

Winslow Township School District
Human Genetics Lab CP (Semester Course)

Unit 1: Fundamental Concepts, Bioethics, & Applications...

Overview: In this unit students will be reintroduced to the discipline of genetics, previously learned during the biology course completed by students. Students will apply the scientific knowledge and skills they have developed thus far through their study of the fundamental genetic concepts, bioethics, and the applications for the modern geneticist. Students will develop an understanding of making informed decisions and how statistics and models play a key role in the process.

Overview	Standards for Science	Unit Focus	Essential Questions
<p><u>Unit 1</u></p> <p>Fundamental Concepts, Bioethics, & Applications for the Modern Geneticist</p>	<ul style="list-style-type: none"> • HS-LS1-1 • HS-LS3-1 • HS-LS3-2 • HS-ETS1-1 • WIDA 1, 4 	<ul style="list-style-type: none"> • evaluate contributions of scientists that have played a role and/or led up to the discovery of DNA, inheritance, human disease, biotechnology, and beyond. • research the criteria necessary to succeed in a specific career in the field of genetics. • identify and appreciate opposing viewpoints while supporting various viewpoints with factual information and/or data and statistics. • identify scientifically accurate information gathered through the scientific method, in contrast to inaccurate information presented through various media outlets. • conservation of genes throughout organisms allow cross-species studies of DNA and human systems. 	<ul style="list-style-type: none"> • How have previous historical events and scientific discoveries led up to the understanding of modern genetics? • Why is specific equipment needed to study genetics and molecular biology? • Why is it important to master the skill and technique of the equipment? • How has the study of genetics expanded career opportunities such as but not limited to medicine, forensics, research laboratories, computer scientists, and law enforcement? • Why is ethical decision making important? • Why do various stakeholders need to be considered when making decisions? • How do you appropriately and agreeably disagree on controversial ethical topics? • Why are model organisms utilized in past and current research? • How do the characteristics of various model organisms provide insight into human genetics? • What human genetic issues are better understood because of the use of model organisms?
<p><i>Unit 1: Enduring Understandings</i></p>	<ul style="list-style-type: none"> • Experimental and mathematical evidence led to the construction and development of the genetic model and caused changes in the model over time. • There are specific tools and techniques that need to be mastered in order to be an effective geneticist. • Many new professions and careers are possible because of current genetic understanding. • The field of genetics requires communication, both oral and written, to demonstrate smart decision making based upon ethical foundations. • Knowledge of human systems can be accurately studied through the use of various species of model organisms. 		

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Curriculum Unit 1	Standards		Pacing	
			Days	Unit Days
Unit 1: Fundamental Concepts, Bioethics, & Applications for the Modern Geneticist	HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.	5	21
	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.	5	
	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.	5	
	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.	4	
	Assessment, Re-teach and Extension		2	

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Disciplinary Core Ideas	Indicator #	Indicator
<p>LS1.A: Structure and Function 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. (secondary to HS-LS3-1) (Note: This Disciplinary Core Idea is also addressed by HS -LS1-1.)</p> <p>LS3.A: Inheritance of Traits 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. (HS-LS3-1)</p> <p>LS3.B: Variation of Traits 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. (HS-LS3-2)</p> <p>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. (HS-LS3-2)</p> <p>ETS1.A: Defining and Delimiting Engineering Problems Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1)</p>	HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.
	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.
	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.

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Assessment Plan

<ul style="list-style-type: none"> • Exploratory activities • Warm-up/Ticket Out activities • Class discussions • Student Participation • Teacher Observations • Virtual/Hands-On Labs • Self-Test Assessments • Scientist Timeline Activity • Clinical Case Study Analysis 	<ul style="list-style-type: none"> • Quizzes and Tests (Chapter 1, 3, 4, 5, and 6 of Textbook, “Genetics: A Conceptual Approach, 6th edition by Benjamin A. Pierce) • Authentic assessments and projects • Exploratory activities • Presentations • Lecture Notes • Think-Pair-Share • Graphic Organizers • Study Questions at the end of each chapter • Multiple Choice and Critical Thinking at the end of each chapter
Resources	Activities
<ul style="list-style-type: none"> • Chromebooks • Textbook (“Genetics: A Conceptual Approach, 6th ed by Benjamin A. Pierce) • Web Quests • Virtual Field Trips • Video Streaming • BrainPOP • Puzzlemaker: Game Based Learning Discovery Education <p>Diversity, Equity & Inclusion Educational Resources https://www.nj.gov/education/standards/dei/</p>	<ul style="list-style-type: none"> • Use various forms of expository writing-procedural writing, narrative writing, descriptive writing, labeling, as well as to create visuals, graphs, tables, diagrams and charts. • Use scientific argumentation with exercises on writing claims, using evidence to support your claim and explaining the reasoning behind their claim. • Mini-lessons • Independent reading • Films • Website exploration • Discussions, dialogues • Debates • Laboratory experiments • Partner or small group work • Student presentations, reports, journals, reflections • In-class assessments

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- Written reports, essays, research, and homework

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.

