GENETICS CURRICULUM

Course 18100

Students in Genetics will learn the principles of genetics with the study of biological function at the level of molecules, cells, and multicellular organisms, including humans. The topics include: structure and function of genes, how traits are passed from parents to offspring, biological variation and inherited disease. This course will also cover mutations and how they could affect the overall evolution of a species. The prerequisites for this course are proficiency on the Biology Keystone Exam or completion of the Keystone Biology course.

GENETICS OUTLINE:

Goals	Skills	Summative Assessments	Time Frame	Main Resources
• Understand the principles that govern inheritance of genes on sex chromosomes. • Discuss how the Rh factor is inherited along with the Human ABO markers. • Understand the terms: DNA molecule, nucleotide, base pairs, genes and chromosomes. • Recognize the relationship between base pairs, DNA molecules, genes, and chromosomes. • Discuss possible treatment techniques for genetic disorders. • Discuss the ethics behind genetic mapping.	• Research genetic traits passed down through a family over time. • Calculate the probability for a specific DNA profile. • Create proper APA citations when completing assignment.	End of Lesson Exams	1/2-year	

GEMETOCS MAP:

TIME FRAME	BIG IDEAS	CONCEPTS	ESSENTIAL QUESTIONS	STANDARDS	OBJECTIVES	DIFFERENTIATION	ASSESSMENT
Lesson 1: Intro to Genetics (Weeks 1-2)	• Genetics is the study of DNA and the transfer of information from one generation to the next.	1. What is genetics? 2. Monohybrid crosses 3. Dihybrid crosses 4. Sex-linked inheritance.	• Who is Mendel and what part did he play in genetics? • What are the differences between monohybrid and dihybrid crosses? • How are genes inherited on sex chromosomes?	3.1.10.B3 Describe the basic structure of DNA and its function in genetic inheritance. Describe the role of DNA in protein synthesis as it relates to gene expression. 3.1.10.B5 PATTERNS Use models to demonstrate patterns in bio-macromolecules. Compare and contrast Mendelian and non-Mendelian patterns of inheritance. 3.1.12.B1 Explain gene inheritance and expression at the molecular level. 3.1.B.B5 PATTERNS Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance. Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, codominant, sex-linked, polygenic, incomplete dominance, multiple alleles) CONSTANCY AND CHANGE Explain how the processes of replication, transcription, and translation are similar in all organisms. Explain how gene actions, patterns of heredity, and reproduction of cells and organisms account for the continuity of life. SCALE Demonstrate how inherited characteristics can be observed at the molecular, cellular, and organism levels. BIO.B.1.1.1	• Define genetics in terms of genes and DNA within humans and other organisms. • Identify differences between monohybrid and dihybrid crosses. • Understand the principles that govern inheritance of genes on sex chromosomes.	Students will be given the following: Preferential seating when applicable. Study guides. Guided notes when applicable, Extended time for assignments when needed. Separate testing environment when applicable.	Daily assignments End of Lesson exams Labs and Classroom activities

				Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis. BIO.B.1.1.2 Compare and contrast the processes and outcomes of mitotic and meiotic nuclear divisions. BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information. BIO.B.1.2.2 Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance. BIO.B.2.1 Compare and contrast Mendelian and non-Mendelian patterns of inheritance. BIO.B.2.1.1 Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles). BIO.B.2.2.1 Describe how the processes of transcription and translation are similar in all organisms. BIO.B.2.2.2 Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins. BIO.B.2.4 Apply scientific thinking, processes, tools, and technologies in the study of genetics. S11.A.1.2.1 Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy).			

				S11.A.1.2.2 Use case studies (e.g., Wright brothers' flying machine, Tacoma Narrows Bridge, Henry Petroski's Design Paradigms) to propose possible solutions and analyze economic and environmental implications of solutions for realworld problems. S11.A.2.2.1 Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality) S11.A.2.2.2 Explain how technology (e.g., GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision. S11.A.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior. S11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes. S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g., dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps). S11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order. S11.A.3.3.2 Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties.			

