Honors Science 8 Unit 2: Genetics and Traits 2019

Content Area: **Science**
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Enduring Understandings:

- DNA is the molecule that determines an organism's traits.
- Organisms reproduce, develop, have predictable life cycles, and pass on heritable traits to their offspring.
- The work of Gregor Mendel describes the basis by which traits, coded for by genetic information, are passed from one generation to the next.
- Variation is DNA result in different phenotypes that can be predicted with simple probability problems.

Essential Questions:

- How can probability be used to predict genetic traits?
- How does the structure of DNA determine our characteristics?
- How has our understanding of genetics changed society?
- Why is the study of heredity important for understanding human health?

Lesson Titles:

- Applesauce Lab
- Bio Technology Web-quest
- Biotechnology Field Trip
- Biotechnology Guest Speaker
- Blood Typing
- Co-Dominance and Incomplete Dominance
- Code Busters Lab
- Corn Crop Gentetics
- Cotton Candy Grapes Informational Test
- Dihybrid Practice
- DNA Forensic Lab
- DNA Necklace Lab
- DNA Protein Synthesis
- Dragon Genetics
- Escape the room
- Genetics Disorders

- Genetics Mutations Intro
- GMO Essay
- Intro to Genetics Quiz
- Introduction to biotechnology
- Introduction to Genetics
- Introductions to Dihybrids
- Practice Problems
- Practice Punnett Square Problems/Vocabulary Development
- SuperHero Genetics
- Test on Genetics
- Toothpick Genetics Lab
- Using Punnett Squares to predict offspring

Career Readiness, Life Literacies & Key Skills

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Inter-Disciplinary Connections:

LA.RST.6-8	Reading Science and Technical Subjects
LA.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
LA.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
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.6-8.5	Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
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).
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
LA.WHST.6-8	Writing History, Science and Technical Subjects
LA.WHST.6-8.1	Write arguments focused on discipline-specific content.
LA.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK:

- 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.

- 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 parents(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.

- This unit deals with how organisms reproduce, develop, and have predictable life cycles. Cells contain DNA which is made up of genes, which is the directions for how to do and make everything in the cell.When we know about parent organisms we can figure out the probability of different traits in the offspring.The unique combination of genetic material from each parent in sexually reproducing organisms results in the potential for variation.This unit will also introduce punnett squares, genetic disorders and sex linked traits.

- tutoring during Academic Enrichment

- 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.

Modifications

Formative Assessment:

- Anticipatory Set
- Closure
- Daily check-ins with students
- Entry and Exit Tickets
- Jigsaw
- Kahoots
- Kahoots
- Quizlet
- Quizlet
- Think-Pair-Share
- Thumbs up / Thumbs Down
- Warm-Up

Alternative Assessments

Performance tasks

Project-based assignments

Problem-based assignments

Presentations

Reflective pieces

Concept maps

Case-based scenarios

Benchmark Assessments

Skills-based assessment

Reading response

Writing prompt

Lab practical

Summative Assessment:

- Alternate Assessment
- Benchmark
- Final Genetics Assessment
- Human inheritance lab
- Intro to key vocabulary quiz
- Marking Period Assessment
- Punnet Square Quiz

Resources & Materials:

- How do Siamese Cats Get Their Color?
- In this activity students analyze a family's pedigrees to make a claim based on evidence about mode of inheritance of a lactose intolerance trait, determine the most likely inheritance pattern of a trait, and analyze variations in DNA to make a claim about which variants are associated with specific traits. This activity serves as a supplement to the film Got Lactose? The Co-evolution of Genes and Culture (http://www.hhmi.org/biointeractive/making-fittest-got-lactase-co-evolution-genes-and-culture). The film shows a scientist as he tracks down the genetic changes associated with the ability to digest lactose as adults. A detailed teacher's guide that includes curriculum connections, teaching tips, time requirements, answer key and a student guide can be downloaded at http://www.hhmi.org/biointeractive/pedigrees-and-inheritance-lactose-intolerance. Six supporting resource and two "click and learn" activities are also found on the link.
- Meiosis: How Does the Process of Meiosis Reduce the Number of Chromosomes in Reproductive Cells?
- MISCONCEPTIONS
- misconceptions: Some students believe that traits are inherited from only one of the parents (for example, the traits are inherited from the mother, because she gives birth or has most contact as children grow up; or the same-sex parent will be the determiner). Other students believe that certain characteristics are always inherited from the mother and others come from the father. Some students believe in a "blending of characteristics." It may not be until the end of 5th grade that some students can use arguments based on chance to predict the outcome of inherited characteristics of offspring from observing those characteristics in the parents.
- misconceptions: Upper middle-school and high-school students have some understanding that characteristics are determined by a particular genetic entity which carries information translatable by the cell. Students of all ages believe that some environmentally produced characteristics can be inherited, especially over several generations. By the end of 5th grade, students know that babies result from the

fusion of sperm and eggs. However, they often don't understand how the fusion brings new life. Before students have an early understanding of genetics, they may believe that the baby exists in the sperm but requires the egg for food and protection, or that the baby exists in the egg and requires the sperm as trigger to growth

- Pedigrees and the Inheritance of Lactose Intolerance:

