Perris Union High School District
Course of Study

A. COURSE INFORMATION

Course Title:
Genetics
X New
☐ Revised

If revised previous course name if changed

Transcript Course Code/Number:
(To be assigned by Educational Services)

Subject Area:
☐ Social Science
☐ English
☐ Mathematics
X Laboratory Science
☐ World Languages
☐ Visual or Performing Arts
☐ College Prep Elective
☐ Other

Is this classified as a Career Technical Education course?
☐ Yes
X No

Grade Level
☐ MS
☐ HS
☐ 5
☐ 6
☐ 7
☐ 8
☐ 9
X 10
X 11
X 12

Required for Graduation:
X Yes possibly as an elective
☐ No

Meets UC/CSU Requirements?
X Yes
☐ No

Was this course *previously approved by UC* for PUHSD?
☐ Yes
X No
(Will be verified by Ed Services)

Credential Required to teach this course:
Single Subject: Science: Biological Sciences

To be completed by Human Resources only.

Signature 12-12-2019
Signature **Date**

Meets "Honors" Requirements?
☐ Yes
X No

Meets "AP" Requirements?
☐ Yes
X No

Unit Value/Length of Course:
☐ 0.5 (half year or semester equivalent)
X 1.0 (one year equivalent)
☐ 2.0 (two year equivalent)
☐ Other:

Submitted by: Jason Miller
Site: Paloma Valley High School
Date: 12/12/19

Approvals	**Name/Signature**	**Date**
Director of Curriculum & Instruction		12-13-19
Asst. Superintendent of Educational Services		12-13-19
Governing Board		

Prerequisite(s) (REQUIRED):

Biology

Corequisite(s) (REQUIRED):

None

Brief Course Description (REQUIRED):

This course will introduce students to the mechanisms that result in the inheritance of traits and the evolution of species. Students will consider the basic structure of chromosomes and genes at the molecular level of DNA. Starting with single-cell organisms and working through to higher level organisms, the basics of genetic inheritance will be studied. Students will study classical Mendelian genetics and modern DNA molecular genetics. Lab techniques and models used for genetic analysis will form the basis of lab investigations. Techniques will include methods used in modern genetic engineering. The use of computer-based bioinformatics tools will also be introduced. Contemporary issues and ethics will be discussed as they relate to such topics as recombinant DNA techniques resulting in transgenic organisms, cloning, crime scene investigations and the Human Genome Project. Students will study population genetics, allele frequencies, and earth science forces that influence allele frequencies. This course will incorporate phenomena and case studies in promoting specific genetic concepts in alignment with the NGSS structure.

B. COURSE CONTENT

Course Purpose (REQUIRED):
What is the purpose of this course? Please provide a brief description of the goals and expected outcomes. Note: More specificity than a simple recitation of the State Standards is needed.

The purpose of this course is to provide students with the scientific aspects of their physical make-up transmitted from a previous generation. This course is meant to be an elective with biology as a prerequisite of biology. Students will leave this course with a greater understanding of the mechanisms that drive how traits are passed on from generation to the next and how those traits are coded from the informational molecule of DNA.

Course Outline (REQUIRED):
Detailed description of topics covered. All historical knowledge is expected to be empirically based, give examples. Show examples of how the text is incorporated into the topics covered.

Topics and Objectives

CLASSICAL GENETICS

A. (Unit 1) **Mendelian Inheritance**

Introduction To Classical Genetics and the Work of Mendel

- Historical aspects of Mendel's experiments with pea plants
- Principle of dominance
- Principle of segregation

Genes and Chromosomes: Classical Mendelian Inheritance

- Monohybrid inheritance
- Dihybrid inheritance

Meiosis and Genetic Recombination

- Crossing over
- Independent assortment
- Segregation of alleles during anaphase I

Punnett Squares, Probability

- Basics of probability used to predict outcomes of genetic crosses

1. Review: Cell Cycle, Cell Division (mitosis & cytokinesis)

2. Students will be able to:

1. Describe the historical development of genetics.
2. Develop basic understanding of Mendelian genetic inheritance
3. Describe and explain classical Mendelian inheritance.
4. Explain Mendelian principles in terms of the specific stages of meiosis where they occur
5. Construct and interpret Punnett squares utilizing basic probability
6. Perform classic Mendelian experiments with *Brassica* plants.