- Presentation of skills and appropriate technique of basic laboratory skills needed for Genetics – A
- Princeton/HHMI Small and Large Volumes Lab (micropipeting basics) – M, T
- Gel electrophoresis Lab (prep gel and buffer, pour gel, load samples, and analyze results) – M, T
- Edvotek #851 - Effects of Alcohol on C.elegans (model organism or equivalent model organism lab) A, M, T
- Edvotek #372 - Quick PCR Lab – M, T
- Model Organism Research Project (Characteristics of the organism making it suitable as a model) – A, M, T
 - Why the organism is an ideal model
 - Genetic information known about the organism
 - Past/Current research with this organism
 - Contributions to science
 - Application to human disorders/disease
- Famous Geneticists/Scientists Timeline (select famous scientist from dnai.org timeline website and create presentation on their life & scientific discoveries & accomplishments) – A, M, T
- Careers in Genetics → Create PowerPoint presentation that includes – A, M, T
 - Description of career
 - Daily activities
 - Average salary
 - Type of personality you may need for your career
 - Classes you should take in high school/activities outside of school you may want to participate in
 - 2 undergraduate colleges you can attend to achieve your career & does your career require you to go further than just getting your undergraduate degree?
 - Helpful websites for anyone who may be interested in your career
- Case Studies/Law [study of bioethical issues such as cloning, stem cell research, reproductive technologies, genetic privacy and discrimination] – A, M, T
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Instructional Best Practices and Exemplars

1. Identifying similarities and differences
2. Summarizing and note taking
3. Reinforcing effort and providing recognition
4. Homework and practice
5. Nonlinguistic representations

6. Cooperative learning
7. Setting objectives and providing feedback
8. Generating and testing hypotheses
9. Cues, questions, and advance organizers
10. Manage response rates

9.1 Personal Financial Literacy, 9.2 Career Awareness, Exploration, Preparation and Training & 9.4 Life Literacies and Key Skills

The implementation of the 21st Century skills and standards for students of the Winslow Township District is infused in an interdisciplinary format in a variety of curriculum areas that include, English language Arts, Mathematics, School Guidance, Social Studies, Technology, Visual and Performing Arts, Science, Physical Education and Health, and World Language.

Additional opportunities to address 9.1, 9.2 & 9.4:

Philadelphia Mint

<https://www.usmint.gov/learn/kids/resources/educational-standards>

Different ways to teach Financial Literacy.

<https://www.makeuseof.com/tag/10-interactive-financial-websites-teach-kids-money-management-skills/>

- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
- 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
- 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
- 9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).

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Modifications for Special Education/504

Students with special needs: The students' needs will be addressed on an individual and grade level using a variety of modalities. Accommodations will be made for those students who need extra time to complete assignment. Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

- Small group instruction
- Audio books/ Text-to-speech platforms
- Leveled texts/Vocabulary Readers
- Leveled informational texts via online
- Modeling and guided practice
- Read directions aloud
- Repeat, rephrase and clarify directions
- Extended time as needed
- Break down assignments into smaller units
- Provide shortened assignments
- Modify testing format
- Repeat directions as needed
- Graphic organizers
- Study Guides, Study Aids and Re teaching as needed

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Modifications for At-Risk Students

Formative and summative data will be used to monitor student success. At first signs of failure, student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations

- Audio books and Text-to-speech platforms
- Leveled texts/Vocabulary Readers
- Leveled informational texts via online
- Extended time as needed
- Read directions aloud
- Assist with organization
- Use of computer
- Emphasize/highlight key concepts
- Recognize success
- Provide timelines for work completion
- Break down multi-step tasks into smaller chunks
- Provide copy of class notes and graphic organizer

