remaining 35 patients received monotherapy with lisinopril 10 mg 1- 2 times a day (individually selected doses) and, if necessary, diuretics .During one-year follow-up, the stage of CKD changed to CKD stage III in 11 patients from the group under observation.The treatment of nephrological pathology carried out in accordance with the existing principles of therapy of the detected nephrological diseases. The indices of the renal blood flow against a background of 6-month treatment with the use of antihypertensive pathogenetic therapy combination of lisinopril and amlodipine, veritably decreased in many cases at the level of a. segmentalis. In patients with CP, all indices did not differ from normal values of almost healthy individuals ($p < 0.05$), except index Vd. In patients with CKD, Vd ($p < 0.05$) and IR ($p < 0.05$) values probably decreased but did not differ from the normal values. And in DN group of patients with hypertension, the indices were torpedo and did not respond to 6-month therapy of the combined use of lisinopril at a dose of 10 mg and amlodipine at a dose of 5 mg once a day. Patients,who were taking lisinopril as monotherapy for renal hypertension, did not show significant changes in the renal blood flow during the 6-month treatment period ($p > 0.05$).

Thouse, it has been determined that the combined use of lisinopril at a dose of 10 mg and amlodipine at a dose of 5 mg per day in the complex therapy of CKD stage I-II patients with AH stage II during a year contributes to the probable improvement of the renal blood flow indices (Vs, Vd, Vvol, TAMX, IR) ($p < 0.05$) of the small renal vessels (at the level of a.interlobaris).

Pazyniuk A.Yu.

FEATURES OF PHARMACEUTICAL EDUCATION ABROAD

Department of Pharmacy
Bukovinian State Medical University

Over the past two decades, the pharmaceutical market has grown significantly, and revenues from drugs worldwide in 2020 amounted to 1.27 trillion US dollars. The United States has become the world's leading pharmaceutical market. European countries (Germany, France, Great Britain) are not the last in their contribution to the pharmaceutical industry. The results of the pharmaceutical organization largely depend on the qualifications and educational level of staff. After all, only high-quality education contributes to personal and professional development, as well as social, cultural, economic, political and environmental development of the country as a whole.

The purpose of the study was the analysis of educational programs for students of leading foreign universities in the field of pharmacy.

The results of the analysis were obtained after exploring the educational programs of the following universities: University of Bonn (Federal Republic of Germany), University of Nantes (France), University of Birmingham (United Kingdom), University of Florida (United States of America), Niigata University of Pharmacy and Applied Life Sciences (Japan).

Curricula of European universities (Federal Republic of Germany, France, Great Britain) have minimal differences from the education of pharmaceutical students in Ukraine.

Upon graduation from French universities, students, in addition to a diploma of higher education, receive a certificate confirming the level of English language proficiency.

The 4-year education in the UK is the shortest of the European pharmaceutical degrees. The internship at the University of Great Britain begins at the end of the first year of study. After graduation, a year-long internship outside the university on public and industrial pharmacy is mandatory, after which there is an exam in the Royal Pharmaceutical Society to confirm professional qualifications. An interesting fact is the lack of refresher courses for pharmaceutical workers in the UK because every pharmacist must adhere to the Standards of Continuing Professional Development made by the General Pharmaceutical Council. Perhaps this helps to increase the self-awareness of pharmaceutical workers in terms of self-education.

There aren't any possible ways to enter one of the higher educational complexes in the USA immediately after graduation from school. Firstly, a student must complete a 2-3 year pre-pharmacy or pre-professional preparatory course, which serves as a preparatory cycle of education. You can attend them in any regional accredited technical (Technical), municipal (Community Colleges) or

junior college (Junior Colleges). When entering a pharmaceutical university, it is mandatory to pass the Pharmacy College Admission Test, which is divided into 6 sections: verbal abilities, knowledge in chemistry and biology, computational skills, reading comprehension and two written sections.

Japanese pharmaceutical education devotes a significant part of educational time to subjects related to the methodology of drug development, such as bioanalytical chemistry, mechanism of action of drugs, pharmacokinetics, pharmaceutical chemistry, toxicology, development of new drugs, targeted synthesis. Minimal attention is paid to the humanities.

Therefore, we can make a conclusion that obtaining such information will help to borrow the experience of world universities, as well as to create own methods of education that will promote faster development of the pharmaceutical industry through the education of highly qualified pharmacists in Ukraine.

Shchudrova T.S.

THERAPEUTIC POTENTIAL AND PERSPECTIVE ON MELATONIN USE FOR DRUG-INDUCED NEPHROPATHY

Department of Pharmacology
Bukovinian State Medical University

The research aimed to review the effects and mechanisms of action of the pineal hormone melatonin, to study the nephroprotective effect of exogenous melatonin in conditions of drug-induced nephropathy, and to assess the prospects of its use for prevention and treatment of kidney diseases based on the literature data and results of own studies. According to literature and results of our previous research, the nephroprotective effect of melatonin has been shown in various experimental models of acute renal injury (AKI). Numerous studies established the antioxidant, anti-inflammatory, anti-apoptotic, immunomodulatory, and cytoprotective effects of melatonin, and showed its ability to restore the function and structure of the kidneys.

The objective of the current study was to evaluate the effects of melatonin (5 mg/kg) on the animal model of acetaminophen-induced AKI. The experiments were conducted on nonlinear mature white rats weighing 150-200 g, and randomly distributed into three groups (n=7). Group I – control; group II – acetaminophen-induced AKI (administration of paracetamol (Health, Ukraine) at a dose of 750 mg/kg); group III – administration of melatonin (Sigma-Aldrich, USA) at a dose of 5 mg/kg against the background of AKI development. Animals were withdrawn from the experiment 24 h later, while blood, urine and kidneys were sampled for biochemical and histopathological assessments. Statistical processing of the obtained data was performed using the SPSS Statistics 17.0 software.

In our experiment, a single administration of the toxic acetaminophen dose to rats (group II) resulted in drug excessive accumulation and damage to the proximal tubular cells. It is known, that cellular toxicity of acetaminophen is associated with translocation and dysfunction of Na+-K+-ATPase, which ensures effective sodium reabsorption. In rats with acetaminophen-induced AKI a decrease in sodium reabsorption and, accordingly, an increase in fractional sodium excretion was found. An increase in the sodium concentration in the tubular fluid led to the activation of tubuloglomerular feedback with a 2-fold decrease in glomerular filtration rate (GFR), reduced urine output, and development of retention azotemia. Significant proteinuria compared to the control confirms the severe toxic damage to renal tubular cells. In animals that received melatonin, treatment (group III) renal dysfunction was less pronounced. Melatonin counteracted the nephrotoxic effect of acetaminophen, as evidenced by the prevention of significant sodium loss due to maintenance of the reabsorption capacity of tubular cells, restoration of urine output due to maintenance of GFR, and prevention of retention azotemia and significant proteinuria. Acetaminophen overdose induced the oxidative stress from the intensification of ROS production, lipid and protein peroxidation processes and the simultaneous decline of the enzymatic antioxidant capacity. In animals from group II, a significant increase in the level of lipid peroxidation end-product malondialdehyde (MDA) and protein oxidative modification products (OMP) was found in kidney tissue ($p<0.05$ compared to the control group). Acetaminophen also compromised local