



# SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

Proceedings of the  
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countries: synergy and integration”

Part 2: Participants' reports in English

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这些会议文集结合了会议的材料 – 研究论文和科学工作者的论文报告。它考察了职业化人格的技术和社会学问题。一些文章涉及人格职业化研究问题的理论和方法论方法和原则。

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## Foreword

*We thank all participants of our conference "Scientific research of the SCO countries: synergy and integration" for the interest shown, for your speeches and reports. Such a wide range of participants, representing all the countries that are members of the Shanghai Cooperation Organization, speaks about the necessity and importance of this event. The reports of the participants cover a wide range of topical scientific problems and our joint interaction will contribute to the further development of both theoretical and applied modern scientific research by scientists from different countries. The result of the conference was the participation of 65 authors from 7 countries (China, Russia, Uzbekistan, Kazakhstan, Azerbaijan, Tajikistan, Kyrgyzstan).*

*This conference was a result of the serious interest of the world academic community, the state authorities of China and the Chinese Communist Party to preserve and strengthen international cooperation in the field of science. We also thank our Russian partner Infinity Publishing House for assistance in organizing the conference, preparing and publishing the conference proceedings in Chinese Part and English Part.*

*I hope that the collection of this conference will be useful to a wide range of readers. It will help to consider issues, that would interest the public, under a new point of view. It will also allow to find contacts among scientists of common interests.*

**Fan Fukuan,**

*Chairman of the organizing committee of the conference*

*"Scientific research of the SCO countries: synergy and integration"*

*Full Professor, Doctor of Economic Sciences*

## 前言

我们感谢所有参加本次会议的“上海合作组织国家的科学研究：协同作用和整合”，感谢您的演讲和报告。代表所有上海合作组织成员国的广泛参与者都谈到此次活动的必要性和重要性。参与者的报告涵盖了广泛的主题性科学问题，我们的联合互动将有助于不同国家的科学家进一步发展理论和应用的现代科学研究。会议结果是来自7个国家（中国，俄罗斯，乌兹别克斯坦，哈萨克斯坦，阿塞拜疆，塔吉克斯坦，吉尔吉斯斯坦）的65位作者的参与。

这次会议的召开，是学术界，中国国家权力机关和中国共产党对维护和加强科学领域国际合作的高度重视的结果。我们还要感谢我们的俄罗斯合作伙伴无限出版社协助组织会议，准备和发布中英文会议文集。

我希望会议的收集对广大读者有用，将有助于在新的观点下为读者提供有趣的问题，并且还将允许在共同利益的科学家中寻找联系。

范福宽，  
教授，经济科学博士，中国科学院院士，会议组委会主席“上合组织国家科学研究：协同与融合”

资源型地区获取矿产资源的必要性  
**IMPERATIVES OF AVAILABILITY OF MINERAL RESOURCES IN A  
RESOURCE-TYPE REGION**

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抽象。远东联邦区的竞争优势之一是俄罗斯联邦拥有最大的自然资源储备：钻石储备的81%，森林的51%，淡水的37%，水生生物资源的33%，44%的黄金，27%的天然气和17%的石油。它还在俄罗斯联邦和亚太地区（APR）中占有独特的经济和地理位置。尽管如此，俄罗斯联邦远东地区的特征是资源开发的巨大潜力与当今该地区采矿业的生产力水平以及运输和能源基础设施的令人满意程度之间存在差异。本文为矿业的有效运营和发展制定了具体的当前实时问题和相应的命令（命令，命令），从长远来看，这将使该地区的经济重新适应有效的发展道路。

关键词：矿业综合体，俄罗斯联邦远东地区，加工业，当务之急，合理的自然管理，有效发展

**Abstract.** *One of the competitive advantages of the Far Eastern Federal District is the presence of the largest natural resource reserves in the Russian Federation: 81% of diamond reserves, 51% of forests, 37% of fresh water, 33% of aquatic biological resources, 44% of gold, 27% of gas and 17% of oil. It also occupies a unique economic and geographical position in the Russian Federation and in the Asia-Pacific region (APR). Despite this, the Far East of the Russian Federation is characterized by a discrepancy between the significant potential of resource development and the level of today's unsatisfactory state of the productive forces of the region's mining industry, as well as its transport and energy infrastructure. The article formulates specific current real-time problems and the corresponding imperatives (orders, imperatives) for the effective operation and development of the mining industry, following which will allow in the long term to reorient the region's economy to an effective path of development.*

**Keywords:** *mining complex, the Far East of the Russian Federation, processing industries, imperatives, rational nature management, effective development.*

The Far East of the Russian Federation, with its richest mineral resources, is characterized by a discrepancy between the significant potential for their development and the current unsatisfactory state of the productive forces of the region's mining industry, as well as its transport and energy infrastructure. This is one of the rather significant factors of the significant lag of the Russian Far East in socio-economic development in comparison with other Russian regions, an increase in the outflow of the population and the emergence of other systemic problems. The presence of large reserves of oil, coal, non-ferrous and rare earth metals, as well as the geographical proximity of the Russian Far East to the rapidly developing countries of the Asia-Pacific Region (APR), including China, suggest that its further development will be associated with an increase in intensification of economic relations. The full use of the mineral resource base of the Far East of the Russian Federation in order to create industrial production facilities with a higher added value in it is currently a fundamentally necessary and in-demand condition for the development of the entire country.

Taking into account the materials of publications [1-4], the following specific problems of the development of the mining industry of the Far East of the Russian Federation were formulated, which made it possible to designate it as a "problem region of the resource type in general":

1. *Significant remoteness of iron and non-ferrous metal ore deposits in the region from the country's metallurgical industries.* The main problem of the mineral resource base of the iron ore industry of the Russian Federation (and, in particular, its Far East) is the significant removal of deposits from metallurgical industries. In regions rich in iron ores, there are no large metallurgical production facilities, and areas where the main steel enterprises are located are significantly removed from the deposits and experience an acute shortage of iron ore raw materials. Therefore, during long-distance transportation of iron ore raw materials, the corresponding transport costs significantly (by 30% or more) exceeded the cost of producing it. This situation is especially indicative for the tin industry of the Far East of the Russian Federation, since almost all reserves of Russian tin are concentrated in the Far East of the Russian Federation (Yakutia, Khabarovsk and Primorsky Krai, the Jewish Autonomous Region), and in fact, the only processing enterprise in the country, the Novosibirsk Tin Plant, is located far beyond the limits of this Far Eastern region [5].

2. *Lack of opportunities to obtain final products (metals).* To date, negative conditions have been preserved, long noted in the already outdated Federal Target Program for the Economic and Social Development of the Far East and Transbaikalia for 1996-2005 [6]. So, until now, the mining enterprises of the Far East of the Russian Federation produce concentrates, and not finished products (metals). The only exception is a small lead plant in Primorsky Territory. It was necessary

to deepen the complexity of the extraction and processing of raw materials. The creation of final redistributions was also due to the fact that the main processing industries were outside the Russian Far East.

Within the framework of solving the problem of deepening the complexity of the extraction and processing of mineral raw materials, creating additional redistributions up to the receipt of final products (metals), the measures outlined in the program were not implemented.

*3. Lack of prerequisites for the integration of mining and metallurgical industries on a vertical technological basis.* The analysis of world experience [7-9] has shown that in ferrous and non-ferrous metallurgy the most effective integration is according to the vertical technological principle. It allows you to combine the technological cycles of individual mining enterprises - from the extraction of raw materials and their processing into concentrate to the production of high value added products, while increasing its competitiveness in world markets. At the same time, the goals of various forms of integration in the mining and metallurgical industry of Russia are on the part of mining enterprises - to obtain a reliable market for their products, the demand for which in the future is not determined, and on the part of metallurgical enterprises - the acquisition or development of their own raw material base. Moreover, both sides also want to achieve common goals - to promptly and adequately resist the threats and challenges of financial and economic independence and security of the main (metallurgical) production; increasing competitiveness in the domestic and foreign markets; implementation of long-term targeted scientific, technical and investment development programs; ensuring and improving product quality; expansion of the range and growth in the output of high-tech products; modernization of the production base; lower production transaction costs.