				S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves). S11.B.2.1.1 Explain the theory of evolution by interpreting data from fossil records, similarities in anatomy and physiology, or DNA studies that are relevant to the theory of evolution. S11.B.2.1.2 Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population. S11.B.2.1.3 Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population. S11.B.2.1.4 Explain why natural selection can act only on inherited traits. S11.B.2.2.1 Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication). S11.B.2.2.2 Compare and contrast mitosis and meiosis in passing on genetic information. S11.B.2.2.3 Explain how different patterns of inheritance affect population variability (i.e., multiple alleles, codominance, dominance, recessiveness, sex-influenced traits, and sex-linked traits). S7.B.2.2.2 Recognize evidence that the gene is the basic unit of inheritance and explain the effect of dominant and recessive genes on inherited traits. S8.A.1.2.3			

				Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics). S8.B.2.2.2 Recognize that the gene is the basic unit of inheritance, that there are dominant and recessive genes, and that traits are inherited.			
Lesson 2: Mendel and His Pea Plants (Weeks 3-4)	• Gregor Mendel's work with pea plants was essential in our understanding of genetics.	1. Mendel's work in genetics 2. Artificial fertilization 3. Virtual pea plant lab 4. Dominant and recessive traits 5. Natural Selection and how it relates to Mendel's peas.	• How was Gregor Mendel important in the field of genetics? • What is artificial fertilization? • What results do students discover during the virtual pea plant experiment?	3.1.10.B5 PATTERNS Use models to demonstrate patterns in bio-macromolecules. Compare and contrast Mendelian and non-Mendelian patterns of inheritance. 3.1.12.B1 Explain gene inheritance and expression at the molecular level. 3.1.B.B5 PATTERNS Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance. Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, codominant, sex-linked, polygenic, incomplete dominance, multiple alleles) CONSTANCY AND CHANGE Explain how the processes of replication, transcription, and translation are similar in all organisms. Explain how gene actions, patterns of heredity, and reproduction of cells and organisms account for the continuity of life. SCALE Demonstrate how inherited characteristics can be observed at the molecular, cellular, and organism levels. BIO.B.1.2.2 Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance.	• Describe Mendel's experiments with his pea plants. • Create and carry out their own virtual pea plant experiment. • Define artificial fertilization and how it was important in Mendel's pea experiments.	Students will be given the following: Preferential seating when applicable. Study guides. Guided notes when applicable, Extended time for assignments when needed. Separate testing environment when applicable.	Daily assignments End of Lesson exams Labs and Classroom activities

				BIO.B.2.1 Compare and contrast Mendelian and non-Mendelian patterns of inheritance. BIO.B.2.1.1 Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles). BIO.B.2.4 Apply scientific thinking, processes, tools, and technologies in the study of genetics. S11.A.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior. S11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes. S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves). S11.B.2.1.3 Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population. S11.B.2.1.4 Explain why natural selection can act only on inherited traits. S11.B.2.2.1 Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication). S11.B.2.2.3 Explain how different patterns of inheritance affect population variability (i.e., multiple alleles, codominance, dominance, recessiveness, sex-influenced traits, and sex-linked traits).			

