DANYLO HALYTSY LVIV NATIONAL MEDICAL UNIVERSITY
PHARMACEUTICAL FACULTY

ANNALS OF PHARMACEUTICAL FACULTY

DANYLO HALYTSKY LVIV NATIONAL MEDICAL UNIVERSITY

Volume 8 **2022**

CONTENTS

MISSION STATEMENT

Students and young scientist (PhD students) participation in research projects is one of the important ways to improve the quality of education and to enhance graduates competitive ability on the labor market and, thereof, rating of a particular university.

Student scientific work is the shortest way to self-affirmation, raisings self-esteem, and gaining authority in the student society.

This issue contains abstracts of original papers of PhD students and abstracts of master projects defended in 2022 at pharmaceutical faculty of Danylo Halytsky Lviv National Medical University and thus represent the scientific interests of pharmacy students.

EXAMINATION COMMISION:

prof. Svitlana Bilous	Department of Drug Technology and Biopharmacy,
assoc. prof. Danylo Kaminskyy	Dean of Pharmaceutical Faculty,
assoc. prof. Evgen Varyvoda	Dean of Faculty of Foreign Students,
prof. Andriy Zimenkovsky	Department of Healthcare Management, Pharmacotherapy and Clinical Pharmacy,
prof. Bohdan. Hromovyk	Department of Pharmacy Organization and Economics,
prof. Borys Zimenkovsky	Rector of the University, Department Pharmaceutical, Organic and Bioorganic Chemistry,
assoc. prof. Natalia Shapovalova	Department of Pharmacognosy and Botany,
assoc. prof. Natalia Yarko	Department of Pharmacy Organization and Economics,
prof. Roman Lesyk	Department Pharmaceutical, Organic and Bioorganic Chemistry,
Nelia Byk	Executive Director of the Galician Pharmaceutical Association,
Nadija Izio	Deputy Head of the State Service for Medicines and Drug Control in Lviv Region.

PhD STUDENTS ABSTRACTS

(APRIL 2022)

SCIENTIFIC AND PRACTICAL MODELING OF PHARMACEUTICAL CARE FOR PATIENTS WITH PANCREATITIS

Mariana Bobko
Scientific Supervisor: assoc. prof. **Oksana Levytska**, PhD, DSc
Department of Organization and Economics of Pharmacy

Keywords: pancreatitis; clinical protocols; medical drugs.

Introduction: Pancreatitis is a serious medical and social problem in the world today. The incidence of acute pancreatitis in the world ranges from 13 to 45 cases per 100 thousand population, and chronic pancreatitis - from 5 to 12 per 100 thousand population. The results of the study of the global burden of pancreatitis (2017) show that Ukraine is in the group of countries where the prevalence of pancreatitis is in the range of 160 - 200 cases per 100 thousand population, and the incidence of this pathology - in the range of 32 - 40 cases per 100 thousand population. That is, in Ukraine the prevalence and incidence of pancreatitis significantly exceeds world figures. Drug treatment of pancreatitis is based on the use of drugs of different pharmacotherapeutic groups, so their study is relevant.

Materials and methods: The materials of the study were unified clinical protocols of primary, secondary (specialized) and tertiary (highly specialized) medical care for acute and chronic pancreatitis (2014), clinical recommendations USA (ACG Clinical Guideline: Acute Pancreatitis, 2013 and ACG Clinical Guideline: Chronic Pancreatitis, 2020), and guidelines for the treatment of pancreatitis in Canada (Canadian Digestive Health Foundation, CDHF), in the UK (The British Society of Gastroenterology), Europe (European Society of Gastrointestinal Endoscopy, ESGE) and China (Chinese Pancreatic Surgery Association, Chinese Society of Surgery, Chinese of Medical Association) and recommendation of World Society of Emergency Surgery, WSES in terms of prescribing drugs.

Results and discussion: The volume of the dissertation is 20%. In the course of research:

• the data of scientific sources on the chosen topic of dissertation research are processed;

• studied the main approaches to the treatment of pancreatitis in different countries (Canada, USA, UK, China, Europe) and in Ukraine and conducted a comparative analysis;

• an article was prepared and submitted for publication in a professional journal.

Credited:

− implementation of disciplines in accordance with the curriculum of the first year of postgraduate study;

− pedagogical practice of the graduate student on the basis of conducting seminars on the subject "Ethics and Deontology in Pharmacy" with first-year students of the Faculty of Pharmacy full-time, practical classes on "Pharmaceutical Law and Legislation" with students third year full-time, practical classes on the subject "Pharmaceutical Management and Marketing" with 4th and 5th year students of the Faculty of Pharmacy full-time and part-time.

Conclusions: Based on the results of the study, an article was prepared and submitted for publication in the "Pharmaceutical Journal".

CLINICAL AND PHARMACEUTICAL SUBSTANTIATION OF THE MODEL OF ACTIVITY OF THE CLINICAL PHARMACIST AT THE IN THE UNIVERSITY MEDICAL DENTAL CENTER

Marianna Shandra
Scientific supervisor: prof. **Andriy Zimenkovsky**, PhD, ScD
Department of Healthcare Management, Pharmacotherapy and Clinical Pharmacy

Keywords: clinical pharmacy, clinical pharmacist, the university medical dental center, pharmaceutical dental care, pharmacotherapy.

Introduction: A specialist who is called to improve the quality of medical care – is a clinical pharmacist who reduces the cost of pharmacotherapy through the rational use of drugs provides pharmaceutical care to the patient and the doctor when prescribing drugs to the patient. There are three dental medical university centers in Ukraine: University Dental Center of Kharkiv National Medical University, Dental Medical Center of the Bogomolets National Medical University, Dental Medical Center of the Danylo Halytskyi Lviv National Medical University is the first and only university center where the activities of a clinical pharmacist are implemented today. The need for specialists in clinical pharmacy, rational pharmacotherapy and pharmacovigilance, and especially in the dental medical university center, remains relevant.

Materials and methods: The research materials were sources of periodical literature and obtained personal data. Methods used: clinical-pharmaceutical, pharmaco-economic, mathematical statistics, generalization and interpretation of result.

Results and discussion: During the reporting period (September 2021 - April 2022) the number of visitors to the University Medical Dental Center [UMDC] for emergency (urgent) dental care for the population during quarantine (for the period from March 2020 to April 2021) was analyzed. The relationship between the visit to the center and the epidemic situation in Ukraine has been established. The Regional Form of Medicines of the Lviv

Region has been updated. Minutes of the meetings of the Infection Control Commission were worked out, which made it possible to develop a model of the clinical pharmacist's activity in the sanitary-epidemiological well-being at the UMDC. The algorithm of actions at management of medical waste for the period of quarantine is investigated. Participated in the improvement of the regional formulary system as a co-chair of the Regional Formulary Committee in Lviv region. Worked on updating the Regional Form of Medicines with the 11th issue (2021). Participated in the development of a gel composition with prolonged action for the treatment of periodontal diseases. Co-author of patent № 125272.

CLINICAL AND PHARMACEUTICAL SUBSTANTIATION OF THE MODEL OF ACTIVITY OF THE CLINICAL PHARMACIST AT THE AIDS CENTER

Yulia Boyko
Scientific supervisor: prof. **Andriy Zimenkovsky**, PhD, ScD
Department of Healthcare Management, Pharmacotherapy and Clinical Pharmacy

Keywords: clinical pharmacy, clinical pharmacist, HIV/AIDS, pharmacotherapy, drug interaction,

Introduction: Clinical pharmacy is the theoretical and practical basis of the pharmacist's professional activity in carrying out consultative work among doctors and the public on issues of rational pharmacotherapy. The participation of the clinical pharmacist in the treatment process contributes to the timely provision of the patient with highly effective drugs, the establishment of rational ways and modes of their introduction, preventing the appointment of incompatible drugs, minimize side effects and reduce polypragmatism. Therefore, the main place of work of a clinical pharmacist should be primarily a treatment and prevention facility. It is here that the issue of pharmacotherapy is difficult to solve without a qualified specialist. Despite the above, in Ukraine only a small number of health care facilities have the position of clinical pharmacist in the staff list, which is held by a properly trained specialist.

Materials and methods: bibliosemantic method - to study the state of use of clinical pharmacy in the field of HIV / AIDS on the basis of scientific literature sources, electronic resources; clinical-pharmaceutical method - for the analysis of drugs used in the field of infectious diseases; pharmaco-economic method - for economic evaluation of the use of drugs in the inpatient department of the AIDS Center according to the prescriptions (form № 003-4 / 0)

Results and discussion: According to the work plan for the reporting period the following tasks of dissertation work are executed: retrospective

analysis of medical records of patients with Covid-19 who received treatment with monoclonal antibodies, based on the results of the article, which is being prepared for publication. The Local Form of the AIDS Center has been updated developed new standard operating procedures for the practical activities of the clinical pharmacist (n = 2) the normative-legal documentation necessary for the practical activity of the clinical pharmacist was analyzed.

SCIENTIFIC JUSTIFICATION OF THE PROFESSIONAL ROLE OF PHARMACEUTICAL SPECIALIST ON THE BASIS OF PROVISIONS THE WHO/*FIP*

Yuliia Kremin
Scientific Supervisor: prof. **Bohdan Hromovyk**, PhD, ScD
Department of Organization and Economics of Pharmacy

Keywords: pharmacist; World Health Organization (WHO); International Pharmaceutical Federation (*FIP)*; professional roles; competence

Introduction: The training of masters of pharmacy is based on a list of competencies and program learning outcomes, so it was important to explore the relationship between general (GC) and professional (PC) competencies and the "ten-star pharmacist" concept. Among the functions of a pharmacist, the professional roles (PR) of “a communicator” and “a teacher” are significant, which are important for disseminating reliable information about vaccination against viral infections, especially during the COVID-19 pandemic.

Materials and methods: The materials of the study were educational and professional programs (EPP) for the preparation of masters of pharmacy in 226 "Pharmacy, Industrial Pharmacy" 22 universities of Ukraine and the results of a survey of 1852 (first group) and 1197 (second group) respondents representing all regions controlled by the Ukrainian government. Methods used: content analysis, questionnaires, mathematical statistics, generalization and interpretation of results.

Results and discussion: The volume of the dissertation is 75%. In the course of research, it was found that:

– in the analyzed EPP there are 15 GCs and 35 PCs. At the same time, the majority of GCs (12 out of 15) and the minority of PCs (16 out of 35) are similar.

– there are significant differences in the formation of PRs of masters of pharmacy, in particular, the analyzed GCs do not sufficiently reflect the PR of a life-long-learner. In PCs, such a picture is typical for PRs a communicator and a teacher.

– there is no unified coherence of the studied EPP on PCs, which will not contribute to the formation of masters of pharmacy, adequate pharmaceutical

practice knowledge, and their acquisition of the necessary PRs in accordance with the "ten-star pharmacist" concept.

– 72.9% of respondents in the first group have never been vaccinated against influenza, and 72.7% would not want to get it. 70.5% of respondents would not want to be vaccinated against COVID-19. At the same time, 39.1% of supporters and 22.4% of opponents of vaccination from the respondents of the second group noted the importance of the pharmacist in educational and informational work on immunization. This actualizes PRs of the pharmacist as a communicator and a teacher.

According to the research results, one publication was published in a journal indexed by the Scopus database, and two articles in scientific professional journals of Ukraine. Abstracts are also presented in one foreign and five domestic scientific and practical conferences. Two scientific and methodological recommendations were issued and 32 acts of implementation in the practical activities of pharmaceutical organizations and scientific and educational processes of universities were received. Credited:

– performance of disciplines in accordance with the curriculum of the third year of postgraduate study;

– pedagogical practice of the graduate student on the basis of conducting seminars on the subject "Ethics and Deontology in Pharmacy" with first-year students of the faculty of pharmacy full-time education, lecture on the elective subject "Ethical Problems in Pharmacy" with third-year students of the faculty of pharmacy full-time education and practical classes in the discipline "Pharmaceutical Management and Marketing" with students of IV and V courses of the faculty of pharmacy full-time and correspondence education.

Conclusions: Based on the results of the study, a curriculum and guidelines for the elective subject discipline in the specialty 226 pharmacy, industrial pharmacy - "Theory and Practice Implementation the "Ten-Star Pharmacist" Concept" for full-time and correspondence education.

SYNTHESIS, ANTICANCER AND ANTIMICROBIAL PROPERTIES OF 1-ARYL-4-[(5-ARYL-2-FURYL)CARBONOTHIOYL]-PIPERAZINES

Yuliia Matiichuk
Scientific supervisor: assoc. prof. **Volodymyr Ogurtsov**, PhD
Department of General, Bioinorganic, Physical and Colloidal Chemistry

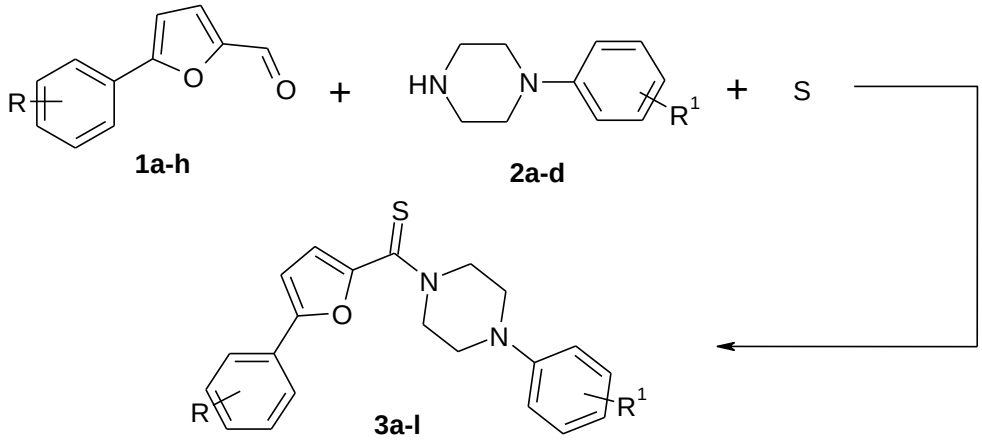
Keywords: arylfurfural, piperazine, Wilgerodt-Kindler reaction, antimicrobial activity, antitumor activity.

Introduction. Furane and piperazine derivatives are important classes of heterocyclic compounds with different types of biological activity. Over the last few decades, considerable attention has been focused on the synthesis of

derivatives of these heterocycles and their pharmacological screening. One of the strategies in the search for biologically active substances is to combine two heterocyclic pharmacophore fragments in one molecule. Therefore, the combination of piperazine scaffold with furan is an effective approach to the design of biologically active substances that are promising for implementation in medical practice.

Materials and methods: organic synthesis, ^{1}HNMR spectroscopy, pharmacological screening.

Results and discussion. The targeted 1-aryl-4-[(5-aryl-2-furyl)-carbonothioyl]piperazines **3a-l** were obtained by Willgerodt–Kindler reaction of arylfuran-2-carbaldehydes **1a-h** with sulfur and arylpiperazines **2a-d**.



1a-h: R = 3-Cl (**a**); 2,3-Cl_2 (**b**); 2,4-Cl_2 (**c**); 3,4-Cl_2 (**d**); 3-CF_3 (**e**); 2-NO_2 (**f**); 3-NO_2 (**g**);4-NO_2 (**h**)

2a-d: R = H (**a**); 3-CH_3 (**b**); 4-CH_3 (**c**); 3-Cl (**d**)

3a-l: R = 3-Cl, R^1 = H (**a**); R = 2,3-Cl_2, R^1 = H (**b**); R = 2,4-Cl_2, R^1 = H (**c**); R = 2,4-Cl_2, R^1 = 3-CH_3 (**d**); R = 3,4-Cl_2, R^1 = H (**e**); R = 3-CF_3, R^1 = H (**f**); R = 2-NO_2, R^1 = H (**g**); R = 2-NO_2, R^1 = 3-CH_3 (**h**); R = 3-NO_2, R^1 = H (**i**); R = 3-NO_2, R^1 = 4-CH_3 (**j**); R = 4-NO_2; R^1 = H (**k**); R = 4-NO_2, R^1 = 3-Cl (**l**).

The structures of the synthesized compounds were confirmed by ^{1}H NMR spectroscopy and elemental analysis. Our new compounds gave spectroscopic data in accordance with the proposed structures. The protons of two $ArN(CH_2)_2$ methylene groups were observed as broad signals at $\delta \sim 3.31–3.47$ ppm. On the other hand, the protons of $C(O)N(CH_2)_2$ groups appear as two broad signals at 3.98–4.16 ppm and 4.32–4.37 ppm. It means that the rotation around the C(S)-N bonds is restricted. The antimicrobial, antifungal and anticancer activities were investigated for the synthesized 1-aryl-4-[(5-aryl-2-furyl)carbon-thioyl]piperazines. These compounds do not exhibit high fungicidal activity. Results revealed that compounds **3a-l** showed moderate or high antibacterial activity. Compound **3l** was the most active against *Staphylococcus aureus* 209 with MIC = 3.91 μg/ml and MBC = 7.81 μg/ml. Also, this bacterial strain was sensitive to compound **3g** (MIC = 3.91 μg/ml and MBC = 15.62 μg/ml) which

is comparable to the comparison drug Bifonazole. Compounds **3a-l** showed moderate anticancer activity against several cancer cell lines with Mean GP = 91.81–107.71%. The most sensitive were RPMI-8226 Leukemia cell line (GP = 62.73%), SK-MEL-5 Melanoma cell line (GP = 63.58%) for the compound **3c** and HOP-92 Non-Small Cell Lung Cancer cell line (GP = 65.89%) – to the **3b**. It should be noted that these compounds **3b** and **3c** actively promoted the growth of MALME-3M Melanoma cell line and RXF 393 Renal Cancer cell line.

Conclusions: A number of new 1-aryl-4-[(5-aryl-2-furyl) carbonotionyl] piperazines were obtained by multicomponent Wilgerodt-Kindler reaction involving 5-arylfuran-2-carbaldehydes, sulfur and arylpiperazines. Their antimicrobial, antifungal and antitumor activities were studied. The 1-(3-chlorophenyl)-4-{[5-(4-nitrophenyl)-2-furyl]carbonothioyl}-phenylpiperazine **3l** was identified as perspective compound for treatment staphylococcal infection.

THESIS OF THE

MASTER PROJECTS

(JUNE 2022)

DEPARTMENT OF GENERAL, BIOINORGANIC, PHYSICAL AND COLLOIDAL CHEMISTRY

(Head of the department – prof. **Iryna Drapak**)

DISCOVERY OF NOVEL BIOLOGICALLY ACTIVE SUBSTANCES AMONG AZOLES WITH *IN SILICO* APPROACHES APPLICATION

Svitlana Prykhod`ko
Scientific supervisor: assoc. prof. **Olena Klenina**, PhD

Keywords: Computational drug discovery, computer-aided drug design, anti-inflammatory activity, virtual screening, thiazolo[4,5-*b*]pyridine-2-ones, ^{1}H-NMR spectroscopy, docking.

Introduction. Nowadays computer-aided drug discovery (CADD) approaches have been developed and integrated in all stages of novel drug candidates discovering. The field of CADD is rapidly advancing, and techniques and methods are under active development. Thiazolidine core is a powerful and effective pattern for rational design of "drug-like" molecules.

Materials and methods: Traditional organic synthesis protocols, pharmacological screening methodologies and *in silico* techniques including molecular modeling and virtual screening were used to discover novel drug-like compounds. Flexible molecular docking as a powerfull virtual screening tool was applied for a series of the investigated compounds as potential anti-inflammatory agents *via* structure-based approach. Organic synthesis including [3+3]-cyclocondensation, cyanethylation, hydrolysis, acylation, [2+3]-cyclocondensation and alkylation reactions were used, elemental analysis and ^{1}H-NMR spectroscopy have been applied to prove the structures of synthesized compounds. Pharmacological *in vivo* screening of anti-excudative effect of novel compounds was performed.

Results. A series of 5,7-dimethyl-3*H*-thiazolo[4,5-*b*]pyridin-2-ones were evaluated for their anti-inflammatory activity and subjected to virtual screening procedure.Flexible molecular docking studies were performed with MOE software using high resolution crystallographic structures of α-methyl-4-biphenylacetic acid:COX-1complex (pdb code 1Q4G), naproxen:COX-2 complex (pdb entry 3NT1), and glutathione:mPGES-1 complex (pdb code 4AL0). Minimized complexes as the docking studies outcome were scored by four scoring functions available in MOE revealing the synthesized compounds moderate potency as non-selective COX-1 and COX-2 inhibitors and were evaluated to form energetically favourable ligand-receptor complexes with thereceptors. The binding modes in the complexes were realized on account of pyridine ring nitrogen atom or oxygen of acetamide moiety of the compounds with Arg120 or Tyr355 side chains of COX-2 isoform. Active dock poses inspection of thiazolo[4,5-*b*]pyridines within the binding pocket of mPGES-1 ensured the acceptor-ligand interaction possibility *via* hydrogen binding confirmed with the effective docking scores.

The next stage provided synthesis of some novel anti-inflammatory drug candidates *via* a structural modification of early obtained 5,7-dimethyl-2-oxo-

3*H*-thiazolo[4,5-*b*]pyridine-3-acetic acid hydrazide. The acylation reaction approach was introduced for its functionalization. The synthetic potential of the basic scaffold hydrazine group was utilized by its interaction with a series of carboxylic acid chlorides. A series of 8 novel compounds was obtained as of N-acylation products of 5,7-dimethyl-2-oxo-2,3-dihydrothiazolo [4,5-b] pyridine-3-acetic acid hydrazide. The composition and structure of the synthesized compounds were confirmed by elemental analysis and ^{1}H NMR spectroscopy. Pharmacological *in vivo* screening of their anti-inflammatory activity was performed which allowed identifying one compound with moderate anti-excudative activity and one highly active lead-compound.

Conclusions. The anti-inflammatory activity evaluation and virtual structure-based screening for a series of N^3 substituted 3*H*-thiazolo[4,5-*b*]pyridine-2-one derivatives were carried out. The proposed virtual screening results provide an excellent starting point for rational design thiazolo[4,5-*b*]pyridine-2-one scaffold based potential drug candidates. The synthetic protocol for thiazolo[4,5-*b*]pyridine system functionalization in fused heterocycle N^3 position were utilized for a series of novel N^3 substituted 5,7-dimethyl-3*H*-thiazolo[4,5-*b*]pyridine-2-one derivatives obtaining as potential anti-inflammatory drug candidates.

DEPARTMENT OF HEALTHCARE MANAGEMENT, PHARMACOTHERAPY AND CLINICAL PHARMACY

(Head of the department – prof. **Andriy Zimenkovsky**)

PHARMACEUTICAL CARE OF ELDERLY PATIENTS WITH CHRONIC HEART FAILURE

Anna Rymar
Scientific supervisor: assist. prof. **Serhiy Babliak**, PhD

The work presents modern views on the problem of heart failure in elderly people, taking into account the psychological and clinical features of this age group. The prevalence of the main socio-demographic factors, duration of the course of this pathology and presence of concomitant diseases in 80 patients were investigated by means of questionnaire survey. The frequency of typical complaints observed in elderly people and peculiarities of pharmacotherapy with different classes of drugs were also revealed. Innovative promising treatment approaches, which will be confirmed or denied by the modern cardiology international community in the next 5-10 years, are also described.

CLINICAL AND PHARMACEUTICAL ASPECTS OF PHARMACOTHERAPY OF DRUG ALLERGY

Anhelina Sakal
Scientific supervisor: assist. prof. **Oksana Horodnycha**, PhD

Keywords: drug allergy, allergic reactions, antihistamines, awareness, pharmaceutic care

Introduction: In recent years, the number of patients suffering from allergies, including drug-induced, is constantly growing, and the course of this pathology is becoming more severe. Healthcare pharmacy staff should make appropriate individualized choices and dispenses of antihistamines, taking into account the specifics of each clinical situation and patient needs.

The aim of the study: to analyze modern scientific approaches to the management of drug-induced allergies, to determine the awareness of pharmaceutical workers about antihistamines and to conduct a clinical and pharmaceutical assessment of the actual practice of dispensing anti-allergic drugs by pharmacy workers.

Research methods: bibliographic, clinical-pharmaceutical, clinical-pharmacological, questionnaire surv, comparison, method of standardization, comparative method.

Results. According to the results of the survey, one of the main reasons for the release of H1-histamine receptor blockers from pharmacies is the prevention and / or treatment of allergic reactions to other drugs, most often antibiotics (72.3%), vitamins (38.3%) and nonsteroidal anti-inflammatory drugs (25.5%). The most common complaints of drug-induced allergies were

itchy skin and mucous membranes (47.8%) and localized rashes (37.3%), which in most cases patients treat on their own, without consulting a doctor. In order to prevent or eliminate drug-induced allergies pharmacy staff mostly recommend drugs with the active substances desloratadine 40.3% and levocetirizine 40.3%, which is rational because of a minimal risk of sedative and hypnotic effects. A somewhat insufficient level of awareness of pharmacy staff about antihistamines (especially about their safety and the principles of rational use) has been determined. For instance, only 38,8% of respondents knew about the possibility of seizures after taking H1-histamine receptor blockers, especially in children, about cardiotoxicity – 16.4%, about the ban on the drug (diphenhydramine + metamisol) from 1 syringe – 32.8%.

Conclusions. The results of a questionnaire survey of pharmaceutical specialists confirms the importance of the pharmacy employee in the medical management of allergic reactions to drugs. At the same time, the development and implementation of effective methods to raise awareness of pharmacy staff about drug management of drug allergies are needed.

CLINICAL AND PHARMACEUTICAL ASPECTS OF PHARMACOTHERAPY OF OTOLARYNGOLOGICAL INFECTIOUS DISEASES IN PEDIATRICS

Angelina Sokach
Scientific supervisor: assist. prof. **Oksana Horodnycha**, PhD

Keywords: otolaryngology diseases, pediatrics, pharmacotherapy, drug-related problems

Introduction: Otolaryngology diseases (ENT diseases) of infectious origin occupy a prominent place in the structure of childhood diseases.

The aim of the study: consists in conducting a clinical and pharmaceutical evaluation of pharmacotherapy of infectious diseases of the ENT organs in pediatrics and identifying typical drug-related problems.

Research methods: bibliographic, clinical-pharmaceutical, clinical-pharmacological, comparison, method of standardization, comparative method.

Results. The results of the analysis of written appointments of doctors for outpatient treatment of ENT pathology in children showed a significant amount of technical (n = 50) and clinical drug-related problems (n = 33). Technical problems included the lack of clear indications for the appointment of drugs (52%), instructions for dosing drugs (20%). Clinical problems concerned improper dosage (67%), incorrect duration no indication of the duration of medication (28%) and no pharmacotherapy (18%), appointment of contraindicated drugs (12%) and drug interactions (3%). The calculated quality indicators for outpatient antibiotic prescribing differs significantly from the

recommended rates. Thus, irrational and excessive prescribing of antibiotics was detected which promote the global problem- antibiotic resistance.

Conclusions. The results of clinical and pharmaceutical evaluation of the use of drugs for the treatment of infectious diseases of the ENT organs, showed a number of technical and clinical drug-related problems that can cause insufficient therapeutic effect of treatment, adverse reactions and chronicity of the process.

RATIONAL USE OF DRUGS THAT AFFECT THE NERVOUS SYSTEM IN GERIATRIC PATIENTS

Alina Vorobyoba
Scientific advisor: assoc. prof. **Yulia Nastyukha,** PhD

Keywords: nervous system drugs, potentially inappropriate medication, elderly, pharmaceutical care.

Introduction. Rational use of drugs in patients of geriatric age (≥65 years old) includes avoiding the use of potentially inappropriate medication (PIM) – drugs that have an unfavorable balance of benefits and harms compared with alternative treatment options. The results of the evaluation of the prescriptions to Australian patients (≥70 years) showed that 21% were given at least one PIM. There were long-acting benzodiazepines more often. According to research conducted in Japan, benzodiazepines for long-term use were the most common among the PIM identified. The American Geriatrics Society Beers Criteria in research conducted in China revealed the use of PIM in 35% of outpatients. Among these, the most common was the use of benzodiazepines. The results of research in Italy showed that in primary care 45.9% of patients (≥75 years) received at least one drug included in the American Geriatric Society Beer Criteria. 19.7% of patients used benzodiazepines / hypnotics, there were the most frequent among PIM. Thus, according to a number of research among PIM drugs that affect the nervous system, benzodiazepines, in particular, are among the most common prescriptions. It confirms the relevance of implementing geriatric tools in clinical practice to improve the pharmacotherapy of elderly patients.

Materials and methods. Methods used: system approach, bibliographic, clinical-pharmaceutical and comparative analysis. Objects of research: available information flows; American Geriatrics Society Beers Criteria, 2019; EU(7)-PIM List, 2015; STOPP / START criteria, version 2, 2015; EURO-FORTA List, 2018; State Register of Drugs of Ukraine (May 2022), State Drug Formulary (issues 13, 2021), Pharmaceutical Care Network Europe Classification for Drug related problems (V 9.1, 2020). Subject of research:

features of rational use of drugs that affect the nervous system in geriatric patients.

Results. It has been established that in a number of researches, contrary to the recommendations of geriatric tools, benzodiazepines are among the most frequently prescribed PIM for the elderly. This indicates the clinical practice necessity of its correction in elderly patients. The list of PIM that affect the nervous system was formed (n = 59) as a result of the analysis of geriatric tools. Representatives of all nine groups are included in the State Register of Drugs of Ukraine (n = 33) and make up 55.9% of the list obtained in the analysis of geriatric tools (n = 59). This proves the appropriateness of taking into account the recommendations of these geriatric tools in order to ensure rational use of medicines, in particular in the provision of pharmaceutical care. Systematization of special recommendations and warnings of the State Drug Formulary for the use of drugs in elderly that affect the nervous system (n = 80) with Pharmaceutical Care Network Europe Classification for DRPs allowed forming a list of potential causes of DRPs (n = 101), which should be avoided.

Conclusion. Increasing the rationality of the use of drugs affecting the nervous system in the elderly, provide due to compliance with geriatric tools, and taking into account the potential causes of drug-related problems (DRPs), identified on the basis of information in the latest issue of State Drug Formulary.

PHARMACEUTICAL CARE OF PATIENTS WITH PAIN

Evelina Luchechko
Scientific advisor: assoc. prof. **Myroslava Sekh**, PhD

Keywords: pain, pharmaceutical care, drug behavior, self-medication

Introduction. According to the resolution of the World Health Organization and the International Association for the Study of Pain (IASP), pain (P) is recognized as a huge global health care problem in the world and the leading cause of disability. More than 550 million working days are lost each year due to chronic pain (CP). The IASP estimates that one in five adults in the United States (US) suffers from pain, and one in 10 is diagnosed with CP each year. The economic burden of acute and CP in the US is between $ 560 and $ 635 billion per year. Significant epidemiology of P leads to the prevalence of self-medication among patients in most countries. Safe self-medication directly depends on both the patient's behavior (patient's medical behavior) and highly qualified pharmaceutical care (PC) provided by the pharmacist. In Ukraine, separate statistics on the epidemiology of acute and CP are not kept among the population. There are also no comprehensive studies on

P management, including the role and place of the pharmacist in this process. The purpose of the study is to investigate the place and role of the pharmacist in the management of self-medication P and to develop an algorithm for providing PC to this category of patients.

Methods and materials. The object of the study were the protocols of questionnaires (n = 314); international clinical recommendations on the research problem (n = 8); information flows on the rational choice of analgesic drugs for different types of P; systematic reviews and analyzes of the role of the pharmacist in the management of self-treatment of patients with P (n = 18).

Subjects of research: drug behavior, self-medication, pharmaceutical care

Methods: standardizations, anonymous questionnaire, system approach, structural-logical, analytical, clinical-pharmaceutical, comparative-analytical, computer data processing.

Results. A questionnaire survey of 314 respondents was conducted on problematic issues related to self-medication and drug behavior when using painkillers. 189 respondents (60.2%) who suffered from P, which required the use of analgesics, were selected. The average age of respondents was 25.5 ± 9.3 years, the youngest - 18 years, the oldest – 64. According to the gender distribution, 12.7% are men and 87.3% are women. Respondents were most often bothered by headache (58.2%), menstrual P (50.8%), spine P (23.3%), joint P (16.9%), toothache (6.9%) and other types of P (12.2%). More than ? respondents (63%) said that they had used analgesics because of a strong P; 13.2% - used painkillers less than once a month; 12.7% - several times a month; 4.2% - once a week; 5.8% - more than once a week and 1.1% - at least once a day. It was found that 72.5% of respondents independently decide to use of analgesic pharmacotherapy and do not consult with any specialist; 16.9% - consult a doctor and 10.6% - seek advice from a pharmacist. It is noteworthy that in 38.0% of cases the respondents chose prescription drugs. According to the results, 1/3 of respondents (30.2%) start pharmacotherapy with the use of ibuprofen, which is not suitable to the international clinical guidelines. Instead, only 5.3% of respondents follow the recommended paracetamol. In cases where the analgesic drug does not remove P, 39.7% of respondents replaced the drug with another; 29.1% - independently increased the dose of drugs; 29.1% - decided to use an additional analgesic. Only 17.5% reported consulting a doctor and 8.5% a pharmacist. At the same time, 19% of respondents observed side effects.

Conclusions. We revealed irrational aspects of medical behavior of a significant proportion of patients, who self-medicate of P (72.5%). Of course, it affects on the results of pharmacotherapy and the quality of care in the future. In our opinion, the proposed mechanism of influencing the drug behavior of painful patients with the participation of a pharmacist using the messages of

evidence-based pharmaceutical care permits to improve the quality of medical care and pharmaceutical care for this category of patients in the future.

CLINICAL AND PHARMACEUTICAL ASPECTS OF PHARMACOTHERAPY OF PREGNANT WOMEN'S CORONAVIRUS DISEASE

Irina Kudatska
Scientific adviser: assist. prof. **Oxana Nepiyvoda**, PhD

Keywords: coronavirus disease, pharmacotherapy, pregnant women.

Introduction. Pregnant women are at risk during the coronavirus pandemic. Because a pregnant woman becomes more vulnerable to COVID-19 due to reduced immunity, stress, overweight, chronic diseases or bad habits.

Materials and methods. Medical documentation of pregnant women with COVID-19 for the period 2019-2021 (10 medical cards were processed). Questionnaire survey was used among ambulance workers on the frequency of hospitalization, approaches to pharmacotherapy and the course of complications of pregnant women with COVID-19 (40 questionnaires were processed). A systematic approach, sociological (questionnaire), statistical, clinical and pharmaceutical methods of analysis are used.

Results. The total number of confirmed cases of coronavirus infection among pregnant women in 2019-2021 was 4053 (100.0%). The results showed that in 2019, there were 1,869 ambulance calls to pregnant women, among them 869 (21.4%) were confirmed cases of COVID-19. In 2020, the number of calls to pregnant women increased to 2298, among them 1134 (28.0%) patients were positive for COVID-19. At the same time, in 2021 the number of calls increased to 2,567, 2,050 (50.6%) pregnant women received confirmation of COVID-19 infection. Thus, the part of confirmed cases of COVID-19 among pregnant women increased from 21.4% in 2019 to 50.6% in 2021, it was increased 2.4 times. The most common complications which pregnant women with severe COVID-19 have are: 2% - miscarriage; 10% caesarean section and fetal growth retardation; 38% - premature birth; 40% - the death of a pregnant woman. Symptoms and complaints most often experienced by pregnant women with COVID-19 seek medical attention: 45% - sore throat, runny nose, temperature 38 ° C, shortness of breath and weakness; 20% - temperature 39 ° C, high blood pressure, dizziness, low back pain and 35% - cough, abdominal pain, headache, runny nose, temperature 39.5 ° C, difficulty breathing.

Conclusions. It was found that in the vast majority (73% of cases) pregnant women who seek emergency care with COVID-19 are hospitalized, and in 47% of cases the condition of patients is severe or very severe. Due to the situation in the world with the COVID-19 pandemic, pregnant women were

classified as at maximum risk. Therefore, every pregnant woman or woman who is planning a pregnancy should be vaccinated, follow all preventive measures and recommendations of the doctor during this period in order to maintain their health and the health of the unborn child.

PHARMACEUTICAL CARE OF PATIENTS WITH JOINT PAIN

Iryna Pidluzhna
Scientific supervisor: assist. prof. **Andriy Koval**, MPA

Keywords: joint pain, pain treatment, NSAIDs

Introduction. Joint pain is a common reason for patients to turn to both general practitioners and specialists. Statistics show that every fifth person who seeks medical help has a joint syndrome of varying severity. Given the variety of diseases associated with joint pain and the wide range of drugs to eliminate it, the issues of rational choice of drugs and pharmaceutical care in their use remain a pressing issue.

Materials and methods. Methods of analysis were used, such as: comparative and system analysis, clinical-pharmaceutical, bibliographic.

Results. According to the results of the analysis, we can say that the frequency of joint pain remains quite high (every 5th inhabitant of the planet) and given the increase in life expectancy has a pronounced tendency to increase, which confirms the urgency of the issue. Musculoskeletal pathology has serious social consequences. Given the variety of diseases associated with joint pain and the wide range of drugs to eliminate it, the issues of rational choice of drugs and pharmaceutical care in their use remain a pressing issue. The most common drugs are oral drugs, including over-the-counter. Significantly affect the pain in the joints of local irritants in the form of ointments that mask and relieve pain.

Conclusions. The pharmacist of the pharmacy, when communicating with a visitor to the institution with joint pain, must first determine whether the existing symptoms are subject to responsible self-treatment, or a doctor's consultation is required. In our opinion, the basic principles of pharmaceutical care for joint pain directed by a pharmacist directed to a pharmacy visitor can improve the effectiveness of treatment and avoid unwanted side effects of drugs. At the same time, such an approach will lead to the prevention and elimination of the danger of irresponsible self-medication.

CLINICAL-AND-PHARMACEUTICAL ASPECTS OF INTRANASAL MEDICINES RATIONAL USE

Makungo Maggie Chanda
Scientific supervisor: assoc. prof. **Oksana Lopatynska**, PhD.

Keywords: intranasal medicines, topical action, systemic action, safety, efficacy, pharmaceutical care.