*4. The disadvantage of integrating the region's mining industries with large foreign and domestic holding corporations.* It is known that over the last ten years, processes such as concentration, integration and diversification have been taking place in the world non-ferrous and ferrous metallurgy. The active formation of holding structures continues, which control a significant part, in particular, non-ferrous metallurgy and are large producers and exporters of metals. The revealed pros and cons of this phenomenon show an undesirable dependence (for example, the lack of independence in choosing the paths of their development) of metallurgical industry enterprises in relation to global oligopolistic corporations (such as "VNV Villiton", "CVRD" and "Rio Tinto"), which produce 35% of iron ore in the world that controls the international resource market and, accordingly, owns the tools to influence the global pricing policy. This kind of oligopolistic integration is taking place in the nonferrous metallurgy of the Russian Federation. So, according to 2014-2015 data, more than 92% of the country's non-ferrous metallurgy indus-

try proceeds are generated by only four domestic corporations located far outside the Far East of the Russian Federation: "Norilsk Nickel", "Rusal", "SUAL" and "UMMC", therefore, the use of the presented Here, for obvious reasons, foreign and domestic experience of vertical integration should be recognized as extremely disadvantageous for the functioning and modernization of the mining industry of the Russian Far East and the effective development of its entire economy.

5. *Insufficient state budget investment in the creation of mining and metallurgical industries in the region.* Table 1 presents investment projects currently being implemented in the Far East of the Russian Federation related to the development of iron ore deposits and the creation of mining and metallurgical enterprises on their basis, as well as projects for the integrated development of tin ore deposits.

**Table 1** – *The ratio of budget and private investments in investment projects of the Russian Far East (calculated according to [10])*

Project, subject of the FEFD	Financial assets (FA), RUB bln			Share BA	Number of jobs	Investor
	Total	Investor (IA)	Budget (BA)			
Construction of MMC (iron ore concentrate), Kamchatka Krai	28	27,2	0,8	0,03*	150	LLC "Petropavlovsk-Kamchatsky Processing Plant"
Development of the Garinskoye iron ore deposit and construction of the MC, Amur Oblast	48,5	21,3	27,2	0,56	1485	MC "Petropavlovsk", LLC "Garinsky MMC", LLC "Petropavlovsk-Black Metallurgy"
Creation of a mining and metallurgical cluster, Jewish Autonomous Okrug, Amur Oblast	25,4	24,9	0,5	0,02	1562	LLC "Kimkano-Sutarsky MC"
Development of the alluvial tin deposit on the Tirekhtyakh, RS (Yakutia)	1,1	0	0	0*	85	JSC "Yanolovo", JSC "Corporation for the Development of South Yakutia"

Construction of a MC Pravourmiyskoye tin ore deposit, Khabarovsk Krai	4,5	0	0	0*	400	JSC "Rusolovo"
Construction of the Taiga iron ore mine, RS (Yakutia)	18,7	17,1	1,6	0,09*	600	CJSC "GMK" Timir "

\* – there is no budget financing or the company is looking for a partner investor

The creation of mining and metallurgical production of products of a high degree of redistribution is one of the most important components of the stability of the economy in the region. It should be borne in mind that there is a real supply of iron ore base and tin resources, more than 95% of Russian reserves are concentrated in the Far East of the Russian Federation. These tables show that the share of budgetary (federal) funds in these especially significant projects is extremely low and that their funding is provided mainly at the expense of investors.

6. *The existing difficulties in the implementation of large investment projects related to the extraction of minerals.* Many large investment projects of the Far East of the Russian Federation related to the extraction of minerals in it have long awaited their implementation, since there are certain general difficulties for their implementation [11]: a deficit in the growth of mineral reserves due to the limited number of exploration works; difficult climatic conditions, insufficient development of infrastructure facilities, reduction of the FEFD population; unbalanced specialization of the raw material sectors of the regional economy; insufficient processing capacity; weak industrial use of mineral resources mined within the region; high physical and moral deterioration of fixed assets of mining and processing enterprises; and etc.; unsatisfactory development of the transport infrastructure of the region's economy and, in particular, its mining industry.

7. *The negative impact of the weak development of the regional economy and especially its transport infrastructure on the investment activities of mining enterprises.* Certain restrictions on the competitiveness of the sectors of the regional economy are associated with insufficient development, and in some cases with the lack of transport infrastructure. First of all, this concerns the rail and road networks. This negatively affects the potential inflow of investment resources into the regional economy, as a result of which even the process of simple reproduction does not take place, not to mention the expanded reproduction of fixed capital. This explains the need to use special economic instruments to stimulate economic activity in the Russian Far East. Statistical data on the structure of investments in fixed assets by type of economic activity in the Far Eastern constituent entities of

the Russian Federation in 2018 confirm the thesis on the preservation of the so-called "transit/export raw materials specialization" of the corresponding region.

8. *Unstable financial condition of a number of mining enterprises in the region.* In the last decade, the mining enterprises of the Far East of the Russian Federation, in their main part, remained less competitive than foreign companies operating in the same segments of the market for mineral raw materials and products of its processing. In addition to the difference in economic, technical and technological factors affecting the activities of both, the non-competitiveness of domestic enterprises was also determined by the insufficiently developed state system for regulating integration relations in the mining industry in the Russian Federation at the micro- and macroeconomic levels. The analysis of indicators of the financial condition of a number of Russian Far Eastern mining enterprises [11] made it possible to ascertain their insufficient (financial) stability for successful competition with foreign companies, and, moreover, to reveal the facts of some of them being at risk of bankruptcy.

9. *The lack of institutional prerequisites inherent in the Russian economy for the creation of a mining FIG registered in the region.* In work [5], it is noted that "in the context of the changing environment of raw materials markets and the exhaustion of the identified mineral resources currently being mined in the region, the specificity of the main mineral being mined - gold, it becomes fundamental for the region to implement such a direction of economic development that would allow creating preconditions for the formation of a new structure of the economy based on the extraction and processing of mineral raw materials of more functional and long-term use (iron, titanium, rare metal ores, etc.) with bringing them into a product of an extremely high stage and added value". The region requires the creation of financial and industrial corporations with a vertically integrated cross-sectoral profile similar to foreign companies (BHP Billiton, Rio Tinto, Glencore, Freeport-McMoRan, Ivanhoe Mines, etc., less diversified but highly specialized) that could dynamically respond to current changes in the world market. Indeed, in world practice, financial and industrial groups (FIGs) are one of the organizational forms of connecting capital with large-scale industrial production. But in the last decade, an economy has developed in the Russian Federation, characterized by negative features [12].

10. *Application in the mining industry of the region of an inexpedient concept of its organization - "raw materials for processing industries".* The creation and development of metallurgy in the Far East of the Russian Federation presupposes an increase in the greening of its mining industry - the use of production processes in which more effective measures have been taken to prevent negative impacts on the environment. Experience shows that reducing the amount of waste to a minimum (waste-free technology) cannot be carried out within the framework of not



only one mining, but also the metallurgical industries of the region, but requires the implementation of intersectoral cooperation and the application of a new (expedient) concept of organization and spatial distribution of the productive forces of the mining industry - "processing industries for raw materials" - in contrast to the outdated and therefore inexpedient concept, which is currently used in the Far East of the Russian Federation - "raw materials for processing industries."

