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БУКОВИНСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ»

М А Т Е Р І А Л И

105-ї підсумкової науково-практичної конференції
з міжнародною участю
професорсько-викладацького персоналу
БУКОВИНСЬКОГО ДЕРЖАВНОГО МЕДИЧНОГО УНІВЕРСИТЕТУ
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Матеріали підсумкової 105-ї науково-практичної конференції з міжнародною участю професорсько-викладацького персоналу Буковинського державного медичного університету, присвяченої 80-річчю БДМУ (м. Чернівці, 05, 07, 12 лютого 2024 р.) – Чернівці: Медуніверситет, 2024. – 477 с. іл.

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У збірнику представлені матеріали 105-ї підсумкової науково-практичної конференції з міжнародною участю професорсько-викладацького персоналу Буковинського державного медичного університету, присвяченої 80-річчю БДМУ (м. Чернівці, 05, 07, 12 лютого 2024 р.) із стилістикою та орфографією у авторській редакції. Публікації присвячені актуальним проблемам фундаментальної, теоретичної та клінічної медицини.

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27%. A combination of modified photoperiod with ethanol administration resulted in the decrease of catalase activity by 34% and a decrease of glutathione peroxidase activity in kidneys by 39% lower than the control level. The decrease in the antioxidant enzymes activity in case of alcohol intoxication along with the permanent light exposure was more significant than that of rats that had alcohol intake under the normal light regime, that might have resulted from a decrease in melatonin synthesis and lack of its antioxidant effect under constant light exposure. Thus, intensification of free radical generation caused depletion of antioxidant defense.

The administration of melatonin at the dose of 5 mg / kg daily at 20^{00} for 7 days to animals exposed to ethanol intoxication caused normalization of catalase and glutathione peroxidase activity in kidneys. Melatonin intake was revealed to be more effective in normalizing catalase activity in case of ethanol combination with constant lighting but the activity of glutathione peroxidase enzyme remained by 21% below control.

Conclusions. The administration of melatonin against the background of alcohol intoxication or its combination with constant light exposure contributed to the normalization of catalase activity in rats' kidneys but revealed less effective in normalization of glutathione peroxidase activity in kidneys.

Dikal M.V.

THE ROLE OF MITOCHONDRIAL REACTIVE OXYGEN SPECIES IN DEVELOPMENT OF METABOLIC DISORDERS IN CELLS

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Introduction. Oxidative stress is associated with many human diseases, including cardiovascular, neurodegenerative, hepatic diseases, and cancer. Mitochondria represent an important target for oxidative damage, which can lead to cell death because damaged mitochondria produce increasingly more reactive oxygen species (ROS). Produced ROS often activate redox-sensitive enzymes of protective signaling pathways and may directly influence cell viability. The accumulation of ROS causes damage to DNA, proteins, and lipids, and links to other pathological processes.

The aim of the study. To study the activity of the mitochondrial energy supply system under the influence of various reactive oxygen species.

Materials and methods. The databases Pubmed, Scopus, Jama were analized.

Results. Mitochondrial ROS are crucial for an organism's homeostasis. By regulating signaling pathways, they activate the adaptation and protection behaviors of an organism under stress. The accumulation of ROS causes damage to DNA, proteins, and lipids, and other pathological processes. ROS are different products from the partial reduction of oxygen, including oxygen free radicals: superoxide [($O_2^{\bullet-}$], hydroxyl [$OH^{\bullet}$], alkoxyl [$RO^{\bullet}$]), and some non-radical derivatives of oxygen (singlet oxygen ($^1O_2$), hydrogen peroxide (H_2O_2), and hypochlorous acid ($HOCl$)).

Hydroxyl radicals are short-lived, highly reactive, and contribute significantly to local organelle damage through protein modification. The intensive generation of ROS can result from the action of p450 monooxygenase, mitochondrial oxidative phosphorylation, monoamine oxidase, lipoxygenase, xanthine oxidase, cyclooxygenase. Mitochondria are not only the source of energy through oxidative phosphorylation on the inner membrane, but also the process of mitochondrial oxidative phosphorylation is the main origin of free radicals. Free radicals a decrease in mitochondrial respiratory function because they impair mitochondrial structure and function by increasing mitochondrial free radical production.

