МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ’Я УКРАЇНИ
БУКОВИНСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ

# МАТЕРІАЛИ

## 106-ї підсумкової науково-практичної конференції з міжнародною участю професорсько-викладацького колективу БУКОВИНСЬКОГО ДЕРЖАВНОГО МЕДИЧНОГО УНІВЕРСИТЕТУ

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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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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.

**Kropelnytska Yu.V.**

## 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 polyepoxypropylcarbazole. The absorption spectra of dye solutions were recorded using an Oceanoptics 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 a 0.1 M tetra-n-butylammonium tetra-fluoroborate solution.

**Results.** A comparison of the absorption spectra of the dye in solution and within the heterostructure shows that applying it to a solid substrate enhances association processes. On the $TiO_2$ surface, associates likely form excimers (J- and H-states), which is typical for this type of dye. The presence of new additional bands at shorter wavelengths than the dye monomer is indicative of this association. As a result, the ratio of narrow bands changes, broadens, and nearly merges into a single band that spans much of the visible spectrum.

**Conclusions.** Electrochemical studies have shown that carbocyanine dyes containing pyran fragments have an energy level higher than the conduction band of $TiO_2$ and can be used as sensitizers when applied to the semiconductor. This conclusion has been experimentally confirmed.

**Krupko O.V.**

## EVOLUTION MECHANISM OF CdS/L-CYSTEIN NANOPARTICLES

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**Introduction.** The study and optimization of the parameters of the synthesis of nanostructures with given properties, which are stable under the operating conditions of devices based on them, and the creation of a new class of instruments for electronics, medicine, and biology have been topical areas of research for more than a dozen years. The size, structure, and, accordingly, the optical properties of nanoparticles (NPs) can be regulated by the conditions of synthesis, the nature of the connection between the semiconductor core and the stabilizing shell of the NPs, and change over time.

**The aim of the study.**Is to study the mechanism of evolution of CdS/L-Cys nanoparticles in the process of growth and maturation from colloidal solutions of the composition $Cd^{2+}$- $S^{2-}$- L-Cys.

**Materials and methods.** High-quality starting reagents were used for the experiments, namely: 0.5 M solution of $CdCl_2\cdot2.5H_2O$, 0.05M solution of L-Cysteine, 0.5 M solution of $Na_2S\cdot9H_2O$, 0.1 M solution of NaOH. A series of syntheses of CdS/L-Cys NPs was carried out at fixed pH values of 7, 9, and 11.

**Results.** In order to study the influence of the composition of the starting reagents on the mechanism of growth and maturation of nanoparticles, the work carried out a study of colloidal solutions of cadmium sulfide synthesized with different contents of $Cd^{2+}$, $S^{2-}$ ions, and L-Cys stabilizer (solutions № 3,7,14).For colloidal solutions of NPs of semiconductors, the process of crystal growth is manifested by the shift of the maximum in the absorption spectra to the long-wavelength region and, accordingly, with the growth of the particle size (radius).

The analysis of the obtained results of the study of the optical properties of colloidal solutions of CdS/L-Sus NPs of different compositions leads to the conclusion that each solution has its own ripening time, although for some solutions the slope of the kinetic dependence is the same (solutions № 7 and 14). The size evolution (reduction) of NPs in solutions № 3 can be explained by the opposite process of agglomeration, namely, the disintegration of agglomerates into components (nuclei). It is important to take into account that in the conditions of an effective excess of sulfide ions, there is a probability of the formation of nuclei of a more "loose" hexagonal shape. Therefore, it can be assumed that the reason for the decrease in the size of NPs (dispersion) in solutions of this composition, regardless of pH (hydroxide ion content), is a change in their structure. Obviously, during the maturation of the nanocrystal, the change in its shape is determined by the desire to achieve the lowest surface energy. Similar processes probably occur in solutions with an excess of Cadmium ions (solution №7). In other solutions with a bathochromic shift of the edge of the optical absorption spectrum, the Oswald ripening mechanism of NPs appears to be the most likely.

**Conclusions.** From the research results, it can be concluded that the formation of NPs in the $Cd^{2+}$-$S^{2-}$-L-Cys system is described by the following schemes: