06_Genetic Inheritance

Content Area: **Science**
Course(s):
Time Period: **Full Year**
Length: **1-2 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

Biology focuses on the diversity, complexity, and interdependence of life on Earth. Students will develop an understanding of how organisms evolve, reproduce, and adapt to their environments. This will include an exploration of how to relate the structure and function of molecules to their role in cell biology and metabolism. Further understanding of evolution and reproduction will be explored through the science of genetics. Knowledge of biodiversity and adaptation will be illustrated through the science of ecology.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

- In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited.
- Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors.
- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Technological advances have influenced the progress of science and science has influenced advances in technology.
- Science and engineering are influenced by society and society is influenced by science and engineering.

CONTENT AREA STANDARDS

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-LS3-3	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
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.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

LA.W.9-10.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
LA.W.9-10.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach, or consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience.
LA.W.9-10.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
LA.W.9-10.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals).
LA.W.9-10.9	Draw evidence from literary or nonfiction informational texts to support analysis, reflection, and research.
LA.RI.9-10.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.) and make relevant connections, to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
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-12.4	Model with mathematics.
SCI.HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand that:

- Genetic mutations produce genetic variations between cells or organisms.
- Genetic variations produced by mutation and meiosis can be inherited.
- New combinations of DNA can arise from several sources, including meiosis, errors during replication,

and mutations caused by environmental factors.
- Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population.

Procedural Knowledge

Students will be able to:

- Students make a claim that includes the idea that inheritable genetic variations may result from:
    - New genetic combinations through meiosis.
    - Viable errors occurring during replication.
    - Mutations caused by environmental factors.
- Students identify and describe evidence that supports the claim, including:
    - Variations in genetic material naturally result during meiosis when corresponding sections of chromosome pairs exchange places.
    - Genetic mutations can occur due to:
        - a) errors during replication.
        - b) environmental factors.
    - Genetic material is inheritable.
- Students use scientific knowledge, literature, student-generated data, simulations and/or other sources for evidence.
- Students identify the following strengths and weaknesses of the evidence used to support the claim:
    - Types and numbers of sources.
    - Sufficiency to make and defend the claim, and to distinguish between causal and correlational relationships.
    - Validity and reliability of the evidence.
- Students use reasoning to describe links between the evidence and claim, such as:
    - Genetic mutations produce genetic variations between cells or organisms.
    - Genetic variations produced by mutation and meiosis can be inherited.
- Students use reasoning and valid evidence to describe that new combinations of DNA can arise from several sources, including meiosis, errors during replication, and mutations caused by environmental factors.
- Students defend a claim against counter-claims and critique by evaluating counter-claims and by describing the connections between the relevant and appropriate evidence and the strongest claim.
- Students organize the given data by the frequency, distribution, and variation of expressed traits in the population.
- Identifying relationships a Students perform and use appropriate statistical analyses of data, including probability measures, to determine the relationship between a trait's occurrence within a population and environmental factors.
- Interpreting data a Students analyze and interpret data to explain the distribution of expressed traits, including:
    - Recognition and use of patterns in the statistical analysis to predict changes in trait distribution within a population if environmental variables change.
    - Description of the expression of a chosen trait and its variations as causative or correlational to some environmental factor based on reliable evidence.

EVIDENCE OF LEARNING

Formative Assessments

- Checks for understanding during lesson.
- Use of student-friendly proficiency scales to track progress.
- Do Now activities.
- Student-centered questioning and discussion that is facilitated by instructor.
- Exit Tickets.

Summative Assessments

- Benchmarks – departmental benchmark given at the end of MP1, MP2, and MP3 based on lab practices
- Alternative Assessments
    - Lab inquiries and investigations
    - Lab Practicals
    - Exploratory activities based on phenomenon
    - Gallery walks of student work
    - Creative Extension Projects
    - Build a model of a proposed solution
    - Let students design their own flashcards to test each other
    - Keynote presentations made by students on a topic
    - Portfolio

RESOURCES (Instructional, Supplemental, Intervention Materials)

Miller & Levine Biology Textbook

- Unit 4 - Genetics
    - Chapter 12 - Introduction to Genetics
        - Case Study: *Genetic Disorders: understanding the odds.*

        - Interactivity: *Segregation.*
        - Interactivity: *Punnett Squares.*
        - Analyzing Data: *Human Blood Types.*
        - Modeling Lab: *A Model of Meiosis.*
    - Chapter 14 - Mutations
        - Interactivity: *Types of Mutations.*
        - Virtual Lab: *Identifying Mutations.*
    - Chapter 15 - The Human Genome
        - Animation: *Sickle Cell Disease.*
        - Develop a Solution Lab: *Gel Electrophoresis.*

POGIL Biology

- Meiosis

Gizmos

- Mouse Genetics (One Trait)
- Fast Plants 1 - Growth and Genetics
- Chicken Genetics

NSTA

Data Nuggets

Online Resources

INTERDISCIPLINARY CONNECTIONS

ELA/Literacy

POGIL Biology

- Meiosis

Gizmos

- Mouse Genetics (One Trait)
- Fast Plants 1 - Growth and Genetics
- Chicken Genetics

Mathematics:

POGIL Biology

- Meiosis

Gizmos

- Mouse Genetics (One Trait)

- Fast Plants 1 - Growth and Genetics
- Chicken Genetics

Technology:

Gizmos

- Mouse Genetics (One Trait)
- Fast Plants 1 - Growth and Genetics
- Chicken Genetics

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.