				S7.B.2.2.2 Recognize evidence that the gene is the basic unit of inheritance and explain the effect of dominant and recessive genes on inherited traits. S8.A.1.2.3 Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics). S8.B.2.2.2 Recognize that the gene is the basic unit of inheritance, that there are dominant and recessive genes, and that traits are inherited.			
Lesson 3: Blood Types (Week 5)	• Blood typing is important in donating blood, receiving a blood transfusion, and determining if an Rh factor exists on the red blood cells. • Blood types are passed down from parental ABO markers.	1. Human ABO markers 2. Punnett squares 3. Rh factor 4. Inheritance	• What are the four human blood types? • How are blood types inherited? • How is the Rh factor inherited?	3.1.10.B3 Describe the basic structure of DNA and its function in genetic inheritance. Describe the role of DNA in protein synthesis as it relates to gene expression. 3.1.10.B5 PATTERNS Use models to demonstrate patterns in bio-macromolecules. Compare and contrast Mendelian and non-Mendelian patterns of inheritance. 3.1.12.B1 Explain gene inheritance and expression at the molecular level. BIO.B.1.2.2 Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance. BIO.B.2.1.1 Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles). S11.A.1.2.1 Explain and apply scientific concepts to societal issues using case studies (e.g.,	• Identify the Human ABO markers associated with blood types. • Create Punnett squares to predict blood types of offspring when given parental blood types. • Discuss how the Rh factor is inherited along with the Human ABO markers.	Students will be given the following: Preferential seating when applicable. Study guides. Guided notes when applicable, Extended time for assignments when needed. Separate testing environment when applicable.	Daily assignments End of Lesson exams Labs and Classroom activities

				spread of HIV, deforestation, environmental health, energy). S11.A.2.2.2 Explain how technology (e.g., GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision. S11.A.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior. S11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes. S11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order. S11.B.2.1.2 Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population. S11.B.2.1.3 Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population. S11.B.2.1.4 Explain why natural selection can act only on inherited traits. S11.B.2.2.1 Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication). S11.B.2.2.3 Explain how different patterns of inheritance affect population variability (i.e., multiple alleles, codominance, dominance, recessiveness, sex-influenced traits, and sex-linked traits).			

Lesson 4: DNA Overview (Weeks 6-8)	• DNA is the material located in the nucleus of a cell that codes for all of the information the body will need to develop.	1. Discovery of DNA 2. Nucleotides (Building blocks of DNA) 3. DNA replication 4. DNA structure.	• What are nucleotides? • What is the basic structure of DNA? • How does DNA replicate?	3.1.10.B3 Describe the basic structure of DNA and its function in genetic inheritance. Describe the role of DNA in protein synthesis as it relates to gene expression. 3.1.B.B1 Explain that the information passed from parents to offspring is transmitted by means of genes which are coded in DNA molecules. Explain the basic process of DNA replication. Describe the basic processes of transcription and translation. Explain how crossing over, jumping genes, and deletion and duplication of genes results in genetic variation. Explain how mutations can alter genetic information and the possible consequences on resultant cells. 3.1.B.B3 Describe the basic structure of DNA, including the role of hydrogen bonding. Explain how the process of DNA replication results in the transmission and conservation of the genetic code. Describe how transcription and translation result in gene expression. Differentiate among the end products of replication, transcription, and translation. Cite evidence to support that the genetic code is universal. 3.1.C.B3 Describe the structure of the DNA and RNA molecules. BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission	• Identify the building blocks that make up DNA. • Describe the basic structure of DNA. • Model the process of DNA replication. • Recognize the relationship between base pairs, DNA molecules, genes, and chromosomes. • Understand the terms: DNA molecule, nucleotide, base pairs, genes and chromosomes. • Build a model of a DNA molecule and identify the different parts and their functions. • Understand that genes provide the code for an organism's traits.	Students will be given the following: Preferential seating when applicable. Study guides. Guided notes when applicable, Extended time for assignments when needed. Separate testing environment when applicable.	Daily assignments End of Lesson exams Labs and Classroom activities

				and/or conservation of genetic information. BIO.B.1.2.2 Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance. BIO.B.2.1.2 Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion). BIO.B.2.2.1 Describe how the processes of transcription and translation are similar in all organisms. BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift). BIO.B.3.1.3 Explain how genetic mutations may result in genotypic and phenotypic variations within a population. S11.A.2.2.2 Explain how technology (e.g., GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision. S11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes. S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g., dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps). S11.B.2.1.2			

				Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population. S11.B.2.1.4 Explain why natural selection can act only on inherited traits. S11.B.2.2.1 Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication). S11.B.2.2.2 Compare and contrast mitosis and meiosis in passing on genetic information. S11.B.2.2.3 Explain how different patterns of inheritance affect population variability (i.e., multiple alleles, codominance, dominance, recessiveness, sex-influenced traits, and sex-linked traits).			
Lesson 5: Human Genetics (Weeks 9-10)	• Human genetics is the study of inheritance as it occurs in human beings, and we can see this inheritance through pedigrees and DNA profiles.	1. Pedigrees 2. Human traits 3. DNA profiles.	• What is a pedigree and how is it read? • What is a DNA profile and how is it created? • What are some common traits easily found to be passed down from parent to offspring?	3.1.10.B3 Describe the basic structure of DNA and its function in genetic inheritance. Describe the role of DNA in protein synthesis as it relates to gene expression. 3.1.10.C3 CONSTANCY AND CHANGE Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of evolution. 3.1.B.B1 Explain that the information passed from parents to offspring is transmitted by means of genes which are coded in DNA molecules. Explain the basic process of DNA replication. Describe the basic processes of transcription and translation.	• Identify traits using a pedigree. • Create pedigrees and DNA profiles. • Research genetic traits passed down through a family over time. Example: colorblindness.	Students will be given the following: Preferential seating when applicable. Study guides. Guided notes when applicable, Extended time for assignments when needed. Separate testing environment when applicable.	Daily assignments End of Lesson exams Labs and Classroom activities

				Explain how crossing over, jumping genes, and deletion and duplication of genes results in genetic variation. Explain how mutations can alter genetic information and the possible consequences on resultant cells. 3.1.B.B3 Describe the basic structure of DNA, including the role of hydrogen bonding. Explain how the process of DNA replication results in the transmission and conservation of the genetic code. Describe how transcription and translation result in gene expression. Differentiate among the end products of replication, transcription, and translation. Cite evidence to support that the genetic code is universal. 3.1.B.C1 Describe species as reproductively distinct groups of organisms. Analyze the role that geographic isolation can play in speciation. Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity within a population. Describe how the degree of kinship between species can be inferred from the similarity in their DNA sequences. 3.1.B.C3 CONSTANCY AND CHANGE Compare and contrast various theories of evolution. Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of evolution. PATTERNS			

				Discuss the implications of a universal genetic code for evolution. 3.1.C.B3 Describe the structure of the DNA and RNA molecules. BIO.B.1.1.1 Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis. BIO.B.1.1.2 Compare and contrast the processes and outcomes of mitotic and meiotic nuclear divisions. BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information. BIO.B.1.2.2 Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance. BIO.B.2.1.2 Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion). BIO.B.2.2.1 Describe how the processes of transcription and translation are similar in all organisms. BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift). BIO.B.2.4 Apply scientific thinking, processes, tools, and technologies in the study of genetics. BIO.B.3.1.1 Explain how natural selection can impact allele frequencies of a population.			

				BIO.B.3.1.2 Describe the factors that can contribute to the development of new species (e.g., isolating mechanisms, genetic drift, founder effect, migration). BIO.B.3.1.3 Explain how genetic mutations may result in genotypic and phenotypic variations within a population. BIO.B.3.2.1 Interpret evidence supporting the theory of evolution (i.e., fossil, anatomical, physiological, embryological, biochemical, and universal genetic code). S11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws. S11.A.1.1.3 Evaluate the appropriateness of research questions (e.g., testable vs. not-testable). S11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g., momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws). S11.A.1.1.5 Analyze or compare the use of both direct and indirect observation as means to study the world and the universe (e.g., behavior of atoms, functions of cells, birth of stars). S11.A.1.2.1 Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy). S11.A.1.2.2			

