

Biology and Ecology

Year 10

(70 hrs, 2 hrs per week)

Biology and Ecology course **aims** at instilling in pupils natural science competences by mastering a system of integrated knowledge on the rules of functioning of living systems, their development and interaction, interaction with the environment; understanding the biological picture of the world and value of such categories as life, nature, health; using knowledge on biology and ecology in everyday life, assessing their role for a stable (balanced) development of humanity, science, and technologies.

Content of educational material	The expected academic performance of a pupil
Introduction (4 hrs approximately)	
<p>Interdisciplinary relations between biology and ecology.</p> <p>Level of organization of biological systems and their interaction.</p> <p>Fundamental features of living organisms.</p> <p>Strategy of stable development of nature and the society.</p>	<ul style="list-style-type: none"> • Understands the following terms: system, biosystem, ecosystem, environment, sustainable development of nature and the society. • Can name the main domains where biological research can be applied. • Provides examples of biosystems of different levels. • Characterizes the features of living organisms: regeneration, self-reproduction, and self-regulation.
Topic 1. Biodiversity (13 hrs approximately)	
<p>Principles of scientific classification of organisms.</p> <p>Modern species criteria.</p> <p>Viruses, viroids, and prions. Peculiarities of their organization and functioning.</p> <p>Hypotheses of virus origin. Interaction with the master cell and its impact on virus functioning.</p> <p>The role of viruses in human organism. Using viruses in biological methods of fighting harmful species.</p>	<ul style="list-style-type: none"> • Makes up species characteristics using species criteria; comparison of viruses, viroids, prions; archaea and bacteria; unicell and multicellular eucariotic organisms. • Classifies certain species of mushrooms, plants, and animals; defines taxonomic status of species in the organic world system. • Assesses the importance of systematics in modern biological studies.

<p>Prokaryotic organisms: archaea and bacteria. Peculiarities of their organization and functioning. Modern views on the system of eucariotic organisms. Biodiversity of our planet as a consequence of evolution.</p>	
<p>Topic 2. Metabolism and energy conversion (approximately 15 hrs)</p>	
<p>Proteins, nucleic acids, carbohydrates, and lipids: overview of the structure and biological role. Metabolism and energy conversion as a basis of functioning of biological systems. Particularities of metabolism of autotrophic and heterotrophic organisms. Energy support of metabolism processes. Means of energy consumption by different autotrophic and heterotrophic organisms. Role of breathing in energy supply of organisms. Structures of cells facilitating metabolism processes. Role of enzymes in the process of metabolism of a cell and the entire organism. Vitamins, and their role in metabolism. Metabolism damaged due to lack or surplus of certain chemical elements and substances. Importance of quality of potable water for human health. Rational diet as a basis of normal metabolism. Negative impact of toxic substances on metabolism. Detoxification in human body.</p>	<ul style="list-style-type: none"> • Provides examples of diseases related to lack or surplus of certain chemical elements and substances; • Makes up schemes of carbohydrates, lipids, and proteins metabolism in human body and interaction between them. • Compares energetic and plastic values of different substances. • Makes assumptions on the impact of different substances (useful and harmful) on human health. • Assesses the importance of quality of potable water and rational diet for human health.
<p>Topic 3. Inheritance and changes (approximately 20 hrs)</p>	
<p>Main concepts of genetics. Rules of inheritance. Hybridologic analysis: main types of hybridization and their consequences. Modern molecular and genetic research methods of human inheritance. Human karyotype and its features. Chromosome analysis as a method to reveal the violations in the structure of karyotype.</p>	<ul style="list-style-type: none"> • Provides examples of hereditary changes (combination, mutagene) in humans; modification changes in humans. • Characterizes types of inheritance of human traits (complete and incomplete dominance, co-dominance; autosomal-recessive and autosomal-dominant inheritance, genetic linkage, and gender linkage); rules of

<p>Modern state of research of human genome. Monogenic and polygenic inheritance of traits in humans. Extrachromosomal (cytoplasmic) inheritance in humans.</p> <p>Laws of changes (hereditary and non-hereditary) of a person.</p> <p>Mutations and their features. Notion of spontaneous mutations. Biological antimutation mechanisms. Protection of human genome from harmful mutagene impact.</p> <p>Genetic monitoring in human communities. Modern tasks of medical genetics. Heritable diseases and conditions in humans, human diseases with hereditary susceptibility, and reasons for them. Methods of diagnosis and prophylaxis of hereditary illnesses of humans. Medical-genetic counselling and its organization.</p>	<p>modification changes in humans; types of human mutations; mutagene factors.</p> <ul style="list-style-type: none"> • Solves typical genetic tasks (monohybrid and dihybrid crossing; complete and incomplete dominance, co-dominance; and gender linkage). • Defines possible genotypes under a given phenotype (and vice versa) upon the crossing results: the dominant (recessive) gene; and type of trait inheritance. • Makes up genealogical tables. • Provides arguments on harmful substances as mutagene factors.
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Topic 4. Reproduction and development (approximately 12 hrs)

<p>Reproduction as a mechanism of species continuity.</p> <p>Special features of human organism regeneration. Tissue and organs transplanting in humans; prospects of the domain. Biological ethical rules.</p> <p>The growth and development of cells, and factors impacting them. Cell aging and death. Reasons for damages in cell cycle and consequences thereof.</p> <p>Concept of oncogenic factors and oncological diseases. Prevention of oncological diseases.</p> <p>Sex cells. Features of human gametogenesis. Essence and biological meaning of impregnation. Reasons for damaged impregnation mechanism of human. Features of human reproduction due to biosocial essence. Reproductive health. Modern opportunities and prospects of reproductive medicine. Biological and social aspects of human reproduction control.</p>	<ul style="list-style-type: none"> • Explains the meaning of regeneration; the essence and biological meaning of impregnation. • Characterizes periods of human embryonic and postembryonic development; • Makes up comparative characteristics of human sex cells; development of male and female sex cells; • Demonstrates the skills of work with a microscope. • Assesses the impact of positive and negative aspects on human growth and development; importance of oncological disease prevention; • Provides arguments on the impact of lifestyle on the formation of human organism and reproductive health; the need of responsible family planning.
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Educational programs in use for teaching Ukrainian children



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Human embryogenesis. Interaction between the parts of developing embryo (embryonic induction).

Aspects that can have a positive and negative effect on the processes of human growth and development.