7. Analyse data from the experiments to evaluate classic monohybrid and dihybrid cross genotype and phenotype ratios.

B. (Unit 2) **Human Heredity**

Human Chromosomes

- Autosomes and Sex Chromosomes
- Karyotypes
- Pedigrees

Human Traits and Genes

- Dominant and Recessive Traits
- Codominance
- Multiple Alleles
- Sex Linkage

1. Review: Chromosome Structure, Genes, Alleles, Dominance, Recessiveness

2. Students will be able to:

1. Describe the difference between human autosomes and sex chromosomes; XX, XY using karyotypes
2. Construct a pedigree chart for human traits
3. Deduce the genotypes or phenotypes of individuals in pedigree charts.
4. Describe ABO blood groups as an example of codominance and multiple alleles
5. Outline how the sex chromosomes determine gender based on the inheritance of X and Y chromosomes
6. State two examples of sex linkage, e.g. hemophilia, color blindness, Duchenne muscular dystrophy
7. Present a poster or powerpoint presentation on a human genetic disorder

MOLECULAR GENETICS

C. (Unit 3) **DNA: Chemistry and Structure**

Chemistry

- Nucleotides and Nucleic Acids
- DNA Double Helix
- RNA Structure

1. Review: Nucleotide structure and Nucleic Acids
2. Students will be able to:

1. Historical importance of the discovery of DNA structure
2. Outline how DNA nucleotides are linked together by covalent bonds and hydrogen bonds to form double helix structure
3. Describe DNA structure based on complementary nitrogenous base pairing; A:T and G:C
4. Use molecular models by building stick-type models and using computer-generated models visualize and understand the structure of DNA
5. Compare structures of DNA and RNA

D. (Unit 4) **DNA: Replication and Gene Expression (Protein Synthesis)**

Molecular Mechanisms of the Central Dogma of Biology

- DNA Replication
- DNA Transcription
- RNA Translation/Protein Synthesis
- The Genetic Code

1. Review: The Central Dogma of Molecular Biology, Protein Composition and Structure, Enzymes
2. Students will be able to:

1. Explain DNA replication in terms of unwinding of the double helix and synthesis of complementary strands of DNA using helicase and DNA polymerase enzymes
2. Understand the importance and significance of DNA replication as the means to transfer identical genetic information from the original DNA strand to daughter DNA strands

3. Outline DNA transcription in terms of the formation of an RNA strand complementary to the DNA strand by RNA polymerase.
4. Explain the process of translation, leading to peptide linkage formation using messenger RNA, transfer RNA.
5. Describe the role of codons and anticodons in the expression of the genetic code to form proteins.

E. (Unit 5) **Gene Expression and Regulation**

Activation and Control of Gene Expression

- The Lac Operon Model
- Post-Transcriptional Processing of RNA
- Post-Translational Processing of Proteins
- Transposable Elements

Students will be able to:

1. Understand the role of operons in regulating gene expression
2. Describe post-transcriptional processing: introns and exons
3. Describe post-translational processing
4. Outline the variety of outcomes possible from gene expression

F. (Unit 6) **Gene Variation and Evolution**

Mutations

- Gene-level Mutations
- Chromosome-level Mutations
- Autosomal DNA mutation
- Gamete DNA mutation

Role of Mutation in Evolution

- Sickle Cell Anemia and Natural Selection

1. Review: DNA Structure, Chromosomes, Basics of Evolution & Natural Selection
2. Students will be able to:

a. Distinguish between the various levels of mutation

b. Describe the different outcomes of the different forms of mutation

c. Use sickle cell anemia as an example of how mutation has effects on the individual and population, and the evolutionary implications in terms of malaria resistance.

d. Use models as examples of how gene mutations affect an individual's genome as well as a population's gene pool

e. Understand the forces that change allele frequency.

G. (Unit 7) **Manipulating DNA – Tools and Techniques of Genetic Engineering**

Tools

- Gel Electrophoresis
- PCR (Polymerase Chain Reaction)
- Recombinant DNA
- Transformation and Gene Transfer

Techniques

- Cloning
- Transgenic Organisms
- Gene Therapy
- Genetic Screening
- DNA Fingerprinting
- Virtual labs for antibacterial resistance

1. Review: DNA Chemistry & Structure, Enzymes
2. Tools of Genetic Engineering

Students will be able to:

1. Explain that gel electrophoresis involves the separation of fragmented pieces of DNA
2. Demonstrate how gel electrophoresis works using electrophoresis equipment
3. Explain how PCR (polymerase chain reaction) copies and amplifies small fragments of DNA
4. Use a computer-simulation to demonstrate how PCR works
5. Describe the basic technique of gene transfer using bacterial plasmids in a host cell
6. Explain the role of restriction enzymes and DNA ligase in gene transfer

