

Biology: Inheritance and Variation of Traits

Stage 1 Desired Results

ESTABLISHED GOALS:	Transfer	
<u>Competencies:</u> ● Patterns: Students will demonstrate the ability to observe and describe patterns in natural and human designed phenomena and use those patterns to support claims about the observed or predicted relationships among phenomena. ● Cause & Effect: Students will demonstrate the ability to investigate, explain, and evaluate potential causal relationships by using evidence to support claims and predictions about the mechanisms that drive those relationships. ● Structure & Function: Students will demonstrate the ability to use evidence to support claims about the relationship among structure and function of natural and human designed objects. ● Nature of Science: Student will demonstrate the ability to work collaboratively and individually to generate testable questions or define problems, plan and conduct investigations using a variety of research methods in a various settings, analyze and interpret data, reason with evidence to construct explanations in light of existing theory and previous research, and effectively communicate the research processes and conclusions. ● <i>Students will demonstrate the ability to analyze and summarize text and integrate knowledge to make meaning of discipline-specific materials.</i> ● <i>Students will demonstrate the ability to produce coherent and supported writing in order to communicate effectively for a range of discipline-specific tasks, purposes, and audiences.</i> ● <i>Students will demonstrate the ability to speak purposefully and effectively by strategically making decisions about content, language use, and discourse style.</i> <u>Content Standards:</u> • HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. • 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. • 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.	<i>Students will be able to independently use their learning to make connections between genetics and heritable traits.</i>	
	Meaning	
	ENDURING UNDERSTANDINGS <i>Students will understand that...</i> • empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. • models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. • 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.	ESSENTIAL QUESTIONS • <i>Is your DNA your Destiny?</i> • <i>What are the limits and abilities of DNA?</i>

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

Acquisition

Students will know...

- that all cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins.
- that in multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.
- that each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.
- that 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 mutations are inherited.
- that environmental factors also affect expression of traits, and hence affect the probability of

Students will be skilled at...

- using models.
- asking questions.
- making and defending claims.
- applying concepts of statistics and probability.

	occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. <u>vocabulary:</u> genetics, gene, alleles, dominant, recessive, genotype, phenotype, homozygous, heterozygous, purebred, hybrid, sex linked, incomplete, codominance, recombinant DNA, pedigree, karyotype, Punnett squares, chromosomes, gametes, genetic engineering, cloning, transgenic, inbreeding, selective breeding, genome, nondisjunction, trait, DNA, RNA (mRNA, tRNA, rRNA), amino acid, nucleotide, ribose, replication, translation, transcription, ribosome, mutation, hydrogen bond, nitrogen base (Adenine, Thymine, Cytosine, Guanine, Uracil), cancer, mutations, biotechnology, pedigree, spindle fibers, mitosis, meiosis, haploid, diploid, enzymes, GMOs, DNA, protein synthesis,	
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Content Area Literacy Standards	21st Century Skills
• RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. • RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. • RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. • RST.9-10.4 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 <i>grades 9-10 texts and topics</i>. • RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., <i>force, friction, reaction force, energy</i>). • RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. • RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. • RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. • WHST.9-10.1 Write arguments focused on discipline-specific content. • WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or	• <i>solve problems</i> • <i>use and manage information</i> • <i>apply technology effectively</i> • <i>be self-directed learners</i>

technical processes. • WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. • WHST.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. • WHST.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.	
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Stage 2 - Evidence	
<i>Evaluative Criteria</i>	<i>Assessment Evidence</i>
	PERFORMANCE TASK(S):
	OTHER EVIDENCE:

Stage 3 – Learning Plan	
Summary of Key Learning Events and Instruction	
<i>Science and Engineering Practices</i>	<i>Mathematics Integration</i>
S&EP 1. Asking questions and defining problems S&EP 2. Developing and using models S&EP 5. Using mathematics and computational thinking S&EP 7. Engaging in argument from evidence S&EP 8. Obtaining, evaluating, and communicating information	• HSF-BF.A.1 - Write a function that describes a relationship between two quantities. • HSF-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 • MP.2 - Reason abstractly and quantitatively • MP.4 - Model with mathematics
<i>Technology Integration</i>	<i>District Materials</i>