

## Genetics Learning Standards

Genetics is designed to provide an in depth study of the field of genetics, with special emphasis on human genetics. Students will explore the molecular and environmental basis for genetics, and how these studies are used to understand heredity. Students will encounter and research Mendelian and Non-Mendelian Genetics, Molecular and Cellular Genetics, Population Genetics and Human Genetics. Students will perform a classical genetics study and molecular genetics lab activities to extract, perform PCR amplification, Gel Electrophoresis, DNA sequencing and online analysis of the students own and other sources of DNA. This course is designed for students with an interest in pursuing a degree in a related field in Biology, Molecular Biology, Biochemistry or Medicine in college. Prerequisite: General Biology H or permission. Chemistry or Chemistry Honors is highly recommended.

LS1 - From Molecules to Organisms: Structure and Processes	
A. Structure and Function	
9-12.SPS.LS1.A.1	Explain replication and structure of DNA at the molecular level.
9-12.SPS.LS1.A.2	Explain molecular cause and effect of chromosomal and genetic mutations.
9-12.SPS.LS1.A.3	Conduct experimentation on DNA/mt DNA by performing; extraction, amplification, gel analysis, interpretation of genotype and phenotype, and DNA sequencing analysis.
9-12.SPS.LS1.A.4	Use online tools to interpret DNA/RNA/ mtDNA sequences.
B. Growth and Development of Organisms	
9-12.SPS.LS1.B.1	Recognize the impact of recent advancements in molecular genetics, genomics, and bioinformatics.
9-12.SPS.LS1.B.2	Demonstrate the ability to predict and analyze multifactorial genetics.
9-12.SPS.LS1.B.3	Become familiar with techniques and uses of bioinformatics.
LS3 - Heredity: Inheritance and Variation of Traits	
A. Inheritance of Traits	
9-12.SPS.LS3.A.1	Apply Mendelian principles of genetics.
9-12.SPS.LS3.A.2	Predict the results of single and multi factor crosses through the use of probability.
9-12.SPS.LS3.A.3	Construct and analyze Pedigrees
9-12.SPS.LS3.A.4	Demonstrate use of rules of probability to predict and calculate outcomes of crosses.
9-12.SPS.LS3.A.5	Perform and interpret Chi-Square analysis of experimental data.
9-12.SPS.LS3.A.6	Demonstrate use of Y branching technique to predict outcomes of multifactorial crosses.
9-12.SPS.LS3.A.7	Calculate allele frequencies from genotypic frequencies and phenotypic data
9-12.SPS.LS3.A.8	Determine Hardy-Weinberg compatibility of allele frequencies.
B. Variation of Traits	
9-12.SPS.LS3.B.1	Recognize and solve problems involving multiple alleles, incomplete dominance, codominance, polygenic inheritance, epistatic genes, pleiotropic genes, lethal genes.
9-12.SPS.LS3.B.2	Investigate and discuss developments in understanding causes of inheritance.
9-12.SPS.LS3.B.3	Solve problems for sex linked and sex influenced inheritance.

9-12.SPS.LS3.B.4	Understand the role of chromosomes, environment and genes in sex determination of a wide variety of animals, including errors of chromosomes and genes in humans.
9-12.SPS.LS3.B.5	Use results of online analysis to develop understanding of mutation, variation, population genetics, and medical diagnostics.
<b>LS4 - Biological Evolution; Unity and Diversity</b>	
A. Evidence of common Ancestry and Diversity	
9-12.SPS.LS4.A.1	Discuss epigenetic effects on understanding of genetics and evolution.
B. Adaptation	
9-12.SPS.LS4.B.1	Discuss fitness, selection, and heritability.
<b>ETS1-Engineering Design</b>	
A. Defining and Delimiting Engineering Problems	
9-12.ETS1.A.1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
9-12.ETS1.A.2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
B. Developing Possible Solutions	
9-12.ETS1.B.1	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
9-12.ETS1.B.2	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
<b>SI - Processes of scientific inquiry</b>	
9-12.SPS.SI.1	Formulate a testable question and explanation.
9-12.SPS.SI.2	Select appropriate investigative methods in order to obtain evidence relevant to the explanation.
9-12.SPS.SI.3	Gather evidence from qualitative and quantitative observations.
9-12.SPS.SI.4	Evaluate explanations (laws/principles, theories/models) in light of evidence (data) and scientific principles (understandings).
9-12.SPS.SI.5	Communicate results and justify explanations.