

## 2019 № 1

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## Review

### NEW CODING SEQUENCES FORMATION BY VIRUSES WITH THE HELP OF HORIZONTAL TRANSFER AND GENE DUPLICATION

7-11

Popov N. N., Sklyar N. I., Kolotova T. Yu., Davidenko M. B., Voronkina I. A.

Besides the gene co-optation discussed in the previous article, viruses are able to form the cellular genome through horizontal gene transfer and by the copy number increase of the cellular genes with the help of amplification or retrocopies production. Previously horizontal transfer was thought to be a rare event. But genome sequence data for a wide range of organisms together with new analytical tools enable to detect a large number of horizontal gene transfer events across eukaryotes species. Many of these transfers have generated evolutionary novelties. Therefore it has been suggested that horizontal transfer of DNA may be an important evolutionary force shaping eukaryote genomes. However, the vectors involved in horizontal transfer of DNA between eukaryotes are poorly understood. Viruses have been proposed as candidate vectors for DNA transfer. Really they are transmitted horizontally, infect a variety of taxa, replicate inside host cells, some have a host genome integration stage and some viruses have germ cells tropism which allows transmission to the progeny. Despite these only limited but growing number of evidence argues that viruses could serve as horizontal transfer vectors between species. In this review we summarized these data. Many genes of large double-stranded DNA viruses have a cellular origin, suggesting the host-to-virus horizontal transfer of DNA. Indeed it has been identified a continuum influx of cabbage looper genetic material in baculoviruses genome. Furthermore at least 21 of the cabbage looper transposable elements integrated into baculoviruses genomes underwent repeated horizontal transfers between various insect species. These data identify potential recurrent gene flow both in virus-to-host and host-to-virus direction. Another example host RNAs encapsidation in the virions of single-strand RNA viruses. Gene duplication is a major driver of organism evolution. Gene retroposition is a mechanism of gene duplication whereby a gene's transcript is used as a template to generate retroposed gene copies. A genome-wide study across a fruit fly, mosquito, zebrafish, chicken, mouse, and human shows that LTR retrotransposons capable of creating retrocopies across a wide range of eukaryotes, which could subsequently evolve to be neofunctionalized retrogenes. Moreover it has been found a significant association between two retroviruses and lineage-specific gene family expansions in the human and mouse genomes. Altogether these data indicate that viruses, once considered as purely junk and selfish sequences, have repeatedly been used as a source of novel protein-coding genes during the evolution of eukaryote.

**Keywords:** endogenous retroviruses, horizontal transfer of genetic information, baculovirus, herpesvirus, alfanodaviruses, virus-like particles, gene duplication, gene retrocopies.

## Experimental works

### PARASITIC STAGES ISOLATION FROM SOIL SAMPLES OF KIRKUK TECHNICAL COLLEGE

12-16

Hiro M. Obaid.

**Introduction:** Soil is an influential source of human diseases, including parasitic infections. Parasitic diseases represent a potential risk factor on human health and his belongings. This study aimed to evaluate soil contamination level with parasitic stages of soil samples from Kirkuk Technical College. **Methods:** 110 soil samples were collected from various sites of Kirkuk Technical College by simple random selection. The samples were scanned by direct wet mount, sedimentation, floatation, Modified acid-fast stain and Baermann method. **Results:** The overall rate of parasitic contamination was 23.63%. The most prevalent parasite stage was *Toxocara sp.* eggs with rate of 7.3%, followed by *S. stercoralis* larva with rate of 5.5%. Concentration technique was more effective in detecting soil parasites comparing with the other used methods. Parasites prevalence was approximately similar in both Autumn and Winter months. Soil parasites were more existed in acidic and moist soil samples. **Conclusions:** Different helminthic and protozoan stages are contaminating soil samples of Kirkuk Technical College; these stages can effectively be detected by concentration method. **Recommendations:** Efforts are better to be directed toward eliminating these parasites through using appropriate ways for waste handling and controlling stray dogs, cats and rodents in the college. More investigations are required on parasitic prevalence among this college staff and students.