11. *Imperfection of the system of tax payments for extractive mining enterprises.* It is known that the country's fiscal system in the field of subsoil use includes tax payments provided for by the Tax Code of the Russian Federation and the Federal Law of the Russian Federation "On Subsoil" (Chapter 17) and, accordingly, consists of two parts. The first part includes taxes that are paid by all Russian enterprises (value added tax, corporate income tax, corporate property tax, etc.), and the second includes specific taxes for subsoil users, that is, payments for the use of subsoil (license fees and participation in the auction, one-time and regular payments), as well as the tax on the extraction of minerals, which occupies a predominant share in the total amount of taxes, which is an ineffective factor.

12. *Forced risk orientation of already risky mining enterprises of the region to the world market with unstable prices for mineral raw materials.* The activity of mining enterprises has a number of the following features associated with the emergence of significant risks in its implementation: the objectively inevitable depletion of natural reserves of mineral raw materials; removal from economic circulation of unprofitable deposits of mineral raw materials; technological losses of mineral raw materials during its extraction; the danger of the destructive impact of mining on the environment; the need to process most types of mined mineral raw materials to obtain various types of products, both directly suitable for use, and intermediate products (concentrates) to be further enriched, purified from impurities, etc.; the compulsory purchase of expensive fixed assets and the formation of significant working capital; implementation of constant investment of large capital investments in the construction of shafts, mines and quarries; especially difficult and dangerous working conditions.

Thus, the successful overcoming of these problems and the achievement of the corresponding **imperatives** (orders, urgent requirements) of environmental management will allow achieving effective development of the mining industry in the Far East of the Russian Federation - it is necessary to neutralize the negative factors indicated in the article.

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俄罗斯，印度和中国的数字经济与网络政治转型前景  
**PERSPECTIVES FOR DIGITAL ECONOMY & NETOCRACY  
TRANSFORMATION IN RUSSIA, INDIA AND CHINA**

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抽象。 本文回顾了俄罗斯，印度和中国（上海合作组织的主要国家）数字经济的发展现状，着重介绍了数字经济发展的总体趋势，这些趋势直接影响着国家和国际关系的未来发展。 其中，存在着一种专制发展的趋势，新的政治和经济趋势的形成与金融和技术部门，银行部门，服务应用的发展以及电信发展的各个方面密切相关。

关键词：数字经济，银行，电信公司，俄罗斯经济，中国经济，网络统治，经济转型

**Abstract.** *The article reviews the current state of development of the digital economy in Russia, India and China - the key countries of the Shanghai Cooperation Organization, highlights general trends in the development of the digital economy that directly affect the future development of countries and international relations. Among them, there is a tendency towards netocratic development, the formation of new political and economic trends closely related to the specifics of the development of the financial and technical sector, the banking sector, the segment of development of service applications and telecom development.*

**Keywords:** *digital economy, banks, telecom companies, Russian economy, Chinese economy, netocracy, economic transformation*

The digital transformation that began in the last decade has initiated a significant number of processes and drew the attention of society and states to many aspects of the imperfection of modern development. So in the field of international relations, international law, the modern world society is in a situation of a certain dead end, initiated by a crisis of confidence and the unwillingness of the parties to "negotiate" and maintain the status quo. The traditional economy, based on the values of raw materials on the one hand, the system of international organizations on the other, the international profile specialization of states and instruments related to the implementation of the political will of countries to interact, has also

found itself in crisis due to the spread of the coronavirus. These and other factors have led to the actualization of the issues of technology development and the possibility of technological development of states both through the introduction of technologies on their territory, and through the export of solutions, ideas, start-ups and know-how. Among them, developments in the field of the digital economy and digital technologies come to the fore, which in many respects make it possible to carry out qualitative breakthrough development in many areas precisely through know-how. At the same time, which is typical, if the traditional economy mainly relies on the special role of large structures, states or corporations, and is also characterized by the presence of a serious dependence on the state and state regulation, the digital economy and the knowledge economy is located in the so-called supranational field, which allows it practically without restrictions to cross borders and exercise their functions with little or no regard for jurisdictions.

The evolution of the digital economy and the actualization of the attention of states on the development of this particular area appeared on the agenda, perhaps in connection with the growing public presence on the modern Internet. The first attention of the states was mainly connected not so much with the regulatory interest in the economic projects developing in the network, but with the interest associated with the control over the dissemination of information, the boom of WEB 2.0 and the issues of state censorship. In general, the ambiguous situation with the implementation of the democratic rights of citizens to freedom of communication and self-expression, which takes place in the SCO countries, only spurred states, as institutions, to participate in the study of information exchange and processes inherent in modern information networks. At the second stage, the states realized the economic potential for the existence of a network economy, developing through the tools of cross-border trade and communication. However, genuine economic growth and interest in the digital economy became noticeable only after the actual beginning of the transition in the SCO countries from the "digitalization of the economy" by shifting traditional economic contacts and targeted actions from the "analog world" to the electronic equivalent, to the "digital economy" itself, understood as a full cycle of production of services, goods and know-how in a digital environment without entering the world of tangible goods, traditional for the economy.

Communications, expertise, decision-making as a *service* (and in the broadest sense, *information as a service*) and the development of service and game applications began to gradually transform into a separate sector, capable, if not of competing with the main directions of economic self-realization of states, then at least of forming a significant share of science-intensive export products. In addition, with an even greater delay, but nevertheless, the states discovered the gradual organization of a new social formation associated with the digital economy. For states with a significant share of the traditional economy and traditional way of life

of their citizens, the emergence of a class of educated young people with a high level of income due to their success in their field, the cross-border demand for their knowledge and skills, was a kind of shock. Awareness of the existence of another political path and critical perception of the development of the national political and economic tradition for these citizens allowed them to be singled out with varying degrees of confidence into a separate motivated social group associated with the term introduced by Alexander Bard - *netocrats* [1].

Indeed, the relative independence of the creative class of netocrats is associated primarily with the absence of material dependence on the means of production. In a world where, in the first place, not even means are valued, but know-how, the presence of network interaction, namely, they determine most of the success of network projects, there is no habitual dependence of business owners on the state. Moving an IT business in the modern world, other things being equal, is not very difficult, since the main value of an IT business as a whole moves freely between virtual machines and is not rigidly tied to a specific location. Transferring computing power from one data center to another can take 1-2 days, which is inconceivable when compared with the task of transferring, for example, a conditional P&G shampoo factory from Poland to Russia. In addition, the development of cloud technologies and virtualization has led to the unleashing of dependence on regional data centers: the availability of ultra-short-term lease of computing power of global services such as Amazon Web services, Google Cloud, Azure, Yandex Cloud or Mail.ru Cloud. At the same time, the main "means of production" of the netocratic world are intellect and knowledge; personality traits and their freedom come into direct conflict with the traditions of countries with a high population density. The conflict of interests of the personal and the collective lies at the heart of the duality of the digital economy and periodically manifests itself at the level of strategies for adjusting digital products to the consumer.

Let's not forget about another feature of the development of the digital economy. On the one hand, the popularization of startups and relying on their own knowledge and intelligence provokes the development of private business, cross-border projects and casts doubt on the traditions protected by the state, but on the other hand, the states are held hostage to the technological race and, with all their desire to preserve the *status quo*, they are forced to invest intensively in development key segments of the digital economy, so as not to be left behind the next round of the technological revolution. So the boom in the development of high-speed Internet access in the countries of the Shanghai Cooperation Organization, the implementation of programs to overcome the digital divide, the development of Internet access tools using the channels of cellular operators and public Wi-Fi zones is adjacent to the tightening of state policies aimed at identifying Internet connections and the turnover of devices with Internet access.

