**Kropelnytska Yu.V.**

## LIGHT-SENSITIVE MATERIALS BASED ON $TiO_2$ AND THE MEROCYANINE POLYMETHINE DYE

*Department of Medical and Pharmaceutical Chemistry*
*Bukovinian State Medical University*

Semiconducting materials exhibiting some photocatalytic properties are regarded as important among functional materials due to their being a basis for new light-sensitive systems for solar energy conversion and accumulation, toxic waste decontamination, development of non-traditional methods of low-tonnage synthesis of valuable substances, etc. However, low coefficient of performance of light usage and insufficient quantum yields of photoprocesses are hindering wider application of these materials. That is why the search for light-sensitive semiconducting materials with advanced light conversion characteristics, including those exhibiting activity within the near-IR range, is a high-priority scientific direction. In order to eliminate such a flaw, the idea was introduced for developing heterostructures (HS) that consist of a dye deposited on a semiconductor's surface in the right amount and protected by a polymer film, which prevents dissolution or washing-off of the dye and creates no obstacles during interphase electron transfer processes. Such HS have ensured high efficiency in the photocatalytic processes of water decomposition, restoration of methylene blue and oxidation of iodide ions.

Titanium (IV) oxide P25 (Degussa), a polymer polyepoxypropylcarbazole (P) and some merocyanine dyes were used to obtain a HS of the above mentioned type ($P/B/TiO_2$). The oxidation and restoration potentials of the dye were determined from cyclic voltammetry data and later on they were used to evaluate photocatalytic performance of the HS $P/B/TiO_2$ and to outline physical and chemical approaches to design new wide-range light-sensitive photocatalytic systems.

According to the general scheme of sensitization, the following stages are involved in the process: dye photoexcitation, electron transfer from the triplet state into the conductivity band of the semiconductor and dye regeneration occurring in the solution through capturing of an electron by a cation-radical formed previously at the initial stage of the process.

LUMO and HOMO energy values of the dyes have been calculated using spectral and electrochemical data. Afterwards, these values were used to analyze the processes that may occur in suspensions and HS being exposed to the light. Then energy diagrams of energy levels configuration in relation to the electrical-physical characteristics of titanium (IV) oxide have been built using the determined oxidation and restoration potentials of the dyes. As seen from the diagrams analysis, the oxidation potentials of the electron-excited molecules (LUMO energy level) of the dyes-sensitizers are located higher than the upper edge of the $TiO_2$ conductivity band. It means that the process of electron injection into the $TiO_2$ conductivity band is thermodynamically allowed and, therefore, the researched dyes can in fact sensitize the semiconductor.

**Kushnir O.Yu.**

## INFLUENCE OF MELATONIN ON AGE-RELATED CHANGES OF PYRUVATE KINASE ACTIVITY IN THE BLOOD OF ALLOXAN DIABETIC RATS

*Department of Bioorganic and Biological Chemistry and Clinical Biochemistry*
*Bukovinian State Medical University*

Melatonin (N-acetyl-5-methoxytryptamine) is the major product of the pineal gland, which functions as a regulator of sleep, circadian rhythm, and immune function.

Aging is characterized by a progressive deterioration in physiological functions and metabolic processes. The loss of cells in vital tissues and organs during aging is related to several factors including oxidative stress and inflammation.

Oxygen free radicals of mitochondrial origin seem to be involved in aging. Available studies are consistent with the possibility that oxygen radicals endogenously produced by mitochondria are causally involved in the determination of the rate of aging in homeothermic vertebrates. Oxidative damage to tissue macromolecules seems to increase during aging. The rate of mitochondrial oxygen radical generation of post-mitotic tissues is negatively correlated with animal longevity.

Melatonin and its metabolites have potent antioxidant/anti-inflammatory properties, and they have proven to be highly effective in a variety of disorders linked to inflammation and oxidative stress.

Hyperglycemia-mediated oxidative stress plays a crucial role in diabetic complications. The consequence of the emergence of this shift can be the appearance of age features in the body's resistance to harmful factors of diabetic mellitus.

Changes in the ontogenesis of sensitivity of the carbohydrate metabolism in the blood on the background of diabetic mellitus and melatonin injections are less studied.

The object of this experimental research was to ascertain the influence of melatonin on the background of aging on the level of glycemia and activity of pyruvate kinase in blood of alloxan diabetic rats.

We used male Wistar rats, two age groups: the 2-month rats (late puberty), and the 4-month rats (adult). Alloxan diabetes was evoked via injecting the rats with a 5% solution of alloxan monohydrate intraperitoneally in a dose of 170 mg/kg. In each age group there were control rats and diabetic animals. Melatonin ("Sigma", USA) preparation was introduced to diabetic animals intraperitoneally in a dose of 10 mg/kg of body weight at 8 a.m. daily during 42 days starting with the fifth day 24 hour period after the injection of alloxan. Blood was taken from the tail vein to evaluate the glycemia level on the fifth and the 47-th day after the injection of alloxan. Rats were sacrificed on the 47-th day of the experiment in accordance with the ethical treatment of animals.

The level of glucose on the fifth day of the experiment in animals of both groups increased on average by 115% from baseline values. However, on 47-th day this index was higher in group of late puberty rats 20% more than in the group of adult rats. Pyruvate kinase activity in erythrocytes of adult and late puberty animals with overt diabetes decrease by 25% and 50% respectively compared with the control rats. The changes may be the result of age-related disorders of energy metabolism due to disturbances in free radical mechanisms. Moreover, hyperglycemia leads to increased free radical mechanism in old rats. We have reached the recovery of the pyruvate kinase activity in the blood of diabetic rats of both age groups by melatonin injections.

Thus, we have determined that there is a change in the course of ontogenesis of the sensitivity of the pyruvate kinase activity in the blood to the effect of diabetic mellitus factors. According to the results of the study, melatonin shows its protective action against hyperglycemia inducing age-related changes of pyruvate kinase activity in the blood of alloxan diabetic rats.

**Lenha E.L.**

## EFFECTS OF ECHINACEA PURPUREA TINCTURE ON TOTAL ANTIOXIDANT ACTIVITY OF RAT SERUM AT DIFFERENT PHOTOPERIOD

*Department of Bioorganic and Biological Chemistry and Clinical Biochemistry*
*Bukovinian State Medical University*

The state of antioxidant defense of the body is determined by many endogenous and exogenous factors. One of them is the duration of the photoperiod, which controls the level of functional activity of the pineal gland, and hence the level of a powerful antioxidant - melatonin. Under conditions of oxidative stress, depletion of endogenous antioxidant systems is widely used antioxidants based on plant materials.

The goal of the study was to study the changes in the total antioxidant activity of the serum (TAAS) of rat blood under conditions of toxic hepatitis and the introduction of Echinacea purpurea tincture (EPT).

Experimental studies were carried out on white adult male rats weighing 180±20 g in the spring. Depending on the lighting conditions, the animals were divided into three groups: I - artificial lighting conditions with periods of 12 hours of light: 12 hours of darkness (12L: 12D); II - 24 hours of light: 0 hours of darkness (24L: 0D) and III - 0 hours of light: 24 hours of darkness (0L: 24D). After a five-day stay under appropriate lighting conditions, each group was divided into subgroups: A - control; B - animals were intragastrically injected by Echinacea purpurea tincture (0.25 ml / kg body weight); C - animals with toxic hepatitis (intragastrically twice (every other day)