**Key words:** Parasitic stages, Isolation, Soil samples, Kirkuk.

### A STUDY OF THE INFLUENCE OF SOLVENTS ON CRYSTALLOGRAPHIC CHARACTERISTICS OF LOCAL ANESTHETICS

17-22

Kovalevska I.V., Borko Ye. A., Poluian S.M.

**Introduction.** Esters of para-aminobenzoic acid (PABA) – benzocaine and substituted amides – lidocaine and trimecaine are used in suppositories as substances with anesthetic effect. When benzocaine is used to reduce pain the effect develops for 1 minute after applying of rectal dosage forms and lasts for 20-30 minutes. The maximum effect of lidocaine is manifested within 15-30 minutes after using the medications. Trimecaine is absorbed rapidly and has a period of action of 60 minutes, but in the presence of inflammation, it is possible to decrease the anesthetic activity. The above local anesthetics have a low toxicity, which is an essential aspect in the formation of medications. **Material &**

**methods.** The study objects were benzocaine (Changzhou Sunlight Pharmaceutical Co., Ltd., China), lidocaine hydrochloride (Societa Italiana Medicinali Scandicci srl (S.I.M.S. srl), Italy) and trimecaine hydrochloride (Interpharma Praha, a.s., Czech Republic). Definition of crystallographic characteristics in a solvent was carried out a microscopic method using a Konus Academi Microscope of Italian production with a DLT-Cam Basic 2MP camera. DLTCamViewer™ software was used to visualize images for definition of the shape and size of particles over time. The solvents used to have different dielectric conductivity: (water - 78.3, propylene glycol - 32.0, ethanol - 25.2, macrogol -400 - 14.1, witepsol - 2.5). The crystallographic characteristics of the substance established on value of the Fere's diameter (Df) and shape factor (k). The statistical processing of result carried out in accordance with the requirements of the SPhU using the software Microsoft Excel 2007. **Results** of the study are showing that the form and size of benzocaine, lidocaine, trimecaine significantly differ from each other. Benzocaine has volumetric particles, which are close to the rectangular shape, with a linear size of 0.5 to 7 µm in maximum measurements,  $k = 0.2 - 0.5$  µm,  $Df = 2$  µm, with an uneven surface and numerous debris. Lidocaine has particles that are capable of agglomeration, linear size 0.1-1.2 µm,  $k = 0.4$ ,  $Df = 0.6$  µm. In the sample of trimecaine there is a uniform distribution of transparent particles that are close to the rectangular shape, capable of agglomeration, with a linear size of 0.05-1 µm,  $k=0,7$ ,  $Df = 0,9$  µm. The resulting data are confirmed by the results of the dispersion analysis of the particle size distribution, shown that to the law of normal distribution is obeyed in a sample of trimecaine. The differential curve of this substance has one maximum similar to a fraction with a particle size of 0.1-0.2 µm. In other samples, the height of the maximum are reducing, the curve becomes more stretched, that indicating about their polydispersity. Lidocaine has the largest area between the differential curve and x-line (Fig. 2), which indicates that it has almost equally particle ratio of all fractions. In a sample of benzocaine, a fraction with size of 0.5 µm is prevailing. The obtained results show the dependence of the samples of dissolution degree on the index of dielectric conductivity. Thus, the solubility of the witepsol decreases with increasing dielectric conductivity and reaches maximum at 2.5. The property of the dissolution of lidocaine and trimecaine is different - the solubility increases with increasing dielectric conductivity, the maximum dissolution at 78.3. Taking into account the obtained data, we can conclude about advisability of benzocaine introduction into suppositories in the form of a solution in the environment with dielectric permittivity to 2.5 and for lidocaine and trimecaine in the range 25-78. The substance can be introduced by suspension in the environment with different dielectric permittivity.

