Science
Biology: Honors
Unit 2: Biological Evolution

Essential Understandings	▪ Species evolve over time. ▪ The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms. ▪ Natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life forms, as well as for the striking molecular similarities observed among the diverse species of living organisms. ▪ The millions of different species of plants, animals, and microorganisms that live on Earth today are related by descent from common ancestors. ▪ Biological classifications are based on how organisms are related.
Essential Questions	▪ What is evolution? ▪ How do species evolve over time? ▪ What evidence do we have that species have changed over the last 3.5 billion years? ▪ What is the mechanism that drives evolution? ▪ What evidence do we have of common ancestry? ▪ How are organisms classified?
Essential Knowledge	▪ Charles Darwin's observations led him to the idea of natural selection. ▪ The fossil record provides evidence of change over time. ▪ Natural selection is the mechanism that drives evolution. ▪ Homologous structures, embryological evidence, and DNA provide evidence for common ancestry. ▪ Organisms are classified based on structural similarities, breeding behavior, geographical distribution, chromosomes, and biochemistry.
Vocabulary	▪ <u>Terms</u>: o evolution, mutation, natural selection, directional selection, stabilizing selection, disruptive selection, fitness, adaptation, survival of the fittest, common descent, homologous structure, hox pool, gene pool, allele frequency, Hardy-Weinberg principle, genetic equilibrium, speciation, fossil, taxonomy, binomial nomenclature, domain, kingdom, phylum, class, order, family, genus, species
Essential Skills	▪ Recognize that fossil records provide a scientific explanation for variation in the species and common ancestors. ▪ Relate the role of natural selection to the development, diversity, and/or extinction of species. ▪ Classify organisms.

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<u>Science</u>
B. The Skills and Traits of Scientific Inquiry and Technological Design
B1. Skills and Traits of Scientific Inquiry
Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis.
a. Identify questions, concepts, and testable hypotheses that guide scientific investigations.
b. Design and safely conduct methodical scientific investigations, including experiments with controls.
c. Use statistics to summarize, describe, analyze, and interpret results.
d. Formulate and revise scientific investigations and models using logic and evidence.
e. Use a variety of tools and technologies to improve investigations and communications.
f. Recognize and analyze alternative explanations and models using scientific criteria.
g. Communicate and defend scientific ideas.
B2. Skills and Traits of Technological Design
Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs.
a. Identify new problems or a current design in need of improvement.
b. Generate alternative design solutions.
c. Select the design that best meets established criteria.
d. Use models and simulations as prototypes in the design planning process.
e. Implement the proposed design solution.
f. Evaluate the solution to a design problem and the consequences of that solution.
g. Present the problem, design process, and solution to a design problem including models, diagrams, and demonstrations.
C. The Scientific and Technological Enterprise
C1. Understandings of Inquiry
Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly.
a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations.
b. Describe how scientists defend their evidence and
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	explanations using logical argument and verifiable results.

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C2. Understandings About Science and Technology
Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems.
a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge.
b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design.
C3. Science, Technology, and Society
Students describe the role of science and technology in creating and solving contemporary issues and challenges.
c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology.
C4. History and Nature of Science
Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society.
a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public.
b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society.
c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists.
d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones.
D. The Physical Setting
D2. Earth
Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems.
c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems.
D3. Matter and Energy
Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy.
h. Describe radioactive decay and half-life.
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Related Maine Learning Results	E. The Living Environment E1. Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species. c. Analyze the relatedness among organisms using structural and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2. Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. 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. 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). 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. 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	▪ Create a geologic time line. ▪ Compare allele frequencies in a population. ▪ Use a dichotomous key. ▪ Lab comparing primate morphology.
Sample Classroom Assessment Methods	▪ Quiz ▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ <u>Publications</u>: o <u>Biology</u> – Kenneth Miller and Josephine Levine o <u>Biology: The Dynamics of Life</u> – Glencoe Internet Resources ▪ <u>Videos</u>: o <u>Evolution</u> – PBS series o <u>Voyage to the Galapagos</u> – Scientific American Frontiers ▪ <u>Other Resources</u> o Lab Supplies