Science:
Biology
Unit 1: Molecular Basis of Heredity

Essential Understandings	▪ In all organisms, the instructions for specifying the characteristics of the organisms are carried in DNA. ▪ Most of the cells in a human contain two copies of each of 22 different chromosomes. In addition, there is a pair of chromosomes that determines sex. ▪ Changes in DNA (mutations) occur spontaneously at low rates.
Essential Questions	▪ Where on the DNA chain are instructions for specifying characteristics located? ▪ What is the function of DNA? ▪ How many chromosomes are found in a human cell? ▪ How is gender determined? ▪ How is genetic material passed from one generation to the next? ▪ How do mutations impact living organisms?
Essential Knowledge	▪ Gregor Mendel is considered the father of modern genetics. ▪ DNA is a double helix. ▪ Chromosomes carry genes. ▪ Gene expression follows specific patterns of inheritance. ▪ Changes in DNA occur spontaneously.
Vocabulary	▪ <u>Terms</u>: ○ DNA, replication, RNA, protein synthesis, mitosis, meiosis, Punnett square, phenotype, genotype, mutations, alleles, gene, pedigree, karyotype
Essential Skills	▪ Identify stages of mitosis. ▪ Complete and analyze a Punnett square. ▪ Construct a DNA model. ▪ Investigate and discuss DNA as the agent of heredity. ▪ Relate the role of DNA analysis to genetic order.

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Related Maine Learning Results	Science E. The Living Environment E3.Cells Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities and differences in the basic functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move. b. Describe the relationship among DNA, protein molecules, and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division (mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems for carrying out life functions. E4.Heredity and Reproduction Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells, and in evolving new species. a. Explain some of the effects of the sorting and recombination of genes in sexual reproduction. b. Describe genes as segments of DNA that contain instructions for the cells and include information that leads to the differentiation of cells. c. Explain how the instructions in DNA that lead to cell differentiation result in varied cell functions in the organism and DNA. d. Describe the possible causes and effects of gene mutations.

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Related Maine Learning Results	E5. Evolution Students describe the interactions between and among species, populations, and environments that lead to natural selection and evolution. a. Describe the premise of biological evolution, citing evidence from the fossil record and evidence based on the observation of similarities within the diversity of existing organisms. b. Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation. c. Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.
Sample Lessons and Activities	▪ Presentations on each chapter. ▪ Identify the stages of mitosis using an *Allium* root tip. ▪ Demonstrate the outcome of genetic crosses using Punnett squares. ▪ Build DNA and RNA models. ▪ Research a genetic disorder.
Sample Classroom Assessment Methods	▪ Quizzes ▪ Labs ▪ Tests ▪ Homework ▪ Research product
Sample Resources	▪ Publications: o Biology – Kenneth Miller and Josephine Levine o Biology: The Dynamics of Life – Glencoe Internet Resources ▪ Other Resources o Lab Supplies