**Keywords:** benzocaine, lidocaine, trimecaine, solubility, shape factor, sphericity.

## ANALYSIS OF CYTOKINES LEVELS IN PATIENTS HAVING HAV DEPENDING ON GENOTYPE AND A PERIOD OF DISEASE DURATION

23-30

**Maliy V.P., Asoyan I.N., Bojko V.V.**

**Introduction.** This article is devoted to the research of connection between different viral Hepatitis A genotypes revealed in Ukrainian territory and peculiarities of the main cytokines production. (ФНП a IJ-2 IJ-4). **Material & methods.** During the dissertation 141 patients having HAV (BГA) were examined. The medical check-up was conducting in the next dynamic: on the inflammation stage and in the early recovering period. Molecular-genetic investigations were carried out with IJIP(PCR) method. Genotyping was conducting with the help of restrictive fragment length polymorphisms analysis method. In IJ 2 IJ 4 ФНА a researching were applied such testing systems as ООО Протеиновый контур (Russia St.-Petersburg). Analysis of statistics and processing results were made with the help of the following program Statistika for Windows (Stat Soft Inc USA). **Results & discussion.** During cytokines levels research on the inflammation stage of disease depending on BГA genotype was revealed that the patients with 3 A genotype were marked with significant increase in anti-inflammatory ФНП a concentration by 1.6 (p 0,001) times and regulating IJ 2 by 3.1 (p 0,001) times and decrease anti-inflammatory IJ-4 by 2,3 (0,001) times as well in comparison with patients having 1 A genotype. When analysing rank structure of cytokines deviation degree in groups with different genotypes BГA (HAV) was found out that the first rank in 1 A BГA group possesses increase of IJ 2 level and the last rank in this category has increase of ФНП a. It's exactly the opposite situation for patients with genotype 3 A BГA –they have increase of ФНП a level on the dominate rank position and IJ-2 belongs to the last rank category. Total results indicate on the relations between BГA(HAV) genotype and functional specification of cytokines link. In this case according to the table 1, the potential difference between 1 A and 3 A lies in IJ-4 production. Taking into account that IJ-4 is produced by Tx2 Lymphocytes and IJ-2 by Tx1 Lymphocytes there was undertaken the analysis in order to elect the character of Tx1/Tx2 balance in the ratio of IJ-2 /IJ-4 indexes. It implies that the state of cytokines exchanges that patients with genotype 3 A have shows us the prevailing of Tx2 Lymphocytes response and developing of cell-mediated immune protection defect. Comparisons between cytokines indexes in patients with different genotypes BГA during the early recovering stage revealed that patients with 3 A genotype in comparison with ones having 1 A genotype own much higher level of IJ-4 amounts (p 0,005) increased thus by 1.7 times and inaccurate growing of ФНП a (p 0,05) and decrease of IJ-2 (p 0,05). When analysing rank structure of cytokines deviation degree in groups with different genotypes BГA on the early recovering stage it was revealed that their difference lies in rank positions IJ-2 and IJ-4. If 1 A genotype patients have significant increase of IJ-2 amounts and thus it takes the first rank, then decrease of IJ-4 amounts takes the second rank. According to 3 A genotype patients-they have increase of IJ-4 amounts on the first rank position and increase of IJ-2 takes the second position in the rank position. This represents the existence of specific metabolism of cytokines and BГA genotype. Prevailing of Tx2 Lymphocytes in 3 A genotype patients unfolds probably the developing of cell-mediated immune protection defect and it also likely acts the role of the unfavourable BГA duration predictor. **Conclusion.** Learning cytokines status in BГA patients has revealed the essential differences depending on the genotype. Thereby 3 A genotype patients in comparison with 1 A genotype ones have more emphasized (p 0,001) cytokines level deviation from controlling indicators on the inflammation stage. The main features of IJK homeostasis disbalance is in the following things: 1 A genotype patients have predominance of IJ-2 over IJ-4 and Contrariwise 3 A genotype patients have predominance of IJ-4 over IJ-2. This fact gives evidence of the developing of cell-mediated immune protection defect. 3 A genotype patients in comparison with 1 A genotype patients are identified as having rapid growth of normal amounts of cytokines in blood serum and this leads to the protracted disease stage.