Techniques of Genetic Engineering

Students will be able to:

1. Outline a technique for cloning using differentiated cells
2. Discuss the ethical implications of cloning mammals
3. Outline examples of the current uses of genetically modified crops or animals
4. Discuss the potential benefits and possible harmful effects the genetic modification of organisms
5. Describe the process of gene therapy using examples
6. Describe genetic screening and discuss the advantages and disadvantages of screening
7. Explain DNA fingerprinting and describe its role in modern forensic science

H. (Unit 8) **The Human Genome**

- The Human Genome Project (HGP)
- Use of DNA Microarray Technology
- Genomics
- Bioinformatics- human genome analysis and comparison; other organism (non-human) genome analysis: evolutionary implications
- Ethical Issues and the Human Genome
-

Students will be able to:

1. View the historical developments behind the HGP (NOVA video: "Cracking the Code")
2. Describe method of microarray technology.
3. Observe microarray technology in a laboratory setting- Field trip to local biotechnology company
4. Conduct internet research about the various types organism's genomes
5. Use online bioinformatics searches and tools to investigate the human and non-human organism genomes
6. Discuss and debate implications of the usage of HGP data and comparative evolutionary aspects with other organisms.
7. Analyze the accuracy of corporate genome and ancestry analysis (e.g. ancestry.com, 23andme.com, etc.).

Writing Assignments (REQUIRED):
Give examples of the writing assignments and the use of critical analysis within the writing assignments.

General Tools and Materials for Instruction

1) Lectures and demonstration

2) Note taking

3) Teacher developed materials

4) Adopted textbook and support materials.

5) Science journals – reading and written analysis

6) Compiled laboratory notebooks

7) Group and individual experimentation

8) Laboratory practice, sterile technique, organism culture and care.

9) Model building and simulations

10) Computers - animation models, simulations, data analysis and internet research

11) Guest speakers

12) Videos, DVDs, audio-visual materials

13) Popular scientific literature

14) Written and oral presentations

Writing assignments may include:

Mendelian genetics problems with critical thinking applications

DNA Coding and amino acid coding problems.

Bioethics writing assignments.

Crime scene, parentage, and possible DNA ethnicity analysis writing assignments with critical thinking applications.

Causes and living with mutation phenomena based writing assignments

INSTRUCTIONAL MATERIALS (REQUIRED)	
Textbook #1	
Title: Genetics: A Conceptual Approach	Edition:6th possibly 7th
Author :Pierce, Benjamin	ISBN-13: 978-1319050962 ISBN-10: 1319050964
Publisher:MacMillan	Publication Date:2017
Usage: X Primary Text ❑ Read in entirety or near	
Textbook #2	
Title: Solutions and Problem-Solving Manual to Accompany Genetics: A Conceptual Approach Sixth Edition	Edition: 6th edition
Author: Choi, Jung MacCallum, Mark	ISBN: ISBN-13: 978-1319088705 ISBN-10: 1319088708
Publisher: Macmillan Learning	Publication Date: 2005
Usage: ❑ Primary Text X Read in entirety or near	
Supplemental Instructional Materials *Please include online, and open source resources if any.*	
Possibly CK12 materials (free)	

Estimated costs for classroom materials and supplies (REQUIRED). *Please describe in detail.* If more space is needed than what is provided, please attach backup as applicable.	
Cost for class set of textbooks: $3600 to 7200 depending on where you buy it	Description of Additional Costs: :$100-200 one time cost of 1 math/solutions manual (listed above) Possible lab materials – variable by year
Additional costs:$100-200 one time cost of 1 math/solutions manual (listed above) Possible lab materials – variable by year	
Total cost per class set of instructional materials:	$7200

Key Assignments (REQUIRED):

Please provide a detailed description of the Key Assignments including tests, and quizzes, which should incorporate not only short answers but essay questions also. How do assignments incorporate topics? Include all major assessments that students will be required to complete

1) Power Point Presentation: Human Genetic Disorders.
2) Poster Presentation: Transgenic Organisms.
3) Computer-based molecular modeling of DNA
4) Bioinformatics: web-based data mining of genome data bases
5) Bioethics: Debate on the Usage of Genetic Technologies: classroom debate or online forum debate
6) Research Report: Evolutionary Comparison of Genomes

Instructional Methods and/or Strategies (REQUIRED):

Please list specific instructional methods that will be use.

Probable labs and modeling activities:

1) DNA Spooling: Genomic DNA Isolation and Purification

Purpose: Isolate DNA from human cheek cells (self) and from plants (wheat germ)

Method: Students will disrupt plant cell walls (grinding, crushing, blender) and plasma cell membranes (detergent based lysis solution). Use protease enzymes to hydrolyse protein in cell prep sample. Induce DNA precipitation by cold ethanol precipitation.

Expected Results: DNA will be isolated and observed.

3) Karyotyping Human Chromosome Model

Purpose: Students will analyze human chromosome paper models to identify chromosomal mutations.

Method: Visual examination of human and animal karyotypes
online http://worms.zoology.wisc.edu/zooweb/Phelps/karyotype.html

Expected results: Identify karyotypes typical of Down's Syndrome (Trisomy 21), Klinefelter's Syndrome and Turner's Syndrome. Discuss cellular mechanisms (nondisjunction) and resulting phenotypes of the syndromes.

4) ABO/Rh Blood Typing

Purpose: Students will use purchased aseptic blood samples todetermine ABO and Rh Factor typing for mock paternity investigation.

Method: Kit containing A-, B-, AB+, and O+ aseptic red blood cells, along with the antisera for demonstrating agglutinations. Simulated offspring and parental phenotypes in paternity suit. Students will test the unknown blood samples along with controls and based on antigen-antibody complex formation will record the blood type.

Expected results: Blood test results compared in conjunction with the offspring and parent blood typing to exclude and include individuals based on blood type inheritance.

5) Glowing Bacteria: E. coli Transformation.

Purpose: Students will use an E.coli colony transformation to create Green Fluorescent Protein (GFP)-expressing bacteria. Introduction to sterile technique.

Method: The pGLO plasmid will be used to transform E.coli which will then be induced to express GFP which will be visualized using UV light excitation. The steps of sterile technique will be introduced and utilized.

Expected results: Transformed bacterial colonies expressing GFP. The colonies will be used for protein isolation and purification.

6) Protein Gel Electrophoresis.

Purpose: Students will isolate and purify Green Fluorescent Protein (GFP) from transformed bacteria. Students will learn the techniques of protein purification and protein gel electrophoresis.

Method: Bacterial transformation and .protein purification.

Expected results: Isolated and purified GFP samples.

7) Restriction Enzyme Cleavage of DNA

Purpose: Students will use restriction enzymes to cut DNA from the bacteriophage lambda into fragments and separate fragments using agarose gel electrophoresis (can also be done via virtual labs and paper modeling)

Method: Samples of lambda DNA will be incubated at 37°C, each with one of three restriction endonucleases: *Bam*HI, *Eco*RI, and *Hin*dIII. A negative control will be incubated without an endonuclease. DNA samples will be separated agarose gel electrophoresis.

Expected results: Visible characteristic number and pattern of bands produced by each restriction enzyme will result in a "DNA fingerprint" of the lambda DNA.

8) PCR Simulation "DNA fingerprinting".

Purpose: Students will use simulated forensic PCR DNA samples and analyse using agarose gel electrophoresis to generate DNA fingerprints from crime suspects. The technique of the polymerase chain reaction will be introduced and discussed.

Method: Predigested DNA from simulated "suspects are obtained from Carolina Biological Supply and subject to agarose gel electrophoresis and stained with methylene blue to generate a DNA fingerprint. These are compare and and matched with simulated DNA evidence from "suspects" in a crime investigation.

Results expected: "Crime scene" DNA samples amplified by PCR are used to match with suspects DNA samples in order to provide evidence in a simulated criminal investigation.

9) Development of Plant Clone.

Purpose: Students will culture plant tissue and observe callus growth and eventual plantlet (clone) formation.

Method: Carrot seeds will be grown in germination medium and stimulated with callus initiation medium and shoot development medium in order to produce geneticaly identical plantlets (clones).

Results expected: The formation of genetically identical carrot plants from an original plant.

10) Antibiotic Resistance in Bacteria Virtual Lab

Purpose and Method: This virtual experiment shows the key elements of transformation and bacterial DNA uptake. Students will use virtual lab techniques to test different antibiotics for the development of antibiotic resistance. (http://www.bigrocketproductions.com/portfolio-item/antibiotic-resistance/)

Expected results: Bacteria containing antibiotic resistant genes will be tested against different antibiotics.

Assessment Methods and/or Tools (REQUIRED):

Please list different methods of assessments that will be used.

