Recommended books:

Campbell Biology (Pearsons from 9th edition)

Russel Biology: the dynamic science. (McMillan 3 edition)

I. MOLECULES AND CELLS

1. Biological molecules

1.1	To describe the significance of water for the cell relating it to the vital functions of the body: transport of dissolved substances, photosynthesis, digestive reactions, homeostasis (thermoregulation).
1.2	To specify carbohydrates as energy (glucose), reserve (starch, glycogen) and constituent (cellulose) materials.
1.3	To describe the diversity of carbohydrates (monosaccharides, disaccharides and polysaccharides) and relate them to the functions of carbohydrates: energy (glucose, sucrose), storage (starch, glycogen) and construction (cellulose).
1.4	To identify proteins as organic matter composed of amino acids, recognize peptide bond and to recognize protein structures (primary, secondary, tertiary, and quaternary). To describe the functions of proteins in the body based on examples: haemoglobin performing the function of gas transport, digestive enzymes catalyzing the breakdown reactions of nutrients, antibodies binding to antigens and detoxifying them.
1.5	To describe fats as energy and reserve materials.
1.6	To discuss the importance of cholesterol in humans: cholesterol as a component of biological membranes, the role of cholesterol in the formation of vitamin D in the skin and in formation of sex hormones in the gonads, accumulation of excessive cholesterol in the arteries as a cause of atherosclerosis.
1.7	To describe the structure of DNA and RNA (nucleotide structure and diversity, number of polynucleotide strands).

2. Cell structure

2.1 To compare prokaryotic and eukaryotic cells indicating the main similarities and differences between them (all cells have plasma membrane, cytoplasm, and ribosomes prokaryotic cells lack nucleus and membrane organelles).

2.2 To describe eukaryotic cell structures (the nucleus, cytoplasm, plasma membrane, cell wall, mitochondria, ribosomes, chloroplasts, endoplasmic reticulum, the Golgi complex, lysosomes, vacuoles), to identify them in figures and diagrams, to describe their functions in the cell nucleus - information storage; endoplasmic reticulum - modifying and transport of synthesized proteins; digestive enzymes and lysosomes are formed in the Golgi complex; lysosomes are involved in intracellular digestion, etc.

2.3 To compare plant, animal, and fungal cells, identifying similarities and differences between them (plant cells have cellulosic, fungal cells have chitin walls, and animal cells have no walls. Only plant cells contain chloroplasts).

2.4 To describe the adaptation of a unicellular organism to perform vital functions - digestion and reproduction - using the example of an amoeba.

2.5 To identify the tissues of organisms belonging to different kingdoms in pictures and diagrams: water vessels and sieve tubes, static mesophile in plants; blood, epithelial, nervous in animals. To link the structure of the cells comprising these tissues with the functions of the tissues.

3. Plasma membrane and transport

3.1 To identify and plot the plasma membrane of cells and its constituent phospholipids and proteins.

3.2 To describe the properties of plasma membrane-forming phospholipids and membrane proteins and relate them to material transport: small hydrophobic, uncharged particles pass through phospholipids, and hydrophilic protein channels pass ions and hydrophilic materials.

3.4 To link the processes in the body with the transport taking place through the plasma membrane of the cell: osmosis, diffusion, exocytosis, endocytosis and active transport.

4. Enzymes

4.1 To describe enzymes as biological catalysts reducing the amount of energy required to initiate biochemical reactions.

4.2 To describe the specifics of enzyme action based on human digestive enzymes (amylase, pepsin and lipase).

4.3 To explain how the activity of the enzyme depends on temperature, pH and substrate. To link the decrease in enzyme activity with denaturation - changes in the spatial structure of protein molecules.

5. Energy transformations in the cell and the body (respiration and photosynthesis)

5.1 To describe ATP as a universal energy carrier and link the ATP production in the cell to its use in the body.

5.2 To describe the intracellular respiration as a controlled process in which the oxidation of glucose releases the energy required for the vital cell activity.

5.3 To describe the glycolysis in the cytoplasm of cells and to relate it to the respiratory stages (the Krebs cycle and the electron transport chain) in the mitochondria, indicating their significance for ATP synthesis.

5.4 Based on the understanding of the alcoholic fermentation of yeast and the formation of lactic acid in muscles to describe glycolysis as anaerobic process.

5.5 To describe the structure of the mitochondria relating its size and surface area of the inner membrane to the processes occurring in the mitochondria.

5.6 To describe how chloroplasts are adapted to perform photosynthesis: chlorophyll in thylakoids absorbs light energy used for the synthesis of organic matter.

5.7 To link light-dependent and light-independent photosynthetic reactions, indicating the reaction site, the use of light, CO_2 and water, and the formation of oxygen and organic matter.