**Key words:** hepatitis A, genotype, cytokines, diagnostics.

## IN VITRO ANTIMICROBIAL STUDY OF NEW MODIFICATIONS OF SALVIA OFFICINALIS EXTRACTS

31-35

**Verkhovodova Y.V., Kireyev I.V., Koshoyi O.M., Osolodchenko T.P.**

**Introduction.** During treatment with antibiotics and up to 12 weeks after its completion, in 5-30 % of patients antibiotic-associated diarrhea is recorded. It arises in connection with the treatment of antibiotics, without other obvious causes, including acute violation of normal intestinal flora. The most common cause of antibiotic-associated diarrhea among children and adults is *Clostridium difficile*. *C. difficile* infection is associated with significant morbidity and mortality. In the case of clostridial infection, antibacterial therapy with metronidazole, vancomycin, rifaximin, fidaxsomylin, which has a number of side effects; there is also a fact of development of microorganism resistance. Actual issue of pharmacy is a development of a safe plant antimicrobial agent. **Materials and methods.** Extracts were obtained at the Department of Pharmacognosy of the National University of Pharmacy (Kharkiv, Ukraine) and provided for study. The antimicrobial activity of derivatives of salivary grass extracts was determined in the Laboratory of Biochemistry and Biotechnology of the Mechnikov Institute of Microbiology and Immunology (Kharkiv, Ukraine) in vitro experiment using the method of diffusion in agar - "the method of wells", which is based on the ability of the active substance to diffuse into agar with a standard test culture. The results obtained with this method allow characterizing the antimicrobial activity of the test sample, as the zones of growth retardation of microorganisms are formed due to the diffusion of biologically active substances into a dense nutrient medium. It was found that extract No 1 had high activity and delayed the growth of *Staphylococcus aureus* ATCC 26923 to 22-23 mm. At the same time, this extract was maximum effective towards the

representatives of gram-positive microflora, and reduced the activity of the gram negative microflora, the growth retardation zone in *Escherichia coli* ATCC 25922 and *Proteus vulgaris* ATCC 4636 is 16-17 mm. The smallest sensitivity among the studied strains was *Pseudomonas aeruginosa* ATCC 27853. Effect on pathogenic mushrooms, which was *Candida albicans* ATCC 885/653, was also sufficiently sensitive. When modifying the extract by increasing the amount of phenolic compounds and amino acids, we received a multi-directional action. Thus, the inclusion of arginine in the complex of phenolic compounds did not significantly affect the antimicrobial action. The inclusion of amino acid L-lysine to phenolic complex increased the antimicrobial and antifungal activity and slightly decreased the antimicrobial effect in relation to the representatives of gram-negative flora. **Conclusions.** 1) For the first time, extracts of *S. officinalis* in most have antimicrobial activity at the level of weakly active or active substances. 2) The inclusion of L-lysine phenolic complex provided more pronounced antimicrobial effect on most strains in comparison with phenolic complex. 3) Derivatives of *S. officinalis* extracts are promising objects for further study of anti-inflammatory activity as potential effective substances for the treatment and prevention of infectious intestinal diseases.

**Keywords:** *Salvia officinalis*, antimicrobial, extracts, in vitro

36-39

## ANTIBACTERIAL ACTION OF THE PHYTOSUBSTANCES FROM *LEDUM PALUSTRE* SHOOTS

Tolmachova K.S., Kireyev I.V., Osolodchenko T. P., Koshoviy O.M., Upyr T.V.

**The aim of the research** is to study the antibacterial activity of phytosubstances from *Ledum palustre* shoots. **Materials and Methods.** The study objects were 8 phytosubstances from *Ledum palustre* shoots. The study of the antibacterial activity of phytosubstances with *Ledum palustre* was performed at the premises of Mechnikov Institute of Microbiology and Immunology of the NAMS of Ukraine in the Laboratory of Biochemistry and Biotechnology under the supervision of the head of the Laboratory, Candidate of Biology (Ph.D.) Osolodchenko T. P. **Results.** The study has shown that phytosubstances from *Ledum palustre* shoots exhibit the antibacterial action against pathogens of respiratory tract diseases, namely *Moraxella catarrhalis*, *Haemophilus influenzae*, *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Klebsiella pneumoniae*. According to the results of the study, phytosubstances, which in their composition have terpene compounds, have antibacterial effects in relation to *Klebsiella pneumoniae* and *Staphylococcus aureus*. Meanwhile, the *Ledum palustre* phenol complex exhibits a pronounced antibacterial effect to *Haemophilus influenzae* and *Streptococcus pneumoniae*, also medium antibacterial effect in relation to *Moraxella catarrhalis*.

