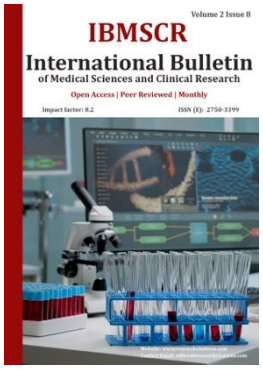

MOLECULAR BASIS AND BIOLOGICAL SIGNIFICANCE OF BIOCHEMICAL PROCESSES IN LIVING ORGANISMS.

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Annotation. This article highlights the basic concepts of biochemistry, the chemical processes occurring in living organisms, and their biological significance. The study analyzes metabolic reactions at the cellular level, as well as the structure and functions of proteins, carbohydrates, lipids, and nucleic acids. In addition, the catalytic properties of enzymes and their role in biological processes are examined. The results of the article contribute to a deeper understanding of the importance of biochemical processes in organismal functioning and serve as a valuable resource for education and scientific research.

Keywords: biochemistry, metabolism, enzymes, proteins, carbohydrates, lipids, nucleic acids, cellular processes, biological catalysis, energy metabolism

Introduction. Biochemistry is an important field of science that studies the chemical composition of living organisms and the chemical processes occurring in them. This science was formed at the intersection of biology and chemistry, revealing the essence of life processes at the cellular and molecular levels. Biochemical processes play an important role in the growth, development, adaptation, and survival of the organism. In the process of the development of modern science, biochemistry is developing in close connection with many fields, such as medicine, pharmacy, genetics, biotechnology, agriculture, and ecology. In particular, disorders of metabolic processes are one of the main factors in the occurrence of various diseases, the study of which plays an important role in the development of methods for early detection, prevention, and effective treatment of diseases.

All chemical reactions occurring in living organisms are carried out with the participation of enzymes. Enzymes have high selectivity and catalytic activity, controlling the speed and direction of biochemical reactions. Key biomolecules, such as proteins, carbohydrates, lipids, and nucleic acids, serve as structural and functional units of the cell, ensuring energy exchange, information transfer, and metabolic balance. The main purpose of this article is to illuminate the theoretical foundations of biochemistry, analyze metabolic processes occurring at the cellular level, and the biological significance of biomolecules. The research results serve to deepen biochemical knowledge and make it possible to effectively use them in the educational process and scientific research.

Methods. In this research work, theoretical and practical methods of analysis were used to study biochemical processes. At the initial stage of the research, domestic and foreign scientific literature, textbooks, and scientific articles on biochemistry were analyzed. Based on these sources, the main metabolic processes occurring in living organisms and the functional properties of biomolecules were systematically studied. In the research process, comparison and generalization methods were used to determine the structure and biological functions of proteins, carbohydrates, lipids, and nucleic acids. When assessing the catalytic activity of enzymes, scientific data on their selectivity to the substrate, their influence on the reaction rate,

and optimal conditions (pH and temperature) were analyzed. Modeling and graphical analysis methods were also used to explain metabolic reactions at the cellular level. The obtained data were logically analyzed, and the significance of biochemical processes in the activity of the body was scientifically substantiated. In the process of summarizing the research results, an analytical-synthetic approach was applied.

Results. The research results showed that biochemical processes are the main mechanisms that ensure all vital activities of living organisms. Metabolic reactions occurring at the cellular level are continuous and interconnected, and their balance ensures the normal development and functional stability of the organism. The harmony between the anabolic and catabolic stages of metabolism determines the efficiency of energy metabolism and metabolism.

During the study, the leading role of proteins in the structure of cells and enzymatic activity was revealed. Proteins act as enzymes, carriers, receptors, and structural elements, ensuring the speed and accuracy of biological processes. It has been observed that carbohydrates serve as the main source of energy for the body, as well as play an important role in intercellular communication and signal transmission. Lipids, as the main component of the cell membrane, play an important role in maintaining cell integrity and creating energy reserves.

Analysis of nucleic acids showed that the processes of storage, transmission, and realization of genetic information are carried out on the basis of biochemical mechanisms. The close relationship between the structure and function of DNA and RNA molecules confirms that cell activity is under genetic control. Also, when studying the catalytic properties of enzymes, it was found that they increase the rate of biochemical reactions several times and ensure the course of biological processes in a specific direction. The dependence of enzyme activity on external factors, in particular pH and temperature, showed that metabolic processes are sensitive to environmental conditions. In general, the research results confirmed the decisive role of biochemical processes in the vital activity of the organism. The obtained results enrich the theoretical foundations of biochemistry and make it possible to widely use them in practical fields, including medicine, pharmacy, and biotechnology.

