

# Unit 1 - DNA and Chromosomes

STAGE 1   DESIRED RESULTS		
Standards	Transfer	
<p>3.1.9-12.A 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.</p> <p>3.1.9-12.P. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.</p> <p>3.1.9-12.Q. 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.</p>	<p><i>Students will be able to independently use their learning to...</i></p> <ul style="list-style-type: none"> <li>❑ Locate objects in a frame of reference and predict, using mathematical models, where they will be in the future.</li> </ul>	
	Meaning	
	<p><b>UNDERSTANDINGS</b> <i>Students will understand that...</i></p> <ul style="list-style-type: none"> <li>❑ DNA sequences are the blueprints of life.</li> <li>❑ Mutations provide the variation necessary for life to persist.</li> <li>❑ As an organism grows and develops, carefully orchestrated chemical reactions activate and deactivate parts of the genome at strategic times and in specific locations.</li> </ul>	<p><b>ESSENTIAL QUESTIONS</b> <i>Students will keep considering...</i></p> <ul style="list-style-type: none"> <li>❑ What controls the expression of our genes?</li> <li>❑ How does the structure of nucleic acids, genes and chromosomes relate to their function?</li> <li>❑ What is the relationship between the processes of replication, transcription, and translation?</li> <li>❑ What are the ultimate causes of genetic errors?</li> </ul>
	Acquisition	
	<p><i>Students will know...</i></p> <ul style="list-style-type: none"> <li>❑ DNA structure and function.</li> <li>❑ Central dogma of life.</li> <li>❑ Processes of DNA replication, transcription, and translation</li> <li>❑ Protein processing.</li> <li>❑ History of the discovery of DNA and relevant experiments .</li> <li>❑ Role of RNA.</li> <li>❑ Types of mutations.</li> <li>❑ Effects of atypical chromosome number and structure.</li> <li>❑ Mechanisms of control in gene expression.</li> <li>❑ Relevance of the epigenome.</li> </ul>	<p><i>Students will be skilled at...</i></p> <ul style="list-style-type: none"> <li>❑ Relate the structure of DNA to its function.</li> <li>❑ Explain the relationship of DNA, genes, and chromosomes.</li> <li>❑ Demonstrate the processes of DNA replication and protein synthesis.</li> <li>❑ Identify regulatory factors in the processes of DNA replication, transcription, translation, and protein processing.</li> <li>❑ Investigate the role of the environment in gene expression.</li> <li>❑ Describe how genetic mutations alter DNA and their effect on phenotype.</li> <li>❑ Research genetic disorders resulting from mutations.</li> <li>❑ Discuss current topics in the field of genomics.</li> </ul>