**Key words:** phytosubstances from *Ledum palustre* shoots, antibacterial action, respiratory tract infections.

40-46

## PRIMARY MICROBIOLOGICAL SCREENING OF AMINO ACIDS AND THEIR MODIFIED VARIANTS

Osolodchenko T. P., Andreieva I. D., Ponomarenko S. V., Komisarenko A.N., Koshoviy O. M., Zavada N. P., Ryabova I. S.

**Introduction.** The Fight against infectious diseases is still the most relevant problem in medicine [1]. Antimicrobial chemical agents have the leading role in prophylaxis and treatment of diseases of microbial genesis [2]. The main negative consequence of antibiotic therapy is the progressive resistance of the microorganisms [3-5]. With increasing frequency, the specialists turn to the natural treatment approaches, especially towards plants that possess antibacterial activity and towards the compounds that compose the biological structure of the organisms and display various properties. **The aim of the study** – to substantiate microbiologically the use of new antimicrobial agents based on the modified amino acids variants. **Materials and methods.** 20 native amino acids and 52 synthetic derivatives of 7 amino acids were studied. All synthetic compounds were produced and characterized at the department of pharmacognosia of the national pharmaceutical university of the Health Ministry of Ukraine. For the primary screening standard test cultures of gram-positive and gram-negative bacteria were used that belonged to different taxonomic groups. Determination of antimicrobial and anticandidal activity of the new compounds was carried out with the help of the standard methods of double serial dilution in the nutritive medium (macromethod). The testing was carried out in the volume of 1 ml of each dilution of the compounds with the final concentration of the studied microorganism approximately  $5 \times 10^5$  CFU/ml. The minimal inhibiting concentration (MIC) was established according to the minimal concentration of the studied substance that suppressed the visible growth of the culture. For determination of the minimal bactericidal concentration (MBcC) measured seedings onto solid mediums (Muller-Hinton agar) from all the probes where no microorganism growth was observed were undertaken. The lowest concentration that caused death of no less than 99,9% bacteria was accepted as MBcC. **Results and discussion.** Therefore, the primary microbiological screening of the 52 new synthetic amino acid derivatives has shown significant antimicrobial activity of the synthetic compounds against reference strains of gram-positive microorganisms (*S.aureus* ATCC 25923, *B. subtilis* ATCC 6633), mild antimicrobial activity of the overwhelming majority against gram-negative microorganisms (*P. vulgaris* ATCC 4636, *E. coli* ATCC 25922, *P. aeruginosa* ATCC 27853), and weak antifungal activity against *Candida* spp, fungi (*C. albicans* ATCC 885-653). For the more detailed study of the range and levels of the antimicrobial activity in the future, the lysine derivative compounds 6.1, 6.1.1, 6.1.2, 6.3, 6.6 and arginine derivative compounds 7.1.3, 7.1.5, 7.1.6, 7.1.7, and 7.1.11 were chosen, in order to develop antimicrobial agents based thereof. **Conclusions.** 1. Among the studied 20 native amino acids, only lysine and glycine had mild antimicrobial activity against reference strains of gram-negative and gram-positive microorganisms. 2. Primary microbiological screening of the 52 new synthetic amino acid derivatives has shown their high antimicrobial activity against reference strains of gram-positive microorganisms (*S. aureus* ATCC 25923 and *B. subtilis* ATCC 6633) in 94 % studied compounds (MIC in the range 3,9 – 15,6 µg/ml). 3. More than 80 % studied synthetic amino acid derivatives have shown high or mild activity (MIC in the range of 7,8 – 62,5 µg/ml) against gram-negative microorganisms test strains. 4. Based on the results of the study, the level of sensitivity of *C. albicans* ATCC 885-653 test strain to the synthetic amino acid derivatives was low. 5. It was proven experimentally that further studies of the range and level of antimicrobial activity of the certain most active compounds with the aim of new antimicrobial and antifungal agents development is both expedient and promising.