Introduction. Most drugs are usually introduced through the oral or parenteral route for fast action, better patient compliance, and ease of administration. However, the low bioavailability and limited exposure of orally administered drugs pose a considerable challenge in treating different disorders. To overcome these problems, intranasal (IN) drug administration is one of the promising routes which is considered one of the most popular approaches for drug delivery, owing to the ease of administration, particularly for patients requiring long-term therapy, improvement in quality of life of patients, the improved efficacy and bioavailability of administered drugs, lower risk of a drug overdose, and easier compliance with stringent pharmaceutical regulations

The aim of research: lies in the investigation of the main problems of the rational use of IN medicines and the formulation of practical advice on the IN drug application in different dosage forms.

Materials and methods. Current evidence-based literature and online data materials (adopted from Cochrane, EMBASE, PubMed, Google Scholar, and Research Gate). Clinical guidelines (AAN, ECTRIMS/EAN, NICE, SIGN, ABN, EFNS); information on drugs using (n=236), results of a cross-sectional survey in Ukraine (n=48) and in Zambia (n=34). Used methods: literature and online data search, content analysis, clinical-and-pharmaceutical, analytical, comparative, model development, questionnaire survey targeting patients.

Results. Analyzing the discovered information that reveals the mechanism of action, pharmacological properties, indications, and contraindications, we concluded that IN medicines are valuable in managing many diseases. However, the investigation results have shown that the problem of rational use of IN medication has many unresolved issues of clinical and pharmaceutical nature, among which the most important are the issues of their clinical efficacy and safety. It is established that when choosing topically and systemic applied intranasal medicines should take into account several factors, among which are important: the potency of active ingredient, type of dosage forms, dose and duration of application, limitation, contraindications, and occurrence of side effects (SE), the effectiveness of previous treatment, safety and comfort for the patient. The results of the questionnaire survey revealed the certain patterns and trends in clinical and pharmaceutical problems associated with IN medicines use in Zambia and Ukraine. It was established, that the patients younger than 30 belong to the key group of people who the most often use IN medicines both in Zambia and Ukraine (50.0% vs 43.8%), indicating the likelihood of developing relevant problems at a relatively young age. Almost 1/3 of surveyed patients in Zambia and 1/2 – in

Ukraine, when choosing IN medicines, are guided by the principles of self-appointment and self-medication, which is a severe clinical and pharmaceutical problem. Almost 75% of respondents in Zambia and Ukraine violate the duration of IN medicines use, which can be considered a drug-related problem. Almost 35% of respondents in Zambia and Ukraine have a causal relationship between the occurrence of SE and the application of IN medicines. The incidence of SE after applying IN drugs in groups of respondents who were disposed to self-medication was higher than in those who used for medical care or consulted with a pharmacist in a pharmacy (64.3% vs 21.9% in Zambia and 39.4% vs 19.7% in Ukraine). Almost 1/3 of the respondents in Zambia and Ukraine do not follow or do not always follow the recommendations on the rational use of IN medicines, which is due, in most cases, to the insufficient provision of patients with evidence and available information. Pharmacists can contribute to positive outcomes by educating and counseling patients to prepare and motivate them to follow their pharmacotherapeutic regimens and monitoring plans. As research results, the information concerning correct administration techniques of different types of dosage forms for intranasal administration has been collected, which can be used by pharmacists and pharmacy teams for patients advising on how to use intranasal drugs to avoid common mistakes.

Conclusions: Because of their undisputed efficacy and modern advancement, IN medicines constitute one of the largest groups of drugs being used to treat different diseases and show local and systemic activity. SEs are rarely seen when IN medicines are used correctly, in short bursts, and provided certain precautions are taken. With the help of pharmaceutical care tools, even the most potent intranasal medicines for systemic activity can be used safely and effectively.

CLINICAL AND PHARMACEUTICAL APPROACHES TO SYMPTOMATIC, TREATMENT OF ENZYMATIC PANCREATIC INSUFFICIENCY

Oleh Kalimbet
Scientific supervisor: assist. prof. **Andriy Koval**, MPA

Keywords. Enzyme drugs (ED), exocrine pancreatic insufficiency (EPI)

Introduction. Exocrine pancreatic insufficiency (EPI)**:** a condition characterized by a deficiency of the digestive enzyme produced by the pancreas, leading to impaired digestion of food. EPI can occur in association with other diseases that affect the pancreas, like chronic pancreatitis and cystic fibrosis. The symptoms of exocrine pancreatic insufficiency are related to the defect in digestion and include abdominal pain, gas, diarrhea, and unusually foul-smelling stools. Weight loss and vitamin deficiencies can also result from

EPI. Pancreatic enzyme replacement therapy medications are the primary treatment.

Purpose. Develop clinical and pharmaceutical approaches to the symptomatic treatment of EPI.

Materials and methods. Method of comparative and system analysis, clinical-pharmaceutical method, computer data processing, bibliographic, questionnaire and standardization method were used. Period of the survey: March 2022. - April 2022

Results. Clinical and pharmaceutical approaches to symptomatic, treatment of EPI have been processed and formulated the main aspects of pharmaceutical care in the release of ED directed by the pharmacist to the patient, which can improve the effectiveness of treatment and avoid unwanted side effects of drugs.

Each group of ED has its own, strictly limited dose, improper use of these drugs leads to a lack of positive effect or even deterioration of the patient's condition. It is important to keep in mind that the dose of ED depends on the degree of pancreatic insufficiency and the content of lipase in the drug. Therefore, if a patient needs to take a drug with high enzymatic activity, the use of such a low enzymatic activity will not give the desired result and may even be harmful.

Conclusion. The results of the analysis of the data of modern information flows on the problem showed that the treatment of EPI is a difficult task that requires a comprehensive approach; when choosing a treatment regimen, an individual approach is required, taking into account the degree of exocrine insufficiency, the severity of abdominal pain and endocrine disorders.

FUNCTIONING OF PHARMACOLOGENCY - THE GUARANTEE OF RATIONAL PHARMACOTHERAPY

Ostap Molenda
Scientific supervisor: assoc. prof. **Nataliya Stepanyuk**, MD, PhD, ScD

Keywords: pharmacovigilance, pharmacotherapy, side effects, drugs.

Introduction: Drug safety (DS) has been one of the most pressing health problems worldwide. The major evaluation criterion for drug distribution in the pharmaceutical market is known to be the benefit/risk ratio, whereas the principal aim of rational pharmacotherapy (FT) of patients lies in mortality reduction and their life quality improvement. Thus, people who use medicines in their disease treatment may face the following risks: the risk of adverse drug reactions (ADR), the risk of adverse consequent effects following the clinical drug use (disability, new pathology emergence or death) and the lack of drug

efficacy. In terms of pharmacotherapy adverse effects associated with drug use, their occurrence may depend on the properties of drug active substance or its components, individual responses to drug use or inadequate drug quality. Inadequate drug quality causes much fewer adverse effects of pharmacotherapy in contrast to adverse drug reactions attributed to pharmacodynamic and pharmacokinetic properties of the drug molecule or individual body response to drug administration. This is caused by the emergence of many drugs with high biological activity, the use of which may be accompanied by side effects, various degrees of their manifestation and severity, increased sensitization of people to chemicals and biological substances, irrational use of medicines or using substandard drugs.

Materials and methods: Application of methods of system and clinical-pharmaceutical analysis, pharmacological and statistical approach, information retrieval.

Results: Pharmacovigilance system or the system of pharmacological control is a state system of data collection, which monitors reporting information about adverse drug reactions in the usual drug consumption and processes such data as evidence to provide affirmation of relevant regulatory decisions on licensed medicines. According to the card reports of side effects we conducted an analysis of side effects of drugs that were prescribed by doctors in health care institutions of Lviv Oblast in 2021. In terms of the incidence of adverse reactions, the leading drugs were chemotherapy (59.1%), drugs affecting the cardiovascular system (12.7%) and drugs acting on the central nervous system (6.9%). Among the side effects of drugs, the dominance of the gastrointestinal tract (28.5%), alergic reactions (25.1%), as well as reactions from the central nervous system (23.7%).

Conclusions: When prescribing any drug, every doctor should always be prepared for an adverse reaction and the ability to provide qualified medical care.

PHARMACEUTICAL CARE OF MIDDLE-AGED AND ELDERLY WOMEN WITH ARTERIAL HYPERTENSION AND CONCOMITANT PATHOLOGY

Sarah Gohar
Scientific supervisor: assoc. prof. **Serhii Babliak**, PhD

Keywords: arterial hypertension, risk factors, comorbidities, antihypertensive drugs, pharmaceutical care.

The **aim** of the work was to study the main aspects of pharmaceutical care for middle-aged and elderly women with diagnosed hypertension and concomitant pathology. Using an extended questionnaire of 84 female

respondents (44 from Egypt and 40 from Ukraine) aged 45-85 years, the analysis of socio-demographic indicators, risk factors, prevalence of comorbidities and prescribed medications was conducted. The following methods were used in writing the thesis: systematic analysis, bibliographic, clinical-pharmaceutical, clinical-pharmacological, comparative-analytical. The first chapture discusses the main problems faced by women during menopause. It presents a modern classification of hypertension depending on blood pressure levels, describes the impact of menopause on the onset and progression of the disease, and presents the results of foreign studies on this issue. The relationship between estrogen levels in women and the course of different phases of menopausal syndrome is also emphasized, and the effects of oral contraceptives are discussed separately. The second chapter investigates the socio-demographic characteristics of patients from Egypt and Ukraine suffering from hypertension, taking into account bad habits, body mass index, and region of residence. The data obtained are presented graphically in the form of figures. The third section presents the current international classification of antihypertensive drugs. In the context of pharmaceutical care for persons suffering from hypertension, the mechanisms of action of diuretics, beta-blockers, ACE inhibitors, sartans, calcium antagonists, and alpha-blockers are described. The main trade names of the most common antihypertensive drugs of each group are briefly presented, and the possibility of adverse side effects is indicated. The fourth section explains the practical aspects of pharmaceutical care for women with hypertension and concomitant pathology in the postmenopausal period. The recommendations for lifestyle modification and prevention of cardiovascular and cerebrovascular complications in patients of this age group are analyzed.

Based on the results of the work, **conclusions** have been drawn regarding the impact of pharmacists' activities on the process of rationalizing pharmacotherapy for women with hypertension and concomitant pathology, and it is emphasized that the systematic provision of individualized pharmaceutical care can not only improve the control of hypertension, but also positively affect the duration and quality of life of such patients.

PLACE OF PHARMACEUTICAL CARE IN RATIONAL PHARMACOTHERAPY OF CORONAVIRUS INFECTION

Vadim Boyko
Scientific supervisor: assoc. prof. **Marta Zayats,** PhD

Keywords: drugs, coronavirus infection, clinical pharmacy, pharmaceutical care

Introduction. The new coronavirus of 2019 (SARS-CoV-2) is a new virus that causes the development of respiratory diseases in humans (including acute respiratory disease COVID-19) and can be transmitted from person to person. The virus was first identified during an investigation into an outbreak in Wuhan, China, in December 2019. In Ukraine, according to the latest data, 4,809,624 people fell ill with the coronavirus, among them, unfortunately, 105,505 died from complications of the disease.

Materials and methods. The materials of the study were available official sources for the treatment of coronavirus infection, sources of statistical information on the problem, as well as the results of a questionnaire survey of pharmacy workers (pharmacists, pharmacists. N = 205). Research methods: analytical, descriptive, clinical-pharmaceutical, pharmacoeconomic.

Results. According to the WHO, almost 82% of patients do not need inpatient treatment, but are observed under the supervision of a family doctor at home and receive pharmaceutical treatment at the nearest pharmacy. This can lead to unwanted contact of an infected and healthy person on the premises of the pharmacy and can lead to new infections with COVID-19. Therefore, compliance with quarantine requirements in pharmacies is an important component of overall safety during a pandemic and the role of pharmacists in compliance is significant. We conducted a questionnaire survey of pharmaceutical workers (n = 205) who worked during the coronavirus pandemic in pharmacies in Ukraine and developed the main directions of providing pharmaceutical care for drugs for coronavirus infection. Respondents were heads of private pharmacies (35.6%), heads of state pharmacies (4.7%); pharmacists of a private pharmacy (41.6%); pharmacist of the state pharmacy (4.5%); and others (13.6%). According to our survey, it was found that during the pandemic, demand for some groups of drugs increased.

Conclusions. The results of the study found that coronavirus infection significantly affected the pharmaceutical sector, the specifics of pharmaceutical care and the demand for certain drugs. According to the results of a survey of pharmacists, it was found that the demand for antibacterial drugs in 2020 compared to 2019 increased by 57.4%, in particular, beta-lactam antibiotics - 60.1%; respiratory fluoroquinolones - 19.2%; macrolides - 14.7%, cephalosporins - 6.0%. Taking into account the results of a survey of pharmacists during the pandemic, we have formed the main elements of pharmaceutical care aimed at patients with mild coronavirus infection.

PHARMACEUTICAL CARE IN PHARMACIES DURING COVID-19 PANDEMIC

Viktor Startsev
Scientific supervisor: assist. prof. **Olga Boretska**, PhD

Keywords: pharmaceutical care, COVID-19, Pandemic

Introduction. The timely provision of medicines and the provision of special-purpose pharmaceutical care (PC) are crucial to improving health situations during a coronavirus pandemic. Services of PC during pandemic COVID-19 have different properties due to the specifics of the disease, related changes in patient needs and are aimed at optimizing the use of drugs to improve the results of pharmacotherapy. Therefore, it is important to study the specifics of providing PC in pharmacies during the COVID-19 pandemic.

The purpose of the study. To research the specifics of the implementation of PC in pharmacies during the COVID-19 pandemic.

Results. The results of the survey of pharmaceutical specialists and students of pharmacy showed that the best suited for implementation in the remote format are the following areas of PC: the choice of over-the-counter drugs and provision of recommendations for their proper use (75,5%); support for proper implementation of the recommendations of health professionals on the dosage of drugs, duration of pharmacotherapy, etc. (73,6%) and information on side effects of the drugs (69,8%). Dependence on technical conditions and lesser coverage of elderly patients in this form of PC are considered as disadvantages by most respondents (73,6%%). On the other hand, the possibility of providing PC during the pandemic, especially if social distancing and/or quarantine restrictions are required, as well as the possibility of counseling patients who are physically unable to visit the pharmacy were considered the most importand advantages (94,3% and 81,1% respectively). Regarding the readiness to provide PC remotely, 39,6% of the surveyed pharmaceutical specialists and students of pharmacy answered «unequivocally yes», and the same number – «rather yes, than no». Undecided, do not know how to answer – 9,5% of respondents and 11,3% – «rather not, than yes». None of the respondents gave «unequivocally no» as an answer.

Conclusions. We believe that the results of a survey of pharmaceutical professionals and students of pharmacy indicate a positive attitude to the possibility of implementing a remote format of PC in pharmacies. Therefore, further research on the wider introduction of remote forms of providing PC to patients in special conditions of pharmaceutical practice is promising.

CLINICAL-AND-PHARMACEUTICAL APPROACHES TO THE ANTISPASMODICS RATIONAL USE

Viktoria Chopyk
Scientific supervisor: assist. prof. **Tetiana Ryvak**, PhD

Keywords: questionnaire, antispasmodics drugs, self-treatment.

Introduction. Antispasmodics are a widely used group of over-the-counter drugs used to self-treat spastic conditions that are characteristic of a significant number of diseases. Therefore, the importance of rationalization of symptomatic pharmacotherapy, which uses antispasmodic drugs, is growing.

Materials and methods. The research covered 140 respondents of different ages and areas who carried a sample questionnaire specially formed protocol with regard to problem issues relating to the antispasmodics rational use. The standardized poll algorithm was used, what allowed to achieve equality of conditions within the study group. The system approach, sociological (questionnaire), statistical, clinical-and-pharmaceutical methods are used.

Results. It was found that 80.0% of respondents believe drotaverine is the safest antispasmodic. At the same time, 51.0% of respondents most often use it to relieve spastic pain, 40.0% - antispasmodics combined with analgesics, 4.0% - mebeverine, 3.0% - papaverine, 1.0% - prifinium and hyoscine. 74.0% of respondents take antispasmodics for menstrual pain, 58.0% for headaches and 38.0% - stomach pain. Given that 65.0% of respondents rely on their own experience when choosing antispasmodics, 23.6% - resort to "off-label" use of drugs, ie take the injection solution orally; 4.3% - use antispasmodics for more than 7-10 days (risk of adverse reactions), 3.6% - use drotaverine more than 6 tablets (> 240 mg) per day (cardiotoxicity), 7.1% develop adverse drug reactions with its application, we consider the role of the pharmacist in dispensing over-the-counter antispasmodics to be a priority to warn of all possible complications of pharmacotherapy.

Conclusions. In 92.1% of respondents, antispasmodics are available in the home first aid kit. The vast majority of respondents consider antispasmodics the safest over-the-counter drugs, therefore, the warnings mentioned in the instructions for medical use are often ignored, so we consider the pharmacist's recommendations on potential risks and complications associated with their improper use to be extremely important.

CLINICAL AND PHARMACEUTICAL APPROACHES TO THE SYMPTOMATIC TREATMENT OF DISORDERS OF THE GALLBLADDER AND BILIARY TRACT

Yaryna Dizhak
Scientific supervisor: assist.prof. **Koval Andriy**, MPA

Keywords: biliary dysfunction, treatment, drugs, features of the use of drugs, drug interaction, adverse drug reactions.

Introduction. The incidence of biliary dysfunction is growing every year. Early diagnosis and treatment of functional biliary dysfunction are very important. First of all, it improves patient well-being. In addition, functional diseases can be the basis for the progression of biliary tract diseases and the development of organic pathologies.

Materials and methods. Methods of the system and comparative analysis, clinical-pharmaceutical, and bibliographic are used.

Results. As a result of the analysis of the literary sources, clinical and pharmaceutical approaches to the symptomatic treatment of disorders of the gallbladder and biliary tract have been allocated. Treatment of biliary dysfunction requires a comprehensive approach – non-drug methods and pharmacotherapy. Pharmacotherapy of dysfunction of the gallbladder and biliary tract is aimed at eliminating the symptoms. Bile acids and their derivatives, herbal remedies and other groups of drugs, including antispasmodics, prokinetics, antisecretory drugs are used. Analysis of the pharmaceutical market of Ukraine showed that most drugs for the symptomatic treatment of disorders of the gallbladder and biliary tract are of plant origin. Their advantages are high safety, good tolerability and a minimum of side effects.The classification of biliary dysfunction should be considered for the correct choice of drugs. Choleretics with antispasmodics and cholespasmolytics should be used for patients with hyperkinetic form; cholekinetics and choleretics should be used for patients with hypokinetic form. The choice of pharmacotherapy should take into account individual characteristics - age, hormonal status, concomitant diseases, intolerance to certain substances, concomitant use of other drugs, the ability of drugs to cross the placental barrier, breast milk, and other signs that are specific to each case.

Conclusions. A clinical and pharmaceutical evaluation of over-the-counter drugs registered on the pharmaceutical market of Ukraine for the treatment of gallbladder and biliary tract disorders was performed.

DEPARTMENT OF DRUG TECHNOLOGY
AND BIOPHARMACY

(Head of the department – accoc. prof. **Svitlana Bilous**)

DEVELOPMENT OF COMPOSITION AND TECHNOLOGY OF SEMI SOLID PRODUCT WITH WOUND HEALING ACTION

Abdelaaty Aya Mohamed Gadelkarim
Scientific supervisor: assoc.prof. **Oksana Strus**, PhD, ScD

Keywords: .gel, wound healing action, technology, standardisation.

Introduction. One of the actual problems of modern pharmacy is the creation of new wound healing agents with expressive anti-inflammatory, antimicrobial, reparative properties and at the same time lack of toxic effects on the body. This is due to the presence of large number of patients with wounds and skin damage that require both surgical, and local treatment. Annually millions of surgical wounds are created during routine surgical operations. The development of such drugs has become even more relevant in connection with war in Ukraine, which led to an increase in the number of damages to the skin and wounds of various etiologies.

Materials and methods. Research object is gel with wound healing action. Research subject: elements of pharmaceutical development of SSDF for the treatment of burns and wounds at the second stage of the wound healing process. Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. The composition of the gel base was developed, namely: carbopol 1.0, propylene glycol 5.0, trometamol 0.8, potassium sorbate 0.2 and purified water up to 100 g. On the basis of the analysis of literature data and results of experimental researches as API introduction dexpanthenol, allantoin and urea is proved. Dexpanthenol provides anti-inflammatory and dermato-protective effects, stimulates regeneration processes. When applied topically, it is rapidly absorbed and converted into pantothenic acid, binds to plasma proteins. Stimulates skin regeneration. Allantoin a substance that has a strong moisturizing effect. Penetrating deep into the skin, allantoin delivers other components, retains moisture in the skin and promotes regeneration, helping to restore cell structure, heal burns, wounds and various skin damage. It has an antibacterial effect, kills harmful bacteria on the skin, reproducing a new healthy tissue. The regenerating properties of allantoin are used in the production of cosmetic preparations for the rapid restoration of connective tissue. Urea has antiseptic, moisturizing, soothing properties, enhances protective functions and promotes regeneration. The technology of dermatological semi-solid product is developed and quality indicators of the developed product are investigated.

Conclusions. Composition and technology of a new semi solid product with wound healing action in the form of gel were scientifically and experimentally justified. Quality and stability of developed preparation were assessed.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF ANTICOUGH MEDICINE

Andriana Huzar
Scientific supervisor: assoc.prof. **Oksana Strus**, PhD, ScD.

Keywords: cough, plantain, syrup, medicinal plant raw materials, technology, standardization.

Introduction. In patients with chronic cough, the long process leads to physical, social and psychological problems. The quality of life of patients is significantly deteriorating. In the exacerbation of chronic diseases of the respiratory tract (bronchial asthma, chronic bronchitis) when the cough has a multicomponent pathogenesis, the combination drugs is rational used. Rational choice and timely inclusion of antitussive drugs in the complex therapy of respiratory diseases accompanied by cough, significantly increases the effectiveness of basic treatment, and the development of new antitussives is an topical task. The aim of our work was to theoretically and experimentally justify and develop the composition and technology of combined anticough syrup.

Materials and methods. Research object is anticough syrup. Research subject: elements of pharmaceutical development of liquid dosage forms. Methods: literature monitoring, pharmacotechnological, physical-chemical, and mathematical.

Results. Effective agents with bronchodilator action are syrups that contain plantain, which combines the secretolytic properties of polysaccharides with anti-inflammatory and antibacterial action of aucubin. Aucubin possesses a strong anti-inflammatory, antibacterial and antioxidant effect, inhibiting the peroxidation of lipids in the membranes of bronchial cells and thus enhancing the bronchodilator effect of polysaccharides. Therefore, the indications for the use of mucolytic drugs in this group are clinical conditions in which there is a cough with thick, viscous, difficult to separate sputum. Acetylcysteine is an effective mucolytic agent. By diluting sputum and increasing its volume, acetylcysteine facilitates its excretion; promotes expectoration, also reduces inflammation. The composition of antitussive syrup containing 2.0 acetylcysteine, 15 ml of plantain extract, sodium benzoate 0.5 and sugar syrup up to 100.0 was developed. The technology of syrup with acetylcysteine and plantain extract was proposed and standardized according to the description, pH value, density and relative viscosity, and it was found that the syrup remains stable during storage for 3 months at room temperature. Developed a combined drug that combines the secretolytic properties of polysaccharides with anti-inflammatory and antibacterial action, effectively dilutes sputum and promotes expectoration, which can be used for people of all ages.

Conclusions. Composition and technology of a new anticough drug with plantain extract and acetylcysteine in the form of syrup were scientifically and

experimentally justified. Quality and stability of developed preparation were assessed.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF THROAT LOZENGES ON THE BASE OF MEDICINAL PLANT RAW MATERIALS

Bogdana Danylchuk
Scientific supervisor: assoc. prof. **Oksana Yezerska**, PhD

Keywords: Monarda fistulosa, wild bergamot extract, lozenges, excipients

Introduction. Sore throat is a common symptom of an acute respiratory viral infection that forces patients to seek medical help or self-medication. Despite the vast arsenal of available drugs for sore throat, the problem of finding new highly effective drugs remains relevant. Therefore, development of throat lozenges on the base of medicinal plant raw materials is a topical task.

The purpose of this work is to study and summarize the literature on the development, production and quality control of drugs in the form of lozenges and to develop the composition and technology of lozenges with wild bergamot extract.

Materials and methods. Research object are lozenges with wild bergamot extract. Research methods - analysis of literature data, physical-chemical, pharmaco-technological and statistical methods.

Results. Sore throat - this is the dominant symptom of acute respiratory infection of the upper respiratory tract, which is associated with the occurrence of an inflammatory process in the oropharynx, tonsils**.** Antiseptics and antimicrobials are prescribed to treat the throat. An assortment of solid drugs used in diseases of the throat was analyzed. It was found that the majority of drugs used in diseases of the throat registered in Ukraine are of foreign manufacture (76 %). Among the dosage forms lozenges and tablets dominate (42 % and 52 % respectively). Considering the availability, a wide spectrum of medicinal plants action and proven effectiveness in the treatment of psoriasis among traditional medicine is a promising study of medicinal plants to develop new herbal formulations. Having analyzed literature data, we have chosen the wild bergamot for creation of drugs the used in diseases of the throat. *Monarda fistulosa L.* is an annual or perennial medicinal plant known for its strong therapeutic effects: its essential oils and flavonoids are characterized by high antibacterial, antimycotic, and anti-inflammatory activities. Lozenges are the flavored medicated dosage forms intended to be sucked and held in the mouth or pharynx containing one or more medicaments usually in the sweetened base. On the basis of theoretical and experimental studies, a composition of lozenges was developed, and wild bergamot extract and essential oil of sage was

introduced into the lozenges as the main active pharmaceutical ingredients. Isomalt, xylitol, sorbitol, citric acid, fragrance “Raspberry”, dye was used as excipients. The technological process consists of the following stages: auxiliary stage, preparation of reparation of lozenges base, mixing of active pharmaceutical ingredients with lozenges base, formation of lozenges, quality control, packaging and labeling. The technological scheme of the lozenges with wild bergamot extract manufacturing has been developed. Quality control of the developed product was conducted according to the requirements of Ukrainian State Pahrmacopoeia: an average lozenges weight is 2,8 ± 5%. Stability of lozenges with wild bergamot extract at room temperature storage was proved.

Conclusions. We have scientifically and experimentally proved the composition and the technology of new medicinal product with wild bergamot extract in the form of lozenges. The developed medicinal product is a lozenge with wild bergamot extract that meets the requirements of analytical documentation requirements, is stable in storage and can be recommended for the further research with the purpose to be implemented in production.

DEVELOPMENT OF THE COSMETIC AND MEDICINAL CREAMS WITH THE PROPOLIS TINCTURE

Dariia Hrebenka
Scientific supervisor: assoc. prof. **Natalia Hudz**, PhD, ScD

Keywords: cream, wound process, propolis, technology.

Introduction. A person's appearance plays an important role in his life. The emotional and physical state of a person indicates the appearance of the skin. The result of a healthy lifestyle, nutrition and careful cosmetic care is a healthy skin. In some cases, despite all efforts, the skin has a bad appearance, and then special cosmetics or medical products are used. Therefore, the development of creams based on propolis tincture is a topical issue of pharmaceutical technology.

The aim of the study was to develop and substantiate the composition and technology of laboratory batches of creams based on propolis tincture (1: 5).

Materials and methods. While carrying out the research the following methods were used: analysis, synthesis, systematization and comparison of the information for the processing of published scientific data on the composition; experimental technological and analytical studies.

Results. According to the results of this work, the information of literature sources on the use of creams, physical and chemical properties of excipients for processing the composition and technology of creams is summarized. Our studies were directed at the development of semisolid dosage

forms (ointments, creams and teeth pastes) with tinctures of propolis (1 to 5). We selected the compositions with the usage of two bases: Lekobaza lux and Eucerin. The composition and technology of propolis tincture of Ukrainian origin (1: 5) with the use of temperature and ultrasonic treatment were developed. The functional purpose of the creams and ointment components was substantiated. Two compositions and technology of lipophilic creams based on propolis tincture using lipophilic base *Lekobaza lux* and three compositions of lipophilic ointment based on Eucerin were developed. *Lekobaza* plus is the hydrophobic creamy base which contains 65% of water, emulsifying agents (triglicerol diisostearate, isopropyl palmitate), citric acid, potassium sorbate and other components. Eucerin contains white vaseline 93.5%, alcohol cetostearylic 0.5% and sterol alcohols from lanoline 6.0%. The feature of the euceryn base is a large absorbing activity. The technological scheme of emulsion ointment and creams production, which consisted of several stages, is offered. Propolis tincture was added to the bases, the components were mixed with a homogenizer for 2 min and the stability of the emulsion system was monitored.

Conclusion: The developed cream has a yellowish tinge. Ointment based on yellow Eucerin, the intensity of which increased with increasing content of propolis tincture. Future studies will be directed at the microbial and toxicological studies of the developed semisolid cosmetic and dosage forms.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF COSMETIC PRODUCT FOR SKIN CARE AROUND THE EYES

Diana Voloshyn
Scientific supervisor: assoc.prof. **Oksana Strus**, PhD, ScD.

Keywords: cream, technology

Introduction. The eyes are the most expressive part of the face, and the skin around the eyes can tell about bad habits, the effects of fatigue, stress. The skin around the eyes is constantly exposed to aggressive external factors. In addition, its special sensitivity is due to the special structure. The first signs of aging appear in this area much earlier than in other areas, so the paraorbital area needs special care. The aim of our work was to develop the composition of an emulsion cream for the care of the paraorbital area around the eyes.

Materials and methods. Research object is cream for the care of the paraorbital area around the eyes. Research subject: elements of pharmaceutical development of for topical treatment of hyperkeratosis. Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. The literature data on anatomical and physiological features of the skin structure of the periorbital region are analyzed, the main cosmetic defects and methods of their correction are described. An analysis of the

nomenclature of biologically active substances in skin care products for the eye area and found that the main BAS in cosmetics for skin care around the eyes are essential and vegetable oils, vitamins, proteins, extracts of raw material and their individual components, phospholipids, AHA -acids, as well as innovative substances Based on the results of research (study of thermal stability, colloidal stability, pH values, organoleptic parameters and sensory characteristics) substantiated the composition of the cream with corn oil, almond and wheat germ, emulsifiers of ricinoleate sodium and glyceryl monooleate as well as biologically active substances - hyaluronic, lactic acids and chamomile extract. To ensure microbiological purity, the preservative germaben was added. The technology of the cream has been developed and the compliance of the developed cream with the requirements of the current normative documentation has been established.

Conclusions. Composition and technology of a new cream for the care of the paraorbital area around the eyes in the form of lipophilic cream were scientifically and experimentally justified. Quality and stability of developed preparation were assessed.

MODERN APPROACHES TO THE PRODUCTION AND CERTIFICATION OF COSMETIC PRODUCTS

Diana Shchur
Scientific advisers: assoc. professor **Svitlana Bilous**, PhD, ScD

Keywords: cosmetics, cosmetic products regulations, certification.

Introduction. Modern approaches to the development, production and certification of cosmetics, which are determined by regulatory documents, are designed to ensure the quality and safety of cosmetics and create conditions for their recognition in different countries. Therefore, the urgent task is to study the legal documents governing the production of cosmetics in Ukraine, their compliance with international requirements, as well as to identify problematic issues related to the production of these products.

Materials and methods. Sources of scientific medical and pharmaceutical information, regulatory documents on cosmetics, in particular the EU Regulation in the field of cosmetics № 1223/2009 and the Technical Regulation on cosmetic products.

Results. The modern cosmetic industry in Ukraine is actively developing and using innovative achievements of medicine, chemistry, pharmacy, which, in turn, is accompanied by a change in approaches to regulating this area and updating the means and methods of cosmetic care. In order to harmonize technical regulation in Ukraine with EU legislation, namely the EU Regulation in the field of cosmetics № 1223/2009, the Technical Regulation on cosmetic products has been developed, which should come into force in August 2022. For the first time, the Regulation

proposes the term "cosmetic products" to unify the numerous terms currently used, lists the categories of cosmetic products, and approves the procedure for putting cosmetic products into circulation at the request of the responsible person who brings cosmetic products closer to medicines. The production of cosmetic products, in accordance with European requirements, must comply with good manufacturing practice. According to the Technical Regulation, manufacturers will not be able to test cosmetic products on animals, but will have to use alternative testing methods, such as tests on human skin models. The technical regulations do not define natural, organic, medical cosmetic products, etc., but manufacturers can voluntarily carry out certification for compliance with the relevant standards, as is the case in world practice.

Conclusions. The introduction of the Technical Regulation on Cosmetic Products in Ukraine will increase the requirements for its development, production and safety and create conditions for the recognition of domestic products in other countries.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF THE TOOTHPASTE WITH DEODORIZING PROPERTIES

Hegezi Mahmoud Shehata Attia Saad
Scientific supervisor: prof. **N. I. Hudz**, PhD, ScD

Introduction. Currently, there is a tendency of steady growth of different periodontal pathologies. Periodontitis is considered to be one of the most frequent pathologies that accompany different somatic diseases. Therefore, the development of teeth pastes with antioxidant, antimicrobial and dezodorating properties for local treatment of inflammatory damages of mucous membrane of oral cavity and for care for the oral cavity and halitosis is important issue for dentistry and pharmaceutical technology.

The purpose of this work was to develop a composition and technology, and conduct the research of the toothpastes with antioxidant, antiinflammatory, and antimicrobial activities for the application in case of diseases of mucous membrane of the oral cavity caused by the influence of various factors.

Materials and methods. While doing the research the following methods of investigation are used: analysis, synthesis, systematization and comparison for processing of published scientifical data on damages of periodontal tissues, antioxidant properties of beekeeping products.

Results. Among the natural herbal preparations with anti-inflammatory and antimicrobial properties are extracts of propolis and herbal preparations of essential oil bearing plants. Toothpaste on the base of calcium carbonate and thickeners xanthan gum and carbopol was a subject of our study. The tinctures of propolis and *Satureja montana* are also incorporated into toothpastes as preparations with antioxidant, anti-inflammatory and antimicrobial properties.

Sorbitol, glycerol, propylene glycol and xylitol are employed as wetting agents and plasticizers to produce plastic mass. Xylitol also adjusts the microflora of oral cavity and activates the process of remineralization of teeth. The tinctures of propolis and *Satureja montana* additionally provide a pleasant specific odour to the toothpastes. The propolis tincture was received with the aid of maceration method. A special features of the preparation of the toothpastes are: obtaining the solution of sorbitol and xylitol by heating; obtaining gel base by means of mixing of two the thickeners, wetting them with glycerol, propylene glycol and adding the cooled solution of xylitol and sorbitol. The adding of calcium carbonate into the gel base was carried out gradually while stirring until homogeneous mass is obtained. The mixture was thoroughly stirred until homogeneous mass is obtained. The toothpastes were packed in plastics containers.

Conclusion: The developed toothpastes have a nice strong smell of thymol with a slight odour of propolis, a sweet taste with a slight tingling tongue tip.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF ANTI-CELLULITE SCRUB

Ilona Dobushovska
Scientific supervisor: assist. prof. **Oksana Strus**, PhD, ScD

Keywords: chestnut extract**,** pineapple powder, anti-cellulite scrub, technology

Introduction. Cellulite can be considered a minor esthetic defect that can significantly reduce self-esteem and quickly cause serious complexes, but in the case of adipocyte hypertrophy, accompanied by impaired microcirculation and adipose tissue metabolism, this condition can be regarded as pathological. Scrubs are one of the most effective anti-cellulite products. Abrasive particles of scrubs are able to remove dead particles and deep dirt from the skin surface, perform micromassage, improve blood microcirculation, the skin is more saturated with oxygen and nutrients, improves lymphatic outflow. Active anti-cellulite substances, such as extracts of herbs and algae, essential oils promote the breakdown of fat, excretion of toxins. As a result of using anti- cellulite scrub, the skin becomes softer and smoother, the manifestations of bumps are reduced. The aim of research is the development of composition and technology of cosmetics product with anti-cellulite action.

Materials and methods. Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. Cellulite treatment is comprehensive and includes diet, exercise to increase muscle tone, as well as various procedures to stimulate blood and lymph circulation with the use of anti-cellulite drugs. According to the results

of anti-cellulite research, the most common are extracts from medicinal plant raw materials, seaweed, caffeine and essential oils of citrus, labial and coniferous. The composition of the gel-scrub for the use of the following composition in the first and second stages of cellulite was substantiated and developed: jojoba granules (5.0), chestnut extract (5 ml), pineapple powder (10.0), carbopol gelling agent (1.0), glycerin (5.0), germaben (0.8), essential oils of orange and lemongrass, PEG-40 GRO (1.0), purified water (up to 100.0). The technology of anti-cellulite gel scrub has been developed, which consists of 6 technological stages and includes: preparation of gel base, preparation of BAS solution, filtration, production of essential oil solution, gel production, quality control, packaging, The stability of the developed gel was studied when stored at room temperature for 3 months. Gel quality indicators remained stable throughout the shelf life..

Conclusions. The developed gel scrub according to organoleptic parameters, pH value, meets the requirements of analytical and regulatory documentation and can be recommended for further study for individual use and for small-scale pharmaceutical production.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF DRUG PRODUCT FOR TREATMENT OF ORAL CANDIDIASIS

Iryna Vynnyk
Scientific supervisor: assoc.prof. **Kateryna Vashchenko**, PhD

Keywords: candidiasis of the oral mucosa, treatment, gels, composition, technology.

Introduction. Among the diseases of the oral mucosa (OR), fungal lesions are dominant, and during the last years the incidence of OR candidiasis has significantly increased. For the fungal diseases OR treatment are widely used medicines of the local action, among which are widely used herbal preparations in the form of tinctures, infusions, decoctions etc. However, using the medicines in liquid forms often gives a temporary effect, which provides short-term remission due to a rapid decrease in the concentration of the medicines in the lesion. Prolonged combined medicines that contain extracts from plant raw materials and antifungal substance are more effective, but the range of such long-acting drugs is insufficient, so the development of new medicines in convenient dosage form is an urgent problem of modern dentistry and pharmacy.

Materials and methods. The object of study is a gel for the treatment of oral mucosa candidiasis. Methods included data monitoring, grouping and systematization of information, logical analysis. Physical-chemical and technological methods were also used.

