

North Carolina Essential Standards for Biology

Structure and Function of Living Organisms

Essential Standard 1.1: Understand the relationship between the structures and functions of cells and their organelles.

Objective 1.1.1: Summarize the structure and function of organelles in eukaryotic cells and ways that these organelles interact with each other to perform the function of the cell.

Objective 1.1.2: Compare prokaryotic and eukaryotic cells in terms of their general structures (plasma membrane and genetic material) and degree of complexity.

Objective 1.1.3: Explain how instructions in DNA lead to cell differentiation and result in cells specialized to perform specific functions in multi-cellular organisms.

Essential Standard 1.2: Analyze the cell as a living system.

Objective 1.2.1: Explain how homeostasis is maintained in the cell and within an organism in various environments.

Objective 1.2.2: Analyze how cells grow and reproduce in terms of interphase, mitosis, and cytokinesis.

Objective 1.2.3: Explain how specific cell adaptations help cells survive in particular environments.

Ecosystems

Essential Standard 2.1: Analyze the interdependence of living organisms within their environments.

Objective 2.1.1: Analyze the flow of energy and cycling of matter, such as water, carbon, nitrogen, and oxygen, through ecosystems relating the significance of each to maintaining the health and sustainability of an ecosystem.

Objective 2.1.2: Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.

Objective 2.1.3: Explain various ways organisms interact with each other including predation, competition, parasitism, mutualism and also how they interact with their environments resulting in stability within ecosystems.

Objective 2.1.4: Explain how ecosystems can be relatively stable over hundreds or thousands of years, even though populations may fluctuate due to availability of food and shelter, as well as the number of predators, or disease.

Essential Standard 2.2: Understand the impact of human activities on the environment (one generation after the next)

Objective 2.2.1: Infer how human activities (including population growth, pollution, global warming, burning of fossil fuels, habitat destruction, and introduction of non-native species) may impact the environment.

Objective 2.2.2: Explain how the use, protection, and conservation of natural resources by humans impact the environment from one generation to the next.

Evolution and Genetics

Essential Standard 3.1: Explain how traits are determined by the structure and function of DNA.

Objective 3.1.1: Explain the double-stranded, complementary nature of DNA as related to its function in the cell.

Objective 3.1.2: Explain how DNA and RNA codes for proteins and determine traits.

Objective 3.1.3: Explain how mutations in DNA result from interactions with the environment such as radiation and chemicals or from new combinations in existing genes lead to changes in function and phenotype.

Essential Standard 3.2: Understand how the environment, and/or the interaction of alleles, influences the expression of genetic traits.

Objective 3.2.1: Explain the role of meiosis in sexual reproduction and genetic variation.

Objective 3.2.2: Predict offspring ratios based on a variety of inheritance patterns (including dominance, co-dominance, incomplete dominance, multiple alleles, and sex-linked traits)

Objectives 3.2.3: Explain how the environment can influence the expression of genetic traits.

Essential Standard 3.3: Understand the application of DNA technology

Objective 3.3.1: Interpret how DNA is used for comparison and identification of organisms.

Objectives 3.3.2: Summarize how transgenic organisms are engineered to benefit society.

Objective 3.3.3: Evaluate some of the ethical issues surrounding the use of DNA technology (including cloning, genetically modified organisms, stem cell research, and Human Genome Project).

Essential Standard 3.4: Explain the theory of evolution by natural selection as a mechanism for how species change over time.

Objective 3.4.1: Explain how fossil, biochemical, and anatomical evidence support the theory of evolution.

Objectives 3.4.2: Explain how natural selection influences the changes in species over time.

Objective 3.4.3: Explain how various disease agents (bacteria, viruses, chemicals) can influence natural selection.

Essential Standard 3.5: Analyze how classification systems are developed upon speciation.

Objective 3.5.1: Explain the historical development and changing nature of classification systems.

Objectives 3.5.2: Analyze the classification of organisms according to their evolutionary relationships (including dichotomous keys and phylogenetic trees).

Molecular Biology

Essential Standard 4.1: Understand how biological molecules are essential to the survival of living organisms.

Objective 4.1.1: Compare the structure and functions of the major biological molecules (carbohydrates, proteins, lipids, and nucleic acids).

Objectives 4.1.2: Summarize the relationship among DNA, proteins, and amino acids in carrying out the work of cells and how this is similar in all organisms.

Objective 4.1.3: Explain how enzymes act as catalysts for biological reactions.

Essential Standard 4.2: Analyze the relationship between biochemical processes and energy use in the cell.

Objective 4.2.1: Analyze photosynthesis and cellular respiration in terms of how energy is stored, released, and transferred within and between these systems.

Objectives 4.2.2: Explain ways that organisms use released energy for maintaining homeostasis (active transport)