5.8 To explain the dependence of the photosynthesis reaction rate on the light intensity based on the acquired practical skills in the photosynthesis study.

5.9 To describe the importance of photosynthesis in linking this process in plants to the use of glucose and oxygen in cells of other organisms.

II. INHERITANCE OF TRAITS OF ORGANISMS AND GENE TECHNOLOGIES

6. Gene functions and genome

6.1 To describe DNA as a component of chromosomes and the carrier of genetic information.

6.2 To describe a gene as a unit of genetic information and as a piece of DNA that contains the information needed to synthesize the corresponding protein.

To describe the genetic code and explain its universality.

6.3 To describe how information is transmitted during protein synthesis.

Indicate the relationship between the gene and the polypeptide chain. To explain the formation of a polypeptide chain.

6.4 To describe gene and chromosomal mutations and their causes.

6.5 To describe the genome as a set of genes specific to the whole biological species.

7. Cell cycle and new cell formation

7.1 To describe the cell cycle as the process by which cells with the same genetic information are formed.

7.2 To identify and depict complementarity in pictures and diagrams, describe its significance for replication.

7.3 To describe how genetic information (sister chromatids) is evenly distributed to new cells after replication.

7.4 To link cell division with the growth of multicellular organisms, tissue regeneration, asexual reproduction.

7.5 To Compare of male and female gametes: haploid chromosome number, cell size, adaptation of sperm to move and penetrate the ovum, adaptation of the ovum to be fertilized only by one sperm.

7.6 To associate gamet formation with meiosis.

7.7 To describe the stages I and II of meiosis during which cells with a haploid chromosome number are formed.

7.8 To link germ cell formation (random secretion of sex chromosome pairs and crossover) and fertilization to the emergence of genetic diversity in organisms of the same species.

7.9 To describe the significance of sexual reproduction and mutations for the processes evolution and selection.

8. Inheritance and variability of traits of organisms

8.1 Describe the role of genes and chromosomes in the formation of homozygous and heterozygous organisms and link them to the inheritance of traits.

8.2 Explain allelic gene interactions: incomplete dominance, codominance

8.3 Analyze the cross-breeding schemes depicted by genetic symbols, to solve genetic problems: monohybrid, dihybrid, test-cross, to explain the inheritance of sex-linked traits and AB0 blood groups.

8.4 Analyze and construct a pedigree tree.

9. Reproduction of organisms

9.1 To link the vegetative propagation of plants with the constancy of traits and the reproduction by seeds with the variability of traits.

9.2 To describe the significance of pollination and fertilization for the biological diversity of plants.

To describe the flower as reproductive organs (stamens and pistils) of a plant in which male and female gametes reach maturity.

9.3 To compare internal and external fertilization as well as direct and indirect postembryonic development in animals.

9.4 To describe the development of the human embryo before implantation (a cleavage of the zygote by mitosis and embryo embedding in the uterus).

9.5 To describe the role of the human placenta in foetal development, being able to explain effects of the mother's diet and harmful habits (smoking and alcohol consumption etc.) on the development of foetus

9.6 To describe the role of testosterone and estrogen in the maturation of girls and boys and in the formation of male and female gametes.

9.7 To explain the changes in the woman's body during the menstrual cycle

10. Gene technologies

10.1 To explain how genetic testing of human embryos allows to diagnose genetic disorders before birth on the example of Down’s syndrome.

10.2 To describe the study of the human genome as a significant achievement of the modern genetic science and to provide examples that illustrate its significance in

the diagnosis or treatment of genetic diseases.

10.3 To indicate the importance of recombinant DNA for gene technology.

III. METABOLISM AND TRANSPORT

11. Gas exchange in water and on land

11.1 To explain how the frog's respiratory system ensures adequate gas exchange in water and during the transition to land.

11.2 To explain how the respiratory system of insects ensures adequate gas exchange on land.

11.3 To specify human respiratory system: trachea, bronchi, lungs. Based on the structure of the human respiratory organs (trachea, bronchi, lungs) explain the mechanism by which air enters and leaves the human lungs.

11.4 To identify the connection between the structure of the alveoli (large surface area in terms of volume, thin and wet surface) and the gas diffusion in the lungs.

11.5 To describe how the human respiratory organs due to the ciliated epithelium are adapted to protect the lungs from the damage and infection.

12. Transport of substances in plants

12.1 To describe the arrangement of vascular bundles in plant roots and leafs. Explain the gas exchange process on in plants.

13. Human blood circulation

13.1 To describe the functions of the heart and the blood circulatory system. To identify the circulatory circuits and indicate the direction of arterial and venous blood flow in charts.

13.2 To link a particular structure of the heart (atria, ventricles, valves, and their wall thickness) to the function being performed by it.