Results. The results of the information sources analysis showed that the increase in the incidence of oral and periodontal mucosa, the role of fungi of the genus Candida in the formation and progression of these pathological conditions, limited range of antifungal medicines for topical use in the oral cavity. for therapeutic dentistry with polyvalent prolonged action, including antifungal. Effective means for local application are means in the form of gels which have considerable advantages: combine properties of a firm body and liquid therefore are very effective at applications; due to the formation of aqueous internal structures, the gel allows to include in its composition different medicinal substances, which determines the possibility of obtaining medicine of combined action; able to reduce swelling and wetting, well distributed on the mucous membrane, create local therapeutic concentrations, provide prolonged release of active substances. We have theoretically and experimentally substantiated the use in one medicine of several active pharmaceutical ingredients with different mechanism of action (antifungal substance - clotrimazole and a mixture of essential oils - clove and tea tree), which will effectively influence the main pathogenetic factors of fungal diseases OR. The gel contains auxiliaries - methylcellulose, solvent - purified water, co-solvent - macrogol 400, moisturizer and penetrant - propylene glycol, flavoring and preservative - xylitol. Gel technology and technological block diagram of production in industrial conditions are developed. The technological process consists of 7 technological stages.

Conclusions. The composition and technology of the gel for the local treatment of OR candidiasis have been developed. The developed gel meets the requirements of analytical and regulatory documentation, is stable during the storage and can be recommended for further research for implementation in production.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY TOOTHPASTE WITH ACORUS CALAMUS

Juliya Yosenko
Scientific supervisor: assoc.prof. **I.S. Hrynovets**, PhD

Keywords: abrasives, Acorus calamus, hygiene products, toothpaste, oral cavity.

Introduction. In Ukraine, the incidence of caries in young people (15-30 years) is 92-95%, and periodontal disease occurs in 75% of people in this age group.It is established that with the correct implementation of individual preventive measures reduces the level of caries intensity by 20-25%, acid resistance of enamel increases by 16%, regulates the quantitative composition of microorganisms in the oral cavity.Hygiene products used for oral care are important. They help eliminate food residues and inhibit the overgrowth of

microorganisms.Toothpaste is a complex system, in the formation of which involved abrasive, moisturizing, binding, foaming, surfactants (surfactants), preservatives, water, biologically active substances (BAS); the ratio of these components determines the properties, purpose, mechanism of action and effectiveness of pastes.By type of use toothpastes are divided into pastes for household and professional use. Today, there are several classifications of toothpastes. The classification is based on various factors. Depending on the content of active ingredients, modern toothpastes are classified into: hygienic, therapeutic and curative, as well as for children, smokers, sensitive enamel, combined action, whitening, anti-inflammatory, anti-caries, fluoride, coniferous, antiseptic, antimicrobial special, etc.

Materials and methods. As a result of physical, chemical and microbiological studies it is developed an original composition and technology of toothpaste with acorus calamus.

Results. We analyzed the literature and developed the composition of the cosmetic in the form of Toothpaste with calamus root. The chemical composition of calamus is an essential oil plant.To strengthen the teeth and gums, a toothpaste of natural origin, acorus root powder, was added to the toothpaste.The microbiological purity of toothpaste with calamus root was determined in accordance with the requirements for cosmetic forms that are applied topically to the oral mucosa.The development of Acorus calamus root toothpaste is not only an extension of the range of hygiene products - it is an improved approach to restoring microbiocinosis, the ability to clean teeth from plaque and freshen the breath, which is constant in the daily care of oral disease.

Conclusions.A toothpaste with acorus calamus can be used not only for the daily care of the oral cavity and dentition (as an independent hygiene and prophylactic agent), but also as part of therapeutic therapies in dental practice, for example: after scaling, during periodontal disease and other.

DEVELOPMENT OF COMPOSITION AND TECHNOLOGY OF PRODUCT FOR PREVENTION AND TREATMENT ALOPECIA

Kristina Kolesnik
Scientific supervisor: assist. prof. **Tetiana Shostak**, PhD

Keyword: alopecia, lotion, peppermint tincture, liquid extract of hop cones.

Introduction. Hair is an important sign of self-perception, especially for women, it is a business card of beauty and health. And increased hair loss is a real problem for centuries, because excessive hair loss causes psychological discomfort and reduces the quality of life. Despite the wide range of anti-hair loss products, the range of domestic products is limited. Therefore, the urgent

task is to develop a new domestic medicinal cosmetic product for the prevention and treatment of alopecia.

Materials and methods. The object of study is lotion. Subject of study: an element of pharmaceutical development of a medicinal cosmetic product for the prevention and treatment of alopecia. The methods of information search, analysis of literature data, marketing research and technological methods were used in the work.

Results. An analysis of the range of cosmetics on the basis of three pharmacies in Lviv and found that most of the products of this range are foreign-made (France) and have a high cost, and domestic product are only 18%. A study was also conducted of the range of medicines according to the State Register of Medicines of Ukraine. As a result of the comparison between medicinal and cosmetic forms of release, it was found that the leader in the forms of release among cosmetics are shampoos, and among medicines - skin solution. The choice of the form of a therapeutic and cosmetic product for the prevention and treatment of alopecia in the form of a lotion is substantiated. When developing the composition of the medicinal cosmetic product, peppermint tincture was chosen as active pharmaceutical ingredients, which has a local cooling and irritating effect and stimulates blood circulation in the scalp, and a liquid extract of hop cones, which provides an antiseptic and astringent effect, and also has a mild antibacterial effect. The technology of lotion production is substantiated and the structural scheme of its production is given. The lotion was studied by organoleptic (appearance, color and smell) and physicochemical methods (pH, mass fraction of alcohol). According to the studied indicators, the medicinal cosmetic product remains stable.

Conclusoins. The composition of a new medicinal cosmetic product in the form of a lotion for the prevention and treatment of alopecia, containing a tincture of peppermint and a liquid extract of hop cones, has been theoretically and experimentally substantiated. The medicinal cosmetic product meets the requirements of the State Pharmacopoeia of Ukraine and will help expand the range of domestic medicinal cosmetic products for the prevention and treatment of hair loss.

DEVELOPMENT OF ANTIMICROBIAL OINTMENT FOR THE TREATMENT OF PANARITIUM

Marta Voloshyn
Scientific supervisor: assoc. prof. **Natalia Hudz**, PhD, ScD

Keywords: gentamicin sulfate, antimicrobial ointment, suspension ointment.

Introduction. Patients with surgical infection make up a significant part of patients in surgical inpatient and outpatient departments. The occurrence and

development of acute purulent soft tissue diseases are based on common pathoanatomical, pathophysiological, microbiological and immunological mechanisms, which leads to common approaches to their treatment. Panaritium is the most common purulent hand disease. The frequency of wound infectious complications reaches 14-20% .There are more patients with purulent processes that lead to the development of septic conditions and reduce the efficiency of patients, increasing the duration of their inpatient treatment.

The aim of the study was to develop the composition and technology and to conduct research on the wound antimicrobial ointment on the base of gentamicin.

Materials and methods. While carrying out the research the following methods were used: information retrieval, analysis, generalization, systematization, and comparison of information; experimental technological research; microbiological research.

Results. As the results of the conducted work, the composition and technology of the wound antimicrobial ointment are proposed. The main component of the developed suspension ointment was gentamicin sulfate. The functional purpose of ointment components was justified. Gentamicin has antimicrobial, wound healing and anti- inflammatory effects. Two compositions of ointments with gentamicin were used in the preparation of the tested suspention ointment. In research the lipophilic base Lekobaza lux and the hydrophilic base Lekobaza were used, respectively. According to biopharmaceutical studies, gentamicin sulfate is released better from the hydrophilic ointment. The technological scheme of the tested ointment is offered.

Conclusion: The developed composition and technology of hydrophilic antimicrobial ointment with gentamicin can be used for further research for pharmaceutical production or preparation in pharmacies, as well as for preclinical studies or clinical trials.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF DRUG PRODUCT FOR TOPICAL TREATMENT OF SEBORRHEIC DERMATITIS

Marta Ivashkiv
Scientific supervisor: assist. prof. **Oksana Vashchenko**, PhD

Keywords: seborrheic dermatitis of the scalp, treatment, shampoos, technology

Introduction. Seborrheic dermatitis (SD) is one of the most common dermatoses: its share in the structure of dermatological morbidity is up to 10%. The most common form of SD is SD of the scalp and face. Many topical medications (MEDS) have been proposed for the treatment of SD, mainly in

mild dosage forms (DFs), but physicians and consumers have noted inconveniences in using medications is these DFs. The optimal DF of drugs for the local treatment of SD of the scalp are shampoos, the range of which is limited in the pharmaceutical market of Ukraine, so it is important to develop a new MED of combined action in this form.

Materials and methods. The object of research is a shampoo for the treatment of SD. Methods included data monitoring, grouping and systematization of information, logical analysis. Physical-chemical and technological methods were also used. Results. The problem of SD treatment today is relevant in connection with the steady increase in the number of patients and cases of resistance to traditional therapy, frequent recurrence of the disease. Tactics of therapy and methods of treatment depend on the form and stage of the disease, as well as the presence of concomitant pathologies. Treatment of SD is comprehensive, aimed at eliminating clinical manifestations and correcting the diseases that caused it. Topically applied etiotropic therapy using antifungal medications. In the treatment of SD of the scalp, the causative agent of which is Malassezia furfur, the most effective are azole drugs and allylamines and drugs with zinc pyrithione. Effective remedies for the local treatment of SD are drugs in liquid form of combined action - antifungal, anti-inflammatory, keratolytic and antipruritic. As the optimal DF for a new MED, a shampoo was chosen, which has significant advantages: rapid therapeutic effect; high pharmacological activity due to dispersion and, as a consequence, the achievement of therapeutic effect at lower doses; convenience, ease of use. We have theoretically and experimentally substantiated the composition of shampoo for local treatment of SD with zinc pyrithione (antifungal component), calendula tincture (normalizes sebaceous glands), salicylic acid (keratolytic), tea tree essential oil (has antifungal, bactericidal and antipruritic action), which allow to influence the main pathogenetic factors of SD effectively. Shampoo technology and technological block diagram of shampoo production in industrial conditions have been developed. The technological process consists of 7 technological stages. Quality control of the developed spray was performed on the appearance, color, odor, pH value, volume of the container.

Conclusions. The composition and technology of shampoo for the treatment of SD have been developed. The developed shampoo meets the requirements of analytical and regulatory documentation, is stable during storage and can be recommended for further research for implementation in production.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF DRUG PRODUCT WITH MILK THISTLE EXTRACT

Maryana Kropyvnytska
Scientific supervisor: assoc. prof. **Olha Yakymiv**, PhD

Keywords: Hepatoprotective drugs medicinal plant raw materials, syrup, milk thistle extract dry, licorice extract dry

Introduction. Due to growing pollution and increasing the number of liver diseases, the demand for herbal medicines is growing. Phytotherapy has a number of advantages, because the main directions of pathogenetic therapy of liver diseases can be implemented in one drug of plant origin. Hepatoprotective drugs based on extracts of medicinal plants have choleretic, antispasmodic, analgesic, antitoxic, membrane-stabilizing effect. Therefore, recently more and more people prefer complex combined phytopreparations that contain a balanced qualitative and quantitative composition of ingredients that have a complex effect on the body, resulting in a high therapeutic effect. Among the medicinal plants used in the treatment of liver diseases, the central place is occupied by milk thistle. The most promising area of development of dosage forms, in particular for pediatrics and geriatrics, is the creation of liquid adjusted drugs for oral use, due to biopharmaceutical and psychological factors. Therefore, it is important to develop a new hepatoprotective drug in the form of a syrup based on plant extracts.

Materials and methods. Medicinal plant raw materials, dry plant extracts, syrups; information retrieval, monitoring of literature data, grouping and systematization of data, logical analysis, physico-chemical, pharmaco-technological.

Results. The current state and prospects of development of hepatoprotective drugs, in particular preparations of milk thistle. The range of medicinal milk thistle according to the State Register of Medicinal Products of Ukraine has been studied. It has been established that a total of 22 drugs with milk thistle have been registered in Ukraine. Medicines containing milk thistle are presented in different dosage formats: mostly solid(capsules, tablets, dry extract, raw materials, collection of medicinal plant raw materials) - 86.4%, much less liquid (tincture, oral drops, elixir for oral use) - 13.6 %. Among the presented solid drugs dominate in the form of capsules - 40.9%. Among the registered drugs, dominate monopreparations - 59.2%, and monopreparations are represented only by solid medicines. Combined products containing milk thistle are represented by drugs in both solid and liquid drugs. Most drugs containing milk thistle of domestic production (13 means - 59.2%). Given the effectiveness of hepatoprotective agents of combined action and their small range, as well as the advantages of products containing milk thistle, it is important to develop a complex herbal remedy with milk thistle extract dry in the form of adjusted liquid dosage form. Because for the treatment of liver

disease, in addition to the main types of action (complete absorption, pronounced ability to bind highly active compounds or prevent their formation, lack of toxic effects on the body, stimulate liver regeneration), drugs must show other activity (antiinflammatory, antioxidant), the composition of the syrup was introduced dry licorice extract. The choice of dosage form syrup is theoretically substantiated. On the basis of the conducted experimental researches the composition and rational technology of syrup with dry extracts of milk thistle and licorice are developed. The technological block diagram of syrup production in industrial conditions is offered. The technological process of syrup production consists of 7 technological stages. The quality control of the developed drug was carried out.

Conclusions. It is established that complex herbal preparations are optimal for effective therapy of liver diseases. Based on experimental studies, the composition and technology of a new liquid corrected drug with hepatoprotective action in the form of a syrup with extracts of milk thistle and licorice, which can be recommended for further research.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF NASAL SPRAY

Marta Lastovetska
Scientific supervisor: assoc. prof. **Oksana Yezerska**, PhD

Keywords: rhinitis, nasal dosage form, spray, sodium chloride, chlorhexidine, dexpanthenol

Introduction. The problem of improving the quality of treatment and prevention of inflammatory diseases of the nasal mucosa - rhinitis is one of the most important in pharmacy. Therefore, the development of new drugs for treatment and prevention of rhinitis in the form of a spray is a promising task of pharmaceutical technology.

Materials and methods. Material is nasal spray for treatment and prevention of rhinitis with sodium chloride, chlorhexidine and dexpanthenol. The methods of the research are literature monitoring, physical chemical and technological methods.

Results. Rhinitis, also known as coryza, is irritation and inflammation of the mucous membrane inside the nose. Information analysis on classification, etiopathogenesis, symptoms and modern methods of treatment and prevention of rhinitis. After analyzing the literature, it was found that for the treatment and prevention of rhinitis, it is recommended to use nasal cleansers, which are sodium chloride solutions, to moisten the nasal mucosa, hygienic cleaning of the nasal passages and reduce the need for vasoconstrictor sprays. On the basis of the conducted research the choice of a dosage form for application in rhinology, and also the main components as a

part of the combined nasal means for treatment and prevention of rhinitis in the form of a nasal spray is substantiated. The advantages of sprays include aesthetics, hygiene, speed of action, high efficiency at a relatively low cost of active pharmaceutical ingredients. Containers used for packaging nasal spray are hermetically sealed and prevent contamination of the drug from the outside, as well as protect the drug from drying, light and moisture. Sodium chloride, chlorhexidine and dexpanthenol have been proposed as active ingredients in the development of the spray. Sodium chloride has emollient and moisturizing effects, chlorhexidine has antiseptic and disinfectant effects, dexpanthenol - wound-healing, anti-inflammatory effect, stimulates regeneration, propylene glycol - prolongs the action of active ingredients, and helps to increase the penetration of skin. Technology of spray for treatment and prevention of rhinitis was developed and manufacturing scheme was proposed. The technological process of manufacturing a nasal spray of complex action includes the following stages: auxiliary stage; preparation of solution; sterile filtration; preparation of vials, caps and valve-spray mechanisms; packing of concentrate in containers and sealing of containers; marking and packing of containers in cardboard packs; packing of products in cardboard packs. Quality control of the developed product was conducted according to the requirements of Ukrainian State Pahrmacopoeia. Stability of the developed product at room temperature storage for 6 months (observation time) was proven.

Conclusions. The composition and technology of nasal spray for treatment and prevention of rhinitis with sodium chloride, chlorhexidine and dexpanthenol were developed. The proposed spray for organoleptic and physico-chemical indicators meets the requirements of the current documentation.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF MEDICINAL COSMETIC PRODUCT FOR CHILDREN'S SKINCARE FROM THE FIRST DAYS OF LIFE

Maria Nasinnyk
Scientific adviser: assoc. prof. **Svitlana Bilous**, PhD, ScD

Keywords: baby cosmetics, cream, skin care, extemporaneous preparations.

Introduction: Features of the structure and functions of the baby's skin, in particular high sensitivity, susceptibility to irritation and infection require proper daily skin care. Therefore, the right choice of skin care products for children from the first days of life is extremely important.

Materials and methods: methods of information research, literature data analysis and technological methods.

Results: In babies, various skin lesions can often be observed - diaper, atopic, seborrheic and contact dermatitis, candidiasis and others, which requires the use of medical cosmetics. The market of children's cosmetics in Ukraine is represented mainly by products of foreign production, which have a high cost. In the cosmetics market there is only a small number of domestic products, including medicinal cosmetics, which is insufficient to meet the needs of consumers.

The most convenient and effective form of cosmetic product for the care of affected children's skin is a cosmetic cream that is easily applied to the skin and evenly distributed on its surface, providing a therapeutic and cosmetic effect.

Creating effective children's medical cosmetics is one of the most difficult tasks of modern cosmetology. This is due to the high requirements for the following products: hypoallergenic, natural basis, lack of synthetic dyes, preservatives and alcohol. Based on the results of studying the compositions of ready-made cosmetics from different manufacturers and analysis of extemporaneous formulations, the choice of components for medicinal cosmetics that can be used for skin lesions for children from the first days of life is justified. Technological instructions for extemporaneous production of medicinal cosmetic cream in pharmacies have been developed.

Conclusion: The developed cream due to the content of chlorophyllipt oil solution, hyaluronic acid and grape seed oil will relieve redness and soothe the skin, enhance regenerative processes, provide hydration and maintain the necessary physiological condition of the skin.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF FOAMING COSMETIC PRODUCT

Nataliia Tkhir
Scientific supervisor: assoc.prof. **Oksana Strus**, PhD, ScD

Keywords: foaming cosmetic product, urea, dexpanthenol, technology

Introduction. Hygiene is an integral part of a person's life and affects their ability to work and life expectancy. In the hygienic care of intimate areas, there are several features that should be considered when choosing a foam cosmetic product. Women's intimate areas are characterized by a more acidic environment than the skin on the body surface: the pH value for them ranges from 3.5 to 4.5, due primarily to the vital microflora - in particular, resident lactobacilli Lactobacillus doderlein, which produce lactic acid. This pH range of the intimate areas helps to inhibit the reproduction of pathogenic microorganisms. Improper care of the intimate areas can lead to disorders of

the genitals: candidiasis, vaginitis, hives, microcracks, rashes, irritation of the mucous membranes, changes in the nature of secretions. The aim of our work was to theoretically and experimentally justify and develop the composition and technology of foam for intimate hygiene of women in the form of a gel with satisfactory consumer properties and low irritant effect.

Materials and methods. Research object is foaming cosmetic product in the form of gel. Research subject: elements of pharmaceutical development of foaming cosmetic product

Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. The analysis of literature sources identified the main groups of excipients used in the pharmaceutical development of foaming agents, and also found that a natural products of caring for a woman's intimate area should not contain components such as: SLS and SLES, carcinogenic preservatives, chemical dyes, parabens, sulfates and hard detergents. It is established that it is rational in the development of means for intimate hygiene of women to use a surfactant mixture of surfactant mixtures of anionic, amphoteric and nonionic nature, which reduces the irritant effect of the product. Due to physico-chemical studies, the composition of the gel for intimate care on the basis of foam was developed, which included detergents: anionic (magnesium laureth sulfate - 15.0%), amphoteric (cocamidopropylbetaine - 6.0%) and non-ionic (ethoxylated rapeseed oil amide 1.5%), HEC thickeners (0.3%) and sodium chloride, sodium benzoate preservative and BAS - dexpanthenol (1%) and urea (0.5%). The industrially technology of foaming agent is justified and developed, and also the block diagram of production is developed. The stability of the developed gel for intimate hygiene during storage at room temperature for 3 months is proved. It was experimentally proved that the pH value was stable for the test sample and was in the range of 3.5-4.5, the foam number of the gel for intimate hygiene was in the range of 203.0 mm, and the stability of the foam was 0, 93.

Conclusions. Composition and technology of a foaming cosmetic product with urea and dexpanthenol in the form of gel were scientifically and experimentally justified. Quality and stability of developed preparation were assessed.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF COSMETIC PRODUCTS FOR ACNE SKIN CARE

Oksana Sydorchuk
Scientific supervisor: assoc. prof. **Oksana Vashchenko**, PhD

Keywords: acne, skin care, lotion, gel, tea tree oil, salicylic acid.

Introduction. Acne is one of the most widespread dermatological diseases and it is the primary reason for consulting a dermatologist. Scientific evidence suggests that a proper skin care for acne can improve the clinical outcome of treatment, especially in the early stages of the disease, as well as in remission. At the same time, a basic skin care routine should be rational and adaptive. Development and implementation of cosmetic products for acne skin care, therefore, is a well-judged task.

Materials and methods. Research objects are lotion and gel with tea tree oil. Research subject: elements of development of cosmetic products in the form of lotion and gel. Methods: informative, physical, physical-chemical, and mathematical.

Results. Having analyzed the etiopathogenesis and clinical manifestation of acne, it was decided to develop a set of cosmetic products for using at different stages of skin care routine. Lotion and hydrogel were selected as release forms of the cosmetics. Tea tree oil was chosen as active ingredient to provide a necessary therapeutic effect. Salicylic acid was also added into the composition of the lotion to possess its effect. Glycerol, ethyl alcohol 96%, water purified were used as excipients of the lotion. The following excipients were used to develop the hydrogel: carbomer 934, glycerol, methyl parahydroxybenzoate, ammonia solution 10 %, water purified. The lotion and the gel with tea tree oil can be prepared both in pharmacy and industrial conditions. Manufacturing process of the products consists of 7 stages. Process flow diagram for the manufacture of the lotion and the gel in industrial conditions was developed. Quality of the lotion was evaluated by the following parameters: appearance, color and odor, relative density, content of ethanol. Quality of the gel was evaluated by the appearance, color and odor, consistency, and pH value. Stability of the developed products at room temperature storage for 3 months (observation time) was proven.

Conclusions. Composition and technology of a cosmetic set with lotion and gel for the acne skin care was developed. Quality and stability of the developed preparation were assessed. Due to the properties of the added ingredients, it can be considered that the lotion will provide a proper cleansing and antimicrobial action, while the gel, besides antimicrobial properties, will have a moisturizing effect.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF COSMETIC PRODUCT FOR MASSAGE

Olga Vakarova
Scientific supervisor: assoc. prof. **Oksana Yezerska**, PhD

Keywords: massage, face, cream, allantoin, collagen

Introduction. Today, such a procedure as cosmetic facial massage has become popular. The range of facial massage products on the Ukrainian market is provided mainly by foreign manufacturers and there is only a small number of domestic products, which is insufficient to meet the needs of consumers. Therefore, the development of scientifically sound composition and technology of domestic cosmetics for facial massage, in particular in the form of a complex action cream is an urgent and promising task.

The purpose of our work is the scientific and experimental substantiation of the composition and technology of facial massage cream with allantoin and collagen.

Materials and methods. Research object is cream with allantoin, collagen, vitamin E and rose essential oil. Research subject: elements of development of facial massage cream. The methods of the research are informative, physical, physical-chemical, and mathematical.

Results. As a result of the analysis of literature data, the characteristics, classification and types of massage, as well as information on the historical aspects of massage. The results of the analysis of the literature showed that the problem of creating facial massage products continues to be one of the most relevant, as the market for cosmetics for the care of this area of domestic production is quite limited. Having analyzed literature data, it was decided to develop a new facial massage product in the form of oil in-water cream, which is lighter in structure, not greasy, easy to apply, and water-soluble ingredients from these creams are quickly absorbed into the skin. Considering the general principles for the development of cream, the following ingredients have been selected: allantoin, collagen, vitamin E and rose essential oil as active ingredients. Allantoin is an ingredient found in skin care products. It can help with hydration and dull, dry, or scarred skin. Collagen improve skin elasticity, reduce visible wrinkles, and increase blood flow to the skin. The base of cream was formed by the following ingredients: grape seed, jojoba and wheat germ oils – hydrophobic phase; emulsifier No.1 – o/w emulsifying agent; monoglycerides – w/o emulsifying agent; preservative euxyl; water purified – hydrophilic solvent. Manufacturing process of facial massage cream with allantoin, collagen, vitamin E and rose essential oil in industrial conditions was developed with consideration of properties of the ingredients and it consists of 8 stages. Quality of cream was assessed on appearance, color and odor, pH value, colloidal and thermal stability. Stability of the developed product at room temperature storage for 6 months (observation time) was proven. The developed face massage cream is suitable for all skin types, stimulates microcirculation and metabolic processes in the skin, nourishes, moisturizes the skin, removes fine wrinkles, prevents dehydration and inflammation, and has a positive effect on skin color.

Conclusions. Composition and technology of new facial massage cream with allantoin, collagen, vitamin E and rose essential oil in the form of oil-in-

water cream were scientifically and experimentally justified. The proposed cream for organoleptic and physico-chemical indicators meets the requirements of the current documentation.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF PRODUCT FOR BURNS

Olha Maslova
Scientific supervisor: assoc. prof. **Oksana Vashchenko**, PhD

Keywords: methyluracil, chlorophyllipt soft extract, cream, burns, wounds.

Introduction. Burn injuries remain one of the commonest forms of trauma that result in lifelong physical and psychological scarring, causing pain, itching, and influencing mental health, quality of life, ability to return to work etc. Since burn injuries are associated with high risk of developing infectious complications, development and implementation of cutaneous drug products with antimicrobial properties for the treatment of burn wounds, therefore, is a well-judged task.

Materials and methods. Research object is cream with methyluracil and chlorophyllipt soft extract. Research subject: elements of pharmaceutical development of product in the form of cream. Methods: informative, physical, physical-chemical, and mathematical.

Results. There are numerous causative mechanisms for burns, including physical and chemical factors. Nevertheless, body response for trauma always includes inflammation and pain, and severe burn injury can be accompanied with increased incidence of infection. In order to develop a new drug product for burns, we analyzed the mechanisms of burn wound healing process and decided to develop a preparation for use at the stages of proliferation and reepithelialization. Lipophilic cream was chosen as an optimal dosage form for the product. Methyluracil and chlorophyllipt soft extract were selected as active pharmaceutical ingredients that will provide anti-inflammatory, antimicrobial and remodelling effects. The following excipients were used to develop the cream base: glycerol, olive oil refined, emulsifier No.1, glycerol monostearate, potassium sorbate and water purified. Technology of the cream in both pharmacy and industrial conditions was developed, and the process flow diagram for the manufacture of the cream was elaborated. Manufacturing process of the cream with methyluracil and chlorophyllipt soft extract consists of eight stages. Quality of the cream was evaluated by the following parameters: appearance, color, odor, pH value, colloidal and thermal stability. Stability of the developed cosmetic product at room temperature storage for 3 months (observation perios) was proven.

Conclusions. Composition and technology of a new drug product for the treatment of burns were scientifically and experimentally substantiated. Quality and stability of the developed product were evaluated. Due to the properties of the added ingredients, it can be considered that developed lipophilic cream with methyluracil and chlorophyllipt soft extract will provide antimicrobial, anti-inflammatory and wound healing activity. The developed cream can be recommended for further research in order to implement into the market.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF DRUG PRODUCT FOR TOPICAL TREATMENT OF CHEILITIS

Orysia Butkovska
Scientific supervisor: assoc. prof. **Kateryna Vashchenko**, PhD

Keywords: lip balm, balm technology, cheilites, treatment.

Introduction. One of the most common diseases of the mouth shell are various forms of cheilitis. At present, there are some difficulties in prescribing topical treatments for cheilitis, due to the ineffectiveness of conventional drugs and the discomfort of their use, which leads to the search for new methods and means for the treatment of cheilitis. Given the above, it is important to develop new tools for the local treatment of cheilitis in a convenient form - lip balm.

Materials and methods. Research object is lip balm. Methods: literature monitoring, market investigations, physical, physical-chemical, pharmacotechnological and mathematical methods.

Results. In recent years, the number of patients with cheilitis has increased. The prevalence of certain types of independent cheilitis among different groups of the population varies widely - from 6.8 to 25.0%. We have considered the classification of cheilitis, the characteristics and causes of various forms of cheilitis, methods of treatment. Treatment of cheilitis should be comprehensive (include the principles of local and general treatment). Local therapy for various forms of cheilitis includes: sanitation of the oral cavity, the prescribing of hygienic lipsticks, balms and creams that contain vitamins, extracts from plant materials, carotenoids, hormonal drugs and more. It is established that meteorological cheilitis is quite common. Local application of drugs is a obligatory stage of treatment of meteorological cheilitis, as well as other forms, and the most optimal form is balms that contain natural ingredients. We have substantiated the research methodology in the development of a new product in the form of balm, considered the classification and characteristics of products in this form, analyzed the composition of lip balms. The composition of lip balms should include wax, which provides a stable protective coating on the lips, protecting them from drying out; firm oils - batteries, vegetable and essential oils, extracts from vegetable raw materials, vitamins, which are selected depending on the

problem. Taking into account the results of the analysis of information sources, the composition of the lip balm-stick, intended for the treatment of meteorological cheilitis, was developed. Carotolin, raspberry oil, peppermint essential oil, vitamin E are introduced as active ingredients. As excipients in the balm introduced beeswax, cocoa butter, olive oil, lanolin. The technology of fat-based lip balm has been developed and the technological scheme of production has been proposed. The technological process consists of 7 stages.

Conclusions. The ingredients and technology of the balm-stick for the prevention and treatment of meteorological cheilitis have been developed. As a result of physico-chemical and pharmaco-technological studies, it was found that the developed lip balm meets the requirements of analytical and regulatory documentation on key indicators and is stable during storage for 6 months (observation period). The main quality indicators are in acceptable limits.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF DENTAL MEDICAL FILM WITH DIOXIDINE

Roksolana Luchechko
Scientific supervisor: assoc.prof. **Ihor Hrynovets**, PhD

Keywords: Dental medicinal films, dioxidine, application dosage forms, periodontal disease.

Introduction. The range of mild dosage forms for the treatment of inflammatory diseases of the oral cavity is quite limited, so the development and processing of dental medicinal films as a means of prolonged action, which will have a systemic combined - antibacterial and anti-inflammatory action is relevant today.

Materials and methods. Based on the data of the scientific literature, a new composition of the application form in the form of dental medicinal films has been developed and a number of experimental studies have been carried out.

Results. The polymeric type of the base allows to achieve a gradual prolonged and controlled release of active substances from the drug and ensures their painless penetration through the epithelial tissues. The use of dioxidine in the application form, namely in the Dental Medicinal Films of hydrophilic type allows to improve the therapeutic regimen of treatment of dental patients with diagnoses such as stomatitis, canker sores of various etiologies, gingivitis, periodontitis, and can be used prophylactically.

Conclusion. Dental medicinal films - a dosage form for topical application to the mucous membrane of the mouth or gums on a polymer basis in which you can enter various active pharmaceutical ingredients.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF THE ANTISEPTICS WITH *MENTHA PIPERITA* FOR HANDS

Soliman Ahmed Khaled Ali Mansour
Scientific supervisor: prof. **N.I. Hudz**, PhD, ScD

Introduction. The coronavirus disease COVID 2019 pandemic greatly increased the frequency of disinfecting surfaces in public places and treating hands, causing a strain on the ability to obtain disinfectant and antiseptics solutions, respectively. Contaminated hands are the most active factor in the transmission of pathogenic microorganisms in everyday life, including virus SARS-CoV-2. Therefore, this qualification magister paper was dedicated to the problem of antiseptics elaboration for hand treatment for the prevention of spreading of COVID 19 that is transmitted in a contact way.

The aim of the study was to elaborate a composition and pharmacy technology, and perform the study of the antiseptic gel with the tincture of *Mentha piperita* leaves for the treatment of hands in everyday life.

Materials and methods. While carrying out the research the following methods were used: analysis, synthesis, systematization and comparison for processing of published scientific data on the composition and assignment of antiseptic gels; potentiometric analysis for the determinination of the pH value of the developed samples.

Results. As a result of performing research, a new composition and technology of some cosmetic gels for skin care were elaborated. The following excipients were used: carbopol 2020 or 980 as gelling agents, glycerin as a hydrophilic solvent and moisture keeper and purified water as a solvent. As active substances for the development of the gel, ethanol and tincture of *Mentha piperita* leaves were used, which orovide with antimicrobial and partly wound healing effect on the skin and impart yellow colour to the elaborated gel. The tincture of *Mentha piperita* leaves was incorporated into the gels as preparations with antioxidant, anti-inflammatory, and antimicrobial properties. The tincture of *Mentha piperita* leaves was obtained with the aid of remaceration method. It was established that triethanolamin was optimal adjuster of pH of antiseptic gels on ethanol. Concentrations of other components were taken on the base of literature data and experimental results.
The special characteristic of the gel preparation were: a previous preparation of the tincture; previous preparation of the concentrated gel base of carbopol (2.5%); adding triethanolamin, ethanol and the tincture; packaging and quality control. The adding of the liquid components (ethanol, adjuster of pH and tincture) into the concentrated neutralized gel base of carbopol was done out gradually while stirring until homogeneous mass was obtained. Adding the tincture was carried out befoe the final adding water to the determined volume. The mixture was thoroughly stirred until homogeneous mass was obtained. The antiseptic gel was packed in plastics containers of an appropriate volume.

Conclusion: The developed gel with the tincture had a yellowish colour and nice strong smell of *Mentha piperita*, pH of samples of the developed gel was in the range of 5.0-7.0.

DEVELOPMENT OF THE ANTI-INFLAMMATORY GEL FOR THE ORAL CAVITY

Tetiana Shcherba
Scientific advisers: assist. prof. **Anna Filipska**, PhD, prof **Natalia Hudz**, PhD ScD

Keywords: oromucosal gel, propolis tincture, metronidazole, carbomer

Introduction. Among the most pressing problems of modern dentistry due to the high prevalence and complexity of treatment are diseases of the periodontium and oral mucosa (POM). The prevalence of inflammatory diseases of POM, according to various estimates, is from 70 to 90% of the population, also according to WHO experts, 80% of schoolchildren in different countries have periodontal disease, and among adults it occurs in almost 100% of cases. Therefore, it is important to develop medicinal products for the treatment of initial stages of diseases of POM, especially of medicinal products on the base of natural products for the treatment of children

Materials and methods. Such methods of study were used: information search, data analysis of literature, technological, quality control methods, analysis, generalization, systematization and comparison of information; technological experimental research, quality control research: organoleptic (color, odor); physicochemical and chemical (pH determination).

Results. In group A01A "Tools for use in dentistry" according to the anatomical and therapeutic classification as of 2021 registered 76 positions of drugs. Drugs are presented in various dosage forms, which according to the type of dispersion medium can be classified into dosage forms with liquid (oral solutions, oral sprays, aerosol, tinctures, liquid extracts, drops), solid (tablets), plastic or elastic, viscous dispersion medium (gels, pastes), as well as without dispersion medium (medicinal plant raw materials). Gels are a new generation in dentistry because they provide a long-lasting effect of active substances and are easy to use. Of the 13 gels registered in 2021 shown for the treatment of infectious and inflammatory periodontal diseases and POM, only 4 gels are manufactured directly in Ukraine. Optimally selected composition of gel bases provides the necessary adhesion to mucous membranes and high bioavailability of active pharmaceutical ingredients. It is established that during the pharmaceutical development of oromucosal gels it is necessary to justify the introduction of different groups of excipients: gelling agents, solvents, penetrants, moisture retainers and preservatives. Based on the literature data, the composition of the combined antibacterial and anti-inflammatory gel for

the treatment of inflammatory diseases of the periodontium and oral mucosa - 1% metronidazole and propolis tincture - 25% was presented. Carbomer (gelling agent), glycerin (moisture retainer), propylene glycol (moisture retainer, penetrant), xylitol (sweetener) and triethanolamine (for pH adjustment) were selected as excipients. The laboratory technology for obtaining a combined gel was developed and substantiated, which involves the preparation of a concentrated gel base, a certain procedure and method of administration of active substances. A block diagram of production in industrial conditions is proposed, which includes 7 stages. The choice of the main indicators of the quality of the developed drug, the limits of acceptability, as well as methods of their control. For prototypes, organoleptic quality indicators and pH determination were determined.

Conclusion. The composition of a new combined oromucosal gel with propolis and metronidazole for the treatment of inflammatory diseases of the oral cavity was developed, the technology of manufacturing in pharmacies was developed and the technological scheme of industrial production was proposed.

USE OF COLLAGEN FIBERS AFTER EXTRACTION OF WISDOM TOOTH

Valeriia Mykyta
Scientific supervisor: prof. Natalia Hudz, PhD, ScD

Keywords: collagen cone, gentamicin, chloramphenicol.

Introduction. After tooth extraction, the alveolar process undergoes unstable resorption and atrophies to some extent during the first three months. Techniques for preserving holes and alveolar ridge using modern biomaterials such as collagen from animal protein are effective. Collagen sponges are resorbable, which means their self-absorption in the wound. Purified collagen type I and III (from bovine tendons) is used in gentamicin sponge. This natural polymer has low allergenicity and is biodegradable. Thus, as a carrier for gentamicin, the collagen sponge can be considered a completely biocompatible product. Collagen sponges (cones), which are resorbed after the release of the drug, are widely used as carriers of active substances. Topical application of gentamicin in the form of absorbable collagen sponge provides a gradual release of active substances over a short period of time, which improves wound healing without nephrotoxic or ototoxic effects of aminoglycosides.

The aim of the study was to develop the composition and industrial technology of 4% gentamicin solution for injection, the composition and pharmacy technology of 10% alcohol solution of chloramphenicol, as well as to develop a procedure for filling collagen sponges with these solutions for use in dentistry.

Materials and methods. Methods of information search, analysis, generalization, systematization, comparison of information were used to solve the tasks set in the work; experimental technological and analytical studies for the development of the composition and technology of 4% solution of gentamicin sulfate for injection, 10% alcohol solution of chloramphenicol, as well as for filling collagen-containing materials with the solutions of antibiotics.