# Unit 2 - Genetic Engineering

STAGE 1   DESIRED RESULTS		
Standards	Transfer	
3.1.9-12.A 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.	<p><i>Students will be able to independently use their learning to understand...</i></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> DNA is the code of life.</li> <li><input type="checkbox"/> Technology allows for the analysis and modification of genetic information.</li> <li><input type="checkbox"/> Individuals and society must consider the benefits and ramifications of using biotechnology.</li> </ul>	
	Meaning	
	<p><b>UNDERSTANDINGS</b> <i>Students will understand that...</i></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Scientific research often leads to technological advances that can have positive and/or negative impacts upon society as a whole.</li> <li><input type="checkbox"/> Modern biotechnologies manipulate DNA providing new ways to study, monitor, treat diseases and alter the environment.</li> </ul>	<p><b>ESSENTIAL QUESTIONS</b> <i>Students will keep considering...</i></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> How will genetic technologies contribute to our understanding and treatment of common human genetic diseases?</li> <li><input type="checkbox"/> What regulations should be enacted on these technologies?</li> <li><input type="checkbox"/> What legal and ethical problems have arisen from new DNA technologies?</li> <li><input type="checkbox"/> Just because we can should we (use these technologies)?</li> </ul>
	Acquisition	
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Genetic Engineering</li> <li><input type="checkbox"/> Restriction enzymes.</li> <li><input type="checkbox"/> Gel Electrophoresis</li> <li><input type="checkbox"/> PCR</li> <li><input type="checkbox"/> Bioethics</li> <li><input type="checkbox"/> CRISPR technology</li> <li><input type="checkbox"/> DNA microchip analysis</li> <li><input type="checkbox"/> Genetic Testing</li> <li><input type="checkbox"/> DNA fingerprinting</li> <li><input type="checkbox"/> New Terminology- genomics, proteomics, metagenomics.</li> </ul>	<p><i>Students will be skilled at...</i></p> <ul style="list-style-type: none"> <li>• Define Genetic Engineering and describe its subcategories and aims in various biological fields.</li> <li>• Explain the properties of DNA that lend to its manipulation in the laboratory.</li> <li>• Evaluate current research techniques in treating genetic diseases.</li> <li>• Summarize the major methods of analyzing DNA and their results.</li> <li>• Perform and analyze DNA gel electrophoresis patterns.</li> <li>• Explain how restriction enzymes are used in mapping.</li> <li>• Explain how linkage studies led to sequencing of the human genome.</li> <li>• Describe the technology behind</li> </ul>	

		identifying, sequencing, synthesizing, and amplifying DNA. <ul style="list-style-type: none"> <li>• Discuss moral and ethical considerations of gene therapy.</li> <li>• Describe several applications of DNA fingerprinting and microarray analysis.</li> </ul>
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# Unit 3 - Cell Growth and Reproduction

STAGE 1   DESIRED RESULTS		
Standards	Transfer	
3.1.9-12.D Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.	<i>Students will be able to independently use their learning to understand...</i> <ul style="list-style-type: none"> <li><input type="checkbox"/> Genetic information is transferred during cell division of preexisting cells to newly formed cells</li> <li><input type="checkbox"/> Cells differentiate down cell lineages by differential gene expression.</li> </ul>	
	Meaning	
	<b>UNDERSTANDINGS</b> <i>Students will understand that...</i> <ul style="list-style-type: none"> <li><input type="checkbox"/> Cells maintain a balance between cell division and cell death.</li> <li><input type="checkbox"/> Cancer is uncontrolled cell growth.</li> <li><input type="checkbox"/> Scientific research often leads to technological advances that can have positive and negative impacts on society.</li> <li><input type="checkbox"/> Sexual reproduction results in genetic variation of species.</li> </ul>	<b>ESSENTIAL QUESTIONS</b> <i>Students will keep considering...</i> <ul style="list-style-type: none"> <li><input type="checkbox"/> Why is regulation of the cell cycle important?</li> <li><input type="checkbox"/> How are cancer cells different from other cells?</li> <li><input type="checkbox"/> What is the importance of stem cells?</li> <li><input type="checkbox"/> How does sexual reproduction result in genetic variation?</li> <li><input type="checkbox"/> What causes birth defects?</li> </ul>
	Acquisition	
<i>Students will know...</i> <ul style="list-style-type: none"> <li><input type="checkbox"/> Stages of the cell cycle.</li> <li><input type="checkbox"/> Events that occur in the stages of mitosis.</li> <li><input type="checkbox"/> Control/ regulatory factors of the cell cycle.</li> <li><input type="checkbox"/> Events that occur in the stages of meiosis.</li> <li><input type="checkbox"/> The differences between mitosis and meiosis.</li> <li><input type="checkbox"/> Role of Apoptosis.</li> <li><input type="checkbox"/> Role of stem cells in cell proliferation.</li> <li><input type="checkbox"/> Process for cell differentiation.</li> </ul>	<i>Students will be skilled at...</i> <ul style="list-style-type: none"> <li><input type="checkbox"/> Identify stages of mitosis in onion root tips utilizing the microscope.</li> <li><input type="checkbox"/> Discuss various regulatory factors in the control of the cell cycle.</li> <li><input type="checkbox"/> Prepare a comparison chart between mitosis and meiosis.</li> <li><input type="checkbox"/> Prepare a concept map describing cell differentiation/ cell lineages.</li> </ul>	