So over the past 10 years, the banking sector in Russia has made a qualitative leap towards digital transformation. Most of the services have been digitized and embedded in mobile applications, and some players (for example, Sberbank) set the task of building deployed eco-systems based on this infrastructure and the level of consumer penetration. The state is not lagging behind in this regard, pushing other players towards high-quality development, introducing micropayment services (for example, the Fast Transfer Service) and forcing banks to look for new segments to generate profitability, instead of the traditional parasitic functionality of transferring funds. It is believed that in this form, a hardening vaccination of the banking sector is implemented against the massive arrival of cryptocurrency and electronic payment systems, the onset of which cannot be left even to state regulation. [2, p. 9] If this is a reasonable assumption, then compared to the level of banking and payment services operating, for example, in Europe and the United States, Russia and the economically connected space of the CIS are in a more developed and more technologically successful field. The banking sector in India and China is developing at a similar pace. Here, the same inoculation to the banking sector is being implemented due to the massive availability of applications of microfinance organizations and the P2P lending platform (Freecharge, Bajaj Finserv, MoneyTap, KreditBee, CashBean, etc.). Briefly characterizing the current trends, it should be noted that, for example, for India, banking services have already been largely supplanted by the turnover of so-called electronic wallets and payment systems due to the centralized UPI ID tool (a single payment interface linked to a bank account). Due to the openness of the platform, tools based on UPI ID as of 2020 confidently overtake services offered by banks themselves in terms of the number of users. A monopoly position, which, for example, is enjoyed by Sberbank in Russia in terms of penetrating the user environment through a title service and an application for creating an ecosystem and a parasitic offer of additional services and options, is impossible in India: banks have frankly missed the moment. On the other hand, a competitive toolkit is implemented on the basis of wallet applications - this is how Mobikwik specializes in the sale of gift certificates, Paytm lending - in the sale of transport tickets. GooglePay and PhonePe are trying to occupy the niche of "investment for the poor" (mutual funds), which is essentially identical to the ideas of smart contracts and micro-investments that can be accessed through blockchain technology and implemented incl. to bitcoin.

Unlike Russia, in India, ecosystems based on wallets are more understandable to telecom companies, and the introduction of broadband Internet access services is also understandable, first of all, to telecoms. The leader here is the mobile operator Jio and its pursuer, Airtel, which in recent years have been betting not so much on voice transmission as on content transmission and, in parallel with the development of networks, use tools to impose their own financial instruments. Their unex-

pected success, which blew up the Indian market in 2018-2019, prompted Russian players to seek opportunities for a synergistic merger between the banking and telecom sectors: this is how Sberbank-Mobile, VTB-Mobile, Tinkof-Mobile and vice versa MTS-Bank were born. As in India, in Russia the ideology was copied from the logic of lifestyle-service services.

The structure of China's digital economy is somewhat different from that of India due to significantly less competition and a greater concentration of users. So, in China, the main payment applications are WeChat and Alipay. They also concentrate up to 60% of insurance services. The success of the application is due in part to the relatively low prevalence of POS terminals, with applications allowing transactions using a QR code. Curiously, in Russia this feature has been promoted by SBP since 2018, in China this service has been operating since 2013. However, not everything is so smooth here and the rapid digitalization of the economy leads to excesses: society still remains at the level of pre-digital development, and the fact that a specific person was taught "like a monkey" to press buttons and pay for something using a QR code does not mean that this person understands what he is doing: he is really paying for the transport fare in Beijing or giving the command to download a Trojan. According to the observations of iFlytek, in 2017, more than 23% of viruses and Trojans in China were spread using QR codes. [3] And, of course, not the bright minds of the digital economy are to blame for this, but illiterate users. However, it is much more offensive when not only users, but also regulators commit rash actions, introducing a mandatory threshold for non-cash transactions, which provoked in the same India in 2016 an avalanche-like interest in the gray zone of crypto payments hidden from the state. [4, p. 170-192]

The digitalization trend of the Chinese economy, like in Russia, is also multi-directional. But while banks in India have essentially lost the battle for bulk payments, in China applications are acquiring pocket banks to provide microfinance and microcredit services. The flagships of the digital economy and fintech here are the *digital-only* bank WeBank (WeChat project), a hybrid QQ project for a young audience from small cities by Chinese standards. The Alipay project has gradually transformed from an add-on system for secure payments on the Internet into an off-line product, however, it cannot seriously go beyond the borders of China even to the regions of the so-called "Chinese world", although it has begun to offer a revolutionary overdraft technology for the Celestial Empire. Direct analogs of the Russian MTS Bank are the BestPay wallet project (ChinaTelecom Corp), Yandex - the Baidu search engine wallet application, and the most pretentious, most solid, most massive, but at the same time the least interesting in terms of bonuses for the user of the system, direct analogue of the Sberbank Pro100 project - UnionPay.

It is curious that despite significant differences in information environments and economies, the development of the digital economy proceeds in a co-direc-



tional manner in all countries of the region. All countries deal with the issues that arise differently, but the questions themselves are always the same. It is always a question of financial payments, it is always a question of transactions, their cost and its reduction. It is a matter of accessibility, mobility and acceleration of payments, especially for digital services. Gradually and confidently, investment services and IPO services begin to occupy a significant share. Almost everywhere, technologically advanced companies are ahead of banks in the development of services, while banks where they can (due to their unique position) prefer to buy technologically advanced companies and then talk about their "innovativeness". Everywhere there is an acute issue of the development of networks and the state, despite political fears of an even greater development of opaque social and communication networks under the pressure of the economy, they are forced to invest in the development of 5G, the development of education in the IT sector, and the popularization of e-governance. But in all cases, from the ecosystems of Sberbank (Sber.mobile, etc.) to Xiaomi (Xiaomi.Finance, etc.), we can talk about the actual merger of entire segments of economies, the rebirth of functional logic and the confident intention of each company to go beyond national boundaries. borders, if not by physical presence, then at least by the provision of their services. And on this field, in the next 10 years, we will see the battle of the titans.

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改变21世纪学校的新挑战  
NEW CHALLENGES FOR CHANGING 21<sup>ST</sup> CENTURY SCHOOL

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抽象。本文提出了一种解释教育和学校转型为核心机构的可能方法之一的愿景。最近在教育中引入了许多新的教育和教学工具和技术（教育平台，电子学习，在线游戏，在线课程，模拟器，数字教科书等）。在他们的影响下，新的虚拟和数字教育环境迅速形成和发展。在数字化转型的影响下，教育变得越来越个性化。教学的内容从根本上改变了它的价值，含义，方向以及教育和教学语言。学习的重心从教学（指导）转向学生活动，因此，教师在教学中的专业地位发生了变化。由于21世纪知识社会的挑战，在虚拟和数字教育环境的影响下，教学变得更加虚拟化和数字化。

关键词：教育转型教育范式学校4.0；教育环境；能力数字和虚拟教育；数字学校；数字老师；教育和教学技术；数字教育环境

**Abstract.** *The article presents a vision of one of the possible approaches to the interpretation of transformation of education and school as its core institution. Quite new educational and pedagogical tools and technologies have recently been introduced in education (educational platforms, e-learning, online games, online courses, simulators, digital textbooks, etc.). Under their influence there is a rapid formation and development of new educational environment, virtual and digital. Education is becoming more individualized under the influence of its digital transformation. The content of teaching and learning change radically its values, meanings, orientations and educational and pedagogical discourses. The center of gravity in learning shifts from teaching (instruction) to student activity, therefore, teacher's professional position in teaching and learning changes. Teaching becomes more virtualized and digitalized under the influence*

*of the virtual and digital educational environment due to the challenges of the 21<sup>st</sup> century knowledge society.*

**Keywords:** *transformation of education; educational paradigm; school 4.0; educational environment; competences; digital and virtual education; digital school; digital teacher; educational and pedagogical technologies; digital educational environment.*

The relevance of the problem of theoretical and methodological analysis of the principal's leadership activity at school is determined by the specifics of the modern dynamics of education development as a resource of social and human capital. The present-day global social and cultural shifts, transformations and systemic changes determine the fundamental basis for the formation of a new civilizational culture as the culture of a post-industrial society based on knowledge, information and innovative technologies.