Results. As the results of the work we developed the composition and developed the technological process of production of gentamicin sulfate, solution for injection, 40 mg / ml in 1, 2 ml in ampoules, and also proposed the composition of 10% chloramphenicol solution using 96% ethanol in pharmacy, and filled collagen cones with these solutions under sterile conditions. We proposed a method of saturation of collagen-containing products with gentamicin and chloramphenicol in aseptic conditions in a hospital pharmacy and compared theoretical calculations and experimental results. The study showed that the absorption of collagen-containing cone by theoretical calculations coincides with practical results.

Conclusion: Therefore, the procedure of the saturation of collagen-containing materials by antibiotics was elaborated for further research and use in dental surgery.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF ANTISEPTIC PREPARATION

Viktoriia Sakovska
Scientific supervisor: assoc.prof. **Oksana Strus**, PhD, ScD

Keywords: antiseptic gel, Propolis, Carbopol, technology

Introduction. A number of Ukrainian and foreign experts consider that hand antiseptics as a suitable alternative to soap and water to maintain hand hygiene. They believe that the most reliable method to prevent the transmission of dangerous diseases is to wash your hands with soap and water. If you do not have access to soap and water, it is recommended to use an antiseptic for hands that contains at least 60% alcohol. It should be noted that drugs of natural origin have certain advantages - the lack of allergies and negative side effects of treatment, the inability to cause antibiotic resistance or reduced sensitivity of microorganisms to antiseptics. Accordingly, the development of antiseptic drugs based on antibacterial substances of natural origin is currently an extremely important task.

The aim of the work was to develop the composition and technology of antiseptic for hands based on antibacterial substances of natural origin.

Materials and methods. Research object is antiseptic gel. Research subject: elements of pharmaceutical development of semi solid dosage form for

topical use. Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. As a result of the analysis of the composition of group D08 - antiseptics and disinfectants, it was found that the vast majority are presented in liquid dosage forms (72%) in the form of solutions for external use (aqueous, oily, alcoholic, glycerin), semo solid (22%) (ointments,creams, liniments), solid dosage forms (6%) (powders and tablets for the preparation of solutions for external use). Monocomponent agents predominate (90%). Based on the analysis of the range of the pharmaceutical market, it was found that antiseptics in the form of a gel are not available on the domestic market, which confirms the topicality of the development of a drug in the form of a gel. The composition of antiseptic gel was developed, consists of Propolis tincture 5 ml, Calendula tincture 2.5 ml, Carbopol Ultrez 10 2.0, Ethyl Alcohol 96% 70 ml, Propylene Glycol 10.0 g, Glycerin 10.0 g, Sage essential oil 0, 5. The technology of industrial gel production is offered, the technological block diagram of industrial production of antiseptic gel is developed. At all stages of the technological process of making gels, it is necessary to take measures to reduce the evaporation of 96% ethanol. The gel was standardized according to the following indicators: description, homogeneity, pH value, colloidal and thermal stability, and it was confirmed that the developed gel meets all the specified parameters in terms of quality. The gel remained stable during storage for 3 months at a temperature of 25 ± 2 ° C.

Conclusions. Composition and technology of a new antiseptic gel were scientifically and experimentally justified. Quality and stability of developed preparation were assessed.

DEVELOPMENT OF THE COMPOSITION, TECHNOLOGY AND RESEARCH DENTAL POWDER WITH SALVIA OFFICINALIS

Viktoriia Herchak
Scientific supervisor: assoc.prof. **Ihor Hrynovets**, PhD

Keywords: abrasives, hygiene products, microorganisms, tooth powder, Salvia officinalis.

Introduction. Oral hygiene is a complex set of preventive measures that involve usage of objects and means aimed at preventing the development of pathological processes in the oral cavity. For oral hygiene, a complex of products is used: tooth powders, pastes, gels, rinses, elixirs, balsams, chewing gum and care items - toothbrushes, dental floss, intradental brushes and toothpicks. Tooth powders are made from chemically precipitated chalk (calcium or magnesium carbonate), both abrasive components and various excipients (biologically active substances, fillers, adsorbents, flavors, bleaches, dyes, flavors, anti-inflammatory and flavor components). Hygienic form in the

form of tooth powder in comparison with other forms of release (balms, gels, solutions, pastes) has the ability to better clean the tooth enamel surface. Powder is a tool that cleans the surface of the teeth not only from soft plaque, but also from hard, and also neutralizes the acids formed in the oral cavity, thus regulating the microbiocenosis. In addition, it has disinfectant and deodorizing properties. Tooth powder with extract Salvia officinalis will prevent diseases of the oral cavity of various etiology, thoroughly remove plaque, regulate microbiocenosis and give a pleasant smell and flavor - will refresh the breath. Sage leaves are used as a medicinal plant raw stuff, which has astringent, bactericidal and anti-inflammatory effects. An example of the use of sage in the composition of drugs is the drug Salvin, which is prescribed for various pathological processes in the oral cavity, such as stomatitis, gingivitis and others. It also destroys pathogenic microflora, has anti-inflammatory and capillary-strengthening properties. And also control the quality of tooth powder with Salvia officinalis extract was made. In particular, the quality control of tooth powders was carried out in accordance with the requirements of the regulatory documentation of GOST 592-77 "Tooth powder" and organoleptic and physicochemical parameters.

Materials and methods. As a result of research the technology of manufacturing and composition of tooth powder with sage was developed.

Results. Elaboration of informative material in the analyzed sources allowed to choose the appropriate form and select the active ingredient and, as a result, to substantiate the composition and technology of tooth powder with sage. Quality control of tooth powder containing sage was determined in accordance with the requirements of cosmetic forms applied topically to the oral mucosa. Developed hygienic form, powder type has therapeutic and prophylactic properties due to the content of herbal medicine (folium salve) and demonstrate antimicrobial, analgesic, anti-inflammatory, capillary-strengthening and regenerating effects, as well as performs the functions of daily hygiene products.

Conclusions. Tooth powder with folium salve not only expands the range of hygienic products for oral care, but can also be used as part of a therapeutic scheme in the provision of medical care to dental patients and as a preventive measure against recurrence.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF COSMETIC PRODUCT FOR AFTER-SHAVE SKIN CARE

Vladyslav Hladchenko
Scientific supervisor: assoc.prof. **Kateryna Vashchenko**, PhD

Keywords: masculine cosmetic, balsam aftershave, technology

Introduction. In recent year known cosmetic companies turned the special attention for development of the facilities intended specially for men. At development of such facilities basic descriptions of masculine skin and real necessities of modern business man are taken into account. For men, a wide range of cosmetics for different purposes in different forms of release, but the range of products for facial skin care after shaving is insufficient. Therefore, it is important to develop new effective aftershaves for implementation in domestic production

Materials and methods. The object of research is a balm for skin care of men after shaving. Methods included data monitoring, grouping and systematization of information, logical analysis. Physical-chemical and technological methods were also used.

Results. The results of the analysis of information sources showed that for the care of men's skin it is necessary to develop cosmetics taking into account certain anatomical and physiological features of men's skin. We are analyse modern principles of development of cosmetics for men and the methodological going is offered near development of cosmetics for a supervision upon the skin of face aftershave. When developing cosmetics intended for men, it is necessary to take into account that the concentration of active substances in such products should be much higher than in cosmetics female line (through rough male skin). Short shaves after shaving should provide moisturizing, nourishing, anti-inflammatory, antiseptic and capillary-strengthening effect. Men's cosmetics should be aimed at removing irritation and reducing oiliness. Given the methodological approaches to creating cosmetics after shaving, the balm should contain substances that have antiseptic and anti-inflammatory effects, affect the blood supply and microflora of the skin, promote wound healing and microcracks, moisturize and nourish the skin. Aftershave balm should have a soft texture, not leave a greasy shine, have a pleasant "masculine" aroma. We have substantiated the composition of the balm after shaving with a creamy consistency on an emulsion basis of the "oil in water" type. Purified oak bark extract, dexpanthenol, vitamins A and E were introduced as the main biologically active components. Purified water (solvent), glycerin (humidifier) were added to the "oil in water" emulsion base; grape seed oil, shea butter (hydrophobic phase); a mixture of emulsifiers - emulsifier Lanette SX (emulsifier 1 kind) and glyceryl monostearate (emulsifier 2 kind). The technology of balm and technological block diagram of production in industrial conditions is developed. The technological process consists of 8 technological stages. Quality control of the developed gel was performed by appearance, color, odor, pH value, colloidal and thermal stability.

Conclusions. The composition and technology of the aftershave balm have been developed. The developed balm meets the requirements of analytical

and regulatory documentation, is stable during storage and can be recommended for further research for implementation in production.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF MOUSHWASH WITH DIOXIDINE

Yuliia Libych
Scientific supervisor: assist. prof. **Ihor Hrynovets**, PhD.

Keywords: dioxidine, mouth cavity, tooth rinse.

Introduction. Proper oral care is one of the most important preventive measures to prevent dental diseases of various etiologies. It is established that in case of activation of a number of local factors there is a start and further development of pathogenic processes - aphthae, stomatitis or caries. Hygienic means allow not only to carry out daily cleaning of the oral cavity, but actually prevent the development of diseases of various etiologies of the oral cavity. The range of hygiene items and tools is quite large today. In particular, hygiene items include: toothbrushes, floss (dental floss, floss), brushes, toothpicks, irrigators and interdental stimulators, and hygiene products include: rinses, balms, elixirs, aerosols, toothpastes, gels, ointments, gels, ointments chewing gum. Rinses play an important role in the daily care of the oral cavity, because, due to the liquid aggregate form, they have a high rate of fluidity, and thus are able to penetrate into hard-to-reach places inaccessible to the toothbrush (intradental spaces). The purpose of the work. Development of the composition and technology of the mouthwash, which includes an antimicrobial agent - dioxidin.

Materials and methods. In our work we used the methods of information search, analysis of literature data and experimental researches.

Results. In the process of work, the optimal composition of the mouth rinse was developed and developed, which has a pronounced antimicrobial effect and contains the following components: dioxidine -0,1, sodium bicarbonate- 2.0,glycerin -5.0, menthol -0.05, saccharin -0.01 and purified water to 100.0.

Conclusions.The use of hygienic products in liquid form, in particular, rinse with dioxidine will not only expand the range of products for daily care, but also significantly complement the therapeutic regimen in the treatment and prevention of recurrence of oral diseases of various etiologies.

RISK ASSESSMENT IN THE MANUFACTURE OF STERILE DRUG PRODUCTS

Yuliia Mandzyuk
Scientific supervisor: prof. **Natalia Hudz**, PhD, ScD

Keywords: risk, quality, sterility

Introduction. In terms of sterility, all dosage forms can be divided into sterile and non-sterile. The preparation and manufacture of sterile products is subjected to special requirements to minimize the risk of contamination by microorganisms, particles, pyrogens and to avoid the release of substandard batches of drug products. The manufacture of substandard products can have a negative impact primarily on the health of patients, as well as on the financial and economic activities of the pharmaceutical company or producing pharmacy.

The aim of the master's thesis was to develop the composition and technology of sterile semisolid dosage forms with metronidazole and erythromycin, taking into account various risks, for the treatment of blepharitis.

Materials and methods. Methods of information search, analysis, generalization, systematization, comparison of information were used to solve the tasks set in the work; experimental technological and analytical research.

Results. Based on the literature review, a classification of possible risks in the pharmaceutical manufacture of drug products or in pharmacies was established. The types of sterilization in the pharmaceutical manufacture are characterized, namely, thermal, air, sterilization by ionized radiation, gases and sterile filtration. The importance of choosing the method of sterilization for a particular type of dosage form and compliance with all rules of the technological process and sterilization is substantiated. The possible risks that may arise during the pharmaceutical manufacture of sterile drug products to ensure its quality are analyzed and assessed. The Ishikawa diagram is constructed, which clearly shows the critical risk factors and depicts the strategy of manufacturing a quality drug in the pharmacy. Demodex potentially induces ocular surface inflammation, meibomian gland dysfunction, and lash abnormalities. Infection of Demodex spp. often occurs in the course of chronic blepharitis. The composition and technology of three eye ointments with metronidazole and erythromycin with usage of eurecyn and vaseline with lanolin in a ratio 8 to 2 and 9 to 1 were substantiated and developed. Eucerin contains 93.5% of white vaseline, 0.5% of alcohol cetostearylic and 6.0% of sterol alcohols from lanoline 6.0%. The feature of euceryn base is a large absorbing activity, which can reach even ten times the mass of this base. Among active substances were Metronidazole and erythromycin. Metronidazole is regarded as an effective active substance for the treatment of chronic *Demodex blepharoconjunctivitis*.

Conclusion. The developed composition and technology of hydrophobic eye ointments with metronidazole and erythromycin can be used for further

research for pharmaceutical manufacture or preparation in pharmacies, as well as for preclinical studies or clinical trials.

DEPARTMENT OF ORGANIZATION

AND ECONOMICS OF PHARMACY

(Head of the department – prof. **Bohdan Hromovyk**)

STUDY OF THE STATE OF THE PHARMACEUTICAL INDUSTRY IN GHANA

Amamadi Safia Yahaya
Scientific supervisor: assoc. prof. **Kateryna Dorykevych**, PhD

Keywords: pharmaceutical industry, local manufacturing, medicines.

Introduction: The Republic of Ghana has one of the most attractive pharmaceutical markets in West Africa. Medicines production in the country has state support. The National Drug Policy emphasizes the need to develop local pharmaceutical industry. The purpose of this work was to study the development, state and prospects of pharmaceutical local manufacturing in Ghana.

Materials and methods. The materials for the research were scientific publications on the pharmaceutical industry in Ghana, official website of the Ministry of Health of Ghana, and the own survey results. Methods of literary search, system analysis, and economic analysis were used.

Results. Currently 31 pharmaceutical manufacturing companies are registered in Ghana (2020). In total they cover almost a third of the needs of the health care system. Local manufacturers develop in the direction of WHO qualification and GMP certification, and are supported by the government's policies. According to Ghana National Drug Policy, local pharmaceutical production is a priority, especially for emerging diseases for which no treatment is previously known. Analysis of the affordability for treatment of malaria in adults shows that the ratio of wage days for a person to purchase first-line medicines for Private and Mission sectors is 1.4:1, for treatment of hypertension – 1.3:1:1, and for treatment of typhoid fever – 1:1:1 as for Public, Private and Mission sectors appropriately. Research of local pharmaceutical manufacturers revealed that currently there are 31 companies accounting for 30% Ghana`s pharmaceutical market. In general oral dosage forms predominate in the product portfolios of these companies (tablets, capsules, solutions, suspensions, tinctures, elixirs, powders), 22.6% of those companies produce topical dosage forms (liquids, ointment, creams, jelly, paste, liquids for external use, etc.), also two companies (6.5%) produce veterinary drugs. Analysis of 9 main local manufacturers of Ghana shows that Danadams Pharmaceuticals Limited, Kinapharma and Ernest Chemists Limited have the biggest market shares (40.69%, 15.82% and 14.82%) with appropriate volume of sales – $138.09, 53.69 and 50.44 million. These biggest pharmaceutical manufacturers are producing Anti-malarials, Antihistamines, Antibiotics, AntiUlcers, Anti-septic & Disinfectants, Anthelmintics, Anti-hypertensive Anti-protozoal, Anti-asthmatic Anti-diabetic Aromatic-carminative Nutritionals, Pain killers, Supplemments. The production analysis of these manufacturers revealed the growth of production capacities, participation in

United States Agency for International Development programs, good network of warehouse facility, high capacity for production lines, improving the supply chain, etc. The perspectives analysis of these manufacturers revealed activity in improving anti-counterfeit measures, focusing on patronage and sponsorship, emphasis on environmental protection, etc. A survey on consumer perception (30 respondents were interviewed of the average age – 26.5 years, mostly students and employees (63.3%)) of domestic pharmaceutical producers and their products showed that only 6.6% of respondents prefer domestic products. 43.3% of consumers are satisfied with the quality of domestic products. For 53.3% of respondents the prices for local pharmaceutical production are adequate or low. Every 9 respondents of 10 (93.3%) think that it`s advisable to develop domestic production of pharmaceuticals in Ghana, especially there is lack of medical devices (43.3%) and related products (40.0%) in the market.

Conclusions. The study of the state of Ghana's pharmaceutical industry showed that almost a third of domestic manufacturers cover the needs of the country's health care system and are actively developing with state support to meet WHO and GMP-certification requirements. At the same time, only a small proportion of consumers firmly prefer local pharmaceutical products.

THE ROLE OF PHARMACIES AND PHARMACISTS IN MODERN SOCIETY IN EGYPT

Amin Mohamed Khaled Mohamed
Scientific supervisor: assoc. prof. **Kateryna Dorykevych**, PhD

Keywords: pharmacy, pharmacist.

Introduction: Egypt is a transcontinental country with over 100 million inhabitants. It has one of the longest histories of any country, and the medicine of the ancient Egiptians is some of the oldest documented. The purpose of this work was to study current role of pharmacies and pharmacists in Egypt.

Materials and methods. The materials of the study were scientific publications on the history of pharmaceutical development in Egypt, the peculiarities of the functioning of pharmacies and the work of pharmacists, as well as the own survey results. Methods of literature search, systematic analysis, interviews and online surveys were used.

Results. Community pharmacy is the most well-known type of pharmacy in Egypt. There are approximately 75,165 community pharmacies and 216,072 registered pharmacists as of 2016; on average there is one pharmacist for 438 citizens (23 pharmacists for 10000 citizens). One of the problematic issues in the health care system is the dispensing of prescription drugs without a doctor's prescription.

We`ve conducted a survey among Egyptians (41 respondents, the average age of which - 23 years, the vast majority of them - men (90.2%), mostly – students (85.4%), 75.6% live in cities) on the role of pharmacies and pharmacists. It was found that 87.9% of respondents believe that there are enough pharmacies. Among the main functions of pharmacists - dispensing of drugs (85.4%) and related products (dietary supplements, cosmetics) (51.2%), and also providing first aid to the population (51.2%). The pharmacist's primary responsibility is to ensure the rational use of medicines and medical devices (90.2%). 95.1% of respondents agree that pharmacists play an important role in counteracting of Covid-19. 56.1% of respondents believe that the responsibilities of pharmacists in the current pandemic are the same as usual. The role of pharmacies won`t change in the near future. We conducted a pilot study to examine the views of pharmacists on the role of pharmacies by interviewing them. Pharmacies in Egypt successfully carry out their main vocation: to provide the population with medicines, medical devices, pharmaceutical care and additional services, including measuring blood pressure and glucose levels.

Conclusions. The role of pharmacies and pharmaceutical professionals is difficult to overestimate: these are health care institutions and professionals who work responsibly, conscientiously fulfill their responsibilities for providing the population with medicines and educational work, including during a pandemic.

MONITORING OF THE DOMESTIC MARKET OF PSYCHOTROPIC DRUGS

Diana Pokotylo
Scientific supervisor: assist. prof. **Dzvenyslava Grushkovska,** PhD

Keywords: psychotropic drugs, combination medications, market conditions, market analysis, information.

Introduction. The topicality of the problem of providing and supplying the market of psychotropic drugs is conditioned by their prevalence, significant impact on a huan's life quality and social functioning in all areas. At the same time, in recent decades, much attention has been paid to mental health problems around the world, primarily due to their high prevalence and medical and social consequences. Psychotropic drugs are used to treat epilepsy, mental disorders, as hypnotics. Thus, at present in our country there is a problem of treatment and the problem of psychotropic drugs (NPD) to patients who need them for medical reasons. It is advisable to conduct marketing research NPD, the results of which provide an opportunity to establish trends in the market of the studied medication drugs.

Materials and methods. Official legal documents, search for medical and pharmaceutical information, scientific articles and publications were used as sourcing materials. In the course of work the method of information search, statistical and graphic methods were used.

Results. The domestic market of psychotropic drugs was analysed to identify the availability of these drugs for consumers; a quantitative assessment of the range of psychotropic drugs; the leading manufacturers in the pharmaceutical market of Ukraine were identified; the price situation of psychotropic drugs was analyzed and liquidity and solvency adequacy ratios were determined. The studies can be used to optimise pharmaceutical care for patients with psychoemotional disorders, severe, mild to moderate pain as well as to relieve pain in cancer patients.

Conclusions. The results indicate the need to optimise the supply of psychotropic drugs. In addition, drugs of these groups are not included in the National List of Medicines and are not subject to reimbursement, which is important for the treatment of schizophrenia, psycho-emotional diseases and other illnesses requiring psychotropic drugs which are currently quite common in Ukraine and around the world.

VITAMIN MARKET RESEARCH

Dmytro Dziuba
Scientific supervisor: assist. prof. **Iryna Horodetska**, PhD

Keywords: multivitamin, vitamin, supplements

Introduction: Mandatory prophylactic use of multivitamins has recently become popular, making them an integral part of the modern lifestyle. This determines the relevance and necessity of research of the market of vitamin and mineral products in Ukraine, including those in the form of dietary supplements.

Materials and methods: Generalization, systematization, comparison.

Results: As a result of the analysis of the dynamics of the range of vitamin medicines during 1999-2022, it has been established that the maximum amount of vitamins was presented on the pharmaceutical market of Ukraine in 2007 (267 positions by trade name). This is slightly different from the beginning of the study (264 positions). A sharp decrease in the number of vitamin preparations is observed from 2011 to 2016. with a minimum - 119 positions - in 2016, currently the number of vitamin medicines is 167. A study of the dynamics of the number of assortment items in terms of subgroups of the 3rd level of the ATC classification has been conducted and three groups of changes have been identified. A significant decrease in the number of positions was observed in 4 subgroups: A11A "Multivitamins with supplements" - from

72 to 18 (by 4 times); A11J "Other combined vitamin preparations" - from 21 to 6 (by 3, 5 times); A11B "Multivitamin complexes without supplements" - from 48 to 14 (by 3.4 times); A11 H "Other simple vitamin preparations" - from 41 to 23 (by 1.8 times). The increase in the number of vitamin preparations has been observed in 2 subgroups: A11D "Vitamin B_1 reparations, including in combination with vitamins B_6 and B_{12}"- from 11 to 32 (by almost three times) and A11G" Preparations of ascorbic acid (vitamin C) and combined preparations containing it "from 34 to 43 (by 1.2 times). Minor changes have occurred in 2 subgroups: A11C "Vitamins A and D, including combinations of these vitamins" and A11E "B vitamin complexes, including combinations". As of the beginning of April 2022, 15 Ukrainian manufecturers offered 108 vitamin drugs, which is 64.7% of registered positions. 59 positions of vitamin drugs (35.3% of the analyzed totality) are represented by 22 manufacturers from 15 countries. Among foreign producers, the largest number of positions are offered by producers from Germany (10), France (7), Israel (5) and Thailand (5). Leaders in the number of positions of vitamin drugs are domestic producers of JSC "Kyiv Vitamin Plant" - 45 positions, LLC "Pharmaceutical Company "Zdorovye"- 14 positions and JSC" Lekhim-Kharkiv "- 11 positions. At the beginning of April 2022, 600 items of vitamin DS for nutrition were presented on the Compendium.online information resource in the section "Dietary supplements".

Conclusions: The pharmaceutical segment of vitamin dietary supplements is 3.6 times higher than the number of registered vitamin medicines.

INDIA AND ITS ROLE IN THE PROVISION OF MEDICINES TO THE POPULATION OF UKRAINE

Ewais Daniel
Scientific supervisor: assoc. prof. **Oksana Levytska**, PhD

Keywords: medicines, Indian manufacturers of medicines, medical supply (medical provisions)

Introduction: Today, India ranks 3rd in the international pharmaceutical market in terms of pharmaceutical production and 14th in terms of value. It is the largest supplier of generic medicines to many countries around the world, including Ukraine. Therefore, it is important to study the contribution of Indian pharmaceutical companies in the provision of medicines to domestic consumers of medicines.

Results: It is established that in fiscal year 2020, India was the second largest exporter of drugs to Ukraine ($ 222 million), which accounted for 11.27% of total imports of medicines in Ukraine. The share of Indian

manufacturers in the total market of drugs in 2020 in monetary terms was 5.7%, and in kind - 3.7%. It was found that one of the elements of the infrastructure of the Ukrainian pharmaceutical market is the public organization "Association of Indian Pharmaceutical Manufacturers", which includes 11 companies: Dr Reddy's laboratories, Eurolifecare private limited, Macleods pharmaceuticals ltd, Mega life sciences, Organosyn ltd, Sun pharma Industries Ltd , Abryl pharm llc, Dia Pharma Limited, Hetero Labs Limited, M.Biotech Limited and Zandra life sciences pvt. ltd., which offer Ukrainian consumers drugs for the treatment of cardiac, neurological, gastroenterological, urological, and other infectious diseases. Situational analysis of the nomenclature of drugs presented in the Ukrainian pharmaceutical market by Indian firms participating in IPMA - showed that at the time of the study (January 2022) this nomenclature was 182 names of drugs in various dosage forms and 8 dietary supplements. The maximum number of Indian drugs is represented by the pharmaceutical company Dr Reddy's laboratories - 34 items. The same (29 nomenclature items) and in general also a significant number of drugs from two companies - Organosyn ltd and Sun Pharma. The number of drugs from seven other Indian pharmaceutical companies ranges from 21 (Hetero Labs Limited) to 7 (Mega life sciences). Zandra life sciences pvt. ltd. represents on the Ukrainian pharmaceutical market 7, and the firm M.Biotech one nomenclature position of dietary supplements. Indian-made drugs are represented in 10 anatomical groups according to the ATX classification. In this case, drugs of three anatomical groups, such as J - Antimicrobial agents for systemic use; A - Drugs affecting the digestive system and metabolism and M - Drugs affecting the musculoskeletal system accounted for almost 60% of the total range of Indian drugs. They represent 58 groups of therapeutic subgroups. Thus, the largest assortment range by quantity are the class 3 characteristic of anatomical group A with (11 therapeutic subgroups).

Conclusion: Thus, the Indian pharmaceutical companies, which are members of the public organization "Association of Indian Pharmaceutical Manufacturers", make a significant contribution to the provision of medicines to the population of Ukraine.

PHARMACEUTICAL COMPONENT OF TREATMENT OF VISUAL IMPAIRMENTS

Khrystyna Mahur
Scientific supervisors: assist. prof. **Iryna Chukhray**, PhD

Keywords: ophthalmology, drugs, dietary supplements, questionnaire.

Introduction. Eye diseases are among the most common types of diseases. The reasons of increasing the number of people with impaired vision

are global demographic trends, changes in behavior and lifestyle etc. Not only treatment of existing ophthalmological pathologies is important, but also prevention of their occurrence by following a balanced diet and the use of complex drugs that help maintain vision.

Materials and methods. The objects of the study were the State Register of Medicines, instructions for medical use, prices for dietary supplements, questionnaire results. Methods of analysis and synthesis, logical generalization, questionnaire was used.

Results. As a result of marketing analysis of ophthalmic drugs (DR), was found, that as of 01.04.2022 in The State Register of Medicines of Ukraine are included 263 drugs of this group, which according to the third level of PBX classification belong to 11 groups. The greatest range completeness is characteristic of group S01E - Antiglaucoma drugs and miotics assets (111 L3).

Research of the pharmaceutical market of dietary supplements to improve vision, which contains blueberries showed, that there are 12 such drugs, half of them - made in Ukraine. The cost of the daily dose of these drugs - from 0.98 UAH to 10.47 UAH.

According to the analysis, 14 drugs with lutein of 57% of Ukrainian production are presented on the pharmaceutical market. The cost of the daily dose of these drugs - from 4.33 to 15.22 UAH. Drugs in this market segment are generally more expensive than drugs with blueberries to improve vision.

A questionnaire survey of 164 students of the Pharmacy Faculty found that slightly more than half of respondents (50.6%) have vision problems. Almost a third of respondents perform eye exercises. 45.1% do not take any drugs to maintain and improve vision. The rest use most often vitamin complexes (40.2%) or drugs with blueberries (24.4%). Slightly more than a third of respondents (37.2%) buy drugs to improve vision in pharmacies. A small part of respondents buys these drugs in specialized stores, sites or in online pharmacies.

Conclusions. Commodity and price characteristics of pharmaceutical market segment of drugs are set, which are used for the ophthalmic disease's prevention and treatment. The vision related problems were identified in students of the Faculty of Pharmacy by conducting the survey. The attitude of respondents for prevention of visual impairment was studied.

ANALYSIS OF NON-STEROIDAL ANTI-INFLAMMATORY DRUGS FROM THE POSITION OF SOCIAL PHARMACY

Oksana Halushko
Scientific supervisor: assoc. prof. **Nataliia Khanyk**, PhD.

Keywords: nonsteroidal anti-inflammatory drugs, retail pharmaceutical market, assortment, retail prices, physical and economic accessibility, Defined Daily Dose, liquidity ratio.

Introductions. Nonsteroidal anti-inflammatory drugs (NSAIDs) occupy a leading position in terms of consumption. Thus, worldwide more than 30 million people are forced to take non-steroidal antiinflammatorydrugs, and 300 million consume them in short courses. NSAIDs remain the most effective means of combating pain of inflammatory origin. Nowadays a sufficient number of NSAIDs has been registered in Ukraine. These were drugs from both foreign and domestic manufacturers. Their availability (physical and economic), as well as rational use were the subjects of study of social pharmacy.

Materials and methods. Information retrieval, analysis, generalization and marketing research. The analysis of physical availability of NSAIDs in State Register of Meditional Drugs of Ukraine and at the retail pharmaceutical market of Lviv was established. Only 64.7% of the total number of registered drugs could be purchased in Lviv pharmacies. NSAIDs are most often marketed in the form of tablets (48.1%), capsules (22.2%) and injectable solutions (16.2%). In January 2022, 74 trade names of injectable NSAIDs based on 10 INNs could be purchased in Lviv pharmacies. The most popular on the market were drugs with meloxicam (21 trade names), dexketoprofen (20 trade names), diclofenac (15 trade names) and ketorolac (8 trade names). More than half (55.4%) of injectable NSAIDs were imported from 17 countries Analysis of solid dosage forms of NSAIDs presented in pharmacies in Lviv for the active substance showed that there are 20 INNs of investigated drugs in 194 trade names on the market. The top three were drugs with ibuprofen (43 trade names), meloxicam (31 trade names) and diclofenac (23 trade names). 68% of them were imported. One-fifth of solid NSAIDs were Indian-made. A study of the cost of DDD showed that not always more DDD in the package indicated a lower cost of drugs. It depended on the manufacturer. Thus, in drugs with parecoxib, lornoxicam and ketoprofen, the cost of 1 DDD was lower in packages with fewer units. A comparative analysis of the value of 1 DDD with the number of their offers on the market showed that not always a lower price guaranteed a large width of the distribution channel. The cheapest injectable NSAIDs were drugs with diclofenac, although these drugs were characterized by a large difference between the maximum and minimum cost. Injectable drugs with ketorolac, meloxicam, dexketoprofen and ketoprofen were also

slightly more expensive. Injectable drugs with parecoxib, lornoxicam and tenoxicam were much more expensive. Injectable ibuprofen with a DDD cost of UAH 645 proved to be the most expensive on the market. The cheapest NSAIDs in solid dosage forms were drugs with diclofenac, indomethacin and piroxicam. The most expensive – NSAIDs with etoricoxib. Unlike injectable NSAIDs, solid dosage forms are characterized by a large number of different dosages.

Only 6 injectable and 19 non-injectable NSAIDs had price liquidity ratio within the normal range, as price fluctuations for drugs should not exceed 15%. A comparative analysis of average retail prices in Polish and Ukrainian pharmacies showed that prices are lower in Poland, moreover, calculated solvency ratio indicated that these drugs were 4-8 times more affordable for patients in Poland.

Conclusions. The special characteristics of Ukrainian market of NSAIDs were defined due to the assortment of these medicines, the kind of medical forms, cost of 1 DDD, etc. The obtained results are important for the further forming of the assortment and the price policy of NSAIDs

ORGANIZATIONAL AND ECONOMIC RESEARCH ON VETERINARY PHARMACY

Oleksandra Dvylyuk
Scientific supervisor: prof. **Bohdan Hromovyk**, PhD, ScD

Keywords: veterinary pharmacy, market of veterinary drugs, legislative regulation, falsified veterinary drugs.

Introduction. An important part of our country's economy is veterinary medicine, which ensures the health and well-being of animals, reproduction, productivity in industrial livestock, improving the safety and quality of food. The implementation of these tasks will be successful only in the presence of effective and safe veterinary drugs and the development of the veterinary pharmacy industry.

Materials and methods. Materials – domestic and foreign literature, statistical data, regulations of Ukraine, the current state of the domestic market of veterinary drugs. Methods – systematic, informative search, documentary analysis, comparison, analysis and synthesis, mathematical statistics, generalization.

Results. The state and problems of public administration in the field of veterinary pharmacy and the current state of the situation in the market of veterinary drugs are analyzed. The market shares of pharmaceutical countries-holders of registration certificates and companies-manufacturers of these products are determined. The system of state regulation of the market of

Ukraine at the present stage is not effective enough. It is established that the production of veterinary preparations is carried out exclusively by those registered in Ukraine. The peculiarity of the registration of veterinary drugs at the present stage is that its validity lasts 5 years, but from 2023 indefinite state registration of veterinary medicines is envisaged. Modern pharmacological classification of veterinary drugs is carried out using the ATCvet system and is based on the same general principles as the ATC system for medicines of human medicine. In Ukraine, as of April 8, 2022, the market of veterinary preparations is represented by 2034 assortment items of domestic and foreign production. The list of registered veterinary drugs is 71%, and the list of veterinary immunobiological agents is 29%. The share of domestic production is only 46%. Among registered veterinary drugs, solutions (35%), powders (24%) and suspensions (16%) have the largest market share. A serious problem in the field of veterinary pharmacy in Ukraine is the growth of the shadow industry, which requires strict state regulation. Also, the situation is unsatisfactory in providing official statistics, which makes it impossible to properly assess the current state of formation and development of the national market of veterinary preparation.

Conclusions. There is a need to develop the field of veterinary pharmacy and stimulate innovative activities of manufacturers of veterinary drugs. The main source of meeting the needs of Ukrainian consumers in veterinary drugs should be the domestic branch of veterinary pharmacy. In the market of veterinary drugs of Ukraine there are opportunities for new entrants. Adaptation of the main legislative requirements in Ukraine for the production of veterinary pharmacies, in accordance with EU requirements, will ensure the competitiveness of domestic industry. Combining the efforts of regulatory and law enforcement agencies should be a crucial step in the fight against illegal exploitation. There is also a need to raise awareness of the responsibility of animal owners.

RESEARH OF FEATURES OF THE PHARMACEUTICAL SUPPLY FOR THE INHABITANTS OF A SMALL TOWN (FOR EXAMPLE, THE SETTLEMENT SHKLO, IN THE LVIV REGION)

Oleh Fedyk
Scientific supervisor: assjc. prof. **Oksana Levytska**, PhD

Keywords: medicines, pharmaceutical supply, urban-type settlement

Introduction: Today, one of the most important tasks in the social policy of the state is high-quality and affordable pharmaceutical provision for the population. This problem is acute among the inhabitants of villages and towns. Therefore, it is important to study the features of pharmaceutical supply for

residents of urban-type settlements, which was carried out by us on the example of Shklo urban village of Lviv region.

Results: A questionnaire on the attitude of consumers to the pharmacy with the participation of 169 residents of Shklo urban village of Lviv region showed that slightly more than a third of respondents (31.4%) buy drugs in a pharmacy they trust, regardless of its location. Almost the same number of respondents (30.2%) buy medicines in any pharmacy located in their locality. Most often, the choice of this pharmacy is determined by its location (80.5% of respondents). It was found that a doctor (89.3%) or a pharmacist (73.4% of respondents) has a decisive influence on the purchase of drugs. Respondents most often buy over-the-counter drugs at the pharmacy (81.7% of respondents), as well as hygiene items (65.7%) and prescription drugs (65.1%). The survey showed that almost 57% of respondents believe that drug prices have risen significantly this year. When the price of the necessary medicine in this pharmacy is high, 66.9% of respondents still buy this medicine because "health is more expensive". Almost 28% of respondents will look for a cheaper analogue among those offered, and 5.3% refuse to buy. Based on a situational comparative analysis of the nomenclature of drugs of two pharmacies in Shklo (pharmacies "ArnikA №1" and Pharmacy №1), which are in high demand among the population of this village, it is established that the common nomenclature in both pharmacies includes 220 drugs (Pharmacy № 1– 308 drugs, in the pharmacy “ArnikA №1” - 335 drugs). At the same time, the maximum share according to the ATX classification falls on drugs of anatomical group C - Agents that affect the cardiovascular system: 52.8% in the pharmacy "ArnikA №1" and 48.1% in the pharmacy «1. It was found that in the Pharmacy № 1 compared to the pharmacy "ArnikA №1" retail prices for the vast majority of drugs (148 items) are lower. At the same time, in the pharmacy "ArnikA №1" compared to the Pharmacy №1 retail prices are lower by 34 drugs. In addition, the retail prices for 38 drugs in the studied pharmacies are the same. It was found that for the vast majority of assortment items of drugs of the pharmacy "ArnikA №1" (87.6%) and 70.6% of the assortment items of drugs of the nomenclature of the Pharmacy №1 retail prices are higher than the competitor by 1 - 10%.

Conclusion: Formulated possible ways to improve the organization of pharmaceutical supply in the urban village (urban-type settlement) or small town for example Shklo, in particular, the introduction of its alternative forms, the search for new logistics solutions and fuller use of the potential of urban pharmacies, etc.

ANALYSIS OF THE IMPACT OF MACRO FACTORS ON THE PHARMACEUTICAL MARKET

Zine el Abidine Abounnaim
Scientific supervisor: assoc.prof. **Nataliia Khanyk**, PhD.

Keywords: macro factors, pharmaceutical market, cultural factors, halal pharmaceuticals.

Introduction. Macro environment factors significantly influence the company's marketing strategy. These factors cannot be controlled. The study of the impact of these macro factors reflects the opportunities and threats of the external environment and provides a basis for developing measures to strengthen market positions and ensure a sufficient level of competitiveness of the pharmaceutical organization.

Materials and methods. The objects of the study were results of the questionnaires, statistic data on Muslim population. Methods of data retrieval and generalisation, mathematical analysis, literature monitoring, overview, and questionnaire survey were used.