13.3 To draw the connection between the structure of blood vessels and their functions.

13.4 To explain the causes of high blood pressure (obesity, smoking, low physical activity, age), indicating how a healthy lifestyle can help to prevent high blood pressure.

13.4 To describe the composition of blood and to identify blood cells in the pictures. To explain how changes in blood composition such decreased haemoglobin, increased white blood cell count and decreased platelet count may affect the body. To link the function of the oxygen transport with the structure of

erythrocytes and haemoglobin as their main functional component, the structure of leukocytes with immunity, the structure platelets with blood clotting.

13.5 To describe the internal medium of the human body as a system in which blood, lymph, and tissue fluid are involved in the transport of substances.

13.4 To describe the A, B, O system, and Rh blood groups and develop an educated and reason-based opinion on blood donation.

14. Significance of digestion for the human body

14.1 To describe human digestion as the process by which nutrients are broken down and absorbed by enzymes.

Associate the structure of the small intestine with the intake of nutrients.

14.2 To describe the functions performed by the glandular epithelium related to the activity of the digestive glands (liver and pancreas).

14.3 To link enzyme activity to the digestive function and specify nutrient breakdown products.

14.4 Explain the importance of digestion to the body.

IV. HUMAN HEALTH

15. Health and healthy lifestyle

15.1 To analyze the prevalence of infectious and non- infectious diseases and describe the causes of their occurrence based on the information provided.

16. Nutrient and energy needs

16.1 Describe adequate and balanced human nutrition based on the knowledge and understanding of organic and inorganic substances, nutrients and energy content of different foods. To link energy needs with carbohydrates and fats in food, growth and regeneration processes with proteins and amino acids, regulation - with vitamins A, C, D.

Based on the given information about inorganic substances be able to describe their significance for the human body. Explain the role of amino acids, fatty acids and vitamins (B_{12}, C, D and E) for the human organism.

16.2 Explain the importance of chemical elements (Fe, Ca, P, J, K and Na) in the human body. Evaluate the sources of nutrients needed by humans.

17. The effect of a healthy lifestyle on the vital systems of the human body

17.1 To explain the importance of a correct posture and an active lifestyle for human health through the understanding of the muscle - skeletal system.

17.2 To describe the effect of physical activity on health based on the understanding of gas exchange between the alveoli and the blood, between the blood and tissue cells of the body.

17.3 To describe the dependence of heart rate, blood pressure and breathing rate on sport exercises.

17.4 To describe the risks of smoking (chronic bronchitis, lung cancer, heart attack) based on knowledge of the structure of the respiratory and circulatory systems.

To explain systolic and diastolic blood pressure based on an understanding of the cardiac structure and cardiac cycle.

18. Defences against disease

18.1 To link white blood cell adaptations to protect the body from disease-causing organisms with the body's natural defences.

Describe how human skin, respiratory mucosa, blood, stomach acid protects against the harmful effects of microorganisms.

18.2 Describe the factors influencing bacterial growth (temperature and food content).

18.3 Examine the structure of viruses and explain the reproduction and spread of viruses using the example of HIV.

18.4 To link the interaction of antibody and antigen with the development of immunity.

V. ANIMAL ORGANIZATION AND HOMEOSTASIS

19. Importance of homeostasis

19.1 To explain how mammals maintain constant body

Temperature using the example of a human. To describe the role of the hypothalamus and of skin in thermoregulation.

19.2 To describe how insulin and glucagon regulate glucose concentration in blood. To link glucose concentration regulation in blood with the function of pancreas.

20. Excretion and osmoregulation

20.1 To describe kidney as an organ composed of multiple nephrons in which urine is formed and to explain how it maintains the water-salt balance in the body.

20.2 To explain how the changes in urine composition: glucose, protein and blood cells, can be used to diagnose disorders based on the provided urine composition data

20.3 To explain how organisms living in different environments are adapted to regulate water and salt balance.

21. The nervous system

21.1 To describe a neuron as the functional unit of the nervous system. To link the structure of the neuron with its function of the nerve impulse transmission. To describe the reflex arc and to distinguish between conditional and unconditional reflexes.

21.2 To explain the structure of a synapse and the nerve signal transmission at synapses.

21.3 To specify the nerve system consisting of central nerve system (head and spinal cord), and the peripheral nerve system consisting of nerves.

21.4 To describe in what functions the parts of the central nervous system are involved: medulla oblongata – in the formation of respiratory reflexes, intermediate brain - in homeostasis, and the cerebellum – in coordinating accurate body movements.

21.5 To describe the cerebral hemispheres as the central part of the nervous system responsible for conscious human activity.

21.6 To specify the peripheral nervous system as a part of the nervous system composed of nerves. To explain the structure of the nerve and link it to the peripheral nervous system's function to transmit nerve impulses from the central nervous system to the organs and backwards

22. The endocrine system

22.1 To indicate the endocrine glands (pituitary, thyroid, adrenal, pancreas, gonads) of the human body and their functions.