Quite a new mission of education, as well as its vision, determined by new social, cultural and educational orientations, values and meanings are being actively formed. The repertoire of social, cultural and educational roles of a developing person in different practices realized at modern school is significantly expanded. It is tightly connected with the process of productive development of such person's key competencies for the 21<sup>st</sup> century as: a competence in creation quite new orientations, values and meanings of social, cultural and long-life educational activities; an information competence; critical thinking; creativity; a competence of interactions with oneself, the other people and the world around [Universal'nye kompetentnosti i novaya gramotnost' (2020), p. 19]. The role of academic and socio-professional mobility and migration is increasing. New tools of knowledge and development of the surrounding world and its cultures are being formed.

The market of educational services is being formed and expanded, becoming not only national, but also international and global. Competition in the field of quality of educational services is increasing, and, consequently, the competitiveness of educational organizations offering educational services is strengthening. Changing strategies, goals, and the content of state educational policies in almost all countries of the world has led to the formation of a new image of education and its landscape.

This, in turn, serves as a fundamental basis for the formation of a new paradigm of education for the 21<sup>st</sup> century, on the one hand, and, on the other, - transforms educational institutions of compulsory education changing them into "School 4.0" of the post-industrial society based on knowledge, information, and innovations. This fact is proved by the present-day achievements and outcomes of national systems of education of Finland, Japan, South Korea, Denmark, Norway, the UK and Sweden. These countries have become the world leaders in education

and innovations.

The quest for sustainability and innovations is radically changing the competitive landscape of education based on the principles of digitization, digitalization and digital transformation. There is no doubt, that it will allow to force educational institutions, educators, students and their parents, stakeholders, - society as a whole, - to change the way they think about education for the 21<sup>st</sup> century.

All of the above mentioned actualizes the problem of “a digital school” and “a digital teacher” including the aspects of changing educational environment, digital and virtual, and the quality of teacher’s academic and professional background, professional pedagogical values, meanings and the way of thinking, his knowledge, skills and competences implemented into ‘digital’ teaching practices.

Due to the new paradigm of the civilization development, education is integrating with culture actively. That also concerns to a digital culture. In this aspect, education can be defined as a process of cultural development and pedagogical support in socialization and enculturation to adapt a person for demands the changing world and to help him to identify himself and to self-realize in different creative social practices.

Under these conditions education is to fulfil quite new functions, such as:

(a) facilitation and stimulation of “inner forces” of a person (interests, values, meanings, orientations demands and motives of cognitive activity and social practices) in a situation of an educational alternative and an educational choice;

(b) development and support of an individualized educational environment to assist an individuality to construct and to implement his own unique educational route;

(c) joint creation of new ways of social and pedagogical interaction realized on the basis of the wider repertoire of educational and pedagogical discourses (individualization, differentiation and personalization). In the long run, the mission of the present-day education is focused on the development of skills and competencies of the 21<sup>st</sup> century.

The cultural approach to educational transformation is based on the following principles:

*First.* The main purpose of teaching and learning is development of cognitive, emotional and strategic (universe) competences under the conditions of real cultural and social practices realized by a student.

*Second.* Students are competent and rightful members of the academic community.

*Third.* Every student has his own educational route to construct his own unique knowledge.

*Fourth.* Students take their own decision concerning the subject they are interested to study, the ways of learning and the resources they need for that.

*Fifth.* The process of learning is organized on the principles of collaboration,

team activity and productive interactions with fellow students, teachers and the cultural, social and educational environment in a situation of an educational alternative and educational choice.

Therefore, it is quite evident that the center of gravity in learning *shifts from teaching (instruction) to student activity. His professional position in teaching and learning changes*. However, the role of the teacher remains, but his professional culture that determines his professional position in educational and pedagogical practice transforms. As it is mentioned in the sociological report made by the High School of Economics in Moscow [Digital Transformation of Education (2019); Frumin, I.D., Dobryakova, M.S, Barannikov, K.A., Remorenko I.M. (2018)]. There is a great diversity in attitudes and teaching practices between generations of teachers.

Thus, teachers over the age of 50 are much more focused on modern pedagogy, and they pay much more attention to active learning than their younger colleagues. To achieve sustainable knowledge is important for 38% of young teachers and only for 19% of older teachers; whereas to teach critical thinking and self-study is considered important by 72% of older teachers and only half of the young. Differences are also expressed in educational and pedagogical practices. Teachers of the older generation are more likely to use methods focused on the development of critical thinking and learning skills, more trying to individualize students' educational experience. On the contrary, young teachers are more likely to focus on the well-known problems of behavior and checking homework [Dobryakova, M. S., Yurchenko, O. V., Novikova, E. G. (2018), pp. 49-50].

At present, teachers are facing to quite new educational and pedagogical functions, such as: facilitation, collaboration, metacognition, blending, authentic learning, modeling, student-active learning, assessment, support, bridging theory/practice gap. Quite evidently, that together with teacher's digital competence, digital literacy, computer literacy and media literacy they will characterize "digital teacher" and his professional culture.

To the opinion of experts from the Institute of Education (the National Research University "High School of Economics", Moscow), "the integration of ICT in education, which has been underway for several decades, has now reached a new quality level. The transition from a simple replacement of outdated information tools to digital ones, to the full use of the potential of digital technologies for a fundamental renewal of education, has begun.

Today, the digital technology supports changes in the content, methodology and organization of educational practices, which would have been impossible without the ICT use. This process is in general defined as the digital transformation of education. It leads to radical changes in the everyday work of educational organizations and significantly improves their operations. Digital transformation

promises to ensure equal access to quality education for all, as well as the achievement of the required educational results for each student. Artificial Intelligence (AI) is one of the frontier technological breakthroughs. It is one of the most promising areas for educational research and development.” [Digital Transformation of Education (2019)].

The main goals of the Priority Russian Federation National Project “Education” (2019-2024) are the following:

(a) to implement new advanced methods of teaching and learning as well as new advanced educational and pedagogical technologies to develop students’ skills and competences of the 21<sup>st</sup> century (social and behavioral skill and competencies; cognitive skills and competencies; digital skills and competencies);

(b) to create a modern and secure digital education environment that ensures high quality and accessibility of education of all types and levels as well as digital equality in education;

(c) to implement the national system of professional development of teachers, covering at least 50 percent of teachers of educational organizations.

In the long run, the new strategies of education in the Russian Federation for the 21<sup>st</sup> century are tightly connected with the perspectives of:

(a) virtual and digital schools and universities;

(b) virtual and digital educational environment;

(c) new ways of educational and pedagogical interaction that determine quite new technologies, methods and tools of teaching and learning on the bases of the individualized educational process with individual teaching and learning trajectories;

(c) new actors of the educational process (including “digital” teachers and “digital” students).

Taking into consideration the fact, that digital education is a very important personal problem solving tool, and at the same time, it is the main product of the fourth industrious (=post-industrious) revolution, the vision of the modern School 4.0 model can be defined and characterized from the perspectives as follows:

(a) the content of education is the result of different cultural, social and educational practices (individual or group activity, i.e. through innovative activity);

(b) the process of knowledge transfer is enhanced by positive reflection of the innovative activity and creativity based on the 24/7 and 1:1 ubiquitous model – everywhere, any time, on any device, in different cultural, educational and social practices;

(c) teaching and learning are carried out in a global network, replacing the classroom;

(d) parents identify school as one of the most important centers of innovative activity of students, teachers, families and communities;

(e) all software is personalized;

(f) teachers active participants of the educational process and one of the resources of innovations and innovative production, by means of adaptability of software they become partners in the educational activity, cultural and social practices;

(g) stakeholders view school-leavers and graduates as persons producing innovations that enable the construction of new knowledge.