Results. Six groups of macro factors, which influence the pharmaceutical market and the company were identifies and described. The impact of these factors was done on the example of cultural factors analysis. Many religious beliefs affect medicine use and patient adherence. Taking into account that there were more than two billion Muslims worldwide, making Islam the second-largest religion in the world, exceeded only by Christianity, Muslim population in European countries was analysed. According to the results of the research, 16.3% of population of Europe were Muslims. Among Northern European countries, United Kingdom had the biggest quantity of Muslims (4,130,000 of Muslims), but in comparison to the total population of the country it was at the second place (6.3%) after Sweden (8.1%). Among Western European countries France (8.8%), Austria (8%) and Belgium (7.6%) were the leaders for the quantities of Muslim people. In Mediterranean European countries more than half of the population of Albania (58.8%), Bosnia and Herzegovina (50.7%) were Muslims. Eastern Europe are the least attractive for Muslim population. The leader among these countries was Bulgaria (13.4%). Halal governs lifestyle choices for Muslims around the world. Halal refers to any action or practice that is lawful under Islam. Pharmaceuticals business sector estimates halal pharmaceuticals to be multimillion dollars industry. The attitude and necessity in halal pharmaceuticals in Ukraine was analysed on the base of questionnaires of the Muslim students studded in Danylo Halytsky Lviv National Medical University of Ukraine in 2022. Only 44.8% and 10.3% of respondents were using only Halal medications, or used them from time to time respectively. The main reason to decline Halal pharmaceuticals was that Islamic law tolerates

consumption of the non-halal products in life-threatening situations. Almost 43.8% of students indicated impossibility to buy Halal pharmaceuticals in Ukrainian pharmacies. Only 10.3% of asked students told about awareness of Ukrainian doctors and pharmacist on Halal medicines. 44.8% of them decided that health care professionals have not enough knowledge in this direction. Only three forth of respondents had knowledge and correctly identified Halal pharmaceuticals. 41.1% of students showed need in information about Halal medicines in Ukraine and 17.4% wanted this data from time to time. According to their opinion, doctors and pharmacist (59.3%) and self-medication (22.2%) should be the main resources of this information. Almost two third of respondents knew about Halal Product Guarantee Law and need halal logo on the package of medicines and healthcare products.

Conclusions. The impact of macro factors on the pharmaceutical market was done on the base of analysing religions restriction of Muslim population and special characteristics of its influence on Ukrainian market were identified.

RESEARCH OF STRATEGIES OF CORPORATE SOCIAL RESPONSIBILITY OF PHARMACEUTICAL ENTERPRISES

Veronika Fabin
Scientific supervisor: assist. prof. **Iryna Horodetska**, PhD

Keywords: corporate social responsibility (CSR), pharmaceutical enterprise.

Introduction. CSR practices have started to be implemented in Ukraine since the early 2000s. At that time, enterprises used different approaches and strategies based on world experience. Therefore, the study of the current state of application of CSR strategies by pharmaceutical enterprises is relevant.

Materials and methods. Summarization, systematization, comparison.

Results. 8 domestic pharmaceutical manufacturers, which were among the top 20 marketing companies in terms of pharmacy sales of drugs and dietary supplements in 2021, have been selected for content analysis of their official websites on the use of CSR strategies. In terms of volume, completeness and relevance of information on CSR programs in the activities of the joint-stock company "Farmak", it is significantly ahead of all other analyzed companies. The key areas of the company's projects in the field of sustainable development: ecology, health, education and science, charitable assistance - the same as in the pharmaceutical company "Darnitsa", "Arterium Corporation" and the pharmaceutical company "Zdorovye", but significantly exceed them by the number of events and the amount of information provided. Only joint-stock company "Farmak" publishes an up-to-date report on CSR for 2020 - a document made in PDF-presentation format (62 slides), which

contains 6 sections and annex 1 - reporting indicators in accordance with GRI (Global Reporting Initiative) standards. Information on CSR of the pharmaceutical company "Darnytsia" is concise, relevant and constantly updated, but CSR reports are not published. On the website of "Arterium Corporation" in the section "Responsibility" there are sections "Patients", "Employees", "Ethics", "Society", "Ecology", which contain a significant number of programs and events, as well as 8 CSR reports, the last - for 2018 p. Information on participation in CSR programs of the pharmaceutical company "Yuria-Pharm" is fragmentary, non-systematic and not updated (5 years old). There are no reports on CSR. Detailed information on social projects of the pharmaceutical company "Zdorovye" is provided with reference to specific events, the most recent of which date back to 2020. There are no reports on CSR. Public joint-stock company "Borshchahivskiy CPP " does not pay much attention to social projects, information on environmental activities is not presented on the website, no reports on CSR are published. Two manufacturers, joint-stock company "Kyiv vitamin plant" and group of companies "Kusum pharm" do not pay attention to CSR issues.

Conclusions. As a result of the content analysis of the official websites of the leading domestic manufacturers of drugs and pharmaceuticals, 6 criteria for comparing CSR programs were processed, only the joint-stock company "Farmak" fully meets all of them.

ORGANIZATIONAL PECULIARITIES OF PHARMACEUTICAL SUPPORT FOR THE POPULATION OF LVIV REGION

Vitalii Stepaniuk
Scientific supervisor: assoc. prof. **Oleksandra Korniyenko**, PhD

Keywords: Lviv oblast, administrative-territorial unit, pharmaceutical supply, pharmaceutical manufacturer, pharmacy, localization.

Introduction. There has been a slight increase in the number of pharmaceutical establishments (PEs) in the structure of the domestic pharmaceutical market in recent years, but due to fierce competition between businesses, unprofitable PEs are forced to cease their activities, giving way to powerful pharmacy networks. Given that Lviv region, which consists of 7 districts and 73 amalgamated territorial communities (ATG) is a fairly large administrative-territorial unit of the western region of Ukraine, the study of the structure and localization of pharmaceutical establishments is relevant.

Materials and methods. Research materials: License registers for the production of drugs (medicines) (in pharmacies), wholesale and retail trade of drugs, industrial production of drugs and the right to engage in economic activities in the circulation of drugs, psychotropic substances and precursors as

of 01.11.2021, Order of the Cabinet of Ministers of Ukraine from 12.06.2020 № 718-r «About definition of administrative centers and approval of the territories of territorial communities of Lviv oblast», statistical data on the population of Lviv oblast. Methods of information search, system analysis, comparison and generalization have been used.

Results. It has been found out that there are 6 pharmaceutical manufacturers and 1345 PEs in the region, including 15 pharmacy warehouses, 1093 pharmacies and 237 pharmacy points. All pharmacy warehouses and 46.8 % of holders of licenses for retail trade of drugs operate in Lviv district, in particular 86.7 % of pharmacy warehouses and 35.2 % of pharmacies and pharmacy points operate in Lviv ATG. 37 pharmacies have a license to manufacture drugs, 67.6 % of them are also concentrated in Lviv district, and 56.8 % operate in Lviv. 21 pharmacies have a license to carry out economic activities on the circulation of narcotic drugs, psychotropic substances and precursors, providing 6 out of 7 districts and only 16.4 % of ATG. In the structure of PEs 42.0 % are private limited companies, 25.1 % - private enterprises, 24.6 % - individual entrepreneurs, 8.3 % - communal enterprises, 0.1 % - joint stock companies. 86.4 % of PEs operate in cities, the rest - in rural areas. On average, there are 1868 people per PE in the oblast. This indicator is the highest in Drohobych (1503), slightly lower - in Lviv and Stryi (1805 and 1829 respectively) districts. In Sambir, Zolochiv, Chervonohrad and Yavoriv districts one PE serves 2092, 2104, 2179 and 2225 people respectively. By clustering, the differentiation of administrative-territorial units of Lviv oblast by the provision of PEs to their residents has been carried out.

Conclusions. A number of peculiarities of the infrastructure of pharmaceutical organizations providing pharmaceutical supply to the residents of Lviv region. It has been found out that the provision of PEs to the population in the oblast is 1,7 % higher than the national average indicator (1900 people per PE), but in rural areas of the region only 13,6 % of pharmacies and pharmacy points are functioning, which is almost twice lower than the average in Ukraine (26,0). It has been shown that the cluster «High provision of PEs to the population» includes Drohobych district, «Medium provision of PEs to the population» includes three districts (Lviv, Stryi and Sambir), «Low provision of PEs to the population» also includes three districts (Zolochiv, Chervonograd and Yavoriv).

ANALYSIS OF THE MARKET OF REMEDIES FOR MENOPAUSAL DISORDERS IN WOMEN

Vladyslava Kovaliuk
Scientific supervisor: assoc. prof. **Kateryna Dorykevych**, PhD.

Keywords: menopausal disorders, medicines, dietary supplements.

Introduction: The age of menopause in women is 45-55 years, so about a third of her life every woman spends in a hypoestrogenic state, characterized by deteriorating health, and the transition period (premenopause and menopause) is characterized by menopausal disorders (in 50-85% of women). Thus, a significant part of the female population needs help, including pharmaceutical, for the prevention and treatment of menopausal disorders.

Materials and methods: The method of systematic analysis of the set of data on the treatment of menopausal disorders in women, the method of literature search and the method of interviews were used. The materials of the study were scientific and literature data, data from websites about medicines and dietary supplements and the results of questionnaires.

Results: A segment of the domestic market of drugs for the treatment of menopausal disorders in women has been studied. It is represented by 10 trade names of hormonal drugs (13 assortment items by dosage forms) - groups by ATC-classification: G03CA, G03CC, G03CX, and 9 trade names of non-hormonal drugs (11 assortment items) - group G02CX. The main producers of hormonal drugs are France (38.5%) and Germany (23.1), of non-hormonal drugs – Germany (36.3%) and Switzerland (27.3%). Dosage forms of hormonal drugs are mostly tablets (30.8%) and gels (23.0%), and non-hormonal – tablets (77.8%). According to the drug booking site tabletki.ua, there are 9 hormonal drugs and 10 non-hormonal drugs in Lviv (as of February 21, 2022). At the same time, the most widely used drugs in pharmacies are Proginova (217 pharmacies) and Divigel, 1 g (188), the least – Klimen (1), Klimadinon (15) and Klimaktoplan (21). Prices for hormonal drugs range from UAH 201.50 to UAH 1,050.00; the lowest price is for Divigel, 0.5 g (UAH 201.50), and the highest price is for Proginova (UAH 1,050.00). Prices for non-hormonal drugs range from UAH 149.50 (Klimakt Heel) to UAH 595.00 (Prefemin). Regarding the analysis of the cost of the daily dose, the lowest cost is Remens, 50 ml (UAH 2.96), the highest - Estramon-50 (UAH 67.00). Analysis of the dietary supplement market for the correction of menopausal disorders showed that 39 pf them. 87.2% of these supplements are complex, and 97.5% of them are herbal remedies, most of which contain: soy (13, 33.3%), cimicifuga extract (10, 25.6%) and red clover (6, 15.4%). Most supplements are performed in capsules (22, 56.3%) and tablets (13, 33.3%). The lowest cost has Menostop (UAH 148.00), the highest - Menopause Plus

(UAH 1228.05); in Lviv pharmacies there are 25 out of 39 items (64.1%), of which 72% (18) have a cost of UAH 200-500 per package.

As a result of a survey of women (52 women) on their use of remedies for the treatment of menopausal disorders, it was found that 88.5% of them had symptoms of menopause, and half of them (50.0%) used drugs during menopause, mostly sedatives, 56.5%, calcium and vitamin D, 34.8%, hormonal drugs, 21.7%, sleeping pills (13.0%), and 43.5% of respondents used dietary supplements (mainly of plant origin (35.0%), vitamin-containing (30.0%) and homeopathic supplements (25.0%)). Women used drugs and dietary supplements mainly on the advice of a doctor (65.2%) and a pharmacist (34.8%). For a third of respondents (32.6%) the role of a pharmacist in treatment of menopausal disorders is very important (10 out of 10 points).

Conclusion: A study of the pharmaceutical market segment of remedies for the treatment and correction of menopausal disorders (drugs and dietary supplements) revealed the availability, marketing characteristics, including price, of these remedies, which simplifies the provision of pharmaceutical care to menopausal women.

PECULIARITIES OF CIRCULATION AND PROSPECTS OF DEVELOPMENT OF THE MARKET OF IMMUNOBIOLOGICAL DRUGS

Yuliia Lytvynenko
Scientific supervisors: assist. **Iryna Chukhray**, PhD

Keywords: immunobiological drugs, vaccines, vaccination, immunoglobulins, cold chain.

Introduction. Immunobiological drugs are widely used to prevent infectious diseases. In this case, vaccination is carried out. Its task is to preserve the health of the population through the reduction of morbidity, mortality and disability from infectious diseases and to form collective immunity.

Materials and methods. The regulatory documents, the State Register of Medicines, instructions for medical use, the results of the survey were the objects of the study. Methods of information search, generalization, systematization, analysis, and questionnaire were used.

Results. There are such immunobiological drugs as vaccines, toxoids, immunoglobulins, serums, and other drugs used to prevent infectious diseases. The order of the Ministry of Health approved the calendar of preventive vaccinations, according to which children should be vaccinated from 10 diseases. The pneumococcal vaccine is going to be included to this calendar.

61 vaccines and 8 immunoglobulins have been registered in Ukraine on January 1, 2022. Foreign manufacturers, in contrast to immunoglobulins, which are mainly Ukrainian-made, produce all vaccines. We investigated that vaccines against COVID-19 arrived to Ukraine from the several sources. There were five such vaccines of different origin and method of application in the register of Ukraine.

All used immunobiological drugs should be registered in Ukraine and have a conclusion on their compliance to quality indicators. Transportation, storage and sale of immunobiological drugs must be carried out in abidance with the "cold chain".

In order to study the attitude of parents to the vaccination of their children, a survey of 1,568 people was conducted in the period from 16.09.2021 until 6.11.2021. The survey covered representatives of all regions of Ukraine and respondents from abroad, most of whom were from the Northern (34.37%) and Western (35.01%) regions of Ukraine. Most parents (89.7%) vaccinate their children. Some parents consider vaccination inappropriate. There were such reasons for refusing to vaccinate children as possible side effects, poor health of children, inadequate quality of vaccines, etc.

Most respondents were interested in the composition of vaccines, knew the symptoms and complications of vaccinated diseases and knew the side effects that can occur from the use of vaccines. Respondents indicated that the producer (61.2%) should be responsible for the complications that arose after vaccination.

61.5% of respondents believed that children who did not have preventive vaccinations could not attend preschool or school. 63.2% of surveyed parents wanted their child over 12 to be vaccinated against COVID-19, and 5.5% of them have already been vaccinated. 64.7% of respondents had positive attitude for opening of vaccination points in pharmacies.

Conclusions. The range of immunobiological drugs by type, composition, way of vaccination for which they were used for was analyzed. The study of legal documents allowed to establish the basic requirements for the circulation of immunobiological drugs. The questionnaire survey showed a positive attitude of parents to the vaccination of children. The main reasons for refusing vaccination have been identified and parents' awareness of the peculiarities of immunization has been determined.

DEPARTMENT OF PHARMACEUTICAL, ORGANIC AND BIOORGANIC CHEMISTRY

(Head of the department – prof. **Roman Lesyk**)

APPLICATION OF NAPHTHOQUINONES IN DESIGN OF POTENTIALLY BIOLOGICAL ACTIVE COMPOUNDS

Abdelhafez Ahmed Mohamed Mahmoud
Scientific supervisor: assoc. prof. **Andrii Lozynskyi**, PhD

Keywords: thiopyrano[2,3-*d*]thiazole, anticancer activity, drug-likeness parameters

Introduction. Thiazolidinone derivatives represent a well-known class of patented drugs and substances at different stages of research, which possess hypoglycaemic, anti-inflammatory, choleretic, antitumor, diuretic, immunostimulant, and other activities. From the other hand the structural features of thiazolidinone core allow to obtaining of various polyfunctionalized systems via different heterocyclization reactions as promising biologically active compounds. The prominent interest among functionalized thiazolidinones belongs to their fused derivatives, especially thiopyrano[2,3-*d*]thiazoles which possessed advantages compared to their synthetic precursors, especially in the absence of Michael acceptor properties. In addition, thiopyranoids display wide spectra of biological activities, namely anticancer, anti-tripanosomal, antiviral, antibacterial and anti-inflammatory. The synthesis of mentioned compounds has been accomplished via [4+2]-cyclocondensation reactions of 5-ene-isorhodanines with different dienophiles As a result the purpose of this work was to explore our continuous research effort in the synthesis of a series of novel thiopyrano[2,3-*d*]thiazole derivatives based on *hetero*-Diels-Alder reaction of 5-arylidene-isorhodanines and 1,4-naphthoquinone and biological activity evaluation of these compounds.

Materials and methods. Synthesized thiopyranothiazole derivatives were evaluated by the National Cancer Institute, Bethesda for their anticancer activity at 10-μm concentration toward full NCI 60 cell lines panel representing nine different types: leukemia, melanoma, lung, colon, CNS, ovarian, renal, prostate and breast cancers. Druglikeness properties was determined based on Lipinski and Veber rules using the SwisAdme of Swiss Institute of Bioinformatics website.

Results and Discussion. The hetero-Diels-Alder reaction of 1,4-naphthoquinone with 5-aryl(heteryl)idene-4-thioxo-2-thiazolidinones yielded a series of novel 11-substituted benzo[6,7]thiochromeno[2,3-d]thiazole-2,5,10-triones. Accordingly, a three-component reaction of isorhodanine, hydrocinnamaldehyde and 1,4-naphthoquinone was used to synthesize target 11-phenethyl-3,11-dihydro-1,4-dithia-3-aza-cyclopenta[b]anthracene-2,5,10-trione. The structure of synthesized compounds was confirmed by NMR spectra and X-ray diffraction method. The anticancer screening assay (performed according NCI protocol within Developmental Therapeutic Program) allowed detecting some aspects of structure – anticancer activity relationships, most sensitive cell lines and identify the most active compounds

for further investigation. Study of the drug-likeness parameters of synthesized compounds showed that mentioned compounds possess satisfactory ADME parameters, pharmacokinetic properties and medicinal chemistry friendliness according modern requirements for potential drug-like molecules.

Conclusion. A set of novel fused 11-substituted benzo[6,7]thiochromeno[2,3-*d*]thiazole-2,5,10-triones derivatives have been designed and synthesized. The preliminary anticancer screening results and evaluation of drug-likeness parameters will be pursued for improving of anticancer potency and selectivity and development of new hit and lead-compounds with the thiopyrano[2,3-*d*]thiazole scaffold via rational design and structure optimization.

DRUGS FOR THE TREATMENT OF MIGRAINE

Anastasiia Baryliak
Scientific advisor: assoc. prof. **Ivanna Subtelna**, PhD

Keywords: migraine, CGRP, 5-HT_{1F}, rimegepant, lasmiditan, ubrogepant, mechanism of action, synthesis.

Introduction. According to experts, the prevalence of migraine in one year worldwide is 15%, with a predominance of headaches in women, and a total of 45.1 million years of life with a disability. Thus, it is extremely important to have effective therapies available that can reduce the global burden of the disease. Although the exact etiology of migraine remains unknown, research over the past decade has greatly expanded scientific knowledge on the pathophysiology of migraine, especially the role of serotonin receptors and calcitonin gene peptide (CGRP). This knowledge has greatly contributed to the development of new drugs that are more selective and specific to the mechanisms of migraine pain.

Materials and methods. Research object: receptor-directed drugs CGRP and 5-HT_{1F}. Research subject: physical properties, mechanism of pharmacological action and synthesis of investigational drugs. Methods: literature study, system approach, meta-analysis.

Conclusions. Based on a review of available literature, the key clinical aspects of migraine as a disease of the nervous system were systematized. Recent studies have identified the role of a CGRP in the mechanism of migraine development. A meta-analysis of the safety and efficacy of investigational drugs is also considered, and an assessment of the prospects for their subsequent research is provided.

REACTIONS [4 + 2] -CYCLOCONDENSATIONS IN THE SYNTHESIS OF BIOLOGICALLY ACTIVE THIOPYRANOTHIAZOLES

Anastasia Hadeniuk
Scientific supervisor: assoc. prof. **Andrii Lozynskyi**, PhD

Keywords: *hetero*-Diels–Alder reaction, thiopyranothiazoles, spectral data, SWISSADME.

Introduction. The *hetero*-Diels–Alder reaction has been recognized as one of the most powerful and atom-economical protocol for construction of various heterocyclic compounds. Over the past decades, numerous studies have been presented involving LUMO-lowering activation of electron deficient dienophiles in the synthesis of thiopyran derivatives with vide range of biological activities. Examples of this methodology are the reactions of 5-methylidene-4-thioxo-2-thiazolidinone with different dienophiles including acrylonitrile, acrylic acid and its analogs, fumaric acids derivatives, nitrostyrene, arylidene pyruvic and cinnamic acids derivatives, 2(5H)furanone and norbornene derivatives. Phenylmaleinimides have been also reported as dienophiles in this reaction.

Materials and methods. organic synthesis, spectral data, SWISSADME.

Results. Following our previous results we applied phenylmaleinimides as dienophiles in *hetero*-Diels–Alder reactions for the synthesis of novel fused thiopyrano[2,3-d]thiazole derivatives. The reaction of 5-alkylidene-4-thioxo-2-thiazolidinones and phenylmaleinimides in boiling acetic acid afforded pure fused 6-phenyl-8-phenethyl-3,4a,7a,8-tetrahydro-pyrrolo[3`,4`:5,6] thiopyrano [2,3-d] thiazole-2,5,7-triones and 8-(2,6-dimethyl-hepta-1,5-dienyl)-6-phenyl-3,4a,7a,8-tetrahydro-pyrrolo[3`,4`:5,6]thiopyrano[2,3-d]thiazole-2,5,7-triones. Study of the drug-likeness parameters of synthesized compounds showed that mentioned compounds possess satisfactory ADME parameters, pharmacokinetic properties and medicinal chemistry friendliness according modern requirements for potential drug-like molecules.

Conclusions. In summary, it was established that 5-alkylideneisorhodanines undergo a diastereoselective *hetero*-Diels-Alder reaction providing novel 6-phenyl-8-phenethyl-3,4a,7a,8-tetrahydro-pyrrolo[3`,4`:5,6]thiopyrano[2,3-*d*]thiazole-2,5,7-triones and 8-(2,6-dimethyl-hepta-1,5-dienyl)-6-phenyl-3,4a,7a,8-tetrahydro-pyrrolo[3`,4`:5,6] thiopyrano [2,3-*d*]thiazole-2,5,7-triones.

SYNTHESIS AND STUDY ANTICANCER ACTIVITY OF INDOLE-THIAZOLIDINONE CONJUGATES

Bohdan Stepaniuk
Scientific supervisor: prof. **Roman Lesyk**, PhD, ScD

Keywords: synthesis, indole, 4-thiazolidinones, Knoevenagel reaction, anticancer activity, 2-thioxo-4-thiazolidinones.

Introduction. Development of efficient, easy to conduct methods for the synthesis of different kinds of molecules bearing indole core is an important task for the medicinal chemistry. Taking into account rich pharmacological profile of thiazolidinone derived compounds, the investigation of hybrid molecules combining above-mentioned cores with indole ring is quite promising direction and may lead to novel potent antimicrobial, antiparasitic and/or anticancer agents. An additional argument in favor of the indole analogs had become the results of their anti-trypanosomal activity study that allowed identifying the hit compounds with nanomolar IC_{50} values. Moreover, these compounds showed low cytotoxicity upon human primary fibroblasts as well as relatively low acute toxicity. It should be mentioned that the thiazolidinone fragment in molecules may facilitate further chemical optimization of the hit compounds.

Materials and methods. Organic synthesis, spectral analysis, *in vitro* anticancer activity, COMPARE Analysis, Gibbs Energy Analysis

Results. The target 3-(4-oxo-2-thioxothiazolidine-5-yl)-1*H*-indole-2-carboxylic acids' derivatives were synthesized in the Knoevenagel condensation of the indole-3-carboxaldehydes with 2-thioxo-4-thiazolidinone (rhodanine). The reaction proceeds in the acetic acid medium in the presence of sodium acetate under reflux for 3–4h. Further modification included the hydrolysis of compounds that gave fused tricyclic derivatives 1-oxo-9*H*-thiopyrano[3,4-*b*]indole-3-carboxylic acids. According to the data about alkaline hydrolysis of related rhodanines, the reaction goes through the formation of appropriate 3-substituted-2-mercaptoacrylic acids that undergo spontaneous heterocyclization to form target compounds. Utilizing the methyl 3-formyl-1*H*-indole-4-carboxylates with rhodanine in Knoevenagel reaction, we aimed at synthesis of 7-membered ring systems. Interestingly, that the hydrolysis reaction did not proceed as expected. The 3-(1*H*-3-indolyl)-2-mercaptoacrylic acids derivatives linked by the disulfide bridge were obtained instead. The hydrolysis was performed in the presence of 30% NaOH solution under reflux for 30 min. To evaluate the possibility of the formation of 7 membered cycle the changes of reactions Gibbs free energy were calculated on DFT level. Thus, first cyclization is thermodynamically favorable unlike second cyclization where equilibrium is shifted to the starting compound. It causes passing the competitive reaction of oxidative dimerization in disulfide.

Antitumor activity studies were performed for the compounds according to the NCI DTP (USA) standard protocol. 5-Fluoro-3-(4-oxo-2-thioxothiazolidin-5-ylidenemethyl)-1H-indole-2-carboxylic acid methyl ester was selected for the in-depth screening at concentrations ranging from 10^{-4} to 10^{-8} M. Two independent experiments were performed toward 59 and 58 cell lines, respectively. Compound inhibited growth of all tested cancer cell lines at submicromolar and micromolar concentrations. The average meanings of three dose-response parameters: GI_{50} (molar concentration of the compound that inhibits 50% net cell growth), TGI (molar concentration of the compound leading to the total inhibition) and LC_{50} (molar concentration of the compound leading to 50% net cell death) were 0.45/0.65 mM, 31.50/44.02 mM and 91.96/93.66 mM, respectively.

Conclusions. A mild and efficient method for the synthesis of 1-oxo-9H-thiopyrano[3,4-b]indole-3-carboxylic acids and dimerized 3-(4-carboxy-1H-3-indolyl)-2-propenoic acids via alkaline hydrolysis of 3-(rhodanin-5-yl)-1H-indole-2-carboxylic acids derivatives was elaborated. Anticancer activity screening in NCI60-cell lines assay allowed identification of5-fluoro-3-(4-oxo-2-thioxothiazolidin-5-ylidenemethyl)-1H-indole-2-carboxylic acid methyl ester 2a with significant antimitotic activity atmicromolar and submicromolar concentrations.

SYNTHESIS OF THIAZOLOTHIOPYRANES BASED ON THIORODANINES

Iryna Karpinets
Scientific supervisor: prof. **Roman Lesyk**, PhD, ScD

Keywords: synthesis, indole, 4-thiazolidinones, Knoevenagel reaction, anticancer activity, 2-thioxo-4-thiazolidinones.

Introduction. The Diels–Alder reaction is the most powerful synthetic method for unsaturated sixmembered rings. It takes place under mild conditions with high regio- and stereoselectivity usually providing a rapid increase in skeletal complexity. Substantial gains in insight and methodology have been accomplished with a body of creative and conceptually new applications in organic synthesis concerning Diels–Alder reactions. A variant is the hetero-Diels–Alder reaction, in which either the diene or the dienophile contains a heteroatom, most often nitrogen or oxygen. This alternative constitutes a powerful synthesis of six-membered ring heterocycles. Thus, the use of dienes containing a sulfur atom opens synthetic pathways to various thiopyran derivatives. Involvement of the hetero-Diels–Alder reaction in domino or tandem processes makes this approach one of the most powerful methods for the synthesis of polycyclic compounds. This method has also been applied to the preparation of biologically active compounds. Thus, hetero-

Diels–Alder reactions have been used as an excellent synthetic instrument for obtaining thiopyrano[2,3-*d*][1,3]thiazole derivatives combining thiazolidinone and thiopyrano fragments in the fixed skeleton. Thiopyrano[2,3-*d*][1,3]thiazoles have become a promising area of research because of their diverse biological activities, such as anticancer, antitrypanosomal, antimycobacterial, antibacterial and antifungal, and antiviral.

Materials and methods. Organic synthesis, spectral analysis, *in silico* druglikeness, predict biotargets

Results. We evaluated the reaction between 5-(orthohydroxybenzylidene)-substituted thiohodanines and citraconic acid or its anhydride as dienophiles. The reaction proceeded smoothly in acetic acid at reflux with a catalytic amount of hydroquinone to prevent of polymerization processes. We found that in such conditions there is a regio- and diastereoselective tandem acylation-*hetero*-Diels–Alder reaction affording the pure rel-(5R,5aR,11bS)-5-methyl-2,6-dioxo-3,5a,6,11*b*-tetrahydro-2*H*,5*H* chromeno[40,30:4,5]thiopyrano[2,3-*d*] thiazoles in good yields. The reactions with citraconic acid and citraconic anhydride as dienophiles were both effective giving the target products, but method B was slightly less productive (yield varies between 63 and 69%), in the same time yield in method A equals 69–72%. The regioselectivity of the reaction is due to the electron-donating properties of the methyl group, which leads to a redistribution of the electron density of the double bond of citraconic acid and its anhydride. The diastereoselectivity of the studied tandem reaction of citraconic acid and 5-(ortho-hydroxybenzylidene)-isorhodanines with the formation of rel-5R,5aR,11bS diastereomers is explained by endo transition state at the stage of the [4+2]-cycloaddition. The [4+2] adduct formed undergoes intramolecular lactonization with the formation of a tetracyclic derivative. Citraconic anhydride reacts similarly. For 11-methyl-9-oxo-15-thioxo-8-oxa-12,16-dithia-14-azatetracyclo[8.7.0.02,7.013,17]heptadeca-2(7),5,13(17)-triene 11-carboxylic acid potential druglikeness were investigated and predicted potential biotargets.

Conclusions. We have reported an efficient regio- and diastereoselective method for the preparation of novel 11-methyl-9-oxo-15-thioxo-8-oxa-12,16-dithia-14-azatetracyclo[8.7.0.02,7.013,17]heptadeca-2(7), 5,13(17)-triene 11-carboxylic acid via tandem acylation-*hetero*-Diels–Alder reaction of 5-arylidenethiohodanines with ortho-phenolic group at arylidene moiety and citraconic acid or citraconic anhydride and potential druglikeness, predictible biotargets was characterized.

SYNTHESIS AND BIOLOGICAL PROPERTIES OF PIPERAZYNYL - THIAZOLIDINE-4-ONE CONJUGATES

Iryna Spryn
Scientific supervisor: assoc. prof. **Volodymyr Horishny**, PhD

Keywords: synthesis, thiazolidin-4-one, piperazine, biological activity

Introduction. Thiazolidine-4-one scaffold is of constant interest in the construction of various biologically active substances and is considered a privileged structure in medical chemistry. On the other hand, the incorporation of the piperazine cycle is an important synthetic strategy in drug design due to its ease of modification, proper alkalinity, potential ability to form hydrogen bonds, and adjustment of molecular physicochemical properties. Therefore, the combination of piperazine and 4-thiazolidinone scafolds is an effective approach to the design of biologically active substances that are promising for implementation in medical practice.

Materials and methods. The methods of organic synthesis, the multicomponent reactions of condensation and also spectral methods of structure, purity and identity confirmation (NMR spectroscopy), high-efficiency screening for antimicrobial activities are used.

Results. The three-component interaction of rhodanine, piperazine and aromatic aldehyde or isatin was studied. A number of 5-arylidene-2-piperazin-1-ylthiazol-4-ones and 3-[2-(4-methylpiperazin-1-yl)-4-oxo-4H-thiazol-5-ylidene]1,3-dihydroindole-2-ones were obtained . The structure of the synthesized compounds was reliably confirmed by NMR spectroscopy. The synthesized compounds were evaluated according to the parameters of drug-likeness, potential bioactivity and toxicity. The obtained compounds meet the criteria for drug-likeness, and the calculations indicate the feasibility of their study as enzyme inhibitors, which makes it important to study, in particular, their antimicrobial properties, so even in the pathology of relevant diseases involved a significant number of enzymes. The antibacterial and antifungal properties of the synthesized compounds have been studied.

Conclusion. The antimicrobial activity of the synthesized compounds was studied, among which substances exhibiting high antibacterial activity against the methicillin-resistant strain of Staphylococcus aureus ATCC43300 were found.

SEARCH FOR NEW ANTIMICROBIAL AGENTS AMONG THIAZOLIDINE DERIVATIVES

Lilia Romanyuk
Scientific supervisor: prof. **Roman Lesyk**, PhD, ScD.

Keywords: synthesis, 4-thiazolidinone, SWISSADME, spectral data, antimicrobial activity, acute toxicity

Introduction. Thiazolidinone derivatives constitute an important class of heterocyclic compounds in modern medicinal and pharmaceutical chemistry including anti-inflammatory, anticancer, antioxidant, antitripanosomal activities and also display a prominent interest as antimicrobial agents. It should be noted that thiazole/thiazolidinone cycle is present in various commercial drugs, especially penicillin, monobactam, sulfathiazole, thiabendazole and nizatidine. In continuation of this theme, we designed and synthesized new non condensed heterocyclic compounds based on 2-cyano-2-(4-oxo-3-phenylthiazolidin-2-ylidene)-*N*-phenyl-acetamides and their 5-ylidene analogs. The evaluation of their antimicrobial and antifungal activity *in vitro* against several reference and clinical strains was carried out.

Methods: Organic synthesis, NMR spectroscopy, pharmacological screening, SWISSADME protocol.

Results and Discussion: It is known that the reactive methylene group in the C5 position of the thiazolidinone nucleus allows the production of various 5-ethoxymethylidene derivatives, in particular starting compound **2.1** under reaction with triethylorthoformate. Starting from 5-ethoxymethylidene derivative **2.1**, a number of different 2-[5-[(anilino)methylene]-4-oxo-3-phenylthiazolidin-2-ylidene]-2-cyano-*N*-phenyl (o-tolyl) -acetamides **2.2-2.9** were synthesized. In order to expand the compound library of 2-cyano-2-(4-oxo-3-phenylthiazolidin-2-ylidene)-*N*-arylacetamide derivatives and to establish patterns of the structure-activity relationship, in particular to study the impact of 5-enamine and 5-ylidene fragments on biological activity, a number of 2-(5-benzylidene(heterolylidene)-4-oxo-3-phenylthiazolidin-2-ylidene)-2-cyano-*N*-phenylacetamides **2.10-2.14** were synthesized under the Knovenagel reaction. Antimicrobial activity screening allowed the identification of compounds with significant effect against tested microorganisms with MIC/MBC/MFC values in the range of 0.33-0.86 μM.

Conclusions: The synthesized 2-cyano-2-(4-oxo-3-phenylthiazolidin-2-ylidene)-*N*-phenyl-acetamides and their 5-ylidene analogs are a good platform for the development of new highly active and low-toxic agents as potential drug-like molecules with antimicrobial activity.

SYNTHESIS AND ANTIMICROBIAL PROPERTIES OF 2-(THIAZOLE/[1,3,4]THIADIAZOLE/-2-YLIMINO)-THIAZOLIDIN-4-ONES

Liudmyla Chubyk
Scientific supervisor: assoc. prof. **Volodymyr Horishny**, PhD

Keywords: synthesis, thiazolidin-4-one, thiazole, 1,3,4-thiadiazole, biological activity.

Introduction. Widespread use of antibiotics for the treatment of microbial and fungal diseases has contributed to the development of multidrug resistance, which has led to the need for the synthesis of new antimicrobial drugs with a mechanism of action bypassing antibiotic resistance. One of the effective approaches in the search for new promising groups of biologically active substances is molecular hybridization or the so-called hybridpharmacoform approach, which consists in combining several privileged heterocyclic nuclei in one molecule. These include 4-thiazolidone, thiazole and bioisoster 1,3,4-thiadiazole heterocycles, which are characterized, in particular, by a promising antimicrobial profile. Therefore, it is obvious that the appearance of valuable pharmacological properties should also be expected from the combination in one molecule of a 4-thiazolidone cycle with a thiazole or 1,3,4-thiadiazole, which is the basis for the synthesis of the compounds mentioned in the topic.

Materials and methods. The methods of organic synthesis, multicomponent reactions of cyclization and condensation and also spectral methods of structure, purity and identity confirmation (NMR spectroscopy), high-efficiency screening for antimicrobial activities are used.

Results. A method for the synthesis of 1-methyl-3-thiazole / 5-methyl [1,3,4] thiadiazole / -2-ylthioureas has been developed and their multicomponent interaction in the reaction with chloroacetic acid and aromatic and heterocyclic aldehydes has been studied. The structure of the obtained 5-ylidene-3-methyl-2- (thiazole / 1,3,4-thiadiazole / -2-ylimino) thiazolidin-4-ones was reliably confirmed by NMR spectroscopy. Prognostic assessment of physicochemical characteristics, ADME parameters, criteria for drug similarity, pharmacokinetic behavior, bioavailability and metabolic biotransformation was performed using the SwissADME Internet resource and the use of the BOILED-Egg model. The antibacterial and antifungal activity of the synthesized compounds was studied.

Conclusion. The study of antimicrobial properties of synthesized 5-ylidene-3-methyl-2- (thiazole / 1,3,4-thiadiazole / -2-ylimino) thiazolidin-4-ones has identified a number of highly effective compounds that effectively and selectively inhibit the growth of the Cryptococcus strain neoformans ATCC 208821.

SEARCH FOR COMPOUNDS WITH ANTIVIRAL ACTIVITY AMONG 4-THIAZOLIDINONE DERIVATIVES

Marta-Mariia Mykolyshyn
Scientific supervisor: prof. **Roman Lesyk**, PhD, ScD

Keywords: thiazolidinones, synthesis, spectral data, antiviral activity.

