# 07_Evolution and Natural Selection Biology

Content Area: **Science**
Course(s):
Time Period: **Full Year**
Length: **2-3 weeks**
Status: **Published**

## General Overview, Course Description or Course Philosophy

Biology focuses on the diversity, complexity, and interdependence of life on Earth. Students will develop an understanding of how organisms evolve, reproduce, and adapt to their environments. This will include an exploration of how to relate the structure and function of molecules to their role in cell biology and metabolism. Further understanding of evolution and reproduction will be explored through the science of genetics. Knowledge of biodiversity and adaptation will be illustrated through the science of ecology.

## OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

- Genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence.
- Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals
- The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.
- Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment.

## CONTENT AREA STANDARDS

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|---|---|
| SCI.HS-LS4-4 | Construct an explanation based on evidence for how natural selection leads to adaptation of populations. |
| SCI.HS-LS4-5 | Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. |
| SCI.HS-LS4-1 | Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. |
| SCI.HS-LS4-3 | Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. |

## RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

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|---|---|
| MA.S-ID.A.1 | Represent data with plots on the real number line (dot plots, histograms, and box plots). |
| MA.S-IC.B.6 | Evaluate reports based on data. |
| LA.W.9-10.8 | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals). |
| LA.W.9-10.9 | Draw evidence from literary or nonfiction informational texts to support analysis, reflection, and research. |
| SCI.HS-ESS1-6 | Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. |
| TECH.9.4.12.IML.3 | Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8). |

## STUDENT LEARNING TARGETS

### Declarative Knowledge

Students will understand that:

- Patterns observed at multiple spatial and temporal scales (e.g., DNA sequences, embryological development, fossil records) provide evidence for causal relationships relating to biological evolution and common ancestry.
- Evolution is caused primarily by one or more of the four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
- The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.

### Procedural Knowledge

Students will be able to:

- Students identify and communicate evidence for common ancestry and biological evolution, including:
    - Information derived from DNA sequences, which vary among species but have many similarities between species.
    - Similarities of the patterns of amino acid sequences, even when DNA sequences are slightly different.
    - Patterns in the fossil record (e.g., presence, location, and inferences possible in lines of

evolutionary descent for multiple specimens).
    - The pattern of anatomical and embryological similarities.

## EVIDENCE OF LEARNING

### Formative Assessments

- Checks for understanding during lesson.
- Do Now activities.
- Student-centered questioning and discussion that is facilitated by instructor.
- Exit Tickets.

### Summative Assessments

- Exams/Unit Exams.
- Quizzes.
- Laboratory Activities.

## RESOURCES (Instructional, Supplemental, Intervention Materials)

Miller & Levine Biology Textbook

- Unit 5 - Evolution
    - Chapter 17 - Darwin's Theory of Evolution
        - Case Study: *Lizards, legs, and the diversity of life*
    - Chapter 18 - Evolution of Populations
        - Analyzing Data: *Variation of Expressed Traits*
    - Chapter 19 - Biodiversity and Classification
        - Quick Lab: *Using a Dichotomous Key*
    - Chapter 20 - History of Life
        - Analyzing Data: *Extinction Through Time*

POGIL Biology

- Evidence for Evolution
- Evolution and Selection

Gizmos

- Evolution: Natural and Artificial Selection
- Natural Selection
- Evolution (STEM Case)
- Evolution: Mutation and Selection
- Rabbit Population by Season
- GMO's and the Environment

Brainpop

NSTA

Data Nuggets

## INTERDISCIPLINARY CONNECTIONS

ELA/Literacy

Mathematics

Technology

## ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.