The vision of the educational environment of the modern Russian School 4.0 model consists of four basic elements tightly connected with each other:

(a) educational community;

(b) individualized and personal educational environments;

(c) individualized coaching;

(d) LMS and LCMS as automatic systems of management of learning and its content.

Of course, we can analyze the image of modern school for the 21<sup>st</sup> century from different perspectives (cultural, sociological, historic, psychological, etc.), but it is quite clear that it is becoming more and more technological, innovative, mobile and digital. No wonder, that the same concerns the image of the childhood - it is also becoming 'digital'. We agree with those who says that three enduring processes of digital worlds such as interactivity, symbolic flexibility, and vast sources of information determine the mode of life and education of Generation Z. These capacities are especially ripe for expanding imagination, knowledge, thought, and action due to the challenges of the 21<sup>st</sup> century. Cyber security is also of great demand in education of Generation Z.

The further we go on the path of digital transformation of education to School 4.0, the more we experience different professional deficits of a digital teacher. More than 1 million teachers work in educational institutions, including more than 15.2 thousand teachers in non-state institutions. More than 30 % of them have the first or highest qualification category. At the same time, a third of teachers note their professional deficits. A low level of computer and information technology literacy takes the first place in the rate of teacher's deficits. About 30% of teachers declare the absence of professional deficits in teaching. Only 30% of teachers are ready to accept and to implement innovations in teaching, and at the same time 55% of teachers do not have a clear position on this issue, and at about 9% of the respondents totally reject these innovations.

The Deloitte Consulting LPP in its study mentions that digital natives are becoming digital teachers. They write: "81% of teachers with 10 or fewer years of experience believe educational technology at school makes a really big or pretty big positive difference on students' learning. But, only 73% of teachers with 11-20 years of experience and 64% of teachers with 20+ years of experience feel similarly. Harnessing the positive attitudes of newer teachers could help spread wider

use of tech for learning” [2016 Digital Education Survey (2016)].

There are still a number of opportunities and resources for development and growth in school technology adoption. At about 4 of 10 teachers in the USA and in Russia say their school is “behind the curve” when it comes to technology adoption and implementation. 75% of teachers in the USA and some 92% of teacher in Russia believe that digital learning content will totally replace printed textbooks within the next 10 years (and this is one of the outcomes of effective implementation of the “Russian Digital School” project recently). Laptops, desktops and tablets are the most common educational devices used in the classroom with more than half of teachers in the USA and in Russia saying each is used at least weekly, and 42% of teachers say that at least one digital device is used every day. Gaps exist between teachers’ perceived benefits of education technology and their actual frequency of use. Some of the widest gaps exist around learning outside of the classroom. The findings of the study carried out recently by the Moscow High School of Economics are quite similar, and they prove the fact that this is an international problem [2016 Digital Education Survey (2016); Dobryakova, M. S., Yurchenko, O. V., Novikova, E. G. (2018)].

As it is noted in the “Atlas of New Professions 2030”, collected by specialists of the “Skolkovo” Innovation Center in Moscow, the rate of change and the complexity of professional tasks and practices increases throughout the process of the digital economy development in the beginning of the 21<sup>st</sup> century [Atlas of New Professions 2030 (2015)]. The “Atlas of New Professions 2030” makes a prognosis, that new pedagogical professions, such as: an educational moderator, a developer of educational trajectories, a digital tutor, a project training organizer, a coordinator of the online educational platform, a startup mentor, a game master (“a gamificator”), a coach at the mind-fitness, a developer of creating tools for teaching different states of consciousness and cognitive activity, etc. will be introduced in the educational sector within the next decade. In this aspect, the ‘digital teacher’ problem is of great theoretical and practical importance.

The analysis of the problem of teaching and learning digital transformation in education allows us to conclude that despite the fact that teachers are aware of the importance of teaching digital transformation in the future and their professional deficits at present, the vast majority of them are not yet ready to fully accept innovations. The most of the deficits are in the “digital” area dimension of teacher professional activity that makes it professional growth points. At least, there is no alternative to teacher digital culture in the aspects of radical changes in teaching and learning, including new methodologies of digital education, the new content of teaching and learning, new teaching media, new hardware and educational and pedagogical technologies to be used in the process of learning.



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高等教育体系中未来劳动者的数字文化  
**DIGITAL CULTURE OF FUTURE LABRERIANS IN THE SYSTEM OF  
HIGH CULTURAL EDUCATION**

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抽象。 本文致力于分析图书馆学发展的现代趋势。 重点是在全球数字化的影响下改变图书馆员专业活动性质的问题。 实现了新信息技术在扩大图书馆业务中的作用。 特别注意在高等教育系统中改进图书馆学专家的专业培训。 本文介绍了主动教学方法的教育潜力以及在图书馆员数字文化形成中信息和通信技术的使用。

关键词： 知识社会； 图书馆学； 图书馆员的专业活动； ICT技术； 数字化 数字文化； 高文化教育。

**Abstract.** *The article is devoted to the analysis of modern trends in the development of librarianship. The focus is made on the problem of changing the nature of librarian's professional activity under the influence of global digitalization. The role of new information technologies in expanding the library business is actualized. Special attention is paid to the improvement of professional training of specialists in librarianship in the system of higher cultural education. The article describes the educational potential of active teaching methods and the use of information and communication technologies in the formation of librarian's digital culture.*

**Keywords:** *knowledge society; librarianship; librarian's professional activity; ICT-technologies; digitalization; digital culture; high cultural education.*

The transition from an industrial society to a post-industrious society based on knowledge, information and innovative technologies, on the one hand, and the gap between the actual needs of the individual in information, new socio-cultural practices and ways to implement them, on the other hand, actualize the aspect of improving the training process of future specialists able to use effectively digital opportunities and resources in the field of librarianship [Asselin, M. (2017); Cook, L. A., Smith, W. S., Lan, W. Y., & Carpenter, D. (2016); Digital Transformation of Education and Artificial Intelligence (2019)]. .

At the same time, the librarian's professionalism should be considered not only from the aspect of his ability to master advanced technologies, but also as a value orientation that increases the motivation of the library specialist to implement innovations. Changes in the status of libraries and their active informatization and digitalization have led to changes in the requirements for the level of professional competence of library and information specialists [Asselin, M. (2017)]. As it is noted by G. M. Gubaidullina, under the conditions of the intensive development of technological innovations, the growth of technological potential and the adaptation of libraries to modern information technologies, a modern library specialist should widely and effectively use wide knowledge bases, artificial intelligence systems and the other information technologies to analyze the processes and phenomena of his professional activity to make it more productive [Neshcheret, M. YU. (2019)].

As it is stated by researchers, globalization, internationalization and international regionalization are the leading trends and the key factors that determine radical shifts and systemic changes in the Russian Federation as well in the other countries to meet quite new perspectives, opportunities and resources for its further cultural, social and economic development in a way of innovations and knowledge society creation. The strategies of social and economic development of the Russian Federation and the Republic of Kazakhstan are tightly connected with perspectives of global digitalization, and they have a great impact on the present-day education digital transformation. Quite new educational and pedagogical tools and technologies have recently been introduced in education and culture, including librarianship (educational platforms, e-learning, online games, online courses, simulators, digital books and textbooks, etc.). Under their influence there is a rapid formation and development of new educational and cultural environment, virtual and digital. Library work is becoming more individualized under the influence of its digital transformation. The content of librarianship changes radically its values, meanings, orientations and cultural, educational and pedagogical discourses. Librarian's digital skills and competences are one of the key skills and competences for his life-long learning, cultural and professional development and growth due to the challenges of the 21<sup>st</sup> century knowledge society. To fulfil professional cultural, educational and pedagogical functions more effectively and to guarantee optimal implementation of information and communication technologies (ICTs), it is necessary that librarians have adequate skills and competences characterize their digital professional culture of librarianship [Redecker, C., Carretero, S., Vuorikari, R. & Punie, Y. (2017); Red'kina N.S. (2018)].