**Keywords:** modified amino acids, microorganisms, antimicrobial activity

47-54

## APPLICATION OF SYNERGETIC SET OF TRIZ PRICIPLES FOR DEVELOPING cAMP - ACCUMULATION ACTIVATORS AND THEIR INFLUENCE ON MULTI-DRUG RESISTANCE MICROORGANISMS

Farber B., Martynov A., Osolodchenko T., Kleyn I.

**Introduction.** The control over multi-resistant nosocomial strains of microorganisms has been becoming increasingly urgent in recent years. We suggest a new paradigm that is eliminating MDR bacteria death, but makes them sensitive to antibiotics. Based on our paradigm will be decreased and suppressed future selection of resistant bacterial strains. The mechanism of action of the enhancers is caused by the activation of the cAMP high doses accumulation process in the microbial cells. cAMP itself is a substrate for phosphorylation including DNA polymerases. Applying synergetic set of TRIZ Principles from matrix of contradictions, we created pioneer new paradigm to fight multi drug resistant bacteria, which could be not only treated generally, killing "unkillable" bacteria by also it could be done by low dosage antibiotics, which is extremely important for treating patients. **Materials and methods.** MDR resistant strains *Pseudomonas aeruginosa* MDR Kharkov IMI1, *Acinetobacter baumannii* MDR Kharkov-IMI1, and *Klebsiella pneumoniae* MDR Kharkov-IMI1 were used. The following antimicrobial agents of known potency were evaluated: ciprofloxacin, polymyxin B, and amikacin. Characteristics of bacterial growth were determined in a nutrient medium compared to the control group – the broth without the enhancers. cAMP-inducers (Enhancers) are the

derivatives of bis-pyrimidine, isoquinoline and benzimidazole from superfamily phosphodiesterase inhibitors. **Results and discussion.** Enhancers contribute to a significant increase in the antimicrobial sensitivity to polymyxin, ciprofloxacin and amikacin in multi-resistant strains of bacteria. During our research process changes in the growth characteristics and antimicrobial sensitivity are observed mainly in the second passage that demonstrates the need for further studies of the molecular mechanisms of the cAMP effect on the division and growth of microbial cell – Based on our TRIZ approach we may find solution to resolve MDR resistance in infectious disease for different types of MDR microorganisms.

**Keywords:** cAMP-inducers; antimicrobials; MDR strains; *Pseudomonas aeruginosa*; *Acinetobacter baumannii*; *Klebsiella pneumoniae*; bacterial growth; sensitivity to antimicrobials, TRIZ, theory of inventive problem solving, Altshuller, TRIZ in pharmaceutical industry and pharmacology, Laws of technical systems evolution, problem solving, Su-field analysis, drug-design, dynamic self-organizing, quasi live drugs, anti-cancer, antiviral, multidrug bacterial resistance, antibacterial, synergy.

## METHOD OF IMAGES AND INFLUENCE OF LIGHTING RADIATION INTENSITY ON STUDENT LEARNING EFFECTIVITY IN HYGIENE AND ERGONOMICS OF EDUCATION 55-76

Farber B., Manzini D.