Introduction. The non-condensed heterocyclic systems with thiazolidinone and pyrazoline moieties have emerged as powerful scaffolds in drug design. Among diazole-substituted 4-thiazolidinones highly active anticancer agents have been identified including inhibitors of necroptosis, tumor necrosis factor alpha and tyrosine phosphatase. Our previous study, based on a hybrid pharmacophore approach, allowed to establish a number of patterns in the structure-activity relationship (SAR) context for 4-thiazolidinones with a pyrazoline fragment in 2, 3 and 4 positions of the thiazolidone cycle, which possessed antitumor activity. The antiviral activity of heteryl substituted 4-thiazolidinones is also promising. Among thiazole-thiazolidine conjugates and non-condensed derivatives with thiazolidinone and pyridine or pyrimidine cycles, anti-HIV agents were identified. In addition, this group of compounds was active against hepatitis C virus, Tabacco Mosaic virus and Vesicular stomatitis virus. The present master project is an extension of our ongoing efforts towards developing promising biologically active agents using a hybrid pharmacophore approach. We made the design and synthesized hybrid compounds by linking the main structural unit of the 4-thiazolidinone ring system with the pyrazoline, and examined their antiviral activities *in vitro*.

Materials and methods. Organic synthesis, spectral data, pharmacological screening.

Results. It has been shown that chemical modification of compounds at the *N*3 position of the thiazolidinone cycle has a significant effect on the manifestation of biological activity, in particular is an effective approach to the synthesis of *N*3-substituted non-condensed thiazolidinone-pyrazoline hybrid molecules. It was found that 5-(3-naphthalene-2-yl-5-aryl-4,5-dihydropyrazol-1-yl)-thiazolidine-2,4-diones enter into the Mannich reaction, which allowed to obtain a series of novel 5-[5-aryl-3-naphthalene-2-yl-4,5-dihydropyrazol-1-yl]-3-*R*-methylthiazolidine-2,4-dione as potential biologically active compounds. It has been identified 2-{5-[5-(4-Methoxyphenyl-3-naphthalen-2-yl-4,5-dihydropyrazol-1-yl -2,4-dioxothiazolidin-3-yl}-N-p-tolylacetamide (compound 2.3), which shows moderate activity against duck flu virus type A with an EC_{50} value of 21.78 μM and a selective index of 16.3.

Conclusions. The preliminary results allowed to identify some active compounds with promising antiviral activity.

SYNTHESIS AND ANTIMICROBIAL PROPERTIES OF N-(4-OXO-5-QUINOLINYLMETHYLENE-2-THIOXO-THIAZOLIDINE-3-YL) CARBOXAMIDES

Mariana Novak-Toporets
Scientific supervisor: assoc. prof. **Volodymyr Horishny**, PhD

Keywords: synthesis, thiazolidin-4-one, quinoline, antimicrobial activity

Introduction. The problem of multiple resistance of microbial pathogens to modern chemotherapeutics necessitates a significant need for the development of new antimicrobial drugs with mechanisms of action to bypass resistance. The search for antimicrobial drugs is successfully conducted among derivatives of rhodanine (2-thioxo-4-thiazolidone), as evidenced by numerous compounds of this series, effective against gram-negative and gram-positive bacteria, as well as a wide range of different fungi. On the other hand, choline scaffold is also widely used in the design of synthetic compounds with a variety of pharmacological properties, including antimicrobial. Given this, and taking into account that both heterocycles belong to privileged structures in medical chemistry, their combination in one molecule and targeted synthesis of quinoline-rhodanine hybrids is promising in the design of new antimicrobials and is of considerable scientific and practical interest.

Materials and methods. The methods of organic synthesis, heterocyclization reactions, condensation and also spectral methods, conformation of the structure, purity and identity confirmation (NMP spectroscopy) screening for antimicrobial activity.

Results. The interaction of N- (4-oxo-2-thioxothiazolidin-3-yl) carboxamides with quinoline aldehydes was studied and the target N- (4 -oxo-5-quinolinmethylene-2-thioxothiazolidin-3-yl) carboxamides were obtained . The synthesized compounds were evaluated according to the parameters of drug similarity , the forecast of ADME- tox parameters was performed. Antimicrobial activity was studied and it was found that the test substances have antibacterial activity against the strain Escherichia coli ATCC25922 . A critical value (or critical effect) of predominantly quinolin-4- or quinolin-8-yl methylene substituents at the 5-position of the rhodamine cycle for activity was detected.

Conclusions. Identified N-(4-oxo-5-quinolin-4-ylmethylene 2-thioxothiazolidin -3-yl) -isonicotinamide as a hit compound with a MIC value of 4 μg / ml relative to Escherichia coli strain ATCC 25922 , in the absence of toxic effects on human embryonic cells and human erythrocytes.

SYNTHESIS AND PROPERTIES OF 4-THIAZOLIDINONE DERIVATIVES WITH PYRIDINE SUBSTITUENT IN MOLECULES

Mariia Shkodyn
Scientific supervisor: assoc. prof. **Volodymyr Horishny**, PhD

Keywords: synthesis, thiazolidin-4-one, piperazine, biological activity

Introduction. An important task of pharmaceutical chemistry is to create effective, highly selective and low-toxic drugs. One of the solutions to this problem is the concept of "hybrid pharmacophore approach", which is a combination of various biologically important "structural matrices" in one molecule in order to achieve their biosynergy. Such a molecular design strategy often leads to a new pharmacological profile, potentiation of action and reduction of toxicity of "hybrid molecules". In this context, one of the promising areas for the development of "drug-like molecules" is the conjugation of the 4-thiazolidine ring with pyridine. Both of these heterocycles belong to the privileged scaffolds in medical chemistry. Compounds containing both 4-thiazolidinone and pyridine cycles have a wide range of biological activity, many of which have found application in medical practice. Therefore, the molecular design of pharmacologically attractive pyridinyl-substituted 4-thiazolidinones is relevant and promising for the modern process of drug development.

Materials and methods. The methods of organic synthesis, the multicomponent reactions of condensation and also spectral methods of structure, purity and identity confirmation (NMR spectroscopy), high-efficiency screening for antimicrobial activities are used.

Results. The interaction of rhodanine-3-alkanecarboxylic acids and N-(4-oxo-2-thioxothiazolidin-3-yl) carboxamides with pyridine-2-, pyridine-3- and pyridine-4-carbaldehydes was studied. A number of 3-P-5-pyridinylmethylene-2-thioxothiazolidin-4-ones were obtained. The synthesized compounds were evaluated according to the parameters of drug similarity. The forecast of ADME parameters of the synthesized compounds is carried out. It has been found that the synthesized compounds are able to be efficiently absorbed in the intestine, so they may have good bioavailability when administered orally. The antimicrobial activity of the synthesized compounds was studied. It was found that 4-oxo-5-pyridinylmethylene-2-thioxothiazolidin-3-yl-aminocarboxylic acids do not show antibacterial and antifungal activity. At the same time, the studied N- (4-oxo-5-pyridin-4-ylmethylene-2-thioxothiazolidin-3-yl) -carboxamides have a pronounced antifungal effect against strains of Candida albicans ATCC90028 and Cryptococcus neoforans ATCC 208821.

Conclusions.It was identified that N- (4-oxo-5-pyridin-4-ylmethylene-2-thioxothiazolidin-3-yl) isonicotinamide as a hit compound with a MIS value of 16-32 μg / ml in relation to strains of Candida albicans ATCC90028 and

Cryptococcus neoforans ATCC 208821 (or to these strains).

SYNTHESIS OF THIAZOLE DERIVATIVES WITH PYRAZOLE FRAGMENTS IN MOLECULES

Moustafa Khalife
Scientific supervisor: prof. **Roman Lesyk**, PhD, DSc.

Keywords: thiazoles, pyrazoles, anticancer activity, drug-likeness parameters, bio-targets

Introduction. The non-condensed systems containing thiazole and pyrazoline fragments in molecules have received considerable attention recently due to their diverse biological activity and clinical applications. The mechanisms of realization of biological activity among pyrazoline-thiazolidinone conjugates can be associated with their affinity to JNK stimulating phosphatase-1 (JSP-1), tumor necrosis factor TNFa, cyclin-dependent kinase, heat shock proteins and P-glycoprotein. In continuation of this theme, we designed and synthesized novel non-condensed heterocyclic compounds containing 4-thiazolidinone, and pharmacologically attractive pyrazole or pyrazoline moieties.

Materials and methods. Organic synthesis, spectral analysis, *in vitro* anticancer activity, *in silico* druglikeness.

Results and Discussion. The reaction sequences employed for synthesis of the target 4-methyl-5-(5-phenyl-4,5-dihydro-l*H*-pyrazol-3-yl)-*N*-(2-pyridyl)miazol-2-amine. We investigated the reaction of l-[4-Memyl-2-(pyridin-2-ylamino)-thiazol-5-yl]-3-phenyl-propenone and hydrazine hydrate in ethanol led to 4-methyl-5-(5-phenyl-4,5-dihydro-l*H*-pyrazol-3-yl)-*N*-(2-pyridyl)thiazol-2-amines (2.3-2.4) and in glacial acetic acid led to l-[5-[4-methyl-2-(2-pyridilamino)thiazol-5-yl]-3-phenyl-3,4-dihydropyrazol-2-yl]ethanone. The reaction was completed after 1 h under reflux conditions and the precipitate was filtered to give 4-methyl-5-(5-phenyl-4,5-dihydro-l*H*-pyrazol-3-yl)-*N*-(2-pyridyl)thiazol-2-amines in good isolated yields. Synthesized compounds were studied for antitumor activity (MTT assay) on 16 cell lines with different origin. It was used colon, breast, glioblastoma, leukemia and lung cancer cell lines as well as pseudonormal cell lines (Hek293, HaCaT) and normal human lymphocytes. Cytotoxic effect of lead compound 5-[5-(2-fluorophenyl)-4,5-dihydro-1*H*-pyrazol-3-yl]-4-me1hyl-N-(2-pyridyl)thiazol-2-amine was indicated in low μM range as IC_{50} value. For example, IC_{50} for kb-3-1 human cervix carcinoma cell line was reached already by concentration of 13,08 μM. Moreover, it shows a low toxic effect on pseudonormal cell lines and does not reach IC_{50} even by acting it in concentration of 50 μM. The estimation of drag-likeness parameters of synthesized compounds showed that mentioned compounds possess

satisfactory ADME parameters, pharmacokinetic properties and medicinal chemistry friendliness according modem requirements for potential drug-like molecules. The potential affinity of 5-[5-(2-fluoropheny)-4.5-dihydro-1H-pyrazol-3-yl]-4-methyl-N-(2-pyridyl)thiazol-2-amine for different classes of enzymes and the results indicate the potential pharmacological multivectority of the synthesized compound.

Conclusion. Purposeful synthesis of new library 4-methul-5-(5-phenyl-4.5-dihydro-1H-pyrazol-3-yl)-N-(2-pyridyl)thiazol-2-amines was performed. Antitumor activity of 5-[5-(2-fluorophenyl)-4.5-dihydro-1H-pyrazol-3-yl}-4-methyl-N-(2-pyridyl)thiazol-2-amine was studied and potential druglikeness was described.

SUNTHESIS AND ANTIMICROBIAL PROPERTIES OF 5-[3-(5-NITROFURAN)-2-YLALYLIDENE]-2-THIOXOTHIZOLIDIN-4-ONE DERIVATIVES

Nazar Batih
Scientific supervisor: assoc. prof. **Volodymyr Horishny**, PhD

Keywords: synthesis, 5-furylacrolein, 2-thioxothiazolidin-4-one

Introduction. The 4-thiazolidone cycle is considered a privileged structure in medical chemistry. Among the derivatives of this heterocycle, a number of highly active agents with a broad spectrum of biological action were found and leader compounds with antimicrobial, antitubercular, antiviral, antidiabetic, anti-inflammatory, antitumor, anticonvulsant and other properties were identified. On the other hand, a prominent place in medical chemistry is occupied by furan derivatives, which are widely represented in the range of drugs and substances that are at different stages of clinical trials. Therefore, the appearance of valuable pharmacological properties should be expected from the combination of furan and rhodanine cycles in one molecule.

Materials and methods. The methods of organic synthesis, the reaction of condensation, acylation and also spectral methods of structure, purity and identity confirmation (NMR spectroscopy, chromatomass spectroscopy), high-efficiency screening for antimicrobial activities are used.

Results. The methods for obtaining 3-(4-oxo-2-thioxothiazolidin-3-yl)propionic acid and N-(4-oxo-2-thioxothiazolidin-3-yl)carboxamides were reproduced and their interaction with 3-(5-nitrofuran-2)-il)propenal has been studied. As a result, a number of 5-[3-(5-nitrofuran-2-yl) allylidene]-2-thioxothiazolidin-4-ones not described in the literature were obtained. The structure of the synthesized substances was reliably confirmed by the method of NMR spectroscopy. The synthesized compounds were evaluated according to the parameters of drug-likeness, which indicate the compliance of the characteristics of the studied substances with the criteria of drug-likeness.

Acute toxicity of synthesized compounds was predicted. It has been established that they potentially belong to the 4th toxicity class and are promising for the development of drugs. The antimicrobial activity of the synthesized compounds was studied.

Conclusion. It was found that the synthesized 5-[3-(5-nitrofuran-2-yl) allylidene]-2-thioxothiazolidin-4-one show antifungal activity against strains of Candida albicans ATCC 90028 and Cryptococcus neoformans ATCC 208821. The results of in-depth study of the antifungal action of 5 studied compounds allowed to identify two hit compounds with a MIC value of 4-8 μg / ml in relation to the fungus Cryptococcus neoformans.

5-ARYLIDENTHIORODANINES IN THE SYNTHESIS OF THIOPYRANO[2,3-D]THIAZOLES

Rostyslav Dutchak
Scientific supervisor: prof. **Roman Lesyk**, PhD, ScD

Keywords: thiazoles, anticancer activity, drug-likeness parameters.

Introduction. Thiazolidinone derivatives are well-known class biological active compounds with antitumor, anti-inflammatory, hypoglycaemic, diuretic and other activities. Therefore, the synthesis of fused systems based on 4-thioxo-2-thiazolidinone (thiorhodanine) could obtain promising results for futher drug discovery. The reaction of *hetero*-Diels-Alder is important pathway in synthesis of novel thiopyrano[2,3-*d*]thiazoles, thus the development of new synthetic approaches based on this reaction would allow obtaining a series of thiopyrano[2,3-*d*]thiazoles with various substituents in structure. Moreover mentioned substances, are of the special interest as multifunctional reactants for various heterocyclic derivatives synthesis and can be used as attractive building blocks in diversity oriented synthesis of new biological active compounds. Thus the aim of our work was the search of new possible anticancer agents among novel thiopyrano[2,3-*d*]thiazole derivatives.

Materials and methods. It has been analysed the corresponding research in synthesis and adopted synthetic procedure of obtaining of appropriate biologically active thiopyranothiazoles in the in the *hetero*-Diels-Alder reaction. The synthesized compounds were evaluated for anticancer activity in NCI60 cancer cell lines. Druglikeness properties was determined based on Lipinski and Veber rules using the SwisAdme of Swiss Institute of Bioinformatics website.

Results. The novel thiopyrano[2,3-d]thiazole were synthesized from 5-arylidenethiorhodanines and various dienophiles in *hetero*-Diels-Alder reaction. As a result, the library of new thiopyranothiazoles for search of new anticancer agents have been designed and synthesized. The tested

thiopyrano[2,3d]thiazoles demonstrated a promising activity in the *in vitro* screen on the tested cell lines, as well as some distinctive patterns of selectivity. Study of the drug-likeness parameters of synthesized compounds showed that mentioned compounds possess satisfactory ADME parameters, pharmacokinetic properties and medicinal chemistry friendliness according modern requirements for potential drug-like molecules.

Conclusions. The preliminary results allowed to identify the active compounds with promising anticancer activity/

STUDY OF JUGLONE AS DIENOPHILE IN THE HETERO-DIELS-ALDER REACTION

Solomiya Vus
Scientific supervisor: assoc. prof. **Andrii Lozynskyi**, PhD

Keywords: synthesis, juglone, thiopyranothiazoles, spectral data, biological activity

Introduction. 4-Thiazolidinones and related heterocyclic systems have long been of interest to many scientific groups working in the field of medicinal chemistry. One of the new trends in this field is the study of condensed heterocyclic systems based on 4-thiazolidinone, including thiopyrano[2,3-*d*]thiazoles for which a wide range of biological activity was observed. These compounds are characterized by a "fixed" biophore 4-thiazolidine fragment in a "rigid" condensed system, which allows to preserve the biological activity of their synthetic precursors, 5-arylidene-4-thiazolidinones, which on the one hand is a known group of potential biologically active compounds. Due to the electrophilic properties of the exocyclic double bond of the arylidene moiety, 5-arylidene-4-thiazolidinones have recently been considered as potential "Michael acceptors" that can attach nucleophilic protein residues. This property characterizes these heterocyclic derivatives as "frequent hitters" or "pan assay interference compounds", which are considered inappropriate in the modern process of drug creation, due to their lack of selectivity. The objects of our research, namely thiopyrano[2,3-*d*]thiazoles, can be considered as cyclic isosteric mimetics of 5-arylidene-4-thiazolidinones without the properties characteristic of Michael acceptors. Moreover, the combination of thiazole and thiopyrane in a condensed heterosystem is a prerequisite for the creation of "conservative centers" of the target ligand binding complex and increases the potential for selectivity for biotargets. Given the above arguments, the directed search for new chemotherapeutic agents among thiopyrano[2,3-*d*]thiazoles is a justified and promising area of modern medical chemistry. However, one way to optimize the structure of "drug-like molecules" is to introduce pharmacologically "attractive" groups that are close to natural compounds or fragments of existing

drugs. In the present work, we synthesized and studied the biological activity of thiopyrano[2,3-*d*]thiazole derivatives containing a fragment of juglone in the structure.

Methods: Organic synthesis, NMR spectroscopy, pharmacological screening.

Results and Discussion: It has been shown that 5-arylideneisorodanines are effective heterodienes in hetero-Diels-Alder reactions with 5-hydroxy-1,4-naphthoquinone, which allowed to obtain a number of thiopyrano[2,3-*d*]thiazole derivatives with a juglone fragment in the structure. The structure of the synthesized compounds and the interpretation of the conducted chemical studies were confirmed by the methods of NMR spectroscopy, chromato-mass spectrometry, as well as X-ray diffraction analysis. For the synthesized derivative of 11-furan-2-yl-9-hydroxy-3,11-dihydro-1,4-dithia-3-aza-cyclopenta[*b*]anthracene-2,5,10-trione (compound 2.5) was observed significant anticancer activity, which can be considered as a potential area in-depth study of the pharmacological potential of this class of heterocyclic systems. Comprehensive studies of the structure-activity correlation have identified molecular fragments that are critical to the manifestation of the biological activity of this class of compounds.

Conclusions: The synthesized thiopyranothiazole derivatives with juglone fragment in structure are a good platform for the development of new highly active and low-toxic agents as potential drug-like molecules with anticancer activity.

SYNTHESIS OF 2-PYRAZOLYL-THIAZOLIDINES AS POTENTIAL BIOLOGICALLY ACTIVE COMPOUNDS

Sofiia Nakonechna

Scientific supervisors: assist prof. **Ihor Yushyn**, prof. **Roman Lesyk**, PhD, ScD

Keywords: synthesis, pyrazoline, 4-thiazolidinones, [2+3]-cyclocondensation, anticancer activity, druglikeness.

Introduction. Modern drug discovery is aimed at streamlining the development of new potential drug-like molecules based on the relationship between the chemical structure of the drug and biological activity. This approach involves using "drug design" methodology in Medicinal and pharmaceutical chemistry namely using "biophoric" heterocyclic systems, which include pyrazoline-thiazolidinones. Preliminary studies indicate their prospect in the search for new biologically active compounds with low toxicometric parameters, as among them are identified derivatives with antitumor, antitrypanosomal and anti-inflammatory effects.

Materials and methods. Organic synthesis, spectral analysis, *in vitro* anticancer activity, *in silico* druglikeness.

Results. A new method for the synthesis of 2-pyrazoline-substituted 4-thiazolidinones is based on the [2+3]-cyclocondensation reaction with an equivalent of dielectrophilic synton as monochloroacetic acid in the conditions of one-pot three-component reaction with the corresponding carbonyl compounds and catalytic amount of sodium acetate in ice acetic acid. Synthesized non-condensed 5-(4-chlorobenzylidene)-2-[5-(4-dimethylaminophenyl)-3-methyl-4,5-dihydropyrazol-1-yl]-thiazol-4-one demonstrated the antiproliferative activity against CCRF-CEM T-lymphoblastic leukemia cells (IC_{50} = 18.89 ± 2.24 μM), acute myeloid leukemia cells K562 (IC_{50} = 22.15 ± 4.38 μM) and osteosarcoma cell line IC_{50} ± 2.6088 ± 38.28 U2), but showed low cytotoxic effects on human pseudonormal cells BJ (IC_{50} = 50.00 ± 0.00) and MRC-5 (IC_{50} = 45.47 ± 8.47). For 5-(4-chlorobenzylidene)-2-[5-(4-dimethylaminophenyl)-3-methyl-4,5-dihydropyrazol-1-yl]-thiazol-4-one potential druglikeness were investigated, which indicate characterizing the molecule in terms of lipophilicity XLOGP3 4.53, MW size 424.95 g / mol, polarity TPSA 73.57 ?2, solubility log S -5.37, saturation (carbon content) in sp3 hybridization 0.23 and flexibility of rotating links which has a value of 4.

Conclusions. Purposeful synthesis of new library of 5-ylidene-2- (3-methyl-5-phenyl-4,5-dihydropyrazol-1-yl)-thiazol-4-ones was performed. Antitumor activity of 5-(4-chlorobenzylidene)-2-[5-(4-dimethylaminophenyl)-3-methyl-4,5-dihydropyrazol-1-yl]-thiazol-4-one was studied and potential druglikeness was characterized.

SYNTHESIS OF 4-THIAZOLIDINONE DERIVATIVES WITH BENZO[1,3]DIOXOLE SUBSTITUENTS IN THE MOLECULE

Tetiana Havryliuk
Scientific supervisor: assoc. prof. **Inna Demchuk**, PhD

Keywords: synthesis, 4-thiazolidinone, [1,3]benzodioxole, antitumor activity, antimicrobial activity

Introduction. The search for high-efficiency and low-toxic drugs is carried out among various classes of compounds, in particular 4-thiazolidinone derivatives. Among them, leader compounds with antimicrobial, antituberculous, antiviral, antidiabetic, anti-inflammatory, antitumor, anticonvu-sant and other properties have been identified. On the other hand, to optimize the biological properties of 4-thiazolidinone derivatives, the use of benzo [1,3] dioxole scafold is promising, as it is contained in biologically active substances of both natural and synthetic origin. Therefore, the combination in one molecule of 4-thiazolidine and benzodioxole fragments and

the search among the obtained hybrids of biologically active substances is an urgent task.

Materials and methods. The methods of organic synthesis, the reaction of heterocyclization and condensation and also spectral methods of structure confirmation, purity and identity (NMR spectroscopy), analysis of antimicrobial and antitumor properties are used.

Results. A method for the synthesis of 3-benzo [1,3] dioxol-5-yl-2-thioxothiazolidin-4-one has been developed and its interaction with heteroaromatic aldehydes has been studied. Piperonal and 6-chloro [1,3] dioxolo [4,5-d] quinoline-7-carbaldehyde in the reaction with 2-thioxo-4-thiazolidinone-3-alkanecarboxylic acids were studied. The structure of the synthesized compounds was reliably confirmed by NMR spectroscopy. The synthesized compounds were evaluated according to the parameters of drug-likeness, bioactivity and toxic risks. The obtained data indicate the compliance of the characteristics of the studied substances with the criteria of drug-likeness. Toxic risk calculations do not predict the mutagenicity and carcinogenicity of the evaluated ligands, and the predicted acute toxicity (LD50) values include the synthesized compounds in the low-toxicity class 4. The antitumor and antimicrobial activity of the synthesized substances was studied.

Conclusion. The synthesized 4-thiazolidinone derivatives with benzo[1,3]dioxole substituents in the molecule show low antitumor and antimicrobial activity under experimental conditions.

DEPARTMENT OF FARMACOGNOSY
AND BOTANY

(Head of the department – assoc. prof. **Natiliya Shapovalova**)

MEDICINAL PLANTS OF RIVNE REGION: HISTORY OF STUDY, RAW MATERIAL RESOURCES, PROSPECTS OF USE

Angelina Nazaruk
Scientific supervisor: assoc. prof. **Roman Darmogray,** PhD

Keywords: Phytotherapy, folk medicine, Michael and Ivan Nosali, medicinal plants, protection, rhododendron.

Introduction. In the conditions of general deterioration of ecology and health of the population the demand for raw materials of medicinal plants increases. To develop measures for the balanced use of available phytotherapeutic resources, it is important, first of all, to conduct their inventory with quantitative and qualitative analysis of key indicators, as well as the creation of protected areas for unique and typical natural landscapes, biodiversity conservation. These include members of the heather family (Ericaceae), in particular the genus Rhododendron (Rhododendron L.), which has long been used in folk medicine in the treatment of various diseases, as anti-inflammatory, diuretic and wound healing agents.

Materials and methods. The analysis of available scientific sources, printed and electronic periodicals, web-resources, search databases is carried out. Modern methods of phytochemical research and methodology for studying the resource base of medicinal plants.

Results. The resource potential of medicinal plants of Rivne region was studied on the basis of the experience of folk medicine, the current state of their protection, rational use and reproduction. In order to determine the places of germination, mapping of thickets and reserves in July-August 2021, a study of the distribution of yellow rhododendron and the state of raw materials in the western region of Ukraine. In Volyn and Rivne oblasts, surveys were conducted within the Shatsk National Nature Park (Shatsk District), in particular in the vicinity of Pisochne, Luka and Peremut Lakes, and in Rivne Oblast Dubrovytsia, Rokytne, Sarny and Brest districts. During the expeditionary survey in the studied areas, herbarium specimens were prepared, visual assessment and mapping of thickets and stocks of plant raw materials, samples of raw materials for research (leaves, shoots), as well as soils of main germination sites. In terms of pharmacognostic analysis, commodity assessment of harvested samples of plant raw materials (leaves, shoots), determination of the main groups of BAS primarily phenolic compounds.

Conclusion. Studies of the qualitative composition of the main groups of BAS leaves of rhododendron yellow, confirmed the prospects for further study of species of the genus Rhododendron as a source of new biologically active substances based on them.

PHARMACOGNOSTIC RESEARCH OF CABBAGE THISTLE (CIRSIUM OLERACEUM SCOP.)

Alina Shkabko
Scientific advisers: assist. Prof. **Oksana Rybak**; assoc. prof. **Nataliia Shapovalova**, PhD

Keywords: genus Thistle (*Cirsium spp*.), cabbage thistle, chemical composition

Introduction. Pharmacognostic research of promising plants in flora of Ukraine and decelopment on their basis of new medicines is actual task for modern pharmacy. Cabbage thistle (Cirsium oleraceum Scop.) is a member of the genus Thistle, widely distributed in Ukraine as a weed, and it is used in folk medicine as an anti-inflammatory, antimicrobial, diuretic and hepatoprotective agent. Therefore, in order to expand the raw material base for the manufacturing of phytomedicines is relevant a pharmacognostic study of the plant species to establish the possibility of its use in medicine.

Materials and methods of research. The aim of the work was to conduct a pharmacognostic study of cabbage thistle (*Cirsium oleraceum* Scop.). For the purpose of phytochemical study of garden thistle the qualitative reactions, titrimetric method of quantitative determination of tannins and spectrophotometric method for quantification of flavonoids have been used.

Results. Current literature data on the botanical characteristics, chemical composition and pharmacological properties for species of the genus Thistle (*Cirsium* L.), as well as cabbage thistle (*Cirsium oleraceum* Scop.) have been collected, systematizied and summarizied; general phytochemical analysis of the plant material has been carried out, and as a result of it polysaccharides, tannins, coumarins, saponins and flavonoids have been detected in its flowers and leaves; the quantitative yield of tannins, which was 9.15 ± 0.12% in flowers, 12.82 ± 0.86% in leaves, respectively, as well as the quantitative contents of flavonoids, 1.71 ± 0.24%, in the leaves - 0.31 ± 0.09%, respectively, have been determined.

Conclusions. Therefore, the flowers and leaves of cabbage thistle contain a relatively high content of biologically active substances, which indicates the prospects for the research of the studied species. After further pharmacognostic and pharmacological investigations, the new studied kind of plant material might be used in medicine.

PHARMACOGNOSTIC RESEARCH OF PRUNUS DIVARICATA LEDEB.

Bogdan Dutko
Scientific supervisor: assoc. prof. **Oksana Cherpak**, PhD

Keywords: phytochemical, microbiological research, leaves, bark Prunus divaricata

Introduction. Plants of the genus Plunus have a wide range of pharmacological action, as they contain biologically active substances that exhibit anti-inflammatory, antitumor, antimicrobial, cytotoxic, antioxidant, antihemolytic activity, which is due to the presence of tannins, flavonoids, anthocyanins, coumarins and chlorophyll. Pharmacognostic study of medicinal plant raw materials of Prunus divaricata for standardization on phytochemical parameters, including studies of tannins, anthocyanins, flavonoids, carotenoids and chlorophyll, which determine the pharmacological action of the plant, is an urgent problem.

The aim of the work is armacognostic study of Prunus divaricata, Atropurpurea leaves and bark to standardize raw materials, including systematic and morphological characteristics of the species, phytochemical study of medicinal plant raw materials, in particular, qualitative and quantitative determination of tannins, anthocyanins, flavonoids, carotenoids and chlorophyll, and antimicrobial activity decoction of leaves with plum bark spread on gram-positive bacteria Bacillus pumilus.

Materials and methods. The object of the study was medicinal plant raw materials - fresh and dried leaves and bark of Prunus divaricata, Atropurpurea collected in May-June 2021 in the arboretum of the National University "Lviv Polytechnic".

Biologically active substances investigated specific qualitative reactions to investigate medicinal plant material for the content of polyphenolic compounds, in particular, the amount of oxidized phenols, the amount of flavonoids and anthocyanins, as well as carotenoids and chlorophylls. The study of antimicrobial activity was performed by diffusion into agar.

Results. Standardized medicinal plant raw materials - leaves and bark of Prunus divaricata, Atropurpurea spread on physico-chemical quality indicators. Studies of morphological features of the structure of leaves and bark spread revealed their characteristic diagnostic features. Phytochemical study of water, water-alcohol and alcohol extracts of leaves and bark has identified biologically active substances: tannins, saponins, anthocyanins, flavonoids, coumarins, carotenoids and chlorophyll. The maximum content of the sum of oxidizable phenols in the bark which is 1.23 times higher than their content in the leaf. Quantitative content of the amount of flavonoids in the leaves 2.5 times higher than their number in the bark. The quantitative content of the amount of anthocyanins in the leaves spread in terms of cyanidin-3-O-

glucoside chloride is 245 mg%. Microbiological study found that a decoction of leaves with bark of Prunus divaricata, Atropurpurea showed antimicrobial action against gram-positive museum strain Bacillus pumilus, which was 15% higher than the reference drug neomycin sulfate at a dose of 4 μg / ml.

Conclusions. Given that the studied phytomedicine in the form of decoction of leaves with bark Prunus divaricata, Atropurpurea has a pronounced antimicrobial effect, so this medicinal plant material is promising for the preparation of dosage forms as an antimicrobial phytomedicine for the treatment of opportunistic infections.

DETOXIFYING HERBAL FORMULATION: JUSTIFICATION OF INGREDIENTS, DEVELOPMENT OF THE COMPOSITION AND ITS ANALYSIS

Eshak Abanoub Eshak Elkomos Shenouda
Scientific supervisors: assist. prof. **Roman Lysiuk**, PhD

Keywords: herbal drugs, intoxication, detoxification, phytoantidote, herbal formulation, analysis, development.

Introduction. Liver diseases afflict over 10% of the world's population. The liver, as a key organ, is responsible for the metabolism, detoxification and of excretion most substances that enter the organism. Hepatotoxicants, including alcohol, viral infections (hepatitis), food additives, fungal products, bacterial metabolites, minerals, environmental pollutants and chemotherapeutic agents, can damage and induce several ailments of liver. Biologically active substances of medicinal plants have been found to have a high potential for the prevention and treatment of acute and chronic poisoning due to heavy metals and other xenobiotics.

Materials and methods. Informational search in scientific editions, search databases and analytical platforms (Researchgate, Pubmed, Google Scholar) have been performed. The generally accepted research methods have been applied: collection, analysis, systematization, comparison and generalization of information data. Other applied methods compise macroscopical and microscopical techniques.

Results. Data on the beneficial effects of plant materials and individual active principles exhibiting detoxifying and related (gastroprotective, hepatoprotective, antioxidant etc) effects have been collected, analyzed and summarized. The received research outcomes have been applied within development of the composition of herbal collection to manage the intoxication and related symptoms. Composition of a detoxifying formulation, containing official and accessible herbal substances, that has potential to be used for the prevention and treatment of states of intoxication and recommendations on mode, duration of administration and indications for its use have been

substantiated and developed. Experimental macroscopic and anatomical investigations on ingredients of the developed detoxifying herbal collection (*Calendulae flos, Glycyrrhizae radices, Urticae dioicae folium, Betulae folium, Juglandis foloium*) for the prevention and treatment of different types of intoxication and related states have been carried out. The outcomes of the performed experimental studies on macroscopical and microscopical characterization might be useful for substantiation and choice of appropriate methods for quality control of the developed herbal formulation.

Conclusions. The carried out research might provide an optimization pathway for application of safe and effective official medicinal plant materials and their preparations for detoxification and cleansing of the body; protection of the liver and other systems by removal of toxic chemicals in states of intoxication; prevention of chronic toxicity.

SEARCH FOR PROMISING PLANT SPECIES OF TUNISIA WITH ANTIOXIDANTS AND ANTITUMOR EFFECTS

Hchaichi Ahmed Hassen
Scientific supervisor: assist. prof. **Roman Lysiuk**, PhD

Keywords: herbal drugs, flora of Tunisia, natural antioxidants, antitumor Tunisian plants, *Allium roseum*, *Punica granatum*, pharmacognostic investigation.

Introduction. Medicinal plants contain various phytochemicals which can play an important role in reducing occurrences of many diseases by boosting up various organ functions of the human body, by acting as antioxidants and by supplying necessary nutrients. Antioxidants play a vital role in preventing the oxidative stress and also certain degenerative diseases. It has been estimated that 70–80 % of the world's population cannot afford modern medicine, use of medicinal plants can be an important source of natural antioxidants.

Materials and methods. Scientific information retrieval in editions and medical databases (Researchgate, Pubmed, Google Scholar, Scopus, ScienceDirect) has been performed. The generally accepted research methods have been applied: collection, analysis, systematization, comparison and generalization of information data.

Results. Data concerning antioxidants and antitumor effects of medicinal plants, which are considered rich sources of active ingredients and can be used in drug development, playing critical role in the development of human cultures around the whole world, are analysed, processed and summarized. In Tunisia medicinal herbs have been used for pharmaceutical and nutritional therapy for thousands of years. Tunisia has about 2 163 plant species and 149 have been claimed to possess medicinal properties. To this day, traditional

medicine has an important place in Tunisia that is at the conglomeration of several civilizations, where the use of traditional medicine is a matter of concern especially in the management of many diseases such as diabetes, cardiovascular diseases, and disorders of nervous system, kidney and urinary diseases and for cancer. Scientific data concerning floristic diversity in Tunisia have been collected and summarized. Many promising Tunisians plants are important sources of official and folk medicines due to their numerous pharmacological effects, caused by several groups of biologically active constituents, mostly polyphenols. Recent scientific data on antioxidants in medicinal plants, their classification and biological effects, and measurement of antioxidants action have been collected and described.

The search for promising antioxidants with anticancer activity amongst Tunisian medicinal plants has been carried out and over 70 medicinal plant species, grown in Tunisia, exerting significant antioxidant and antitumor effects, have been identified. As the most promising native Tunisian medicinal plant possessing potent antioxidant and antitumor effects can be considered *Allium roseum* and *Punica granatum.*

Conclusions. The performed studies might provide an optimization pathway for application of safe and effective medicinal plant materials of Tunisian flora for maintaining a good health and prevention of different ailments, including cancer, due to their antioxidant and antitumour activities.

SUBSTANTIATION FOR THE CHOICE OF COMPONENTS AND INVESTIGATION OF HERBAL COLLECTION OF IMMUNOMODULATORY ACTION

Iryna Strelchenko
Scientific supervisor: assist. prof. **Roman Lysiuk**, PhD

Keywords: herbal drugs, immune system, immunomodulators, herbal collection, development and analysis.

Introduction. Search and study of herbal remedies that affect the immune system is an important task of modern medicine. The use of phytonutrients with immunomodulatory action has become especially relevant in the context of the pandemic of acute respiratory disease COVID-19 caused by the coronavirus SARS-CoV-2, for prevention and treatment in the early stages of the disease, as well as other infectious diseases.

Materials and methods. Informational search in scientific editions and medical databases (Researchgate, Pubmed, Google Scholar); methods of analysis, systematization, comparison, generalization of information data. Other applied methods compise macroscopical, microscopical, phytochemical techniques. The anatomical structure of the elements of the collection of immunomodulatory action was studied on preparations from the surface using

a light microscope. Qualitative detection of active principles was performed by pharmacopoeial techniques.

Results. The research outcomes comprise summarization of current scientific data on immunodeficiency states, their classification, etiological factors and possible directions of therapy; classification and mechanisms of action of immunotropic drugs, plant immunomodulators. The search for material sources with immunomodulatory activity on the basis of native official herbal drugs with a sufficient material base has been carried out. The data related to morphological and anatomical characteristics, active principles, pharmacological effects and application as the promising agents for the prevention and treatment of immune deficiency states for the following plant sources of the developed herbal collection *Althaea officinalis, Calendula officinalis, Salvia officinalis, Echinacea purpurea* have been collected and described. The carried out phytochemical analysis of extracts of the developed herbal collection revealed occurrence in the analyzed components of the following groups of biologically active compounds: flavones and flavonols, triterpenoid saponins.

Conclusions. The developed herbal collection of immonomodulating activity comprise official medicinal plants with sufficient natural resources and supplies in Ukraine, with the potential in the prevention and treatment of immune deficiency states.