- This lab activity introduces students to the process of meiosis at the chromosomal level. The guiding question for the investigation is: How does the process of meiosis reduce the number of chromosomes in reproductive cells? Students develop an explanatory model based on their knowledge of mitosis and how cells divide. Students are provided with pictures showing various stages of meiosis. Students sequence the pictures and provide a description of what they think may be going on during each stage. The book provides a link (www.nsta.org/publications/press/extras/argument.aspx) to download images of meiosis (sequencing activity). Students use pop bead chromosomes (provided by the teacher) to create a valid model that explains : what happens to the chromosomes inside a cell as it goes through meiosis, why reproductive cells have half the number of chromosomes of the individuals who produce them, and why there are no pairs of chromosomes in reproductive cells. When students have finished the model, and . after they have collected and analyzed the data, they develop an initial argument. They prepare a whiteboard presentation that includes the guiding question, claim, evidence, and justification of evidence and present it to the whole-class using a round-robin format. After collecting feedback, students return to their original small groups for editing and revising before writing a final report. Each lab ends with a list of checkout questions. The book includes an option to extend the lesson by asking students to complete a double-blind peer review of the argument using a rubric provided in the appendix. To provide additional support, four appendixes are included: standards alignment matrixes, options for implementing argument-driven inquiry lab investigations, investigation proposal options, and peer-review guide and instructor scoring rubric. A detailed step-by-step guide that explains the argument-driven inquiry is included for teachers not familiar with the model.

- This resource is an article from the January 2016 issue of The Science Teacher. The unit focuses on an essential question: How do Siamese cats develop their coloration? Students develop explanations by making connections among genes, proteins, and traits. The unit is designed to be implemented over six or seven instructional days. However, each activity can be used as a stand-alone instructional strategy. During the instructional cycle, students develop an initial model to explain how Siamese cats get their coat coloration, learn about enzyme structure and function, use a computer model to see how proteins interact, experiment with Jell-O to see enzymes in action, learn about molecular motor proteins to see how structure relates to function, revise their model of coat coloration, and experiment with precursors of melanin to see how proteins can lead to observable traits. The unit is designed to help teachers extend the central dogma concept beyond the idea that proteins are the final products in the process. The unit provides opportunities for students to develop a conceptual understanding that proteins are important in cellular functions as well as trait-producing mechanisms. The article includes a teacher guide which describes how each activity is aligned to the Next Generation Science Standards. Unit handouts for students and the teacher guide are found on the NSTA website at www.nsta.org/highschool/connections.aspx.

- Tips for Including the Performance Expectation Teacher’s notes include a brief summary of the content needed for this activity. Teachers should not provide a lesson on meiosis prior to this lab. If students are encouraged to focus on the “Introduction,” “Your Task,” and the “Getting Started,” sections of the student pages, they develop a better conceptual understanding of the goal of meiosis rather than memorizing stages. Prior knowledge of mitosis supports students in developing their model of meiosis. During the explicit and reflective discussion, teacher needs to support students in making connections among DNA replication, chromosome structure and function, and how meiosis prevents chromosome overload. Pop bead kits for making chromosomes can be purchased from Carolina Biological (http://www.carolina.com/), Flinn Scientific (http://www.flinnsci.com/), or Ward’s Science (https://www.wardsci.com/). Each group will need at least eight pop bead chromosomes (two long chromosomes using red beads, two long chromosomes using yellow beads, two short chromosomes using blue beads, and two short chromosomes using pink beads). This combination allows students to combine the chromosomes that are the same length and color to make four sister chromatids. If students are unfamiliar with the argumentation strategy and scientific writing, teachers can use scaffolding to model and provide examples at each step of the lesson. It will be helpful to remind students to return each pop bead chromosome to its original form before leaving the classroom.

http://ngss.nsta.org/Resource.aspx?ResourceID=188

- Tips for Including the Performance Expectation The Siamese Cats unit is designed to be taught before the central dogma, replication, transcription, and translation and after instruction on protein structure and functions and cell structure, functions, and specialization. The unit is centered on one essential question and students complete a series of differentiated activities to develop a solution. An NSTA publication Hard -to-Teach Biology Concepts (https://www.nsta.org/store/product_detail.aspx?id=10.2505/978193 8946486) can provide additional instructional strategies to teachers in developing lessons on this content. http://ngss.nsta.org/Resource.aspx?ResourceID=242

- Tips for Including the Performance Expectation This resource can be used as supplemental activities after teaching a genetics unit. Students will need prior knowledge on the central dogma (flow of genetic information among gene, proteins, and traits), complementary base-pairing rules, basic genetic terminology, inheritance patterns, and mutations. The student resource includes a good explanation of pedigree symbols but teachers need to provide additional instruction on pedigree analysis. The teacher's guide suggests showing the film "Got Lactase? The Co-evolution of Genes and Culture "before teaching the lesson. Prior to showing the film, teachers can engage students by asking if they know someone who is lactose intolerant and asking them to make a claim about the mode of inheritance of the lactose intolerant trait. Teachers can use the accompanying film guide (http://www.hhmi.org/biointeractive/filmguides-got-lactase-co-evolution-genes-and-culture) that requires students to focus more on the content of film. After the film, teachers can lead students in a whole-class discussion on their claims about the mode of inheritance. To collect additional evidence to support their claims, students will analyze three family pedigrees and complete the questions on the student handout. At this point, teachers can lead another whole-class discussion about new data and evidence to support their claims. Part 2 of the student pages, asks students to analyze variations in DNA sequences and make a claim about which mutations are associated with specific traits. After completing Parts 1 and 2, teachers can assign students to groups to create a whiteboard argument presentation. Teachers can use the whiteboard presentation to evaluate students' understanding of the content. If additional teaching is required, teachers can use one of the . supporting materials or the "click-and-learn" resources. http://ngss.nsta.org/Resource.aspx?ResourceID=242