42 years ago, studying digital-light-color analogies in combination of mechanoreceptors, we created Method of teaching any subject, based on Images and Patterns. In this article we conducted research related to influence of lighting radiation intensity on student learning effectivity. Good ergonomic lighting depends on more than just artificial luminance levels. Our study, conducted at Farber's Center for Academic Success, Inc and Saratoga Waldorf School shows how much the general luminance in school buildings depend on natural light. Luckily the buildings have plenty of windows in each room and receive plenty of natural light. The reliance of a day school like Farber's Center for Academic Success and Saratoga Waldorf School on natural light offer reasons to research the design possibilities for an optimum use of daylight. However, a classroom is a difficult space to light with daylight, because of the depth of the classroom and the different tasks, which must be performed in it. By combining a good daylight design with a good electric lighting concept student can enjoy better lighting and the energy for electric lighting can be reduced substantially. Incandescent lights appear to be the lighting of choice for the majority of students. Incandescent light bulbs of 100Watts providing 1600 lumens can be the ideal lighting device in school. The light is closest to natural light and is the most preferred by the majority of people. However due to energy consumption reasons, incandescent light bulbs of 60W are used in general, but they don't provide enough luminance especially in the evening. LEDs provide much higher light output on the same input power as comparable incandescent or fluorescent sources, because of their high efficiencies. This is also because the light emitted from the LED is naturally directional, and in almost all applications less light is lost in the fixture compared to traditional light sources. LEDs light represent a good compromise between quality of light and energy efficiency. Also, the price of LED lights is decreasing steadily while quality is increasing, including the possibility of controlling each LED light bulb by remote control allowing the lighting to be dimmable. The fluorescent lights appear to be the worst choice for the school buildings despite the fact that majority of schools in USA use them to save electrical energy. Now that the price of LED is decreasing steadily and you can find affordable LED light bulbs on the market even the claim of energy efficiency is gone for the fluorescent lights. This study has taken place in three schools over the period of 5 years. It has involved hundreds of hours of work, planning, writing, changing light bulbs in the classrooms, ordering supplies, taking surveys, administering tests, interpreting data.

**Keywords:** lighting radiation, school, hygiene, education

## INFORMATIONAL AND EDUCATIONAL INTERNET APPLICATION, AS A FORM OF PHARMACEUTICAL INTERVENTION IN THE MEDICATION-TAKING BEHAVIOR OF THE APPLICANTS OF HIGHER MEDICAL EDUCATION 77-80

Zaremba N., Zimenkovskiy A.

**Aim:** to work out the informational and educational model of pharmaceutical intervention in the medication-taking behavior of the applicants of higher medical education on the basis of modern information technologies to prevent the negative influence of self-medication on their state of health and quality of life. **Materials and Methods.** We have worked out the model of the educational and informative Internet application "Drug Compatibility Test" in the course of working out a new form of pharmaceutical intervention for the applicants of higher medical education regarding the interaction of drugs between themselves. There are used only free publicly available technologies and resources, while developing the Program of "Drug Compatibility Test", namely: Java programming languages (as part of Android Studio 3.2) and VB.NET (as part of Microsoft Visual Studio 2017 Community Edition – free software for individual developers and teams up to 6 participants), markup language of XML (as part of Android Studio 3.2), own graphic design (Paint.NET graphic editor – free software and programmatic graphics generation) and free, on conditions of attribution (placement of the reference to the source in the program), library of sound effects from the site www.zapsplat.com. The base of medicines, which are included in this Program, is formed on the basis of the results of the sociological survey on medication-taking behavior of the applicants of higher medical education. This database is formed on the basis of official instructions for medical use of drugs registered in Ukraine dated from October 28, 2018. **Results.** We have developed the Program of "Drug Compatibility Test" in the course of the study, it is the complete information application of mobile device, aimed at testing knowledge about the compatibility of medicines and certain aspects of the diet and behavioral habits of the user. **Conclusions.** 1. The program covers about 84 % of all mobile devices, in particular 98 % of mobile devices of ecosystem of Android 2. The program is free of charge and free for distribution under any conditions. 3. Base of medicines, which is included in the Program, formed on the basis of the results of our previous sociological survey about the most used drugs by the applicants of the higher medical education. If necessary, the base can be supplemented.

**Keywords:** informational and educational program, mobile internet application, pharmaceutical intervention, applicants of higher medical education.

## EXPERIENCE OF THE USA CONCERNING AN ORGANIZATION OF HEALTHCARE SYSTEM FOR PHARMACEUTICAL PROVISION FOR PRIVILEGED CATEGORIES OF CITIZENS 81-87

Shapovalov V.V. (Jr.), Gudzenko A.O., Andrieieva V.V., Shapovalova V.O., Shapovalov V.V.