The main way of the acquisition of such skills and competences is the implementation of different ICT-technologies and digital materials (texts, books, films, some other digital educational resources) in the educational process. At present the

process of informatization and digitalization in the librarianship is in full swings. It includes equipping libraries with modern ICT-technologies, and implementing them with e-book distribution processes, and replenishing funds with electronic information resources.

This proves the fact that libraries need professionals and require educational institutions to provide the appropriate level of training for students. Universities' train libraries and information services, the system of students' computer literacy and the ability to work with new information technologies, computer networks, and multimedia systems development should be modernized. All in all, the educational process in the system of cultural education should be focused not only on improving the quality of professional training, but also on the competitiveness of graduates in the developing labor market and in the market for providing librarian services [Red'kina N.S. (2018)].

In the current situation on the market for the provision of librarian services, it is very important to develop the students' ability to draw attention to themselves, psychologically competently present an effective solution of a professional problem. Students' participation in game activity, conferences, case-study, debates, imitation of librarian practices stimulates the process of professional development and growth of future librarians. Students? Playing the role on one side or on the other, obtain the most effective ways of solving a professional problem. In our own educational experience we used to organize such master classes as "Library research in the context of the innovative development of scientific libraries", "Electronic environment as a professional space of the library", etc., to stimulate pedagogical interaction with students within academic discipline to achieve didactic goals and aims. Participating in this kind of activity librarian students get acquainted with the main features and peculiarities of the librarian profession and his professional activity, consider goal-setting, selection and structuring of the content of educational material as the most important components in obtaining a set of theoretical knowledge significant for a future professional [Neshcheret, M. YU. (2019); Red'kina N.S. (2018)].

Students, as future librarians, were offered a research task on the topic "Modern library and innovations" before starting to study the topic "Innovative development of libraries". Students had to find out how library readers get out of difficult ethical situations, where they look for answers to difficult questions, what innovations they use in their work, identify the features of the work system and traditions, etc.

To cover the topic, we invite famous cultural figures, use episodes from films, TV shows, excerpts from articles that do not have a clear assessment. For example, we invited Sergey Bykov, a public relations specialist, to have a master-class with students. He used situations from his practice as an example. Students were

asked to discuss a specific library event, where the main goal was to attract readers through social networks.

Daria V. in her speech noted that with the advent of the Internet, the ability to directly access almost any database of information, the library profession must meet modern requirements and needs of society. This is necessary in order to better meet the growing needs of users (readers and subscribers) in information. A possible way out of this situation is to provide information in the form in which it will be required by users, representatives of various fields of knowledge or communities.

It is worth noting that students of the Library science specialty of the West-Kazakhstan State University named after M. Utemisov participate in the Republican Olympiad, initiated by the South Kazakhstan State University named after M. Auezov, from year to year.

The nature of the librarian's work is gradually changing. Until recently, manual labor was mainly used, but now the library employees can transfer many of their functions to various machines and devices. The goal is still the same: to maximize the social effect of human-information interaction. Due to the informatization of the society, the traditional library is becoming more and more automated and digitalized. At the same time, the librarian is still an essential element of any library, including an electronic one. No matter how "wise" a modern machine is, many of the intellectual operations performed by a librarian are not yet up to it. Artificial intelligence, equal to the natural human in its intellectual characteristics, has not yet been created.

The library profession's natural focus on humanistic solutions to the problems of informatization does not contradict its focus on the free development of a person in society. Respect for knowledge and intelligence is a necessary prerequisite for success in informatization, in the development of the library profession, and in meeting the needs of readers.

Alena Z. noted that at present, a person, often an amateur, needs to navigate the flow of information and to select the necessary information quickly. The informatization of society determined the emergence of an ICT-worker profession. And the trend in the development of society is such that today the classical librarian has become an ICT-worker. The values of information service that reflect the meaning of the profession are at the heart of information ethics, or rather the ethics of the librarian or ICT-worker. The ICT-worker (eng. knowledgeworker) is a knowledge worker whose activities are related to processing existing information and obtaining new information; includes programmers, analysts, planners, etc.; sometimes this group includes all employees with a high level of education or related to education.

It should be noted that "a person, who owns the information, owns the world."

Today, his expression could not be more relevant. Among the growing needs of the knowledge society, the need for information is coming to the fore. In this regard, the library profession can get a new impetus to its development.

Librarianship can be a great integrating agent that gives order to the mental life of our time and connects people with their entire environment. It is this formation of the synthesis of human knowledge for the purpose of spreading wisdom that is one of the most important contributions that a librarian can make to a person's mental life; his gift is order and interconnectedness.

At first glance, it may seem that with the advent and development of new technological tools that facilitate access to almost any information (including at the international level), the library profession will not be so popular in the society of information consumers. However, this is not entirely true. Changing in the conditions of the scientific and technological revolution in form, the profession of librarian remains the same in essence. In the context of informatization and automation, the role of the librarian should acquire a new character and become more distinct. The modern period is characterized, on the one hand, by the globalization of library services (access to world information resources), on the other – by individualization, when individual conditions are provided for obtaining information (at work, at home, etc.). Technological and socio – cultural changes in the world have defined a new philosophy of library work – ensuring free access to information. By mastering modern technologies, the librarian becomes more and more necessary for society and users. Therefore, the library profession in the information society will not lose its relevance.

The library profession is one of the most interesting and exciting in the sense that every day brings acquaintance with new books, fresh issues of Newspapers and magazines, new people, unique specific situations arise.

The discipline “Professional ethics” shows students that a librarian is a highly educated person who knows the basics of reader psychology, pedagogical skills, is oriented in the variety of publishing products, knows how to use technical means in work, knows the basics of computer science, propagandist, organizer.

Students were motivated by us to study the discipline of professional ethics. It is important that students understand that not only theoretical knowledge in the main disciplines is important, but also that the chosen profession has a great social significance, that a librarian has no right to be indifferent, not erudite, not to have empathy.

By serving others, you grow yourself. Academician D. Likhachev compared a librarian to a scientist who works not only with his own research problem, but with some other research problems at the same time. The profession of a librarian requires an active position, connection with life, everything that is done in the country is an important business for librarians.

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高校教育过程模块评价组织的框架方法  
**THE FRAME APPROACH TO THE MODULE-RATING  
ORGANIZATION OF THE EDUCATIONAL PROCESS AT  
UNIVERSITIES**

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抽象。 本文旨在揭示和表征框架方法在大学生模块化模块训练中的教育潜力。 框架方法为全面解决任务创造了新的先决条件，以提高教育过程的有效性和培训强度。 使用框架方法时，教学材料的呈现逻辑最完全符合构建用于学生学习和认知活动的算法的要求。

关键词：教育活动； 教学； 学习； 认知活动； 教育过程的模块评分组织； 计划块； 帧； 框架方法。

**Abstract.** *The article aims to reveal and characterize the educational potential of the frame approach in the block-modular training of university students. The frame approach creates new prerequisites for a comprehensive solution of tasks to improve the effectiveness of the educational process and the intensity of training. The logic of presentation of educational material when using the frame approach most fully meets the requirements of building algorithms for students' learning and cognitive activities.*

**Keywords:** *educational activity; teaching; learning; cognitive activity; module-rating organization of the educational process; a scheme block; frame; frame approach.*

Modern scientists, who are engaged in the development and implementation of new forms and methods of teaching and learning in higher education organizations, suggest using non-traditional (active, interactive) forms and methods of educational activity to activate students and increase their interest in classes. In pedagogy, they are often called active forms and methods of teaching and learning because of their reliance on the activity of not only perception, memory and



understanding of students, but above all, on orientation to creative, productive, critical thinking.