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English Language Learners	Modifications for Gifted Students
<p>All WIDA Can Do Descriptors can be found at this link: https://wida.wisc.edu/teach/can-do/descriptors</p> <p>Grades 9-12 WIDA Can Do Descriptors...</p> <p><i>Listening...</i></p> <ul style="list-style-type: none"> • Process <u>recounts</u> by... <ul style="list-style-type: none"> ○ Categorizing perspectives of multiple speakers ○ Identifying important information on specific event & concept from lecture/presentation • Process <u>explanations</u> by... <ul style="list-style-type: none"> ○ Recognizing specific language used to enhance clarity and precision ○ Recognizing and following language related to the same event or phenomenon throughout presentations • Process arguments by... <ul style="list-style-type: none"> ○ Identifying strengths, limitations, and potential biases from oral presentations ○ Organizing claims and counter claims presented in debates <p><i>Speaking...</i></p> <ul style="list-style-type: none"> • <u>Recount</u> by... <ul style="list-style-type: none"> ○ Adjusting presentation style, degree of formality, word choice, tone, and information to the context and audience ○ Presenting information that follows discipline specific organization (e.g., orientation to topic, sequence of events, conclusion) • <u>Explain</u> by... <ul style="list-style-type: none"> ○ Providing precision and accuracy in classifications, procedures, processes, and accounts using abstraction, technical language, and a variety of active/passive verb forms ○ Following discipline-specific organization (e.g., orienting the reader, details, conclusion) and supporting presentations with graphs, formulas, quotes or other media • <u>Argue</u> by... <ul style="list-style-type: none"> ○ Organizing claims and counter claims in debates with evidence from multiple sources ○ Negotiating differing cultural perspectives in pairs or small groups <p><i>Reading...</i></p> <ul style="list-style-type: none"> • Process <u>recounts</u> by... <ul style="list-style-type: none"> ○ Analyzing and comparing how authors use language for specific purposes and audiences ○ Identifying how authors develop and maintain cohesion by connecting ideas or events in extended texts • Process <u>explanations</u> by... <ul style="list-style-type: none"> ○ Recognizing discipline-specific patterns (e.g., orienting the reader, part-whole classification, neutral/ authoritative tone) ○ 	<p>Students excelling in mastery of standards will be challenged with complex, high level challenges related to the topic.</p> <ul style="list-style-type: none"> • Raise levels of intellectual demands • Require higher order thinking, communication, and leadership skills • Differentiate content, process, or product according to student’s readiness, interests, and/or learning styles • Provide higher level texts • Expand use of open-ended, abstract questions • Critical and creative thinking activities that provide an emphasis on research and in-depth study • Enrichment Activities/Project-Based Learning/ Independent Study <p>Additional Strategies may be located at the links:</p> <ul style="list-style-type: none"> ❖ Gifted Programming Standards ❖ Webb’s Depth of Knowledge Levels and/or Revised Bloom’s Taxonomy ❖ REVISED Bloom’s Taxonomy Action Verbs

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- Identifying authors' precision and accuracy in classifications, comparisons, accounts, or procedures as a result of clear language choices
- Process arguments by...
 - Evaluating word choice and nuance as tools for distinguishing facts, claims, reasoned judgment, and opinions
 - Identifying the logical connections among claims, counterclaims, reasons, and evidence

Writing...

- Recount by...
 - Summarizing content-related notes from lectures or readings
 - Producing research reports using multiple sources of information
- Explain by...
 - Developing ideas about phenomena with relevant and sufficient facts, extended descriptions, concrete details, or quotations
 - Maintaining discipline-specific patterns that bridge across key uses (e.g., explanation to argument in history, explanation to recount for information reports)
- Argue by...
 - Evaluating positive and negative implications associated with various positions (e.g., historical events, scientific discoveries, individuals)
 - Organizing information logically and coherently to represent contrasting views

Oral Language...

- Discuss by...
 - Identifying and reacting to subtle differences in speech and register (e.g., hyperbole, satire, comedy)
 - Producing coherent oral discourse appropriate to task, purpose, and audience
 - Synthesizing and sharing information from a variety of sources and perspectives

Students will be provided with accommodations and modifications that may include:

- Relate to and identify commonalities in Social Studies and science in student's home country
- Assist with organization
- Use of computer
- Emphasize/highlight key concepts
- Teacher Modeling
- Peer Modeling
- Label Classroom Materials - Word Walls

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Interdisciplinary Connections

English Language Arts/Literacy

1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. **RST.11-12.1** (HS-LS2-1),(HS-LS2-2),(HS-LS2-6)
2. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **RST.11-12.7** (HS-LS2-6)
3. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **RST.11-12.8** (HS-LS2-6)
4. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **RST.11-12.9** (HS-ETS1-1),(HS-ETS1-3)
5. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. **WHST.9-12.2** (HS-LS2-1),(HS-LS2-2)
6. 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.9-12.7** (HS-LS1-3)
7. 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. **WHST.11-12.8** (HS-LS1-3)
8. Draw evidence from informational texts to support analysis, reflection, and research. **WHST.9-12.9** (HS-LS1-1)
9. **WIDA Standards 1** English language learners communicate for social and instructional purposes within the school setting
10. **WIDA Standards 4** English language learners communicate information, ideas, and concepts necessary for academic success in the content area of science
11. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. **SL.11-12.5** (HS-LS1-2)

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Mathematics

1. Reason abstractly and quantitatively. **MP.2** (HS-LS2-1),(HS-LS2-2),(HS-LS2-6)
2. Model with mathematics. **MP.4** (HS-LS2-1),(HS-LS2-2)
3. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.1** (HS-LS2-1),(HS-LS2-2)
4. Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.2** (HS-LS2-1),(HS-LS2-2)
5. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **HSN.Q.A.3** (HS-LS2-1),(HS-LS2-2)
6. Represent data with plots on the real number line. **HSS-ID.A.1** (HS-LS2-6)
7. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **HSS-IC.A.1** (HS-LS2-6)

Integration of Computer Science and Design Thinking NJSL 8

- 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
- 8.1.12.DA.2: Describe the trade-offs in how and where data is organized and stored.
- 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.
- 8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation.
- 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture.
- 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.
- 8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.
- 8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.
- 8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.
- 8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.