				Use case studies (e.g., Wright brothers' flying machine, Tacoma Narrows Bridge, Henry Petroski's Design Paradigms) to propose possible solutions and analyze economic and environmental implications of solutions for realworld problems. S11.A.2.2.1 Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality) S11.A.2.2.2 Explain how technology (e.g., GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision. S11.A.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior. S 11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes. S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g., dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps). S11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order. S11.A.3.3.2 Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. S11.A.3.3.3			

				Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves). S11.B.2.1.1 Explain the theory of evolution by interpreting data from fossil records, similarities in anatomy and physiology, or DNA studies that are relevant to the theory of evolution. S11.B.2.1.2 Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population. S11.B.2.1.3 Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population. S11.B.2.1.4 Explain why natural selection can act only on inherited traits. S11.B.2.2.1 Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication). S11.B.2.2.2 Compare and contrast mitosis and meiosis in passing on genetic information. S11.B.2.2.3 Explain how different patterns of inheritance affect population variability (i.e., multiple alleles, codominance, dominance, recessiveness, sex-influenced traits, and sex-linked traits). S8.A.1.2.3 Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).			
Lesson 6: Blackett Family DNS	• Examples of inheritance	1. CODIS 2. STR 3. DNA profiles	• What is a Short Tandem	3.1.10.B3 Describe the basic structure of DNA and its function in genetic inheritance.	• Analyze how the STR data	Students will be given the following:	Daily assignments

(Week 11)	allow students to see first-hand how genetic profiles can assist with things like missing person cases by using things like CODIS, STR and calculating for a specific DNA profile.	4. DNA activities.	Repeat (STR) Polymorphism? • What are the 13 core CODIS loci? • How do you calculate the probability for a specific DNA profile?	Describe the role of DNA in protein synthesis as it relates to gene expression. 3.1.10.C3 CONSTANCY AND CHANGE Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of evolution. 3.1.B.B1 Explain that the information passed from parents to offspring is transmitted by means of genes which are coded in DNA molecules. Explain the basic process of DNA replication. Describe the basic processes of transcription and translation. Explain how crossing over, jumping genes, and deletion and duplication of genes results in genetic variation. Explain how mutations can alter genetic information and the possible consequences on resultant cells. 3.1.B.B3 Describe the basic structure of DNA, including the role of hydrogen bonding. Explain how the process of DNA replication results in the transmission and conservation of the genetic code. Describe how transcription and translation result in gene expression. Differentiate among the end products of replication, transcription, and translation. Cite evidence to support that the genetic code is universal. 3.1.B.C1 Describe species as reproductively distinct groups of organisms.	from close relatives can be used to create a genetic profile of a missing person. • Identify how much genetic diversity exists among siblings. • Calculate the probability for a specific DNA profile.	Preferential seating when applicable. Study guides. Guided notes when applicable, Extended time for assignments when needed. Separate testing environment when applicable.	End of Lesson exams Labs and Classroom activities

				Analyze the role that geographic isolation can play in speciation. Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity within a population. Describe how the degree of kinship between species can be inferred from the similarity in their DNA sequences. 3.1.B.C3 CONSTANCY AND CHANGE Compare and contrast various theories of evolution. Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of evolution. PATTERNS Discuss the implications of a universal genetic code for evolution. 3.1.C.B3 Describe the structure of the DNA and RNA molecules. BIO.B.1.1.1 Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis. BIO.B.1.1.2 Compare and contrast the processes and outcomes of mitotic and meiotic nuclear divisions. BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information. BIO.B.1.2.2 Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance. BIO.B.2.1.2			

				Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion). BIO.B.2.2.1 Describe how the processes of transcription and translation are similar in all organisms. BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift). BIO.B.2.4 Apply scientific thinking, processes, tools, and technologies in the study of genetics. BIO.B.3.1.1 Explain how natural selection can impact allele frequencies of a population. BIO.B.3.1.2 Describe the factors that can contribute to the development of new species (e.g., isolating mechanisms, genetic drift, founder effect, migration). BIO.B.3.1.3 Explain how genetic mutations may result in genotypic and phenotypic variations within a population. BIO.B.3.2.1 Interpret evidence supporting the theory of evolution (i.e., fossil, anatomical, physiological, embryological, biochemical, and universal genetic code). S11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws. S11.A.1.1.3 Evaluate the appropriateness of research questions (e.g., testable vs. not-testable). S11.A.1.1.4			

				Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g., momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws). S11.A.1.1.5 Analyze or compare the use of both direct and indirect observation as means to study the world and the universe (e.g., behavior of atoms, functions of cells, birth of stars). S11.A.1.2.1 Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy). S11.A.1.2.2 Use case studies (e.g., Wright brothers' flying machine, Tacoma Narrows Bridge, Henry Petroski's Design Paradigms) to propose possible solutions and analyze economic and environmental implications of solutions for realworld problems. S11.A.2.2.1 Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality) S11.A.2.2.2 Explain how technology (e.g., GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision. S11.A.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior. S 11.A.3.2.2			

				Describe advantages and disadvantages of using models to simulate processes and outcomes. S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g., dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps). S11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order. S11.A.3.3.2 Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves). S11.B.2.1.1 Explain the theory of evolution by interpreting data from fossil records, similarities in anatomy and physiology, or DNA studies that are relevant to the theory of evolution. S11.B.2.1.2 Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population. S11.B.2.1.3 Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population. S11.B.2.1.4 Explain why natural selection can act only on inherited traits.			

				S11.B.2.2.1 Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication). S11.B.2.2.2 Compare and contrast mitosis and meiosis in passing on genetic information. S11.B.2.2.3 Explain how different patterns of inheritance affect population variability (i.e., multiple alleles, codominance, dominance, recessiveness, sex-influenced traits, and sex-linked traits). S8.A.1.2.3 Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).			
Lesson 7: Citations and Research (Weeks 12-13)	• Students should understand proper writing and research techniques for science courses and utilized them in the classroom.	1. Proper Research Techniques 2. APA Citations 3. Proper Writing Style	• What are proper sources to use for research? • How should sources be cited when writing in science? • Are there differences in writing styles between content areas?	CC.1.4.9-10.W 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. CC.3.6.11-12.G Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.	• Demonstrate proper research techniques. • Examine all aspects of the APA style of writing for science. • Create proper APA citations when completing assignment.	Students will be given the following: Preferential seating when applicable. Study guides. Guided notes when applicable, Extended time for assignments when needed. Separate testing environment when applicable	Daily assignments End of Lesson exams Labs and Classroom activities
Lesson 8: Pedigrees (Weeks 14-15)	• Pedigrees are used to track the lineage of a family whether it be human or animal. They	1. Pedigree Structure 2. Reading a Pedigree 3. Creating a Pedigree	• How do you read a pedigree? • Who can create a pedigree and	3.1.10.B1 Describe how genetic information is inherited and expressed. 3.1.10.B3	• Define a pedigree and examine the features of a pedigree.	Students will be given the following: Preferential seating when applicable.	Daily assignments End of Lesson exams

	were important to the rich for inheritance purposes.		for what purpose? • Are pedigrees only for humans? • What key factors are included in a pedigree?	Describe the basic structure of DNA and its function in genetic inheritance. Describe the role of DNA in protein synthesis as it relates to gene expression. 3.1.12.B2 Evaluate the process of sexual reproduction in influencing genetic variability in a population. 3.1.12.B4 Evaluate the societal impact of genetic engineering techniques and applications. BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information. BIO.B.2.3 Explain how genetic information is expressed. BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift). S11.A.1.2.1 Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy). S11.A.1.2.2 Use case studies (e.g., Wright brothers' flying machine, Tacoma Narrows Bridge, Henry Petroski's Design Paradigms) to propose possible solutions and analyze economic and environmental implications of solutions for realworld problems. S11.A.2.2.1 Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality)	• Analyze a pedigree and answer questions in regards to the pedigree. • Create a pedigree of their own and share it with the class.	Study guides. Guided notes when applicable, Extended time for assignments when needed. Separate testing environment when applicable.	Labs and Classroom activities