**Introduction.** Nowadays there is no ideal healthcare system for medical and pharmaceutical provision for privileged categories of citizens in the world. Healthcare systems for medical and pharmaceutical provision for different categories of population of every country, which are the result of historical conditions and economic development, are continuously reformed. Economic approaches to planning of healthcare and pharmaceutical provision as a commodity system threaten the adverse impact on a health of privileged categories of citizens and the functioning of the healthcare system in general. Thus, the best approach is to learn the experience of other world countries in reforming of the healthcare system for medical and pharmaceutical provision for privileged categories of citizens, with a constant assessment of the changes, that taking place and readiness to adapt the system to changing external conditions, with the obligatory observance of all ethical requirements. **Materials and methods.** Conducted a retrospective analysis of healthcare system reform, which applied in the USA during the period from 2000 to 2018. During a research used the following methods of analysis: normative and legal, documentary, comparative. **Results and discussion.** The United States of America is practically the only country in the world with a developed economy where there is

no publicly available medical care. According to the WHO, the American health system ranked 37<sup>th</sup> out of 191 countries by the level and effectiveness of overall healthcare, although USA healthcare costs are 15.7% of gross domestic product. The United States, with its global leader, leading economies, annual budget, several times the budget of any other state, cannot provide the appropriate level of provision and availability of medical care and pharmaceutical provision for the population and its privileged contingents. In addition, part of the USA public spending in total healthcare costs is only 45%, much lower than in any other country of the Organization for Economic Cooperation and Development. That is why there is a need to analyze of healthcare system of the USA and the realization of the rights of the privileged categories of citizens for getting quality medical care and the provision of medicines. The main sources of financing of the American health system are private and non-commercial insurance, which covers approximately 85% of the population (about 50% are insured by their employers, 10% are self-insured, the rest are insured under the state programs). In addition to having a limited income, the applicant applying for the program must belong to specific privileged categories of citizens according to the relevant criteria (age, pregnancy, disability, blindness, USA citizen status or legal immigrant, finding a home for the elderly, children with disabilities, HIV-infected, etc.). The main disadvantage of the healthcare system in the United States of America is the high cost of medical and pharmaceutical care. Per capita costs in the United States of America are 7,290 USD for a year that is more than 2 times higher than the average for industrially developed countries. However, the high level of legal and organizational support for the protection of patients' rights, which manifests on developing lawyers' services in the area of medical and pharmaceutical law, the prevalence of the institutions involved in the protection of consumers' rights, the particular attitude towards the privileged categories of citizens, the senior citizens, the disabled and some other categories of socially disadvantaged sections of the population are unconditional benefits in providing health care in the United States of America. **Conclusions.** The analysis of the USA experience in organizing of health care system has revealed positive and negative aspects that need to take into account for reforming the system for the provision of medicines and medical services in Ukraine. The main advantages of the American model of the healthcare organization are determined, among them the availability of strategic planning of the activity of healthcare institutions; introduction of modern information technologies; protection of patient's rights; priority attention to the prevention of diseases; the desire to achieve the highest possible level of provision of medical and pharmaceutical services at moderate financial costs. The necessity of preserving public administration in the healthcare system in Ukraine for pharmaceutical provision of privileged categories of citizens substantiated. Obligatory health and social insurance must play a supporting role in financing healthcare system.

**Keywords:** USA, organization of healthcare system, pharmaceutical provision, medicines, privileged categories of citizens.

**VLADIMIR PAVLOVICH BOBIN – A DOCTOR AND SOCIAL ACTIVIST OF KHARKIV MEDICAL SOCIETY (DEDICATED TO HIS 160-YEAR ANNIVERSARY) 88-90**

**Bobina I. V., Lutenko M. A., Andreyev G. I., Popov N. N., Davydenko M. B.**

Historical review about Kharkov medical society and social activist Vladimir Bobin, dedicated to 160 – year anniversary