SEARCH FOR PLANT SOURCES OF BIOLOGICALLY ACTIVE SUBSTANCES WITH PREBIOTIC CHARACTERISTICS

Iryna Pavliuk
Scientific advisers: assist. prof. **Oksana Rybak**; assoc. prof. **Nataliia Shapovalova**, PhD

Keywords: probiotics, prebiotics, fructooligosaccharides, dietary supplements

Introduction. In recent decades, the health of the population, according to the World Health Organization (WHO) data, has deteriorated and is characterized by an increase in the number of people suffering from various diseases. According to statistics, in Ukraine there is a deterioration in all categories of the population, which is associated primarily with a decrease in adaptive capacity of the population, which is manifested in reduced immunity to man-made factors, chemical load, emotional stress and other adverse factors. The average life expectancy of Ukrainians is almost 10 years less than in European countries. Diseases of the "civilization" are currently accompanied by disorders of the gastrointestinal tract. Almost 90% of the population of Ukraine suffers from dysbacteriosis to some extent, so this problem attracts the attention of many scientists. One of the reasons for the spread of dysbiosis is a

significant deterioration of the ecological situation on the planet: background radiation has increased, as well as levels of pollution of air, water, soil, food with harmful chemicals, radionuclides; there is a widespread use of antimicrobial, antitumor drugs. Under the influence of all these factors, exceeding the compensatory capacity of the ecological system "host organism and its microflora", various microecological and immune disorders occur in the human body. The problem of dysbacteriosis has recently been dealt with by a wide range of specialists: doctors, nutritionists, pharmacists, and food manufacturers. Prevention and treatment of dysbacteriosis are associated with the restoration of normal intestinal microflora with pharmacopoeial drugs, dietary supplements, herbal remedies, functional foods containing probiotics, prebiotics and synbiotics. Many medicines and dietary supplements with prebiotic action include plant components. Unfortunately, the vast majority of such dietary supplements on the domestic market are produced abroad and they are less affordable. Therefore, all this items determine the relevance of the study of plants containing biologically active substances with prebiotic properties, rational and integrated use of raw materials and the development of new drugs based on the latters.

Materials and methods of research. The aim of the work was to search for current information sources on biologically active substances with prebiotic properties and dietary supplements based on them, to develop the composition of the new prebiotic herbal collection and carry out its analysis.

Results. The current state and prospects for uses of agents that affect the microflora of the gastrointestinal tract with probiotic properties has been considered and the literature on the origin and application of biologically active substances with prebiotic activity has been summarized; the analysis of the domestic market of dietary supplements that have prebiotic properties has been carried out; the composition of the new herbal formulation with prebiotic activity has been worked out and several indices for quality control of the new developed collection have been substantiated.

Conclusions. Therefore, as the problem of very common recently dysbiotic phenomena requires the development of new approaches and treatments, the attention has been paid to the uses of medicinal plant materials containing substances with prebiotic activity and has been proposed a prebiotic herbal collection based on pharmacopoeial kinds of herbal drugs, which should be cheaper and a very promising remedy for the prevention and treatment of disorders of the normal flora of the human body.

DEVELOPMENT, SUBSTANTIATION OF THE COMPOSITION AND ANALYSIS OF THE HAIR STRENGTHENING HERBAL COLLECTION

Kristina Drelikhovska
Scientific supervisor: assist. prof. **Roman Lysiuk**, PhD

Keywords: herbal drugs, hair, hair loss and thinning, premature graying, herbal collection, development and analysis.

Introduction. Patients with a recent history of acute respiratory disease COVID-19 caused by SARS-CoV-2 coronavirus as a result of stresses are quite likely to experience hair loss due to androgenic alopecia, telogen eluvium. Many patients after COVID-19 have an increased intensity of hair loss, and the latency period between an episode of a stressful event and such a manifestation is decreasing.

Herbal remedies are considered as a promising safe source to improve the condition of damaged hair in alopecia (hair loss), premature graying, thinning hair, dandruff, including in patients with COVID-19. This is largely due to the development of adverse effects, insufficient effectiveness in the use of minoxidil, finasteride, dutasteride and other synthetic drugs in patients with alopecia and other hair disorders.

Materials and methods. Informational search in scientific editions and medical databases (Researchgate, Pubmed, Google Scholar); methods of analysis, systematization, comparison, generalization of information data. Other applied methods compise macroscopical, microscopical, phytochemical techniques. The anatomical structure of the elements of the collection of immunomodulatory action was studied on preparations from the surface using a light microscope. Qualitative detection of active principles was performed by pharmacopoeial techniques.

Results. The research outcomes comprise summarization of current scientific data on the structure and development of hair, causes and types of its damage, the impact of the COVID-19 pandemic caused by the coronavirus SARS-CoV-2 on the condition of patients' hair; methods of improving its state, in particular due to the influence of plant substances. The search for material sources to strengthen hair on the basis of native official herbal drugs with a sufficient material base has been carried out. The composition and mode of administration of a new therapeutic and prophylactic phytomedicine for the complex treatment of conditions that are accompanied by damage to the hair structure, based on official species of medicinal plants with sufficient raw materials has been substantiated and developed. Morphological and anatomical research has been carried out and the qualitative chemical composition of the active principles of the developed collection for hair strengthening has been evaluated, which can be further used for the development of methods for quality control. The carried out phytochemical analysis of extracts of the

developed herbal collection revealed occurrence in the analyzed components of the following groups of biologically active compounds: flavones and flavonols, triterpenoid saponins.

Conclusions. The developed herbal formulation for hair strengthening comprise official medicinal plants with sufficient natural resources and supplies in Ukraine, with the potential to improve the condition of damaged hair in alopecia, premature graying, thinning hair, dandruff.

SELECTION AND PHARMACOGNOSTIC INVESTIGATION OF PLANTS FOR REHABILITATION OF PATIENTS AFTER PNEUMONIA

Marta Zaritska
Scientific supervisor: prof. **Natalia Vorobets**, PhD, ScD

Keywords: *Hibiscus syriacus*, biologically active compounds rehabilitation of patients after pneumonia.

Introduction. Pneumonia is one of the key problems in world health. It is believed that, depending on the course and condition of the disease, herbal medicine may find a leading place in the treatment and rehabilitation after pneumonia or be of secondary importance. Therefore, the demand for new drugs, in particular of plant origin, is constantly growing. Rehabilitation has anti-inflammatory and anti-edematous effect, improves blood circulation and lymphocirculation, and normalizes the autonomic regulation of external respiration. The aim of our work was to study the species composition of medicinal plants used in non-specific respiratory diseases of the flora of Lviv region, namely, for the rehabilitation of patients after pneumonia, to analyze the literature on the content of biologically active substances (BAS) in the composition of these plants, to conduct pharmacognostic analysis of the leaves of *Hibiscus syriacus* L. two varieties with pink and white flowers.

Materials and methods. We conducted research on information sources (scientific publications, Internet sources, WEB-resources). The object of pharmacognostic research was leaves of *Hibiscus syriacus* harvested in Botanical garden of Danylo Halytsky Lviv National Medical University. Methods of harvesting, drying, grinding plant material were used; organoleptic research methods; pharmacopoeial phytochemical, spectrophotometric research methods; titration.

Results. More than 80 species of plants with antimicrobial, antiviral, immunotropic, tonic, expectorant, enveloping, anti-inflammatory, antispasmodic, analgesic properties have been identified, which are the most important in the rehabilitation of patients after pneumonia. The least studied are introduced species, among which is *Hibiscus syriacus*. A complex pharmacognostic investigation of two varieties of *Hibiscus*

syriacus leaves with white and pink flowers was carried out. Phytochemical screening of aqueous, water-ethanol and water-salt extracts of *Hibiscus syriacus* leaves of two varieties - with pink and white flowers showed the presence of carbohydrates, glycosides, steroids, proteins, polyphenolic compounds, flavonoids, tannins and tannins. The content of chlorophylls and carotenoids was 0.137 ± 0.0243 and 0.18 ± 0.007 mg / g dry weight of chlorophyll a and 11.47 ± 0.613 and 13.41 ± 0.64 mg / g dry weight of carotenoids in varieties pink and white, respectively. The content of tannins was 3.29 ± 0.263 and 2.69 ± 0.43% / on dry weight in varieties with pink and white, respectively. The content of ascorbic acid 71.17 ± 2.96 and 72.0 ± 5.6 mg / g of dry raw material and the content of free organic acids was 2.47 ± 0.29 and 2.37 ± 0.29 mg / g of dry raw material, in both varieties. The content of phenolic compounds, flavonoids and hydroxycinnamic acids in leaves of *Hibiscus syriacus* pink varietal form was respectively: 76.7 ± 2.47 mg / g DW in gallic acid, 33.7 ± 2.98 mg / g DW, 6.5 ± 0.49%; white varietal form was, respectively: 78.4 ± 4.71 mg / g DW in gallic acid, 30.1 ± 2.6 mg / g DW in terms of quercetin, 6.1 ± 0.49%.

Conclusions. The high content of biologically active compounds in the leaves of Hibiscus syriacus of different varietal forms indicates the prospects for their further study and use to create dosage forms, in particular for the rehabilitation of patients after pneumonia.

PHARMACOGNOSTIC STUDIES OF SELECTIVELY CREATED PLANTS OF THE FAMILY LAMIACEAE

Mariana Mykhalchuk
Scientific supervisor: prof. **Natalia Vorobets**, PhD, ScD

Keywords: Thymus striatus, pharmacognostic analysis, essential oils, antimicrobial activity

Introduction. Essential oil plants of the genus Thymus L., thanks to their valuable components is industrially grown in many countries with appropriate climatic conditions, in particular in the Black Sea region of Ukraine. They accumulate not only essential oils, but also various biologically active compounds. Introduction of existing and creation of new varieties by Ukrainian breeders requires a comprehensive study of their properties before use. In particular, new varieties of essential oil plants of the family Lamiaceae of the genus Thymus, in particular, Thymus striatus. The aim of our work was to conduct pharmacognostic analysis of Thymus striatus.

Materials and methods. We conducted research on information sources (scientific publications, Internet sources, WEB-resources) about biologically active compounds of species of the genus Thymus and their pharmacological activity. The object of pharmacognostic research was herb and essential oil of

Thymus striatus harvested in experimental plots in the Kherson region of Ukraine. Methods of harvesting, drying, grinding plant material were used; organoleptic research methods; pharmacopoeial, phytochemical, spectrophotometric research methods; titration and antibacterial and antifungal investigation of essential oils.

Results. Among the species of the genus Thymus, the species of Thymus striatus remains the least studied compared to other species. Phytochemical screening of aqueous, water-ethanol and water-salt extracts of Thymus striatus herb showed the presence of carbohydrates, steroids, polyphenolic compounds, flavonoids, tannins, coumarins and alkaloid. The content of chlorophylls and carotenoids was 2,34 ± 0,40 and 0,92±0,05 mg/g dry weight of chlorophyll a and chlorophyll b, respectively and 0,70±0,08 mg/g dry weight of carotenoids in herb Thymus striatus. The content of essential oils was 0,13 % DW in flourishing shoots, the content of tannins was 0,57±0,05 % / dry weight in the upground part (herb) of Thymus striatus. The content of ascorbic acid was 3,34 ± 0,5 mg/g DW of herb Thymus striatus. The content of phenolic compounds, flavonoids and hydroxycinnamic acids in the upground part (herb) of Thymus striatus was respectively: 65,8-95,3 mg/g DW in terms of gallic acid, 8,0-22,2 mg/g DW in terms of quercetin and 2,3-6,0 % in terms of chlorogenic acid. High antibacterial activity of essential oil isolated from flowering shoots of Thymus striatus against Bacillus subtilis, Proteus vulgaris, Staphylococcus albus, as well as average against Escherichia coli. High antifungal activity of essential oil isolated from flowering shoots of Thymus striatus was found against Candida pseudotropicalis, C. curvata, C. parapsilosis, and C. kefir.

Conclusions. Based on the analysis of BAS, as well as antibacterial and antifungal activity, Thymus striatus has been identified as a promising type of plant material for in-depth pharmacognostic research and in the future to create dosage forms, apparently with antimicrobial and antidegenerative properties.

PHARMACOGNOSTIC INVESTIGATION OF CALENDULA OFFICINALIS

Nataliya Malankevych
Scientific supervisors: assist. prof. **Oksana Rybak**, assoc. prof. **Nataliya Shapovalova**, PhD

Keywords: pot marigold (*Calendula officinalis L.*), pot marigold flowers, pot marigold leaves, chemical composition.

Introduction. Pot marigold is an annual herbaceous plant of the family Asteraceae, that is used in official medicine as a antiseptic and choleretic remedy. As a medicinal plant material from pot marigold, flowers are used, and the whole above-ground part of the plant (which exceeds the flowers by weight in hundred times) is currently not applied. Therefore, from the point of view of

the rational use of plant resources, a comprehensive pharmacological study of the entire aboveground portionof the plant is important in order to establish the possibility of its use in medicine.

Materials and methods. The purpose of the research was to conduct a pharmacognostic study of pot marigold (*Calendula officinalis L.*).

Results. Data of literature on the chemical composition, pharmacological properties and application of pot marigold were collected and summarized in the research; the general phytochemical analysis of the above-ground portion of pot marigold was conducted, as a result of which the following groups of biologically active substances, such as terpenoids, coumarins, saponins, polysaccharides, tannins, flavonoids, polyphenolic compounds were detected; the determination of the contents of flavonoids in thein vestigated phytomedicine by spectrophotometric method was carried out; the, which can be used in the development of quality control methods for a new kind of medicinal plant material.

Conclusions. Therefore, after further pharmacological study, the investigated new type of the medicinal plant material can find a medical application.

STUDY OF THE RELATIONSHIP BETWEEN THE CHEMICAL STRUCTURE AND PHARMACOLOGICAL ACTION OF FLAVONOIDS AS A CRITERION FOR DRUG DEVELOPMENT

Tetiana Petrushchenko
Scientific supervisor: assist. prof. **Roman Lysiuk**, PhD

Keywords: herbal drugs, flavonoids, standardization, the State Pharmacopoeia of Ukraine, markers, structure – activity, *in silico* analysis, antihypoxants.

Introduction. Flavonoids are one of the most common plant metabolites, characterized by structural diversity, high and diverse pharmacological activity and low toxicity. This type of compounds is an important source of pharmacological and analytical markers.

Flavonoids and their preparations are increasingly applied in medical practice for the treatment of many important common diseases through proven ability to inhibit specific enzymes, mimic certain hormones and neurotransmitters, and scavenge free radicals. Every year the interest of scientists to these compounds, which are being evolutionarily adequate to human body, increases due to important pharmacological effects, as well antioxidant, angioprotective, radioprotective, hepatoprotective, neuroprotective, choleretic, diuretic, antitumor and anti-inflammatory etc.

Materials and methods. Informational search in scientific editions and medical databases (Pubmed, Researchgate, Google Scholar, Science Direct),

analytical and normative documentation. Conventional research methods of analysis, systematization, comparison, generalization and summarization of data. *In silico* analysis using PASS-Online program.

Results. Current scientific data on distribution, classification, characteristics of the chemical structure and pharmacological activity of flavonoids are collected and systematized. The analysis and summarization of analytical and normative documentation on the current state of requirements for standardization in Ukraine of flavonoid-containing herbal drugs have been carried out. The features of the quantitative determination of flavonoids in the pharmacopoeial MPM have been studied. The analysis of scientific sources allowed establishing the influence of structural features of flavonoid molecules on the manifestation of pharmacological effects, in particular nephroprotective and antihypoxant ones.

The method of *in silico* analysis using the PASSOnline program was used to search for promising molecules of the flavonoid group with the predicted antihypoxant activity. The prognosis seems to be an important tool in the search for new therapeutic agents based on promising molecules of natural origin of flavonoid type and herbal drugs containing active markers with the highest Pa values of the studied types of biological activity for further target pharmacological study.

Conclusions. Considering a wide distribution of flavonoids in plants and large structural diversity, these compounds are important objects of research in the field of pharmacognosy, pharmacy and medicine, therefore, the study of current issues on standardization of flavonoid-containing herbal medicines is of great significance, since flavonoid type is an important source of pharmacological and analytical markers. Natural flavonoids are low-toxic, with a wide range of biological action, which makes them attractive for the development of new herbal medicines.

PHARMACOGNOSTIC INVESTIGATION OF MONOTERPENOID CONTAINING MEDICINAL PLANTS OF LEBANON

Yahfoufi Housein
Scientific supervisors: assist. prof. **R.M.Lysiuk**, PhD

Keywords: monoterpenoids, herbal drugs, pharmacognostic investigation, flora of Lebanon, Lebanese spices.

Introduction: Plants have been used for medical purposes for centuries. As such, they have been studied scientifically and traded commercially.
Lebanon encompasses a relatively large flora exceeding 2,600 species, several species were reported to have medicinal applications for prevention and treatment various diseases. Monoterpenes belong to a large and diverse group of naturally occurring compounds. As a group of natural active principles they

exert different useful pharmacological effects. Due to the low molecular weight, many of them exist in the form of essential oils.

Materials and methods: Scientific information retrieval in editions and medical databases (Researchgate, Pubmed, Google Scholar, Scopus, ScienceDirect). The search was done in electronic databases using the key terms and some related synonyms: monoterpenoids, herbal drugs, pharmacognostic investigation, flora of Lebanon, Lebanese spices. Methods of collection, analysis, systematization, comparison and generalization of scientific data.

Results. Recent scientific data on monoterpenoids as a group of natural biologically active substances related to their classification, biogenetic pathways and pharmacological effects have been collected and analyzed. A variety of various plant species containing monoterpenoids as the leading active principles has been identified that demonstrate potent pharmacological effects. Scientific data on morphological characteristics, distribution, major active principles, pharmacological effects, medicinal uses, application as a food, as well as spices and savory herbs, food additions and flavouring agents for promising plant species of the world and Lebanese flora have been collected, analyzed and systematized. As the main objects of research were taken the following monoterpenoid containing herbal drugs: *Rosa spp*, *Juniperus communis*, *Thymus vulgaris*, *Foeniculum vulgare*, *Thymus serpyllum*, *Origanum libanoticum*, *Rosmarinus officinalis*, *Salvia libanotica*, *Melissa officinalis* and *Satureja thymbra*).

Conclusion. The collected and summarized data might be applied for optimization of medicinal and daily food application of herbal drugs, derived from Lamiaceae, native to Lebanon. The described herbal substances might be recommended as sources of nutritional supplements for health support and for prevention of numerous ailments.

ELABORATION OF THE COMPOSITION AND METHODS FOR QUALITY CONTROL OF ANTIALLERGIC HERBAL COLLECTION

Yuliia Baluk
Scientific supervisor: assoc. prof. **Nataliia Shapovalova**, PhD

Keywords: allergic diseases (AD), antiallergicherbal collection, medicinal plants (MP), medicinal plant materials (MPM), biologically active substances (BAS)

Introduction. Allergic diseases (AD) are an urgent medical and social problem, which are the fourth most common in the world, conceding the cardiovascular disease, tumors and injuries. Despite the progress made in the treatment of allergic diseases, their prevalence and incidence continue to increase. Experience of phytotherapyofAD gives grounds to claim that the use

of phytopreparations has proven itself well over the years and allows the long-term treatment with minimal likelihood of adverse events. In many cases, the use of phytomedicines may significantly limit the therapy with antihistamines and hormonal drugs or even its abolition. Therefore, it is important to study the composition and development of promising, scientifically substantiated and effective herbal remedies for the treatment of allergic diseases.

Materials and methods. Literature data, sources of the INTERNET search database, herbal medicines (phytomedicines), mixtures, herbal formulations, phytoteas, medicinal plant species,MPM. The object of the research comprises the MPM, promising for use in the multicomponent herbal collection of antiallergic action. Methods: information retrieval, comparison and systems analysis, chemical, physicochemical, macro- and microscopic analysis.

Results. The data of the literature on allergic diseases, their types, etiological factors, causes, clinical signs, symptoms, diagnostic methods, directions and methods of treatment are collected and summarized; the chemical composition and pharmacological properties of components, indications and recommendations for the administration of 90 prescriptions of phytomedicines used in herbal medicine and folk medicine for the treatment of allergic diseases were studied, their analysis consideringindications and kinds of dosage forms was carried out; information on 72 MP species, used in phytomedicines, was collected and summarized, their chemical composition of BAS was studied and types of pharmacological action required in the treatment of allergic diseases were determined; the composition of the multicomponent herbal collection of antiallergic action has been worked out and substantiated; the study of macro- and microscopic features of the components of the formulation, and the qualitative composition of BAS was carried out; the quantitative extractives and flavonoids contents were determined, a draft method for quality control of anti-allergic herbal collection, according to the requirements of the State Pharmacopoeia of Ukraine 2.0., was processed.

Conclusions. The developed multi-component antiallergicherbal collection based on MPM containing BAS groups that provide pharmacological activities necessary for the treatment of allergic diseases might be recommended for use as an infusion for internal use, as well as externally in the form of lotions, compresses and baths. The processed methods for quality control of the developed antiallergicherbal formulation can be used for its standardization.

PHARMACOGNOSTIC INVESTIGATION SPECIES OF GENUS STELLARIA L.

Yulia Bober
Scientific supervisor: prof. **Natalia Vorobets**, PhD, ScD

Keywords: *Stellaria media, Stellaria holostea*, pharmacognostic analysis

Introduction. Species of the genus *Stellaria* L. are distributed on almost all continents, used in folk medicine in different countries, however, comprehensive information on the content of biologically active substances and pharmacological activity of various extracts and isolated compounds in most species is still lacking. Therefore, the study of the phytochemical profile of these species remains relevant. The aim of our work was to conduct pharmacognostic analysis of the most distributed species *Stellaria media* and *Stellaria holostea.*

Materials and methods. We conducted research on information sources (scientific publications, Internet sources, WEB-resources) about biologically active compounds of species of the genus *Stellaria* and their pharmacological activity. The object of pharmacognostic research were herbs of *Stellaria media* and *Stellaria holostea* harvested in the vicinity of Lviv city. Methods of harvesting, drying, grinding plant material were used; organoleptic research methods; pharmacopoeias, phytochemical, spectrophotometric research methods and titration.

Results. Phenols, flavonoids, coumarins, anthracene derivatives, saponins, tannins, and alkaloids were found to be qualitative reactions in the herbs of both studied species – *Stellaria media* and *Stellaria holostea*. The content of ascorbic acid were 3,9 ± 0,03 and 2,9 ± 0,05 mg/g DW in *Stellaria media* and *Stellaria holostea,* respectively. The content of hydroxycinnamic acids in the herb of *Stellaria media* and *Stellaria holostea* is 2,04 ± 0,03 and 1,94 ± 0,03 % in terms of chlorogenic acid and dry weight of raw materials, respectively.·The content of flavonoids in the herbs of *Stellaria media* and *Stellaria holostea* is equal to 1.99 ± 0.05 and 1.87 ± 0.11 mg/g in terms of quercetin. The content of chlorophylls and carotenoids was 8,13±0,15 and 2,11±0,05 mg/g dry weight of chlorophyll a and chlorophyll b, respectively, and 4,34±0,04 mg/g dry weight of carotenoids in herb *of Stellaria media*. The content of chlorophylls and carotenoids was 1,37±0,33 and 0,84±0,30 mg/g dry weight of chlorophyll a and chlorophyll b, respectively, and 2,94±0,05 mg/g dry weight of carotenoids in herb of *Stellaria holostea*. The content of tannins in the *Stellaria media* and *Stellaria holostea* was 1.6 and 1.85% by dry weight, respectively.

Conclusions. Based on the analysis of biologically active compounds in the *Stellaria media* and *Stellaria holostea* herbs, these species has been identified as a promising ones of plant materials further research and in the future to create dosage forms, apparently for the treatment of skin diseases.

DEPARTMENT OF TOXICOLOGICAL
AND ANALYTICAL CHEMISTRY

(Head of the department – assoc. prof. **Iryna Halkevych**)

COMPARATIVE ASSESSMENT OF THE ALKALOID CONTENT OF THE ABOVE-GROUND AND UNDER-GROUND PARTS OF ACONITE

Anastasia Borys
Scientific supervisor: assoc. prof. **Iryna Halkevych**, PhD.

Keywords: Aconitum alkaloids, Aconite extract, TLC, HPLC

Introduction. *Aconitum* species (Ranunculaceae), which are widely distributed in northern Europe, Asia and North America, contain highly toxic diesterditerpene-type *Aconitum* alkaloids (e.g., aconitine, mesaconitine, hypaconitine). Diterpenoid alkaloids (DAs) are substances produced by various natural plants with significant thematic difficulties, bioactivity, and somewhat disreputable toxicity. Many research efforts, oriented to studying the anti-inflammatory, analgesic, and anticancer activity of DAs, highlighted that numerous C19-DAs and C20-DAs have noticeable effectiveness. The C19- and C20-hetisine class showed the highest possibilities with the lowest toxicity among the other DAs. For this reason, the hetisine compounds may be good starters for developing novel anticancer drugs using alkaloids.

Material and methods. Research object are underground and above-ground parts of *Aconitum napellus* and *Aconitum variegatum.* Research subject: alkaloid contents in extracts of roots and above-ground parts of aconite. Methods: literature monitoring, TLC, HPLC, extraction.

Results. The work was started with the analysis of the alkaloid compositions of several endemic for Carpathian Basin Aconitum species of *Aconitum napellus* and *Aconitum variegatum*. The alkaloid content of the herbal and root samples was screened by using the classical method of alkaloid isolation, based on solvent partitioning at different pH, which allowed the separation and enrichment of alkaloids. For separation of the DAs was used a preparative and thin layer chromatography. The structures of the isolated compounds were determined by means of spectroscopic methods. Quantitative determination of the main preparative layer chromatography in the studied objects was carried out by HPLH.

Conclusions. Using the established TLC (PLC) and HPLC-DAD method, we identified and quantified 6 components of raw and dried Aconiti radix and herbs. This method can be used to control the quality of Aconiti *napellus* and *Aconiti variegatum*. Moreover, the method has the following advantages: high speed, simplicity, and low solvent consumption. Therefore, this method can be used for the qualitative and quantitative analyses of Aconitum products.

TOXICITY ASSESSMENT OF INHALED CORTICOSTEROIDS

Anzhela Buha
Scientific supervisor: assist. prof. **N. Darmohrai**, PhD

Keywords: inhaled corticosteroids, bronchial asthma, chronic obstructive pulmonary disease, side effects, toxicity, poisonings.

Introduction. Bronchial asthma and chronic obstructive pulmonary disease are a pressing medical and social problem worldwide. Common features of these diseases are the presence of chronic inflammation in the airways. Currently, inhaled glucocorticosteroids are the most effective anti-inflammatory drugs for the basic therapy of bronchial asthma and chronic obstructive pulmonary disease and their exacerbations. But objective data on the safety of glucocorticosteroids are not available today. Prolonged use of high doses of inhaled glucocorticosteroids leads to systemic side effects such as growth retardation in children, decreased bone mineral density, ocular side effects (glaucoma and cataracts), thinning of the skin and bruising, and an increased risk of infectious complications.

Materials and methods. Analysis of scientific literature and its interpretation were used.

Results. The main problems of modern therapy of exacerbations of bronchial asthma and chronic obstructive pulmonary disease and the phenotypes of bronchial asthma according to cluster and factor methods of analysis have been studied. The main representatives of the group of inhaled glucocorticosteroids registered in Ukraine are beclomethasone, budesonide, fluticasone and mometasone. We have also studied single-component and combined drugs containing these active substances. It has been established that the use of inhaled glucocorticosteroids is associated with both local and systemic side effects (oral candidiasis, dysphonia, whooping cough, pharyngitis, bronchospasm), which cause rapid clinical discomfort for patients. Prolonged inhalation of fluticasone propionate in children has been shown to be associated with iatrogenic adrenal insufficiency, leading to hypoglycaemia as a secondary symptom of adrenal hypofunction. A number of studies have shown that patients who receive long-term inhaled glucocorticosteroids may be colonized by pathogenic microorganisms, which can lead to changes in the course of the disease, persistence of pathogenic microflora, which significantly complicates effective treatment in this group of patients

Conclusions. Taking into account the tendency to expand the range of glucocorticosteroids for inhalation use and analyzing the above materials, a more careful approach to the study of toxicological safety of these drugs in relation to the human body is needed.

TOXICOLOGICAL EVALUATION OF "BATH SALTS" COMPONENTS

Diana Bunda
Scientific supervisor: assoc prof. **Yuriy Bidnychenko**, PhD.

Keywords: synthetic cathinones, chemical tests, thin-layer chromatography, gas chromatography-mass spectroscopy

Introduction. The annual reports of the United Nations Office on Drugs and Crime show a dynamic increase in the illicit trafficking of new psychoactive substances. And the annual reports of the European Monitoring Center for Drugs and Drug Addiction show an increase in overdose, including fatalities. A significant proportion of these designer drugs are synthetic cathinones.

Material and methods. Research object are synthetic cathinones. Methods: literature review, chemical tests, quantitative determination.

Results. The mechanisms of pharmacological and toxicological activity of synthetic cathinones have been studied. Methods of synthetic cathinones isolation from biological fluids of the human body (blood and urine), which are used in chemical and toxicological analysis of these substances, have been reviewed. Peculiarities of synthetic cathinone derivatives toxicological screening are studied. Chemical and physicochemical methods of synthetic cathinones detection and identification in extracts from biological material are described: qualitative reactions, microcrystalline reactions, immune-chromatographic test systems and thin layer chromatography. The method of synthetic cathinones quantitative determination in extracts from biological material by gas chromatography-mass spectroscopy has been studied.

Conclusions. Review and comparative evaluation of methods of chemical and toxicological study of poisoning by synthetic cathinones was made.

TOXICOLOGICAL CHARACTERISTICS AND CHEMICO-TOXICOLOGICAL ANALYSIS OF NIMESULIDE

Diana Dyda
Scientific supervisor: sen. lec. **Serhiy Kramarenko**, PhD.

Keywords: Nimesulide, nonsteroidal anti-inflammatory medicines, chemical analysis, intoxycations, isolation, extraction, thin layer chromatography, spectrophotometry.

Introduction. Nimesulide is not available in the United States, however is used in other countries for acute pain. It may be used for pain, including period pains. Nimesulide is not recommended long-term, as for chronic

conditions such as arthritis. This is due to its association with an increased risk of liver toxicity, including liver failure. A lot of reports can be found in the literature about lethal intoxications with Nimesulide, with combined intoxications, Nimesulide misuse and suicide poisoning. Takin this into consideration, chemico-toxicological investigation of Nimesulide is actual problem.

Materials and methods. Research object is Nimesulide and biological samples poisoned this drug. Research subject:element of chemical development of Nimesulide for identification, quatification and isolation of this substance. Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. The UV-spectrophometry and thin layer chromatography methods were developed for identification of Nimesulide in pharmaceutical formulations and samples from biological liquids. The spectrum of Nimesulide in acid solution is characterised by one absorbtion maximum at wavelength 285 nm. Four eluent system, which recommended for systematic analysis in forensic toxicology, for determination of Nimesulide in biological samples: chloroform-acetone (4:1), ethyl acetate, chloroform-methanol (9:1) and ethyl acetate-methanol-25% solution of ammonia (17:2:1) were used. Determination was developing on “Sorbfil” plates. Nimesulide identification can be achieved with such reagents: Marquis, Mandelin, potassium permanganate in 0.1 M sulfate acid. The spectrophotometric method was used for Nimesulide quantification. Limit of Nimesulide detection is 3 μg/ml. Linearity of calibration curve is in concentration range 3-20 μg/ml. The proposed method was successfully applied to biological samples for Nimesulide analysis. Relation between pH and Nimesulide extraction amount was investigated. This substance was extracted in high quantities from acid solutions. The WHO recommended techniques were used for Nimesulide isolation from blood and urea samples.

Conclusions. The techniques for identification, quatification and isolation of Nimesulide were developed and demonstrated good results for Nimesulide determination in biological samples.

FEATURES OF FORENSIC-CHEMICAL INVESTIGATION OF CANNABIS PREPARATIONS

Ivan Stotsko
Scientific supervisor: assoc prof. **Yuriy Bidnychenko**, PhD.

Keywords: cfnnabinoids, cannabis preparations, forensic-chemical investigation

Introduction. This decade, we can see more and more curiosity about cannabis and the drugs it contains. The useful properties of the genus of this plant in everyday life and traditional medicine are known from various historical sources. The current strict framework of the law in which these raw materials are now created creates a problem for people who need it due to their own health. These preparations contain legally restricted medicinal substances derived from the plant Cannabis sativa L., which alleviate their suffering and enable them to live a full life. In many countries, the attitude to this plant raw material is becoming more lenient at the legal level. The current problem is the lack of legal regulation of regulations on the scientific development of clinical trials of the beneficial properties of cannabis, its circulation and methodologies for the identification of cannabis by forensic laboratories in Ukraine.

Material and methods. Legislation: Ukraine, the European Union, the United States, the United Kingdom, Guidelines developed by the European Commission and the Food and Drug Administration, recommendations provided by international volunteer groups and research papers. This work is based on dialectical, comparative, analytical, synthetic and complex research methods.

Results. The modern legal framework for the use of medicines and food additives containing cannabinoids in Ukraine has been studied. The normative and technical documentation on quality control and standardization of medicines containing cannabinoids has been studied. Such documents are missing or not yet developed. The normative and technical documentation on quality control of food additives, which include cannabinoids, has been studied. Such documents are missing or not yet developed. The composition of drugs and food additives containing cannabinoids has been studied. Only two cannabis drugs are approved for use in Ukraine – Nabiximols and Nabilone. The biological activity of cannabinoids and their toxicological properties have been studied.Domestic and foreign special literature on the availability of methods for detection and determination of cannabinoids in medicines and food additives.Domestic and foreign special literature on the availability of methods of chemical and toxicological study of cannabinoids. A comparative evaluation of methods of qualitative and quantitative analysis of cannabinoids.

Conclusions. In order to accelerate the practical implementation of these proposals and innovations, it is advisable at the legislative level to make a

number of additions and changes to the Law of Ukraine "On Forensic Investigation" concerning international cooperation of forensic institutions, as well as to provide appropriate amendments to procedural legislation.

TOXICOLOGICAL RESEARCH OF ANTICOAGULANTS OF INDIRECT ACTION

Liliya Melnyk
Scientific supervisor: assist. prof. **N. Darmohrai**, PhD

Keywords: anticoagulants, thromboembolism, bleeding, warfarin, coagulopathy, side effects, toxicity, poisonings.

Introduction. Oral anticoagulants of indirect action are highly effective drugs for primary and secondary prevention and treatment of thromboembolic complications, including atrial fibrillation, deep vein thrombosis, pulmonary embolism, and prosthetic heart valves. Anticoagulant therapy prevents the development of ischemic stroke in patients by 40-80 % and reduces mortality by approximately 30 %, but increases the risk of intracranial and extracranial bleeding by 66 %. Among the indirect anticoagulants in Ukraine, phenindione and 4-oxycoumarin derivatives - acenocoumarol and warfarin are used. This group of drugs is indispensable for long-term or even lifelong prevention of blood clots in certain pathological conditions, especially in cardiac surgery. Indirect anticoagulants accumulate in the body and can cause spontaneous bleeding and hemorrhage, which can be fatal. Fatalities from their uncontrolled use are known. That is why the decision to prescribe anticoagulants should be deeply reasoned and considered.

Materials and methods. Analysis of scientific literature and its interpretation were used.

Results. The general characteristics of anticoagulants of indirect action, features of their pharmacokinetics and pharmacodynamics, metabolism, cumulative effect are studied. It is established that the anticoagulants of indirect action include: warfarin, acenocoumarol, phenindione and neodycoumarin. The composition of drugs containing these substances was studied. Warfarin-induced skin necrosis has been studied as a rare special and unpredictable complication associated with high morbidity and mortality (in severe cases) and requires immediate discontinuation of warfarin treatment. Acquired coagulopathies have been studied as one of the syndromes of critical conditions, which are quite common in overdose of indirect anticoagulants, including warfarin. Other side effects from the use of indirect anticoagulants include hypersensitivity reactions, cholestatic jaundice, hepatitis, vasculitis, nausea and vomiting, diarrhea, and alopecia. In addition, there may be paradoxical thromboembolism with the development of purple finger syndrome

(cholesterol microembolization), skin necrosis, vascular calcification. proved that the nature of nutrition, as well as the use of certain drugs or dietary supplements can significantly affect the outcome of warfarin treatment.

Conclusions. Ehe toxicological safety of indirect anticoagulants needs to be studied more closely.

DEVELOPMENT OF METHODS FOR ISOLATION AND DETECTION OF IMIPRAMINE IN BIOLOGICAL FLUIDS

Maksym Kovalchuk
Scientific supervisor: assist. prof. **Sofiia Davydovych**, PhD

Keywords: imipramine, toxicity, screening, TLC-chromatography, UV-spectrophotometry.

Introduction. One of the common subjects of forensic medicine is chronic and acute poisoning by psychotropic drugs. Reports of poisoning by antidepressants, including imipramine, are quite common in the literature. In the current study, it was interesting to suggest simple and affordable methods for detecting and quantifying imipramine in human blood and urine.

Materials and methods. Research object is chemical-toxicological analysis of imipramine. Research subject: Detection and identification, quantification of imipramine in biological fluids, development of an algorithm for toxicological examination of biological objects for the presence of imipramine. Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. The possibility of TLC screening of imipramine was studied. Among the solvent systems recommended by TIAFT, the following systems were selected for the separation of imipramine, fluoxetine and amitriptyline: ethyl acetate, chloroform-methanol (9:1), chloroform-acetone (10:10) and ethyl acetate-methanol-25% ammonia (17: 2 : 1). The composition of confirmatory solvent systems is proposed. UV light (sensitivity 0.5, blue fluorescence) was used to detect imipramine spots, followed by treatment of the plates with Mandelin reagent (sensitivity 0.2 μg, purple spots). The nature of the UV spectra of imipramine depending on the nature of the solvent was studied and the specific and molar coefficients of light absorption in chloroform and methanol were determined. the relative error of the UV spectrophotometric method for the quantitative determination of imipramine in chloroform solutions is ± 0.71%. Methods of isolation of imipramine from blood and urine based on isolation of the drug with 30% acetic acid solution have been developed. Extraction is carried out with chloroform at pH 8 - 9. Using the method developed by us, 76.56 ± 2.05% of imipramine can be isolated from blood and 90.34 ± 1.59% of imipramine from urine.

Conclusions. An algorithm for toxicological examination of biological fluids for the presence of imipramine is proposed, which includes screening by thin layer chromatography, preliminary chemical tests and UV spectrophotometry to identify and quantify imipramine.

