

# BIOLOGY 1 OVERVIEW

The academic standards and performance indicators establish the practices and core content for all Biology courses in South Carolina high schools. The core ideas within the standards are not meant to represent an equal division of material and concepts. Therefore, the number of indicators per core idea should not be expected to be equal, nor should equal numbers of performance indicators within each standard be expected.

The five core areas of the Biology 1 course standards include:

- Cells as a System
- Energy Transfer
- Heredity – Inheritance and Variation of Traits
- Biological Evolution – Unity and Diversity
- Ecosystem Dynamics

The eight science and engineering practices describe how students should learn and demonstrate knowledge of the content outlined in the content standards. Engaging in these practices will help students become scientifically literate and astute consumers of scientific information. The seven core concepts (patterns; cause and effect; scale, proportion, and quantity; systems and system



**BIOLOGY 1**  
**SCIENCE AND ENGINEERING PRACTICES** (*CONTINUED*)

**H.B.1A.7** Construct and analyze scientific arguments to support claims, explanations, or designs using evidence and valid reasoning from observations, data, or informational texts.

**H.B.1A.8** Obtain and evaluate scientific information to (1) answer questions, (2) explain or

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## CELLS AS A SYSTEM

**Standard H.B.2:** The student will demonstrate the understanding that the essential functions of life take place within cells or systems of cells.

**H.B.2A. Conceptual Understanding:** The essential functions of a cell involve chemical reactions that take place between many different types of molecules (including carbohydrates, lipids, proteins and nucleic acids) and are catalyzed by enzymes.

**Performance Indicators:** Students who demonstrate this understanding can:

**H.B.2A.1** Construct explanations of how the structures of carbohydrates, lipids, proteins, and nucleic acids (including DNA and RNA) are related to their functions in organisms.

**H.B.2A.2** Plan and conduct investigations to determine how various environmental factors (including temperature and pH) affect enzyme activity and the rate of biochemical reactions.

**H.B.2B. Conceptual Understanding:** Organisms and their parts are made of cells. Cells are the structural units of life and have specialized substructures that carry out the essential functions of life. Viruses lack cellular organization and therefore cannot independently carry out all of the essential functions of life.

**Performance Indicators:** Students who demonstrate this understanding can:

**H.B.2B.1** Develop and use models to explain how specialized structures within cells (including the nucleus, chromosomes, cytoskeleton, endoplasmic reticulum, ribosomes and Golgi complex) interact to produce, modify, and transport proteins. M

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## CELLS AS A SYSTEM (*CONTINUED*)

**H.B.2C.2** Ask scientific questions to define the problems that organisms face in maintaining homeostasis within different environments (including water of varying solute concentrations).

**H.B.2C.3** Analyze and interpret data to explain the movement of molecules (including water) across a membrane.

**H.B.2D. Conceptual Understanding:** The cells of multicellular organisms repeatedly divide to make more cells for growth and repair. During embryonic development, a single cell gives rise to a complex, multicellular organism through the processes of both cell division and differentiation.

**Performance Indicators:** Students who demonstrate this understanding can:

**H.B.2D.1** Construct models to explain how the processes of cell division and cell differentiation produce and maintain complex multicellular organisms.

**H.B.2D.2** Develop and use models to exemplify the changes that occur in a cell during the cell cycle (including changes in cell size, chromosomes, cell membrane/cell wall, and the number of cells produced) and predict, based on the models, what might happen to a cell that does not progress through the cycle correctly.

**H.B.2D.3** Construct explanations for how the cell cycle is monitored by check point systems and communicate possible consequences of the continued cycling of abnormal cells.

**H.B.2D.4** Construct scientific arguments to support the pros and cons of biotechnological applications of stem cells using examples from both plants and animals.

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## ENERGY TRANSFER

**Standard H.B.3:** The student will demonstrate the understanding that all essential processes within organisms require energy which in most ecosystems is ultimately derived from the Sun and transferred into chemical energy by the photosynthetic organisms of that ecosystem.

**H.B.3A. Conceptual Understanding:** Cells transform energy that organisms need to perform essential life functions through a complex sequence of reactions in which chemical energy is transferred from one system of interacting molecules to another.

# **BIOLOGY 1**

## **HEREDITY**

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## HEREDITY: INHERITANCE AND VARIATION OF TRAITS (*CONTINUED*)

**H.B.4C. Conceptual Understanding:** Sex cells are formed by a process of cell division in which the number of chromosomes per cell is halved after replication. With the exception of sex chromosomes, for each chromosome in the body cells of a multicellular organism, there is a second similar, but not identical, chromosome. Although these pairs of similar chromosomes can carry the same genes, they may have slightly different alleles. During meiosis the pairs of similar chromosomes may cross and trade pieces. One chromosome from each pair is ra



**BIOLOGY 1**  
**BIOLOGICAL EVOLUTION AND THE DIVERSITY OF LIFE**  
**(2005 STANDARDS)**

**Standard B-5:** The student will demonstrate an understanding of biological evolution and the diversity of life.

Indicators

**B-5.1** Summarize the process of natural selection.

**B-5.2** Explain how genetic processes result in the continuity of life-forms over time.

**B-5.3** Explain how diversity within a species increases the chances of its survival.

**B-5.4** Explain how genetic variability and environmental factors lead to biological evolution.

**B-5.5** Exemplify scientific evidence in the fields of anatomy, embryology, biochemistry, and paleontology that underlies the theory of biological evolution.

**B-5.6** Summarize ways that scientists use data from a variety of sources to investigate and critically analyze aspects of evolutionary theory.

**B-5.7** Use a phylogenetic tree to identify the evolutionary relationships among different groups of organisms

# BIOLOGY 1

## ECOSYSTEM DYNAMICS

**Standard H.B.6:** The student will demonstrate an understanding that ecosystems are complex, interactive systems that include both biological communities and physical components of the environment.

**H.B.6A. Conceptual Understanding:** Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. Limiting factors include the availability of biotic and abiotic resources and challenges such as predation, competition, and disease.

**Performance Indicators:** Students who demonstrate this understanding can:

**H.B.6A.1** Analyze and interpret data that depict changes in the abiotic and biotic components of an ecosystem over time or space (such as percent change, average change, correlation and proportionality) and propose hypotheses about possible relationships between the changes in the abiotic components and the biotic components of the environment.

**H.B.6A.2** Use mathematical and computational thinking to support claims that limiting factors affect the number of individuals that an ecosystem can support.

**H.B.6B. Conceptual Understanding:** Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged between the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.

**Performance Indicators:** Students who demonstrate this understanding can:

**H.B.6B.1** Develop and use models of the carbon cycle, which include the interactions between photosynthesis, cellular respiration and other processes that release carbon dioxide, to evaluate the effects of increasing atmospheric carbon dioxide on natural and agricultural ecosystems.

**H.B.6B.2** Analyze and interpret quantitative data to construct an explanation for the effects of greenhouse gases (such as carbon dioxide and methane) on the carbon cycle and global climate.

**BIOLOGY 1**  
**ECOSYSTEM DYNAMICS** (*CONTINUED*)