22.2 To explain the differences between nervous and humoral regulation (such as the reaction speed, the duration of the response).

VI. EVOLUTION AND ECOLOGY

23. Inherited variability and the process of evolution

23.1 To specify Darwin's initial proposition that natural mechanisms produce and transform the diversity of life on Earth. To describe evolution as the process of adaptation to a changing environment in populations.

23.2 To link hereditary variability (new gene formation of combinations and mutations) with the genetic diversity of organisms.

23.3 To link the forms of natural selections (stabilizing, directional and disruptive) with the formation of new species.

23.4 To explain how new species emerge due to physical barriers that divide the population and the resulting biological isolation.

24. The result of evolution is the emergence of new species

24.1 To describe the species as a whole of individuals who can live in certain environmental conditions (ecological niche of the species), interbreed with each other and produce fertile offspring.

24.2 To point that different species that evolved from the same ancestor have common genes and a similar structure.

24.3 To describe how paleontological, comparative anatomy and embryology data support and provide evidence for the evolutionary process.

25. Systematics and biodiversity of organisms

25.1 To describe the classification of organisms as the formation of a hierarchical classification system of groups of organisms (hierarchy, when groups of organisms are arranged in different levels or ranks: kingdom, phylum or division, class, order, family, genus and species).

25.2 To provide the examples 1 or 2 representatives of kingdoms (monera, protists, fungi, plants and animals) and characterize each of these kingdoms.

To describe the systematics of organisms as their grouping according to evolutionary connections and as a means of cognition of biological diversity

25.3 To describe the significance of viruses, bacteria, protists, and fungi to nature and to humans.

25.4 To identify protists as eukaryotic unicellular or colonial organisms and to describe their adaptation to move, feed, and reproduce.

25.5 To describe the movement, the development and the body cover of the following invertebrates: hydra (Phylum Coelencerata), planaria and tapeworm

Phylum Flatworms), ascarids (Phylum Roundworms), earthworms and leeches (Phylum Ringed worms), Crustaceans: crayfish and daphnia; Arachnids: spider and mites; Insects: grasshopper, bees, ants, butterflies and mosquitoes (Phylum Arthropoda).

25.6 To describe the Phylum Chordata, vertebrate classes of animals: bone-fish, amphibians, reptiles, birds and to explain their adaptations to the environmental conditions. To describe the significance of vertebrates to nature and to humans by providing appropriate examples.

26. The importance of biodiversity for ecosystems

26.1 To describe a community as the totality of organisms living in a particular habitat.

26.2 To explain that in ecosystems different species are linked through a food web and each species is usually dependent on many others.

26.3 To form a food web of at least 8 organisms using the information provided.

26.4 Based on examples (Lake swamping, dune overgrowth) describe the perennial biological succession.

27. Food patterns and levels of organisms

27.1 To describe the functional kingdoms of the living nature (producers, consumers, and decomposers), and explain how the representatives of these kingdoms are linked in ecosystems.

27.2 To describe the saprophytic nutrition of fungi and bacteria while linking this nutrition with the cellular structure of organisms (fungi and bacteria).

27.3 To describe the parasitic nutrition of fungi and animals. To link this nutrition with the cellular structure of the organisms (certain fungi and animals).

28. Material and energy flow in the ecosystem

28.1 To be able to distinguish nutritional levels. To use examples to explain that the food chain is a path that links together different species into a community. To point out the factors limiting the length of food chains.

28.2 To explain the formation of an energy pyramid and using the production pyramid to explain energy transformation and transmission in ecosystems.

28.3 To describe the role of producers, consumers and decomposers in ecosystems.

28.4 To describe the nitrogen cycle in the biosphere while evaluating the significance of degraders, nitrifying, nitrogen-fixing and denitrifying bacteria for nitrogen circulation.

28.5 To describe the carbon and oxygen cycle in the biosphere and the significance of carbon, oxygen and nitrogen cycles for nature and humans.

29. Changes in populations

29.1 To explain that population increases due to high birth rates and immigration, while decreasing due to mortality and emigration.

29.2 To explain that population size at a given point in time is determined by biotic potential, environmental resistance, and environmental capacity.

29.3 To explain that environmental resistance consists of the factors (abiotic and biotic) that inhibit population growth.

29.4 To demonstrate the close interrelationships between two different species of organisms in populations using the example of the predator and prey cycle.

30. Impact of human activities on ecosystems

30.1 To describe the global environmental problems (climate change, acid rains, ozone depletion, surface water and soil pollution) examining the causes of these problems and some possible solutions.

30.2 To explain the measures taken in times when species are threatened with extinction.