CHEMICAL – TOXICOLOGICAL INVESTIGATION OF CYCLOPENTOLATE

Maria Hrynyuh
Scientific supervisor: assoc. prof. **Yuriy Bidnychenko**, PhD.

Keywords: cyclopentolate, body fluids, quality test, solid-phase extraction, thin-layer chromatography

Introduction. There is currently a trend towards the abuse of some new cholinergic blockers, and the replacement of traditional drugs and psychoactive substances with less expensive and more affordable ones. For non-medical purposes, cyclopentolate is used in excess of the therapeutic dose several times to provoke the development of visual and auditory hallucinations and changes in emotional state. There is disorientation in space, distortion of speech and vision, memory lapses and other effects that are inherent in overdose of this drug.

Material and methods. Research object are body fluids. Methods: literature review, chemical tests, solid-phase extraction, thin-layer chromatography.

Results. A method of cyclopentolate isolation from biological fluids of the human body (blood and urine), which is based on the extraction with a mixture of chloroform-propanol-2 (9: 1) from alkaline samples was developed. A method of purification and concentration of extracts from biological fluids by solid-phase extraction with Oasis HLB cartridges has been developed. A method of cyclopentolate identification in extracts from body fluids using Wagner's, Dragendorff's, Mandelin's, Marquis, and concentrated sulfuric acid has been developed. A method of cyclopentolate identification in extracts from body fluids by thin-layer chromatography has been developed. To identify cyclopentolate, the mobile phase of methanol : ammonium hydroxide solution 25% (100 : 1.5) was used, and chromatograms were visualized by UV light followed by spraying with Dragendorff's reagent.

Conclusions. The proposed methods allow isolating, detecting and identifying cyclopentolate in objects of biological origin.

TOXICOLOGICAL FEATURES OF THE HOUSEHOLD CHEMICALS USING

Maria Denkovych
Scientific supervisor: assist. prof. **N. Darmohrai**, PhD

Keywords: household chemicals, synthetic detergents, surfactants, phosphates, eutrophication, enzymes, chlorine, toxicity, poisonings.

Introduction. Household chemicals are an indisputable achievement of modern civilization, however, the damage that these chemical compounds can cause to the human body is significantly underestimated. The main components of household chemicals are: phosphates, phosphonates, surfactants, triclosans, chlorine, petroleum distillates, phenols, formaldehyde and more. Information on their toxicity is limited to individual studies, which mainly focus on irritants and allergens, those effects that are easy to diagnose visually. In addition, household chemicals can pollute the air in the room, irritate the mucous membranes of the eyes, nose and throat, cause headaches and dizziness. At the same time detergents on a natural basis are limited.

Materials and methods. Analysis of scientific literature and its interpretation were used.

Results. The peculiarities of the negative impact of household chemicals on aquatic ecosystems (eutrophication, foaming, changes in water parameters) have been studied. The legislation of Ukraine in the field of using synthetic detergents and household chemicals has been studied. It has been established that household chemicals that contain surfactants can cause skin damage, causing dryness, erythema and edema, and in children - atopic dermatitis. Surfactants also can gradually accumulate in the brain, liver, heart, subcutaneous tissue, thereby continuing the impact on the human body for a long time and disrupting the physiological functions of the body. It has been studied that phosphates get on the surface of the skin together with washing powder and disturb the acid-base balance of skin cells, causing dermatological diseases. Accumulating on tissues and in the circulatory system, phosphates lead to changes in the physic-chemical properties of blood, iimmune dysfunctions, gastrointestinal tract dysfunctions, and even abortion. Synthetic fragrances of household chemicals have been found to be strong allergens and can cause headaches, irritation of the mucous membranes of the eyes, throat and nose, loss of coordination, feelings of anxiety and depression. It is studied that the symptoms of poisoning by household repellents and insecticides are manifested by lesions of the nervous system, convulsions, toxic encephalopathy, hepatotoxic effects, emotional disorders.

Conclusions. After analyzing the above materials, we need to take a more careful approach to the study of toxicological safety of household chemicals.

CHEMICAL-TOXICOLOGICAL ANALYSIS OF METFORMIN

Marianna Okka
Scientific supervisor: assist. prof. **Sofiia Davydovych**, PhD

Keywords: Metformin, overdose, fatal intoxication, TLC, GC/MS.

Introduction: Metformin is an agent belonging to the biguanide class of antidiabetics with antihyperglycemic activity. Metformin is associated with a very low incidence of lactic acidosis.

Materials and methods: A systematic search of PubMed and Google Scholar databases for publications on therapeutic monitoring of metformin in biological fluids. The following words and phrases were used as key words: " metformin ", "plasma", "therapeutic drug monitoring", "detection". Analysis of the literature shows that chromatographic methods for the quantitative determination of metformin have not been sufficiently developed.

Results: The possibility of using solid - phase extraction with modified silica gel on Oasis WCX cartridges to extract metformin from biological fluids has been investigated. Mixture of 25% ammonia-methanol solution (1:20, v/v) was used for eluation of metformin. The efficiency of isolation of metformin from biological fluids was 89.72%. Method for the quantitative determination of metformin by gas chromatography-massspectrometry has been developed (the method is linear in the concentration range from 1.0 μg / ml to 400.0 μg / ml; the relative uncertainty of the average result is ± 2.29%).

Conclusions: A fast, easily reproducible GC-MS method for the determination of metformin in substances, dosage forms and plasma samples has been developed. The advantages of the method include high reproducibility and expressibility. The possibility of application of the developed methods for quantitative determination of metformin in blood plasma after solid - phase purification is shown.

CHEMICAL - TOXICOLOGICAL ANALYSIS OF DEXTROMETHORPHAN

Mariia Homuk
Scientific supervisor: assist. prof. **Sofiia Davydovych**, PhD

Keywords: dextromethorphan, dextrorphan, toxic concentrations, intoxication, chromatography

Introduction: Dextromethorphan is an antitussive used in many over-the-counter cough and cold remedies. At high doses, dextromethorphan is classified as a dissociative general anesthetic and a hallucinogen similar to the controlled substances ketamine and phencyclidine. The active metabolite is dextrorphan, which is formed by O-demethylation of dextromethorphan. At

high concentrations of dextromethorphan and dextrorphan in the blood, the results of drug screening may be false positive, in which case the mass spectrometric method of analysis can confirm or deny the presence of substances.

Materials and methods: A systematic search was conducted in PubMed and Google Scholar databases for publications on the determination of dextromethorphan. Methods of UV spectrophotometry, thin-layer and gas-liquid chromatography have been studied for the identification and quantification of dextromethorphan in extracts from biological material.

Results: The possibility of using solid-phase extraction with modified silica gel on Oasis HLB 30 mg cartridges (Waters, USA) for extraction of dextromethorphan from biological fluids was investigated. The efficiency of selection was up to 95.5%. Methods for quantitative determination of dextromethorphan by UV spectrophotometry (linear method in the range of concentrations from 5.0 μg / ml to 30.0 μg / ml) have been developed.

The GC-MS method was used to confirm the dextromethorphan content. Dextromethorphan was identified by its molecular ion at m / z 271 and fragment ions at m / z 59 and 150. The calibration curve of dextromethorphan was linear from 100 to 2000 ng / ml with a correlation coefficient of 0.999. The limit of quantification of dextromethorphan was the first point of the calibration curve, 100 ng / ml, and the limit of detection of dextromethorphan, which was determined by the signal-to-noise ratio (S / N) = 3 and was estimated as 50 ng / ml in full scan mode.

Conclusions: Conditions for TLC screening of dextromethorphan in specific solvent systems have been developed. The mode of programming the temperature of the chromatographic column for the analysis of dextromethorphan by GC / MS method is proposed and the main regularities of the primary fragmentation of the drug are given. It was found that the limit of detection of dextromethorphan without prior derivatization in the SCAN mode is 50 ng / ml. Given the high specificity and selectivity of the GC / MS method, it is recommended to use it as an alternative method for the detection of dextromethorphan, in parallel with HPLC and UV spectrophotometry. The developed method of determination of dextromethorphan is suitable for the work of forensic departments.

TOXICOLOGICAL ASSESSMENT OF MEDICINAL PLANTS OF THE LANDSCAPE PARK "ZNESINNIA", LVIV CITY

Marta Tsviliuk
Scientific supervisor: assoc. prof. **L. Kostyshyn,** PhD.

Keywords: heavy metals, accumulation in plants, plant material, adaptation.

Introduction. Ecological monitoring of the dynamics of heavy metals in the components of urban ecosystems is relevant for assessing the ecological state of the environment and its pollution by metals. An important part of environmental monitoring is bio indication with the use of plants and other organisms. Therefore, an important scientific problem is the study of the ability of plants common in urban ecosystems to accumulate heavy metals.

The aim of the study was to analyse current scientific data on the bioavailability of metals for plants, the processes of their absorption, transport and accumulation in plant tissues, to consider the phytotoxic effects of metals and plant defence mechanisms.

Results. The research was conducted during 2021. Plants samples for research were taken at two sites in the Znesinnia Park, which is an object of the Nature Reserve Fund of Ukraine, a monument of landscape art of national importance. Herbal plants grown in the wild were selected for the study, namely Anemone Ranunculoides L and Tussilago farfara L. The content of Cd, Co, Cu, Zn, Ni, Pb in the phytomass of early flowering grassy species was analyzed by thin layer chromatography (TLC). The method is based on the formation of metal ion complexes from sodium diethyldithiocarbamate at pH 8-9 or pH 4-5 (for chromium), separation of the formed complexes from aqueous and model solutions with chloroform and subsequent thin layer chromatography. Chromatography was performed in a solvent system of benzene - chloroform (2: 1), detection was performed with 1% aqueous solution of phosphomolybdic acid, followed by activation at t = 100 - 120 ° C for 3 minutes The content of each substance was calculated by the formula. We found a relationship between the phytotoxicity of metals ($PhLD_{50}$) and their physicochemical properties. The relationship between the phytotoxicity of metals ($PhLD_{50}$) and the polarity of their dithizonates (μ) has been established.

Conclusions. The results of research show that the level of accumulation of individual metals in the two analysed plant species is different. It was found that in plant samples the concentration of Cu and Pb collected in the area affected by man-made impact is higher than in samples from areas with less technogenic impact, respectively, 1.6 and 1.7 times, and the content of other metals is not significantly differed.

TOXICOLOGICAL ASSESSMENT OF THE CHEMICAL COMPOSITION OF ELECTRONIC CIGARETTES

Matvii-Oleg Fedevych
Scientific supervisor: assoc. prof. **Iryna Halkevych**, PhD.

Keywords: E- cigarettes, GC, vapor-phase analysis

Introduction. The liquid for electronic cigarettes (also called e-liquid) contains a mixture of propylene glycol (PG) and glycerol (VG) in various ratios. The mixtures can contain nicotine and more than ten other substances with various functions also. These can affect the proper formation of smoke or have an influence on taste, etc. These substances are aldehydes, trace elements, volatile organic compounds, phenols, polycyclic aromatic hydrocarbons, and heavy metals. The aerosol inhaled by the user may contain several hundreds of different compounds, as some chemical substances are formed by thermal decomposition during evaporation: formaldehyde, acetaldehyde, acroleine and other.

The quality and quantity of the carbonyl compounds formed by vaporisation and in the subsequent reactions depend especially on the type of e-liquid used, on the heating temperature, and on the product design, as well as the construction of the e-cigarette. As regards the type of e-liquid, the quality and quantity of Carbone compounds depends on whether propylene glycol or glycerol is used as a base and whether flavourings are used.

Material and methods. Research object are two liquid for electronic cigarettes: FORPODS Fruit and Relx Pro Pods Forest Gems. Research subject: contents in e-liquids nicotine, PG, VG, formaldehyde, acetaldehyde and acroleine. Methods: literature monitoring, gas chromatography (GC), vapor-phase analysis.

Results. Acrolein, propylene glycol, formaldehyde, glycerol, acetaldehyde and nicotine were identified in the e-liquid aerosol by gas chromatography on the PH-1 capillary column. To quantify formaldehyde in the e-liquid aerosol, the procedure of vapor-phase preparation of the sample was used. It was found that with increasing temperature from 150 ^{o}C to 300 ^{o}C the level of formaldehyde concentration in the aerosol increases, which indicates the thermal decomposition of propylene glycol and glycerol.

Conclusions. Using the established GC method, we identified acrolein, propylene glycol, formaldehyde, glycerol, acetaldehyde, and nicotine and quantified formaldehyde in e-liquid aerosol. This method can be used for the qualitative and quantitative analyses of formaldehyde in vapor-phase of e-cigarettes liquid.

TOXICOLOGICAL ASSESSMENT OF THE CHEMICAL COMPOSITION OF HAIR MASKS

Nataliia Berko
Scientific supervisor: assist. prof. **Sofiia Davydovych**, PhD

Keywords: hair masks, chemical composition, toxicological assessment, chromatography.

Introduction. Depending on the functional purpose and the main consumer characteristics of hair masks, different combinations of active substances are used. Most products available on the domestic market use synthetic auxiliary components, so the study of their effects on the body is an urgent task.

Materials and methods. A comparative study of the composition of different types of face masks, the qualitative composition of their active ingredients and excipients. Different samples of face masks were taken from different manufacturers in different outlets. The toxicological safety of these products was assessed on the basis of analysis of the formulation and toxicological characteristics of its ingredients. To do this, we use HSDB, the database of the US National Library of Medicine (TOXNET) and IPCS-INCHEM, the database of the International Chemical Safety Program.

Results. It is established that the studied hair masks contain mainly substances safe for the human body. Although irritants or comedogenic substances found in some products were present in low concentrations, there is a risk of sensitization or significant skin irritation.

Only one of the cosmetic products (Weleda Oats Repair Mask, for dry and damaged hair) does not contain irritating components. The manufacturer also claims that the fragrances listed in the literature are of natural origin.

Conclusions. After analyzing the composition of other studied cosmetic hair masks, conclusions were made about the most common components of hair masks with irritating effect. Among them, special attention should be paid to silicones (dimethicone and amodimethicone), which are difficult to wash off hair and dry the skin. Preservatives used instead of parabens (methylchloroisothiazolinone and methylisothiazolinone, phenoxyethanol, propylene glycol, complexones) are considered to be quite strong allergens.

Based on available data, the composition of popular pharmaceutical hair masks available in pharmacies is safe for short-term use.

ANALYTICAL EVALUATION OF BIOLOGICAL (FOOD) SUPPLEMENTS WITH ANTI-INFLAMMATORY ACTION

Natalia Turash
Scientific supervisor: assoc. prof. **Iryna Halkevych**, PhD.

Keywords: harpagoside TLC, PTLC, HPLC

Introduction. Devil's claw is a common ingredient in nutraceutical products for the treatment of inflammation due to arthritis. The secondary root extract of *Harpagophytum procumbens* contains bioactive iridoid glycosides known as harpagosides. The root powders, water and ethanolic extracts is used as dietary supplements for arthritis treatment. Extract from the bark of the White Willow (*Salix alba*) is used in folk medicine for inflammation, pain, and fever treatment for many years. The principle component of the salix bark water extract is salicine – 2-(hydroxymethyl)phenyl-?-D-glucopyranoside, a human-metabolic precursor to salicylic acid. White Willow is used as a "value-added" constituent in a host of nutraceutical products.

Material and methods. Research object are nutraceutical products with anti-inflammatory action. Research subject: harpagoside and salicine. Methods: literature monitoring, TLC, PTLC, HPLC, microwave extraction.

Results. Qualitative analysis of the botanical root extracts and commercial Devil's claw extracts was made by High Performance Liquid Chromatography. Our work relate on the development of a simple, sensitive, and specific HPLC-UV method to quantify the bioactive ingredient – harpagoside, in *H. procumbens* DC. For separation of the biological-active compounds was used microwave extraction and preparative thin layer chromatography.

Preparations containing willow bark are popular herbal remedies, but they are mostly standardised with respect to only one compound (usually salicine). HPLC-DAD on C18-column eluted with fosphate buffer (pH 5/5) : methanol was used for the characterisation of dried bark in WhiteWillow.

Conclusions. Obtaines results indicate presence of of 7,35 – 7,42 mg salicyne in 400-mg casules and 13,49-13,82 mg in 800-mg capsules; or in percentage – 1,83 - 1,85 % and 1,68 - 1,72 % respectively. Proposed HPLC method allowed determining 32,472±0,027 mg of harpagoside in Dewil's claw extracts, and 13,056±0,045 mg in *H. procumbens* root powder**.**

CHEMICAL - TOXICOLOGICAL ANALYSIS OF DIETARY SUPPLEMENTS CONTAINING EPHEDRA

Olena Reminska
Scientific supervisor: assist. prof. **Sofiia Davydovych**, PhD

Keywords: ephedra, hidden ingredients, dietary supplement, detection, quantification.

Introduction: Ephedra and ephedrine are widely used for weight loss or enhanced athletic performance, but the efficacy and safety of these compounds are uncertain. Dietary supplements containing Ephedrine Alkaloids are adulterated because they present an unreasonable risk. A lot of dietary supplements were withdrawn from sale which was caused by the content of hidden ingredients not listed on the package.

Objective: to assess safety of ephedra used for weight loss and enhanced athletic performance and develop methods for detection of undeclared substances in ephedra-containing supplements.

Materials and methods: A systematic search of PubMed and Google Scholar databases for publications on safety of dietary supplements containing ephedra. In order to detect ephedrine in dietary supplements for weight loss, an analytical procedure was developed, which includes its extraction with ethyl acetate (pH) and the introduction of the extract into a gas chromatograph. The internal standard α-naphthylamine was used to minimize instrumental errors. Methods of UV spectrophotometry, thin-layer and gas chromatography have been studied to identify and quantify the active components of dietary supplements for weight loss in extracts from biological material.

Results: Ephedrine and its internal standard were found to be completely eluted from the column within 8 minutes. The calibration graph of the quantification of ephedrine remained linear in the range of 1.0 to 10.0 μg.

In total, we analyzed the composition of 7 supplements for weight loss. None of them contained undeclared substances. In addition to ephedra extract, each preparation contains compounds of toxicological significance. High doses of caffeine were present in each sample. In particular, four samples contained phenylethylamine (PEA) and synephrine / methylsinephrine, six - yohimbine, all listed on product labels. Two samples reported 1,3-dimethylamylamine (DMAA), which was banned by the FDA in 2012.

Conclusions: Of the tested products, 57.6% contained more ephedra alkaloids than indicated on the label, and 14.3% of supplements contained <90% of this amount. With regard to caffeine, 28.6% of batches of products containing the amount of caffeine contained less than 90% of that amount. No product contains more than 104% of the declared caffeine content. We conclude that product mismatches are common among some commercially available dietary supplements that contain the alkaloids ephedra and caffeine.

CHEMICAL-TOXICOLOGICAL INVESTIGATION OF GAMMA-BUTYROLACTONE AND ITS ANALOGUES

Solomiia Vovk
Scientific supervisor: sen. lec. **Serhiy Kramarenko**, PhD

Keywords: γ-butyrolactone and its analogues, γ-hydroxybutyric acid, chemical analysis, intoxycations, isolation, extraction, thin layer chromatography, gas chromatography.

Introduction. γ-butyrolactone is a chemical. People use it as drug. In humans γ-butyrolactone acts as a prodrug for γ-Hydroxybutyric acid, and it is used as a recreational CNS depressant. The most popular its analogues are γ-hydroxybutyric acid and its salts, and 1,4-butanediol. These substances people use as a recreational CNS depressant too. A lot of reports can be found in the literature about lethal intoxications with γ-butyrolactone and its analogues, with combined intoxications, γ-butyrolactone and its analogues misuse, especially γ-hydroxybutyric acid and its salts. Takin this into consideration, chemico-toxicological investigation of γ-hydroxybutyric acid and its salts is actual problem.

Materials and methods. Research object is γ-hydroxybutyric acid, its salts and biological samples poisoned this drug. Research subject: element of chemical development of γ-hydroxybutyric acid and its salts for identification, quatification and isolation of this substance. Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. The gas chromatography and thin layer chromatography methods were developed for identification of γ-hydroxybutyric acid and its salts in pharmaceutical formulations and samples from biological liquids. Four eluent system, which recommended for systematic analysis in forensic toxicology, for determination of dextromethorphan in biological samples: methanol-25% ammonia solution (100:1.5), cyclohexane-toluene-diethylamine (15:3:2), chloroform-methanol (9:1) and ethyl acetate-methanol-25% solution of ammonia (17:2:1) were used. Determination was developing on "Sorbfil" plates. γ-hydroxybutyric acid identification can be achieved with such reagents: Dragendorf, Wagner, Bushard, Marquis, Frede, Mandelin, potassium permanganate in 0.1 M sulfate acid, solution iron trichloride. The gas chromatographic method was used for γ-hydroxybutyric acid quantification. This method based on reaction between γ-hydroxybutyric acid and BSTFA reagent. Limit of γ-hydroxybutyric acid detection is 5 μg/ml. Linearity of calibration curve is in concentration range 5-70 μg/ml. The proposed method was successfully applied to biological samples for γ-hydroxybutyric acid analysis. Relation between pH and γ-hydroxybutyric acid extraction amount was investigated. This substance was extracted in high quantities from acid

solutions. The WHO recommended techniques were used for γ-hydroxybutyric acid isolation from blood and urea samples.

Conclusions. The techniques for identification, quatification and isolation of γ-hydroxybutyric acid were developed and demonstrated good results.

TOXICOLOGICAL EVALUATION OF DIETARY SUPPLEMENTS AND HERBAL MEDICINES FOR THE ERECTILE DYSFUNCTION TREATMENT

Solomia Ivanets
Scientific supervisor: assist. prof. **Liudmyla Osypchuk**, PhD

Keywords: erectile dysfunction, herbal medicines, dietary supplements, toxicology, safety.

Introduction: Erectile dysfunction (ED) is a common disease in the modern world. Patients with erectile disfunction usually start treatment with medicines (drugs) or dietary supplements (DS) of plant origin, because natural ingredients are often considered safer and easy to buy without a prescription. Despite pharmalogical action plant biologically active substances can cause unwanted side effects and show certain types of toxicity. Fake dietary supplements containing PDE-5 inhibitors are also dangerous. Therefore, conducting toxicological evaluation of drugs and dietary supplements on a plant basis for the treatment of erectile disfunction is an urgent task.

Materials and methods: objects of research – herbal medicines and DS for the treatment of ED. Subject of research: toxicological assessment. Methods: literary search, critical analysis, interpretation of collected information.

Results: For the treatment of erectile disfunction in Ukraine there have been registred four herbal medicines: Yohimbine hydrochloride, Verona, Tribestan and ginseng tincture. The search for DS available in pharmacies was performed using the online service Tabletki.ua. To provide toxicological assessment of plant-based DS and drugs for the treatment of ED, scientific publications containing information on the toxicity of plants that are most common in their composition: tribulus terrestris, yohimbe, ginseng, ginkgo biloba, eurycoma longifolia. It was found that in case of overdose, all these plants are hepatotoxic. In addition, Tribulus terrestris are characterized by nephrotoxicity and neurotoxicity. Nephrotoxicity, neurotoxicity and cardiotoxicity have been reported in yohimbe. Ginkgo biloba is nephrotoxic, neurotoxic, can cause bleeding. In vitro experiments have also shown carcinogenic, cytotoxic, teratogenic, genotoxic and mutagenic effects of ginkgo biloba; carcinogenicity has been confirmed in rodent studies. Ginseng provokes

neurotoxicity, cardiovascular disorders, bleeding and allergic skin reactions. Eurycoma longifolia increases testosterone levels and has a genotoxic effect. Ginseng has been shown to increase the effect of sedatives and inhibit anticoagulants, while ginkgo biloba potentiates the effects of drugs that affect blood clotting and reduces the effects of drugs that are substrates for CYP2C19. The problem of plant-based DS falsification for the treatment of ED with PDE-5 type inhibitors and their analogues is relevant for the whole world. Patients' lack of information about the presence of PDE-5 inhibitors, given the possible absolute contraindications to their use, has dangerous health consequences.

Conclusions: Toxicological assessment of plant-based drugs and DD for the treatment of ED registered in Ukraine, presented on the online service Tabletki.ua, was carried out. The toxicological profile is formed on the basis of information on the toxicity of individual plant components that are part of them, obtained from scientific literature sources.

CHEMICAL - TOXICOLOGICAL INVESTIGATION OF PROPOXYPHENE

Sofia Fartuh
Scientific supervisor: assoc. prof. **Yuriy Bidnychenko**, PhD

Keywords: propoxyphene, body fluids, QuEChERS, quality test, thin-layer chromatography

Introduction. Propoxyfen is a centrally acting narcotic analgesic, which is part of the analgesic drug "Spazmolex". In addition to its main pharmacological effects, it has a high addictive potential. Therefore, drug addicts take it to alleviate the state of withdrawal after the use of tramadol, artisanal acetylated opiates, as well as vicarious anesthesia. Dextropropoxyphene abuse has been widespread in Ukraine since the 1990s. This is one of the most common "club" drugs, which is very popular among young people.

Material and methods. Research object are body fluids. Methods: literature review, chemical tests, QuEChERS extraction, thin-layer chromatography.

Results. A method of propoxyphene isolation from biological fluids of the human body (blood and urine) using liquid extraction from an alkaline environment has been developed.

A QuEChERS method of biological fluids samples preparation for forensic-chemical and toxicological investigation of propoxyphene was applied.

A method of propoxyphene identification in extracts from body fluids by reactions with cobalt thiocyanate solution, Mandelin's, Marquis, Froehde's, and Mecke reagents has been developed.

Thin-layer chromatography method for propoxyphene identification in extracts from body fluids has been developed. The development of the chromatograph was carried out in a system of solvents methanol - 25% ammonia solution (100 : 1.5), and the chromatograms visualized with Dragendorff's and Marquis reagents.

Conclusions. Propoxyphene and (according to our assumption) nor-propoxyphene can be detected in biological fluids by thin layer chromatography. Confirmatory study should be performed by gas-liquid chromatography or high-performance liquid chromatography.

TOXICOLOGICAL EVALUATION OF HERBAL TEAS

Sofiia Fedaniak
Scientific supervisor: assoc. prof. **L. Kostyshyn**, PhD

Keywords: heavy metals, accumulation in plants, plant material, adaptation.

Introduction. The high level of technogenic impact on agricultural landscapes in recent years leads to increased levels of pollution by heavy metals, which are among the most harmful to the environment chemical pollutants. Heavy metals are transferred with a pronounced cumulative effect, due to which their toxicity may manifest itself suddenly in certain parts of the food chain. Due to the intensification of anthropogenic impact on ecosystems, the number of centers suitable for the collection of ecological medicinal raw materials is catastrophically declining. The aim of the study was to analyse the quantitative content of heavy metals in herbal teas, which include plant raw materials and to establish the features of their accumulation.

Results. The subject of our research were five types of plant raw materials that are part of express packages of herbal teas, namely Mint (Mentha piper?ta L.), Melissa (Melissa officinalis L.), Chamomile (Matricaria chamomilla A.), Echinocea (Echinacea purpurea A.), Linden (Tilia cordata Mill.). The average weight of plant samples for the study was ~ 300 g (content of 10 express packages).The content of heavy metals in the samples was determined in their ash solutions by atomic absorption spectrometry on the device - spectrometer AAS-115 PC with electrothermal atomizer. Mineralization of plant samples is carried out by dry aching. Determination of the content of Cu, Zn, Pb, Cd is carried out in an ash solution after mineralization of the analysed material. The metal content in the studied plant samples was calculated by the formula. The data show that different species of

plants accumulate different heavy metals in different ways. The largest accumulation of heavy metals was found in the tissues of small-leaved linden. Concentrations of copper, cadmium and zinc do not exceed the maximum permissible concentrations of heavy metals allowed in vegetable raw materials. But there is an increase in the concentration of lead in linden, which exceeds the permissible values by 1.6 times.

Conclusions. The obtained results explain a clear relationship between the content of heavy metals in plant products and environmental pollution. Probably such data can be explained by the fact that plant raw materials were collected in places bordering on the existing heavy traffic or existing pollution in the area where the plants were collected.

RESEARCH OF THE VITAMIN CONTENT IN COSMETICS

Tetjana Kolodzinska
Scientific supervisor: assoc prof. **Yuriy Bidnychenko**, PhD

Keywords: lotion, nicotinamide, quality test, photocolorimetry

Introduction. The use of nicotinamide in skin care products is a trend in recent years in cosmetics. Based on the data of the scientific literature, the prophylactic and therapeutic effect of nicotinamide in dermatology is considered. There are currently no methods of quality control of nicotinamide lotions.

Material and methods. Research object are liquid skin care products with nicotinamide. Methods: literature review, chemical tests, photocolorimetry.

Results. Domestic and foreign special literature on the availability of methods for detection and determination of nicotinamide in cosmetics for skin care. Methods of nicotinamide detecting in cosmetics using chemical tests with Dragendorf reagent, Sonnenstein reagent, cyanbromide reagent and aniline, and with 2,4-dinitrochlorobenzene in alkali. A photocolorimetric assay of nicotinamide determination in skin care lotions based on the reaction of nicotinic acid with rhodanide bromide and aromatic amines has been developed.

Conclusions. Nicotinamide content in lotions for skin care was determined using the developed photo colorimetric method. The nicotinamide content is in the range from 2% to 5%.

TOXICOLOGICAL FEATURES OF AGROCHEMICALS AT FARMS USING

Tetyana Svyshch
Scientific supervisor: assist. prof. N**. M. Darmohrai**, PhD

Keywords: agrochemicals, organophosphorus compounds, synthetic pyrethroids, agriculture, toxicity, poisonings.

Introduction. Most agrochemicals are biologically active substances that act not only on the objects against which they are used, but are also potentially dangerous to the environment and human health. The use of agrochemicals to protect plants from pests is an integral part of modern technologies for growing crops. At the same time, these compounds have a negative impact on the environment, leading to a reduction in biodiversity. In addition, agrochemicals have a negative impact on human health, both as a result of direct action and indirectly due to the accumulation of residues in agricultural products and drinking water. In recent decades, agrochemicals have been one of the main causes of acute and chronic poisoning among agricultural workers, among the population in household use as insecticides, as well as in accidental or intentional. This requires emergency medical care, accurate diagnosis, effective treatment and prognosing intoxication effects.

Materials and methods. Analysis of scientific literature and its interpretation were used.

Results. The normative documents regulating the transportation, storage and application of agrochemicals have been studied. Types of classifications of agrochemicals by chemical structure, purpose and degree of toxicity have been studied. The composition of preparations of modern agrochemicals by chemical structure has been studied: organophosphorus compounds (pyriphos-methyl, dimethoate, phosalone, chlorpyrifos, malathion), organochlorine compounds, carbamic acid derivatives (propoxur, carbofuran), synthetic synthetic pyrethroids (deltamethrin, permethrin, cypermethrin, bifenthrin). It was found that the clinical picture of acute organophosphorus poisoning is dominated by symptoms of general resorptive action (damage to the central nervous system, visual organs, cardiovascular system, digestive tract, respiratory system, skeletal muscles). It has been studied that all organochlorine agrochemicals are strong protoplasmic poisons and have a general toxic, polytropic effect on the human body. It has been established that the picture of acute pyrethroid poisoning in humans is dominated by symptoms of nervous system damage (signs of mesencephalic disorders, convulsions, toxic encephalopathy, tremor), as well as emotional and volitional disorders.

Conclusions. Taking into account the trend of expanding the range of agrochemicals and the data on their toxicity, more attention should be devoted to their safety for human health.

TOXICOLOGICAL CHARACTERISTICS AND CHEMICO-TOXICOLOGICAL ANALYSIS OF TROPICAMIDE

Tetiana Chernetska
Scientific supervisor: sen. lec. **Serhiy Kramarenko**, PhD

Keywords: Tropicamide, antagonist of muscarinic acetylcholine (mACh) receptors medicines, chemical analysis, intoxycations, isolation, extraction, thin layer chromatography, spectrophotometry.

Introduction. Tropicamide is an alkaloid atropine derived anticholinergic drug and a nonselective antagonist of muscarinic acetylcholine receptors. Usually available in ophthalmic formulations, tropicamide is used to cause mydriasis and cycloplegia for eye exams or ocular procedures. It is also used in combination with [hydroxyamphetamine] for the same indication. A lot of reports can be found in the literature about lethal intoxications with Tropicamide, with combined intoxications, topical abuse of ophthalmic solutions has been reported, but intravenous (IV) abuse of tropicamide seems to be a new phenomenon.

Takin this into consideration, chemico-toxicological investigation of Tropicamide is actual problem.

Materials and methods. Research object is Tropicamide and biological samples poisoned this drug. Research subject:element of chemical development of Tropicamide for identification, quatification and isolation of this substance. Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. The UV-spectrophometry and thin layer chromatography methods were developed for identification of Tropicamide in pharmaceutical formulations and samples from biological liquids. The spectrum of Tropicamide in acid solution is characterised by one absorbtion maximum at wavelength 256 nm. Four eluent system, which recommended for systematic analysis in forensic toxicology, for determination of Tropicamide in biological samples: chloroform-acetone (4:1), ethyl acetate, chloroform-methanol (9:1) and ethyl acetate-methanol-25% solution of ammonia (17:2:1) were used. Determination was developing on “Sorbfil” plates. Tropicamide identification can be achieved with such reagents: Marquis, Dragendorf, Mandelin, potassium permanganate in 0.1 M sulfate acid and 1% ninhydrine solution. The visible spectrophotometric method was used for Tropicamide quantification. Limit of Tropicamide detection is 50 μg/ml. Linearity of calibration curve is in concentration range 50-400 μg/ml. The proposed method was successfully applied to biological samples for Tropicamide analysis. Relation between pH and Tropicamide extraction amount was investigated. This substance was extracted in high quantities from acid solutions. The WHO recommended techniques were used for Nimesulide isolation from blood and urea samples.

Conclusions. The techniques for identification, quatification and isolation of Tropicamide were developed and demonstrated good results for Nimesulide determination in biological samples.

CHEMICAL-TOXICOLOGICAL INVESTIGATION OF PSYCHOTROPIC DRUGS – NEUROTRANSMITTER REUPTAKE INHIBITORS

Vasyl Horban
Scientific supervisor: assist. prof. **N. M. Darmohrai**, PhD

Keywords: psychotropic drugs, neurotransmitter reuptake inhibitors, depression, chemical-toxicological investigation, side effects, toxicity, poisonings.

Introduction. According to a number of international organizations, including the WHO, depression in the coming years will be one of the first places in the world, ahead of cardiovascular disease. Pharmacotherapy remains the main method of control and correction of this group of diseases, in particular psychotropic drugs of neurotransmitter reuptake inhibitors. Under certain conditions, these drugs can have side effects associated with cardiotoxicity and their ability to lead to suicidal intention, especially in adolescents. Cases of chronic overdose, as well as acute and fatal poisoning by neurotransmitter reuptake inhibitors have been reported worldwide. Systematic chemical and toxicological study of neurotransmitter reuptake inhibitors is relevant, taking into account their physic-chemical properties and toxicokinetic characteristics using modern methods of analysis and sample preparation, which are implemented in domestic practice of toxicological research.

Materials and methods. Analysis of scientific literature and its interpretation, modern physic-chemical research methods (thin layer chromatography, UV spectrophotometry) were used.

Results. The general characteristic of psychotropic drugs and their classification is developed. The main mechanisms of action of neurotransmitter reuptake inhibitors are studied. The composition of drugs of these psychotics according to the State Register of Medicinal Products of Ukraine has been developed. We have found that the most common side effects of the study drugs are gastrointestinal, insomnia, anxiety, tremor, sexual disorders, aggression and many others. In simultaneous use of psychotropic drugs of different groups serotonine syndrome is happened and in sudden discontinuation of therapy or decrease in a dosage - a withdrawal syndrome. Fatalities from the use of study drugs in overdose, suicide or in combination with other psychotropic drugs have been studied. The peculiarities of chemical and toxicological study of neurotransmitter reuptake inhibitors, isolation from

biological objects, methods of detection and quantification in extracts from biological material have been studied. A method of isolation of atomoxetine from urine has been developed. A method of cleaning urine extracts by thin layer chromatography is proposed. Methods of identification of atomoxetine isolated from urine by UV spectrophotometry and thin layer chromatography are offered.

Conclusions. The results of research can be used in screening studies of extracts from biological material for the presence of atomoxetine.

TOXICOLOGICAL EVALUATION OF SWEETENERS AND SUGAR SUBSTITUTES

Yelyzaveta Mykhalchenko
Scientific supervisor: assist. prof. **Liudmyla Osypchuk**, PhD

Keywords: sweeteners, sugar substitutes, toxicology, safety.

Introduction: sugar substitutes and sweeteners are a group of food additives used to impart a sweet taste to food. The use of these products can improve the quality of life for people with diabetes and people who control their weight. Given that sugar substitutes and sweeteners are chemical compounds and a part of a lot of foods and beverages, their toxicological evaluation is an urgent task.

Materials and methods: theoretical analysis and generalization of the received information from normative-technical and scientific-methodical literature. Materials from PubChem, Drugbank, PubMed, and Google Scholar databases on physical and chemical properties, metabolism, and side effects of sugar substitutes and sweeteners were used.

Results: All sugar substitutes affect the intestinal microbiota, and in excess of the recommended doses cause disorders of the gastrointestinal tract. Artificial intense sweeteners, including aspartame and saccharin sodium, have the greatest toxicity. Aspartame has carcinogenic, nephrotoxic, hepatotoxic effects and can cause neurological and behavioral disorders, it adversely affects the intestinal microbiota and is prohibited during pregnancy. The use of aspartame for patients with phenylketonuria is especially dangerous. Sodium saccharin is hepatotoxic and nephrotoxic, it has a carcinogenic effect in rats and mice, may cause anaphylactic reactions and obesity; is prohibited for use during pregnancy and lactation. The safest, at the recommended doses, are natural intense sweeteners: thaumatin, neohesperidin dihydrochalcone, and steviol glycosides.

Conclusions: Data from the scientific literature and electronic databases DrugBank, PubChem, PubMed, and Google Scholar on physical and chemical properties, metabolism, side effects, and various types of toxicity of sugar

substitutes and sweeteners were processed and summarized. On the basis of the received information, the toxicological assessment of sugar substitutes and sweeteners is given.

AUTHOR INDEX

Y

Z