Formative assessments
Summative assessments
Projects as assessments
Quizzes
Math assessments
Multiple choice assessments
Short answer, FRQ, and essay assessments

COURSE PACING GUIDE AND OBJECTIVES (REQUIRED)				
Day(s) *	**Objective**	**Standard(s) ****	**Chapter(s)**	**Reference**
~15	**CLASSICAL GENETICS**	HS-LS3-2	1, 3, 5	Pierce

days	A. (Unit 1) **Mendelian Inheritance** Introduction To Classical Genetics and the Work of Mendel • Historical aspects of Mendel's experiments with pea plants • Principle of dominance • Principle of segregation Genes and Chromosomes: Classical Mendelian Inheritance • Monohybrid inheritance • Dihybrid inheritance Meiosis and Genetic Recombination • Crossing over • Independent assortment • Segregation of alleles during anaphase I Punnett Squares, Probability • Basics of probability used to predict outcomes of genetic crosses 1. Review: Cell Cycle, Cell Division (mitosis & cytokinesis) 2. Students will be able to: 8. Describe the historical development of genetics. 9. Develop basic understanding of Mendelian genetic inheritance 10. Describe and explain classical Mendelian inheritance. 11. Explain Mendelian principles in terms of the specific stages of meiosis where they occur 12. Construct and interpret Punnett squares utilizing basic probability 13. Perform classic Mendelian experiments with *Brassica* plants. 14. Analyse data from the experiments to evaluate classic monohybrid and dihybrid cross genotype and phenotype ratios.	LS1.B All applicable direct and indirect standards		

~25 days	B. (Unit 2) **Human Heredity** Human Chromosomes • Autosomes and Sex Chromosomes • Karyotypes • Pedigrees Human Traits and Genes • Dominant and Recessive Traits • Codominance • Multiple Alleles • Sex Linkage 1. Review: Chromosome Structure, Genes, Alleles, Dominance, Recessiveness 2. Students will be able to: 8. Describe the difference between human autosomes and sex chromosomes; XX, XY using karyotypes 9. Construct a pedigree chart for human traits 10. Deduce the genotypes or phenotypes of individuals in pedigree charts. 11. Describe ABO blood groups as an example of codominance and multiple alleles 12. Outline how the sex chromosomes determine gender based on the inheritance of X and Y chromosomes 13. State two examples of sex linkage, e.g. hemophilia, color blindness, Duchenne muscular dystrophy 14. Present a poster or powerpoint presentation on a human genetic disorder	HS-LS3-1 HS-LS3-2 LS3.A All applicable direct and indirect standards	2, 4, 6, 7, 8, sections of 11	Pierce
~20 days	**MOLECULAR GENETICS** C. (Unit 3) **DNA: Chemistry and Structure** Chemistry • Nucleotides and Nucleic Acids • DNA Double Helix • RNA Structure	HS-LS-1-1 HS-LS-3-1 LS1.A All applicable direct and indirect standards	10	Pierce

	3. Review: Nucleotide structure and Nucleic Acids 4. Students will be able to: 6. Historical importance of the discovery of DNA structure 7. Outline how DNA nucleotides are linked together by covalent bonds and hydrogen bonds to form double helix structure 8. Describe DNA structure based on complementary nitrogenous base pairing; A:T and G:C 9. Use molecular models by building stick-type models and using computer-generated models visualize and understand the structure of DNA 10. Compare structures of DNA and RNA			
~25 days	D. (Unit 4) **DNA: Replication and Gene Expression (Protein Synthesis)** Molecular Mechanisms of the Central Dogma of Biology • DNA Replication • DNA Transcription • RNA Translation/Protein Synthesis • The Genetic Code 3. Review: The Central Dogma of Molecular Biology, Protein Composition and Structure, Enzymes 4. Students will be able to: 6. Explain DNA replication in terms of unwinding of the double helix and synthesis of complementary strands of DNA using helicase and DNA polymerase enzymes 7. Understand the importance and significance of DNA replication as the means to transfer identical genetic information from the original DNA strand to daughter DNA strands 8. Outline DNA transcription in terms of the formation of an RNA strand complementary to the DNA strand by RNA polymerase.	HS-LS-1-1 HS-LS-1-4 HS-LS-3-1 LS1.A All applicable direct and indirect standards	11-15	Pierce

