



Biology - Unit 4 - Inheritance

Unit Focus

The final unit brings together several concepts studied during the year. Students will investigate the relationship of DNA and chromosomes in the processes of cell division for growth, repair, and sexual reproduction. Students will uncover how genes are passed from parent to offspring and apply probability rules to determine the likelihood of passing on certain traits. As students engage in applying their understanding of genetics and inheritance to evolution, they will uncover how natural selection is driven by primarily by environmental changes and heritable genetic variations. Students analyze the genetic and physical changes in the populations of the ecosystem they explored in Units 1 and 2 as they examine how and why the populations changed following an environmental shift. In doing so, students will develop and justify scientifically-based explanations for the population shifts.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
Next Generation Science <i>High School Life Sciences: 9 - 12</i> - Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. <i>HS-LS1-4</i> - 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> - 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> Madison Public Schools Profile of a Graduate <i>Critical Thinking</i> - Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)	T1 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions. T2 Communicate effectively based on purpose, task, and audience to promote collective understanding and/or recommend actions.	
	Meaning	
	Understanding(s)	Essential Question(s)
	U1 Cellular growth, division (mitosis), and differentiation produces and maintains a complex organism. U2 In a multicellular organism, cell growth and cell division are carefully regulated by proteins U3 For organisms to grow and repair damaged cells, each cell must be capable of accurately copying itself. U4 DNA is the blueprint which contains the instructions for cells to manufacture proteins U5 The likelihood that an offspring will inherit specific traits, with few exceptions, are governed by the laws of probability U6 Multicellular organisms pass traits to their offspring through the process of reduction division U7 The laws of probability can be used to predict the inheritance patterns among related individuals U8 Natural Selection occurs only if there is variation in the genes and associated traits between individuals in a population U9 The fitness of an organism is dependent on traits or genes	Q1 How do organisms grow and develop? Q2 How does DNA sequence control the traits of organisms? Q3 How do living organisms pass traits from one generation to the next? Q4 How can we explain why certain traits/genes get expressed and not others? Q5 How does Natural Selection affect genetic variation among organisms? Q6 How do we scientifically explain the evidence and mechanisms for biological evolution?

Stage 1: Desired Results - Key Understandings

Collaboration/Communication

- Product Creation: Effectively use a medium to communicate important information. (POG.3.2)

Acquisition of Knowledge and Skill

	Knowledge	Skill(s)
	K1 Prokaryotes divide by binary fission and eukaryotes divide by mitosis. K2 The phases of the cell cycle are G1, S, G2, and Mitosis. K3 The structure of DNA is in the form of a double helix. This structure allows it to be unzipped to be copied by the cell through DNA synthesis. Errors that occur are called mutations. Some can be fixed by DNA repair; others cannot and may result in cancer. K4 Mitosis is the form of cell division used for growth and cell replacement. K5 Cancer cells have lost the ability to control growth. K6 Cells that divide out of control form tumors. K7 Meiosis the form of cell division that reduces the number of chromosomes in gametes for sexually reproducing organisms. K8 Mitosis results in the production of 2 identical diploid (somatic) cells. Meiosis produces 4 genetically unique haploid (gametes) cells. K9 The progression of the cell cycle is regulated through various mechanisms, including cyclins and checkpoint proteins. K10 Exceptions to laws of probability may include acquired mutations, crossing over, and gene linkage K11 The traits that positively affect survival are more likely to be reproduced and are thus more common in the population K12 Selective pressures can promote genetic changes that cause variations in structures in organisms that are descended from a common ancestor. K13 Vocabulary: cell division, mitosis, cytokinesis, chromatid, centromere, interphase, cell cycle, prophase, centriole, spindle, metaphase, anaphase, telophase, cyclin, cancer, genetics, fertilization, true-breeding, trait, hybrid, gene, allele, segregation, probability, Punnett Square, homozygous, heterozygous, phenotype, genotype, independent assortment, incomplete dominance, codominance, multiple alleles, polygenic traits, homologous, diploid, haploid, meiosis, tetrad, crossing-over, gene map, sex-linked, autosomes, karyotype, pedigree	S1 Create models showing the processes of mitosis and meiosis. S2 Apply understanding of genetics and probability to a novel case study and provide an scientifically based explanation for the disorder highlighted in the case study as well as an evidence based explanation claims and predictions. S3 Construct an explanation based on evidence for how natural selection leads to adaptation of organisms in a population