	<ul style="list-style-type: none"> <li><input type="checkbox"/> Crossing over and independent assortment in meiosis.</li> <li><input type="checkbox"/> Occurrence of identical and fraternal twins.</li> <li><input type="checkbox"/> Role of genes in aging process.</li> <li><input type="checkbox"/> Genetics of cancer.-</li> <li><input type="checkbox"/> Relationship of genes to cancer.</li> <li><input type="checkbox"/> Characteristics of cancer cells.</li> <li><input type="checkbox"/> Detection.</li> <li><input type="checkbox"/> Current treatments.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Provide examples of apoptosis in human health.</li> <li><input type="checkbox"/> Research current applications for stem cell technology.</li> <li><input type="checkbox"/> Research new technologies in cancer treatment and detection.</li> </ul>
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## Unit 4 - Transmission Genetics

STAGE 1   DESIRED RESULTS		
Standards	Transfer	
3.1.9-12.R Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.	<i>Students will be able to independently use their learning to understand...</i> <ul style="list-style-type: none"> <li><input type="checkbox"/> Genetics is the study of DNA and the transfer of information from one generation to the next.</li> <li><input type="checkbox"/> Genetics touches our everyday lives.</li> <li><input type="checkbox"/> In sexually reproducing organisms, each offspring contains a mix of characteristics inherited from both parents.</li> </ul>	
	Meaning	
	<b>UNDERSTANDINGS</b> <i>Students will understand that...</i>	<b>ESSENTIAL QUESTIONS</b> <i>Students will keep considering...</i> <ul style="list-style-type: none"> <li><input type="checkbox"/> What are common patterns of inheritance?</li> <li><input type="checkbox"/> What are the exceptions to Mendel's Laws?</li> </ul>

- Mendel's Laws of Genetics can be used to study and predict inheritance patterns.
- Patterns of inheritance can be obscured when genes have many variants, interact with each other and the environment, are in mitochondria, or are linked on the same chromosome.
- Most human traits are multifactorial.
- Our sex chromosomes at conception set the developmental program for maleness or femaleness, but gene expression before and after birth greatly influences what unfolds.

- How can we predict the transmission of traits to future generations?
- What models are used to study inheritance patterns?
- What determines our sexual identity?
- How does the environment influence genetic traits in populations?

**Acquisition**

*Students will know...*

- Mendel's Laws of Genetics
- Single gene inheritance
- Multiple alleles
- Polygenic Inheritance
- Punnett Squares
- Inheritance patterns and pedigree analysis
- Mitochondrial Genes
- Linkage
- Probability
- Sex chromosomes
- Traits inherited on sex chromosomes.
- Sex-limited and sex influenced traits
- X inactivation
- Genomic imprinting
- Multifactorial traits
- Identical twin studies
- Influence of genes on behavior

*Students will be skilled at...*

- Explain how Mendel's Law of Segregation reflects the events of meiosis.
- Explain how Mendel's Law of Independent Assortment follows the transmission of two or more genes on different chromosomes.
- Analyze case studies that appear to alter expected mendelian ratios.
- Solve probability problems utilizing binomial expansion equations and factorial equation method.
- Perform monohybrid, dihybrid and sex-linked crosses utilizing *Drosophila melanogaster* and analyze outcome via Chi Square.
- Analyze pedigrees to determine inheritance patterns.
- Explain how linked traits are inherited differently from Mendelian traits.
- Solve linkage problems and correlate how linkage is utilized in determining gene location and genetic mapping.
- Produce a concept map on the scope of genomic imprinting.
- Discuss issues and experiments in sexual identity.
- Research behavioral disorders analyzing the

		role of genes and environmental influences.
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