				S11.A.2.2.2 Explain how technology (e.g., GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision. S11.A.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior. S11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes. S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g., dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps). S11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order. S11.A.3.3.2 Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves). S11.B.2.1.1 Explain the theory of evolution by interpreting data from fossil records, similarities in anatomy and physiology, or DNA studies that are relevant to the theory of evolution. S11.B.2.1.2			

				Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population. S11.B.2.1.3 Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population. S11.B.2.1.4 Explain why natural selection can act only on inherited traits. S11.B.2.2.1 Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication). S11.B.2.2.2 Compare and contrast mitosis and meiosis in passing on genetic information. S11.B.2.2.3 Explain how different patterns of inheritance affect population variability (i.e., multiple alleles, codominance, dominance, recessiveness, sex-influenced traits, and sex-linked traits). S8.B.2.1.4 Describe how selective breeding or biotechnology can change the genetic makeup of organisms. S8.B.2.2 Explain how a set of genetic instructions determines inherited traits of organisms.			
Lesson 9: Genetic Disorders (Weeks 16-18)	• Modern technology is discovering and treating many genetic disorders, but there are benefits and drawbacks to this knowledge.	1. DNA research 2. Human Genome Mapping 3. 23 and Me 4. Ethics	• How are genetic disorders discovered? • How are genetic disorders treated? • Can a person have their genome mapped?	3.1.10.B1 Describe how genetic information is inherited and expressed. 3.1.10.B3 Describe the basic structure of DNA and its function in genetic inheritance. Describe the role of DNA in protein synthesis as it relates to gene expression. 3.1.12.B2	• Examine common genetic disorders. • Discuss possible treatment techniques for genetic disorders. • Discuss the ethics behind	Students will be given the following: Preferential seating when applicable. Study guides. Guided notes when applicable,	Daily assignments End of Lesson exams Labs and Classroom activities

			• Who should have access to a person's genetic information? • Just because humans can change or repair genes, should they?	Evaluate the process of sexual reproduction in influencing genetic variability in a population. 3.1.12.B4 Evaluate the societal impact of genetic engineering techniques and applications. BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information. BIO.B.2.3 Explain how genetic information is expressed. BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift). S11.A.1.2.1 Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy). S11.A.1.2.2 Use case studies (e.g., Wright brothers' flying machine, Tacoma Narrows Bridge, Henry Petroski's Design Paradigms) to propose possible solutions and analyze economic and environmental implications of solutions for realworld problems. S11.A.2.2.1 Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality) S11.A.2.2.2 Explain how technology (e.g., GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision.	genetic mapping. • Research a genetic disorder of their choosing and write a research paper.	Extended time for assignments when needed. Separate testing environment when applicable.	

				S11.A.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior. S11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes. S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g., dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps). S11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order. S11.A.3.3.2 Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves). S11.B.2.1.1 Explain the theory of evolution by interpreting data from fossil records, similarities in anatomy and physiology, or DNA studies that are relevant to the theory of evolution. S11.B.2.1.2 Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population. S11.B.2.1.3			

				Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population. S11.B.2.1.4 Explain why natural selection can act only on inherited traits. S11.B.2.2.1 Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication). S11.B.2.2.2 Compare and contrast mitosis and meiosis in passing on genetic information. S11.B.2.2.3 Explain how different patterns of inheritance affect population variability (i.e., multiple alleles, codominance, dominance, recessiveness, sex-influenced traits, and sex-linked traits). S8.B.2.1.4 Describe how selective breeding or biotechnology can change the genetic makeup of organisms. S8.B.2.2 Explain how a set of genetic instructions determines inherited traits of organisms.			