	9. Explain the process of translation, leading to peptide linkage formation using messenger RNA, transfer RNA. 10. Describe the role of codons and anticodons in the expression of the genetic code to form proteins.			
~25 days	E. (Unit 5) **Gene Expression and Regulation** Activation and Control of Gene Expression • The Lac Operon Model • Post-Transcriptional Processing of RNA • Post-Translational Processing of Proteins • Transposable Elements Students will be able to: 5. Understand the role of operons in regulating gene expression 6. Describe post-transcriptional processing: introns and exons 7. Describe post-translational processing 8. Outline the variety of outcomes possible from gene expression	HS-LS-1-1 HS-LS-1-4 HS-LS-3-1 LS1.A All applicable direct and indirect standards	9, 16, 17, 18	Pierce
~20 days	F. (Unit 6) **Gene Variation and Evolution** Mutations • Gene-level Mutations • Chromosome-level Mutations • Autosomal DNA mutation • Gamete DNA mutation Role of Mutation in Evolution • Sickle Cell Anemia and Natural Selection 3. Review: DNA Structure, Chromosomes, Basics of Evolution & Natural Selection 4. Students will be able to: a. Distinguish between the various levels of mutation	HS-LS-3-3 HS-LS-4-2 HS-LS-4-3 HS-LS-4-4 HS-LS-4-5 LS3.B LS4.B LS4.C All applicable direct and indirect standards	24, 25, 26	Pierce

	b. Describe the different outcomes of the different forms of mutation c. Use sickle cell anemia as an example of how mutation has effects on the individual and population, and the evolutionary implications in terms of malaria resistance. d. Use models as examples of how gene mutations affect an individual's genome as well as a population's gene pool e. Understand the forces that change allele frequency.			
~30 days	G. (Unit 7) **Manipulating DNA – Tools and Techniques of Genetic Engineering** Tools • Gel Electrophoresis • PCR (Polymerase Chain Reaction) • Recombinant DNA • Transformation and Gene Transfer Techniques • Cloning • Transgenic Organisms • Gene Therapy • Genetic Screening • DNA Fingerprinting • Virtual labs for antibacterial resistance 3. Review: DNA Chemistry & Structure, Enzymes 4. Tools of Genetic Engineering Students will be able to: 7. Explain that gel electrophoresis involves the separation of fragmented pieces of DNA 8. Demonstrate how gel electrophoresis works using electrophoresis equipment 9. Explain how PCR (polymerase chain reaction) copies and amplifies small fragments of DNA 10. Use a computer-simulation to demonstrate how PCR works	HS-LS-1-1 HS-LS-1-4 HS-LS-3-1 LS1.A All applicable direct and indirect standards	19	Pierce

	11. Describe the basic technique of gene transfer using bacterial plasmids in a host cell 12. Explain the role of restriction enzymes and DNA ligase in gene transfer Techniques of Genetic Engineering Students will be able to: 8. Outline a technique for cloning using differentiated cells 9. Discuss the ethical implications of cloning mammals 10. Outline examples of the current uses of genetically modified crops or animals 11. Discuss the potential benefits and possible harmful effects the genetic modification of organisms 12. Describe the process of gene therapy using examples 13. Describe genetic screening and discuss the advantages and disadvantages of screening 14. Explain DNA fingerprinting and describe its role in modern forensic science			
~22 days	H. (Unit 8) **The Human Genome** • The Human Genome Project (HGP) • Use of DNA Microarray Technology • Genomics • Bioinformatics- human genome analysis and comparison; other organism (non-human) genome analysis: evolutionary implications • Ethical Issues and the Human Genome • Students will be able to: 8. View the historical developments behind the HGP (NOVA video: "Cracking the Code") 9. Describe method of microarray technology. 10. Observe microarray technology in a laboratory setting- Field trip to local biotechnology company	HS-LS-1-1 HS-LS-1-4 HS-LS-3-1 LS1.A All applicable direct and indirect standards	21-23	Pierce

	11. Conduct internet research about the various types organism's genomes 12. Use online bioinformatics searches and tools to investigate the human and non-human organism genomes 13. Discuss and debate implications of the usage of HGP data and comparative evolutionary aspects with other organisms. 14. Analyze the accuracy of corporate genome and ancestry analysis (e.g. ancestry.com, 23andme.com, etc.).			

* The days listed are recommended and may adjust according to local school or classroom events (e.g. drills, pep rallies, etc.)

** Many of the units for this genetics course are addressed in more than just the NGSS standards listed here in different direct and indirect ways; some of those standards do not necessarily have numbers associated with them (e.g. the science and engineering practices and crosscutting concepts)

C. HONORS COURSES ONLY
Indicate how much this honors course is different from the standard course.

D. BACKGROUND INFORMATION
Context for course (optional)
History of Course Development (optional)