop list/formula

Honors Modifications

Resources

- Resource 1
- Resource 2
- Resource 3
- Resource 4
- Resource 5