Analysis. Analysis of the research results shows that biochemical processes form the basis of the activity of living organisms and function as an interconnected system. Metabolic reactions occurring at the cellular level are controlled by complex but precisely coordinated mechanisms and play an important role in maintaining the internal balance (homeostasis) of the organism. Analysis of metabolic processes showed that disruption of the balance between anabolism and catabolism leads to various physiological and pathological conditions. For example, disruption of energy metabolism can lead to a decrease in cellular activity, and metabolic disorders can cause metabolic diseases. This circumstance further increases the practical significance of in-depth study of biochemical processes. Analysis of biomolecules confirmed that proteins are the most functionally active and multifaceted substance. Proteins are characterized by their ability to accelerate biochemical reactions as enzymes, maintain cell shape as structural components, and facilitate intercellular communication as signaling molecules. The fact that carbohydrates and lipids perform mainly energetic and structural functions clearly determines their place in metabolism. Analysis of the activity of nucleic acids showed that biochemical processes occur under the control of genetic information. The storage

of information through DNA and the regulation of protein synthesis by RNA ensure the precise and orderly functioning of the cell. This clearly demonstrates the close connection between biochemistry and genetics. In the process of analyzing the activity of enzymes, their high selectivity and effectiveness showed that biological systems operate on the basis of an energy-saving mechanism. The dependence of enzyme activity on external factors expresses the organism's adaptability to the environment. At the same time, changes in enzyme activity can be assessed as an important biochemical indicator in the diagnostic and treatment processes. The results of the analysis show that biochemical processes are important not only theoretically, but also practically. These analyses strengthen the integration of biochemistry with other sciences and create a solid foundation for new scientific approaches and research in the fields of medicine, pharmacy, and biotechnology.

Discussion. The obtained results and their analysis once again confirm the extremely important role of biochemical processes in the life of living organisms. The data obtained during the study are consistent with existing scientific views and further strengthen the theoretical foundations of biochemistry. In particular, the conclusions about the continuity and interdependence of metabolic processes at the cellular level coincide with the results of many modern biochemical studies.

During the discussion, it should be noted that the balance between anabolic and catabolic processes is one of the main factors determining the physiological state of the body. In some scientific sources, metabolic imbalance is associated with various diseases, including diabetes mellitus, obesity, and hereditary metabolic disorders. The results presented in this article also support these ideas and show that in-depth study of metabolic processes is important in developing prevention and treatment strategies.

The discussion of the results obtained on biomolecules shows that proteins play a leading role in biological systems. Some researchers consider carbohydrates as the main source of energy, while other scientific approaches emphasize the importance of lipids as a long-term energy reserve. In this article, it was substantiated that each of these biomolecules has its own unique and complementary functions. This indicates that the body's activity has a complex and multi-stage mechanism.

The discussion on the activity of enzymes made it possible to compare different scientific approaches to their role in biological processes. While many studies have evaluated enzymes as highly effective biological catalysts, the results of this article show that the sensitivity of enzyme activity to external factors is one of the organism's adaptation mechanisms to environmental conditions. This aspect serves as an important scientific basis for modern research in the field of enzymology.

Moreover, discussions about the activity of nucleic acids clearly demonstrate the close connection between genetics and biochemistry. The idea that the realization of genetic information occurs through biochemical mechanisms is consistent with modern molecular biology research. This will create a basis for the development of new scientific approaches in the field of genetic engineering and biotechnology in the future. In general, this part of the discussion serves to reveal the scientific significance of the research results more deeply. The presented ideas and analytical considerations are of great importance in determining the prospects for the development of biochemistry, as well as in the formation of new scientific ideas and methods used in practical fields.

Conclusion. This article thoroughly examines the theoretical foundations of biochemistry, biochemical processes occurring in living organisms, and their biological significance. The research results confirmed that metabolic reactions occurring at the cellular level are the main mechanisms ensuring the vital activity of the organism. It has been established that the balance between anabolic and catabolic processes is important for maintaining the normal development and functional stability of the body.

The analysis showed that the structural and functional properties of proteins, carbohydrates, lipids, and nucleic acids are closely interconnected and ensure cellular activity. In particular, the enzymatic and structural role of proteins, the role of carbohydrates as an energy source, the role of lipids in cell membranes and energy storage, and the role of nucleic acids in the storage and transmission of genetic information were scientifically substantiated.

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