

<p>Important Concepts</p> <p>Adaptations and Changes Over Time</p> <p>9-12 Level</p>	<p>Alaska Science Content Standard <b>C1</b> Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution.</p>
--	---

Grade Level Expectations:

The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution by:

**[9] SC1.1** recognizing that all organisms have chromosomes made of DNA and that DNA determines traits

**[9] SC1.2** using probabilities to recognize patterns of inheritance (e.g., Punnett Squares)

**[9] SC1.3** inferring evolutionary pathways from evidence (e.g., fossils, geologic samples, recorded history)

**[10] SC1.2** explaining how the processes of natural selection can cause speciation and extinction

**[10] SC1.3** examining issues related to genetics (**L**)

**[11] SC1.1** relating the structure of DNA to characteristics of an organism

**[11] SC1.2** researching how the processes of natural selection cause changes in species over time (**L**)

According to AAAS's Benchmarks for Science Literacy\*, some of the things that students should know and understand by the end of twelfth grade are:

The sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations in the offspring of any two parents.

The information passed from parents to offspring is coded in DNA molecules; long chains linking just four kinds of smaller molecules, whose precise sequence encodes genetic information.

Genes are segments of DNA molecules. Inserting, deleting or substituting segments of DNA molecules can alter genes. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment.

New heritable characteristics can result from new combinations of existing genes or from mutations of genes in reproductive cells. Changes in other cells of an organism cannot be passed on to the next generation.

The basic idea of biological evolution is that the earth's present-day species are descended from earlier, distinctly different species.

Molecular evidence substantiates the anatomical evidence for evolution and provides additional detail about the sequence in which various lines of descent branched off from one another.

Natural selection provides the following mechanism for evolution: Some variation in heritable characteristics exists within every species; some of these characteristics give individuals an advantage over others in surviving and reproducing; and the advantaged offspring, in turn, are more likely than others to survive and reproduce. As a result, the proportion of individuals that have advantageous characteristics will increase.

\*Project 2061, American Association for the Advancement of Science, Benchmarks for Science Literacy. New York: Oxford University Press, 1993.

Heritable characteristics influence how likely an organism is to survive and reproduce. Natural selection leads to organisms that are well suited for survival in particular environments.

Chance alone can result in the persistence of some heritable characteristics having no survival or reproductive advantage or disadvantage for the organism

When an environment, including other organisms that inhabit it changes, the survival value of inherited characteristics may change.

Modern ideas about evolution and heredity provide a scientific explanation for the history of life on Earth as depicted in the fossil record and in the similarities evident within the diversity of existing organisms.

Life on earth is thought to have begun as simple, one-celled organisms about four billion years ago. Once cells with nuclei developed about a billion years ago, increasingly complex multi-cellular organisms evolved.

The continuing operation of natural selection on new characteristics and in diverse and changing environments, over and over again for millions of years, has produced a succession of diverse new species.