Conclusions. Increased levels of reactive oxygen species and free radicals generated in damaged mitochondria cause oxidative damage and significant disruption of the metabolic processes of various tissues, impair the flow of electrons along the electron transport chain, increase mitochondrial membrane potential, respiratory control coefficients and cellular oxygen consumption. Studying the relationship between oxidative stress and mitochondrial dysfunction makes it possible to increase the effectiveness of therapy and become an important biomarker for monitoring disease progression.

Kropelnytska Yu.V.

DEVELOPMENT OF PHOTOSENSITIVE MATERIALS BASED ON TITANIUM DIOXIDE AND MEROCYANINE DYES

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Introduction. Since the emergence of life on the Earth, the environment has been polluted by natural and synthetic wastes. In case of natural pollution, the environment independently controls the impact of pollution. However, synthetic materials accumulate in the environment, and therefore, their ingress into the environment, even in small concentrations, can lead to catastrophic consequences. Recently, one of the most urgent tasks facing scientists is to create environmentally friendly chemical technology, materials and processes to combat global pollution and environmental destruction. Much attention is paid to studying light-induced photocatalytic reactions. The use of wide band gap semiconductors like TiO_2 as catalysts, and the consideration of its reaction to UV radiation, not only intensify photocatalysis research but also contribute to the study of the superhydrophilicity of TiO_2 in its use for environmental remediation and solar energy production. For visible photocatalysis, doped-TiO_2 with a sensitizing dye or a narrow band gap semiconductor can be used.

The aim of the study. Our work aims to investigate the possibility of creating new broadband catalysts based on titanium (IV) oxide and merocyanine dyes with different lengths of the polymethine chain and different groups at its ends.

Material and Methods. To obtain photosensitive heterostructures, we used titanium dioxide P25 (Degussa), merocyanine dyes D1-D3, and the polymer (polyepoxypropylcarbazole). The absorption spectra of the dye solutions were recorded on the Ocean Optics USB 2000+XR spectrophotometer. The redox potentials of the dyes were determined by cyclic voltammetry using a BAS 100B/W Electrochemical Workstation (Bioanalytical Systems) with a standard three-electrode cell in 0.1 M tetra-n-butylammonium tetra-fluoroborate solution.

Results. Oxidation and reduction potentials were determined for merocyanine dyes used as TiO_2 sensitizers by cyclic voltammetry, which were applied for HOMO and LUMO energy calculations and construction of energy diagrams of their energy levels relative to titanium dioxide levels. The obtained spectral and electrochemical data were used to determine the dye electron transition energy from the ground state to the excited state. The difference between the light absorption energy and the oxidation and reduction potentials was found to be slight, which allows using the proposed methods to find the energy values. The obtained spectral and electrochemical data were used to determine the dye electron transition energy from the ground state to the excited state. The difference between the light absorption energy and the oxidation and reduction potentials appeared to be small, which makes it possible to use the proposed methods to find the energy values. To ensure the normal functioning of a photocatalytic system, all its relevant energy parameters must be balanced so that all light-induced electron transfer processes are thermodynamically resolved and have an appropriate driving force. In case of a heterostructure based on dye-sensitized TiO_2, this condition must be satisfied for both processes: light absorption by the dye and light excitation of the semiconductor component of the heterostructure. Therefore, the lowest unoccupied energy level of the sensitizer should be located above the upper edge of the conduction band of the semiconductor to ensure electron transfer from the excited dye-sensitizer to the conduction band of the semiconductor. The oxidation potentials of electronically excited dyes (LUMO level) of the studied heterostructures are located above the edge of the TiO_2 conduction band. Thus, the injection of electrons into this band is thermodynamically allowed, which means these dyes can sensitize TiO_2.

Conclusion. New photosensitive heterostructures based on titanium dioxide and merocyanine dyes have been created. The spectral, electrochemical, and energy characteristics of