



# Honors Biology - Unit 4 - Inheritance

## Unit Focus

Students will explore the molecular basis of inheritance of traits as they apply their understanding of cellular organelles and processes to how organisms pass traits from parents to offspring. Beginning with the study of the cell cycle, students will take a deeper dive into the cell as they learn about the structure and function of DNA and RNA, control of cellular reproduction and inheritance. Students will use basic mathematical probability to determine the likelihood of offspring expressing or carrying genes. Students will also learn about mechanisms such as mutation and nondisjunction that can result in unexpected changes to the genetic or chromosomal makeup of organisms. Ultimately, students will use all of the knowledge in this unit to analyze a genetic abnormality, explain how the change to the DNA sequence impacts protein synthesis, and how the lack of functionality in the protein manifests in the person.

## Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<p><b>Next Generation Science</b>  <i>High School Life Sciences: 9 - 12</i></p> <ul style="list-style-type: none"> <li>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. <i>HS-LS1-1</i></li> <li>Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. <i>HS-LS1-4</i></li> <li>Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. <i>HS-LS3-1</i></li> <li>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. <i>HS-LS3-2</i></li> </ul> <p><b>Next Generation Science Standards (DCI)</b>  <i>Science: 9</i></p> <ul style="list-style-type: none"> <li>All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that</li> </ul>	<p><i>Students will be able to independently use their learning to...</i></p> <p><b>T1</b> Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign.</p> <p><b>T2</b> Communicate effectively based on purpose, task, and audience to promote collective understanding and/or recommend actions.</p>	
	Meaning	
	Understanding(s)	Essential Question(s)
<p><i>Students will understand that...</i></p> <p><b>U1</b> Cellular growth, division (mitosis), and differentiation produce and maintain a complex organism.</p> <p><b>U2</b> The sequence of DNA bases controls the formation of proteins and changes to the sequence may result in a variety of consequences.</p> <p><b>U3</b> Although each cell has the same genetic information, each cell can vary in structure and function because different genes are expressed.</p> <p><b>U4</b> Genetic variation can result from mutations caused by environmental factors or errors in DNA replication, or from chromosomes swapping sections during meiosis.</p> <p><b>U5</b> Advances in genetic sequencing have allowed for the identification of mutations that may lead to diseases, or the potential of diseases.</p>	<p><i>Students will keep considering...</i></p> <p><b>Q1</b> How do organisms regulate their growth and development?</p> <p><b>Q2</b> How does the structure of DNA relate to it's function?</p> <p><b>Q3</b> Why do offspring resemble their parents?</p> <p><b>Q4</b> How can health professionals use genetics to predict and treat disease?</p>	

## Stage 1: Desired Results - Key Understandings

<p>contain the instructions that code for the formation of proteins. <i>LS1.9.A2</i></p> <ul style="list-style-type: none"> <li>In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. <i>LS1.9.B1</i></li> <li>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. <i>LS3.9.A1</i></li> <li>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. <i>LS3.9.B1</i></li> </ul> <p><b>Madison Public Schools Profile of a Graduate</b>          Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)          Design: Engaging in a process to refine a product for an intended audience and purpose. (POG.2.2)</p>	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
	<p><i>Students will know...</i></p> <p><b>K1</b> Cellular division occurs in phases, with a specific set of functions taking place at each step.</p> <p><b>K2</b> The cell cycle regulates cell division through signals and checkpoints.</p> <p><b>K3</b> DNA replication is a vital step in cellular reproduction.</p> <p><b>K4</b> DNA contains the genetic information that controls functions and traits.</p> <p><b>K5</b> DNA and RNA are both nucleic acids, but their structure, and therefore their function, differ.</p> <p><b>K6</b> DNA and RNA work in harmony to create the proteins that are essential to life.</p> <p><b>K7</b> Errors in DNA are called mutations and can be helpful, harmful or neutral.</p> <p><b>K8</b> Vocabulary: mitosis, meiosis, apoptosis, regulation, expression, mutation, deletion, addition, substitution, frameshift, autosomal, haploid, diploid, gamete, somatic cell, recessive, dominant, sex-linked, protein synthesis, variation, nondisjunction, crossing-over</p>	<p><i>Students will be skilled at...</i></p> <p><b>S1</b> Research a genetic disorder to determine what is happening at the molecular level and then explain the symptoms of the disease to their peers.</p> <p><b>S2</b> Make and defend a claim based on evidence about how, when, where and why inheritable genetic variations occur.</p> <p><b>S3</b> Apply principles of statistics to the inheritance of traits.</p>