МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
БУКОВИНСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ

М А Т Е Р І А Л И

106-ї підсумкової науково-практичної конференції
з міжнародною участю
професорсько-викладацького колективу
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Матеріали підсумкової 106-ї науково-практичної конференції з міжнародною участю професорсько-викладацького колективу Буковинського державного медичного університету (м. Чернівці, 03, 05, 10 лютого 2025 р.) – Чернівці: Медуніверситет, 2025. – 450 с. іл.

У збірнику представлені матеріали 106-ї науково-практичної конференції з міжнародною участю професорсько-викладацького колективу Буковинського державного медичного університету (м. Чернівці, 03, 05, 10 лютого 2025 р.) зі стилістикою та орфографією у авторській редакції. Публікації присвячені актуальним проблемам фундаментальної, теоретичної та клінічної медицини.

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oxidative phosphorylation, regulation of apoptosis, involvement in lipid, protein, and amino acid metabolism, as well as maintaining intracellular calcium homeostasis. The process of energy synthesis is accompanied by the formation of reactive oxygen species (ROS), which can affect the structure and function of cells, leading to serious health consequences and contributing to the development of various pathological processes and diseases.

The aim of the study. To investigate the causes and consequences of mitochondrial dysfunction in the pathogenesis of diseases.

Materials and methods. Databases such as Web of Science, Pubmed, and Scopus were analyzed.

Results. Mitochondrial dysfunction is a central factor in the development of many pathological processes, as it leads to disruptions in energy metabolism, insufficient energy production, and, consequently, reduced functional activity of cells. This is particularly critical for cells with high energy demands, such as those in the heart, brain, and muscles. For example, in neurodegenerative diseases like Parkinson's and Alzheimer's, energy deficiency results in metabolic disturbances in neurons, accompanied by the accumulation of reactive oxygen species, protein damage, and neuronal cell death.

Excessive formation of ROS and free radicals causes damage to the structure of DNA, proteins, and lipids, leading to genetic mutations, impaired protein functions, and destruction of cellular membranes. These processes form the basis for the development of chronic inflammatory processes and autoimmune diseases. Mitochondrial dysfunction also significantly contributes to the development of metabolic disorders such as type 2 diabetes, obesity, and other metabolic conditions. Defects in oxidative phosphorylation disrupt metabolic pathways, leading to insulin resistance and further complications.

Mitochondrial dysfunction can cause both uncontrolled activation of apoptosis and its suppression, which, in turn, contributes to the development of degenerative diseases or cancer pathologies. Disruption of the apoptosis process stimulates glycolysis reactions and the formation of ROS, creating favorable conditions for the survival and aggressive growth of cancer cells.

Conclusion. Mitochondrial dysfunction is the basis of many neurodegenerative, cardiovascular, metabolic, and oncological diseases. Studying the mechanisms of mitochondrial dysfunction and developing new therapeutic strategies can significantly improve the effectiveness of treatment and prevention of these conditions, opening new possibilities for enhancing the quality of life for patients.

Ferenchuk Ye.O.

CATALASE ACTIVITY IN THE BLOOD AND LIVER OF RATS BY EXPERIMENTAL NEPHROPATHY AND INFLUENCE OF GLUTATHIONE

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Introduction. Under the conditions of entry of toxic substances into the body and activation of redox processes, compounds of natural origin with antioxidant properties are widely used to correct metabolic disorders. Among water-soluble antioxidants, low- and high-molecular compounds containing SH-groups are popular in medicine, mono-, di- and tricarboxylic acids and other anions. Glutathione, a thiol-containing tripeptide, is the main endogenous non-enzymatic antioxidant that exerts cytoprotective and detoxifying properties. The function of the glutathione system affects the implementation of important physiological and biochemical processes: detoxification, antioxidant protection, transformation vitamins C and E, lipoic acid, ubiquinone, regulation of thiol disulfide balance, synthesis of nucleic acids, preservation of the optimal state and functions of biological membranes, participates in the exchange of eicosanoids - prostaglandins and leukotrienes. Oxidative modification or protein carbonylation, which occurs at depletion of glutathione, stimulates covalent modification of endogenous enzymes and proteins, which can lead to loss of their functions. In the kidneys, there are peculiarities of glutathione metabolism.

Therefore, disorders of the structure of the kidneys, diseases of the excretory system require additional studies of glutathione metabolism and antioxidants enzymes.

The aim of the study. To determine catalase activity in the blood and liver of rats by experimental nephropathy and influence of glutathione.

Material and methods. The experiment was carried out on 131 male albino rats with the bodyweight of 0,16–0,18 kg. Experimental nephropathy was modeled by injection of a single intraperitoneal dose of folic acid (250 mg/kg, Sigma-Aldrich). Glutathione (Sigma-Aldrich) was introduced daily (100 mg/kg) by the intragastric way for 3 and 7 days following the injection of folic acid.

Results. After the injection of folic acid, 25% ($p<0,01$) decrease in catalase activity was observed in rats with nephropathy during both experimental days compared to animals of the control group. The glutathione caused 15% ($p<0,01$) increase in catalase activity on the 3rd day compared to the group without administration of the antioxidant. No significant changes were detected on the 7th experimental day.

Under physiological conditions, the body maintains a dynamic balance between the content of oxidants, which stimulate the processes of free radical oxidation of biomolecules, and the activity of antioxidant systems, but under conditions of nephropathy, we found the decrease of enzyme activity in the liver by 26,76% ($p<0,01$) on the 3rd and 32,7 % ($p<0,01$) on the 7th day of the experiment compared to the control. Decreased activity of catalase in response to the development of nephropathy can slow down protection against free radicals and lead to increased peroxidation of lipids and proteins. The use of glutathione contributed to the normalization of the studied parameters in the liver.

Conclusions. Under the conditions of damage renal system, increased formation of reactive oxygen species and inhibition of antioxidant systems contributes to the activation of free radical oxidation processes, the intensity of which depends on the concentration of oxygen in the tissues and on the enzymatic and non-enzymatic systems of antioxidant protection. So, the using glutathione in diseases of kidneys has positive effect on catalase activity and regulation of metabolism through GSH-dependent pathways, antioxidant and detoxification functions.

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PROSPECTS FOR THE USE OF POLYMETHINE DYES AS SENSITIZERS FOR SEMICONDUCTORS

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Introduction. The creation of efficient photocatalytic systems based on TiO_2, which are sensitive to visible and near-IR light, is a significant step towards solving critical issues such as converting solar radiation into electrical energy and environmental protection through the photo detoxification of technogenic pollutants. However, the practical implementation of these possibilities is hindered by the electron-hole recombination process. To mitigate this, various modifications to photocatalytic systems are used, such as adding electron and hole carriers, depositing metals or their oxides onto semiconductors, and utilizing nanoparticles with quantum size effects as photocatalysts.

Special attention is given to functional materials based on "photocatalytic blocks", where a dye-sensitizer (D) applied to a semiconductor-photocatalyst in the required quantity is covered with a polymer film that prevents its dissolution without interfering with the electron processes at the interface. These heterostructures (HS) represent one of the promising directions for designing photocatalytically active materials with an expanded light sensitivity range.

The aim of the study. This research investigates new HS based on TiO_2 and a dye-sensitizer from the class of cationic asymmetric polymethine dyes with varying lengths of the polymethine chain.

Materials and Methods. For the production of light-sensitive heterostructures, we used titanium dioxide R25 (Degussa), cathionic polymethine dyes D1-D3, and the polymer