History as a subject studied by students at universities plays a special role in the cultural development of students, their citizenship and patriotism. Therefore, several points of view on various problems, events, and situations, and the choice of them based on the discussion of the most scientific, optimal and acceptable issues are the most important tasks solved at the lessons of History.

At present university teachers use the module-rating organization of the educational process which shows very positive educational and pedagogical results. The goals and aims of implementing this system are as follows: to increase students' motivation for systematic work, to activate students' independent activity, to improve the quality of education, etc. Modular technology involves planning and organizing the process of studying the history course in thematic modules. Modular structuring of the lesson allows a teacher and a student to identify continuity in the formation of knowledge (for example, the system of work on the assimilation, consolidation and application of concepts, skills, in solving problems of education).

The recent years have been marked by an active search and extensive use of methods that can significantly improve the effectiveness of teaching history, one of which is the frame approach. Frame technology solves several problems simultaneously: it is the formation of complete knowledge and abstract thought of students, systematization, deepening, expansion of theoretical knowledge, etc.

The frame scheme assumes the presence of a visualized rigid frame structure (“blanks”, “clichés”), superimposed on a variety of topics. It is one of the instruments of structuring educational material. At lectures and seminars with students, the method of frame reference schemes is used, which is a mean of intensifying the educational process and activating the cognitive activity of students and schoolchildren. For example, a comparative analysis of personal and professional characteristics and qualities of historical figures, state leaders, major reformers, military leaders, etc. is carried out using a frame table.

There are several ways to explore this topic. Personalities can be studied using a five-step algorithm, the implementation of which allows to evaluate the most essential qualities of the individual. This method contributes to the development of a scientific approach to the study of individuals. However, individual blocks of this algorithm can be excluded from the research chain, depending on the presence (absence) of this aspect in the activity of the individual.

There is another option. In the form of a block diagram, make biographies-characteristics of historical persons, using approximately the following questions:

- 1) Years of life and reign;
- 2) Conviction;

- 3) Ideas;
- 4) Solve problems;
- 5) Stages of activity;
- 6) Historical significance.

At the same time, based on these questions, students fill in the table.

Evaluating everything that was done by a particular ruler, students are convinced that certain qualities of the leader and his environment have always played an important role in Russia, which subjectively colored the process of resolving historical patterns.

The frame approach allows for a deeper study of historical sources. Working out questions of practical significance of the source under study is more or less invested in a certain algorithm of action. It consists of several scheme blocks:

- 1) Selection of a specific example (fact, event, idea, position, etc.) for the analysis;
- 2) Selection of analogs from the source under study;
- 3) Reflection on the possible implementation of historical experience in the current life of society;
- 4) Finding out what these analogs have been developed in modern conditions.

The order of scheme blocks can be changed. Rearranging the scheme blocks can give other options for working out the practical orientation of the ideas and positions of the source under study. When studying historical literature, you can use the method of step-by-step study of sources, which includes 3 consecutive interrelated stages of work:

- 1) Preparatory stage;
- 2) Assimilation of the content of the information source;
- 3) Performing a synthesis and practical assignments.

The preparatory stage includes understanding the terminology of the source, finding out the reasons, time and historical conditions, analyzing facts and events, and identifying the qualitative characteristics of individuals.

At the next stage (assimilation of the content of the information source), the main, nodal issues of the source are highlighted, ideas and main provisions are clarified.

The third stage (performing a synthesis and practical assignments) includes certain interrelations of ideas and positions among themselves, understanding the meaning of the source ideas for the studied historical period and modernity, analysis of events and processes of reality. By introducing students to practical tasks, students are taught to use the rich historical experience of our people.

There are certain rules for reading historical texts.

The differential algorithm, in contrast to the integral one, is based on the method of selecting semantic reference signals.

Schematically, the algorithm can be represented as follows:

*Stage 1.* Selecting keywords in text segments (paragraphs);

*Stage 2.* Completing semantic sentences of the key words in segments of text;

*Stage 3.* Selecting keywords in text segments (paragraphs).

Educational activity on the basis of a differentiated algorithm helps students identify the main meaning of a text or its segment.

There are methods of working with the terminology apparatus. Experts believe that teaching concepts is one of the main tasks of a teacher. This scheme represents a scientific and effective increment of historical knowledge among students:

*Stage 1.* Statement of the study definition of terms;

*Stage 2.* Selection of historical frames (periods, years) that fit into the implementation;

*Stage 3.* Record specific facts that occur in history and fall under the entity.

First of all, a student need to write out the titles of sections from textbooks, to write out the main concepts, categories, to find common concepts or categories that combine all the content of the text, and finally, to build a logical structure (scheme) that includes the selected concepts and categories, taking into account the relationship between them. If a student manages to find generalizing concepts and categories, he can construct a logical scheme with a hierarchical structure. If some concepts follow from others, a student can establish cause-and-effect relationships and build logical chains. If concepts, categories, and facts are related chronologically, a student can build chronological tables. The most important thing, the diagrams should have a purpose and meaning. They should help to understand the causes of many historical events deeper.

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关于在俄罗斯大学教授俄语作为外语的能力培养的综合方法  
**ON AN INTEGRATED APPROACH TO THE FORMATION OF  
COMPETENCIES IN TEACHING RUSSIAN AS A FOREIGN  
LANGUAGE AT A RUSSIAN UNIVERSITY**

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抽象。 本文介绍了在俄罗斯大学学习俄语的学生的能力培养的综合方法。 总结了跨贝加尔湖州立大学俄语系外国语系在学士学位方向“心理学”（“应用语言学”简介）的培训过程中的经验。 请注意在课堂上和课外工作中能力的形成。

关键词：俄语作为外语，一种综合的教学方法，课堂工作，课外工作。

**Abstract.** *The article describes an integrated approach to the formation of competencies in students studying Russian at a Russian university. The experience of the Department of Russian as a Foreign Language of the Trans-Baikal State University during the training of students in the direction of the bachelor's degree "Philology" (profile "Applied Philology") is summarized. Attention is drawn to the formation of competencies both in the classroom and during extracurricular work.*

**Keywords:** *Russian as a foreign language, an integrated approach to teaching, classroom work, extracurricular work.*

The introduction of multilevel education in Russia has become the basis for a global transformation of approaches to teaching at a university. The competence-based approach to education was enshrined in the Government Program for the Modernization of Russian Education until 2010, and then in the materials "On Priority Areas of Development of the Educational System of the Russian Federation".

The competence-based approach is a set of general principles that are necessary in order to determine the goals of education, organize the educational process and evaluate its results. Competence is understood as a system of knowledge, proficiencies, skills and abilities, united by a key system-forming element and aimed at solving certain tasks of activity.

The standard in the direction "Philology" assumes that during training, students should have three types of competencies: general cultural, general profes-

sional and professional [7]. The curriculum indicates the set of competencies that should be formed in the process of studying the discipline by the student. The teacher selects a set of techniques, techniques that should optimize this process. At the same time, the competence significance of the disciplines can be different. For example, when studying the discipline "Primary language (Russian)", five competencies must be formed, while studying the optional course "World Cinematography", the range of competencies is narrowed down to two. Teaching Russian as a foreign language is essentially the formation of a set of relevant competencies. Complexity also applies to the process of forming knowledge, skills, and abilities focused on the future profession. The very concept of the applied bachelor's degree is based on practically oriented teaching, therefore, in the process of mastering any discipline, a student must acquire in a complex not only knowledge, but also certain skills and abilities. When developing the work program of the discipline, the teacher assumes 3 levels of knowledge, skills and abilities among students - threshold, standard and reference.

Competencies aimed at mastering knowledge about the language system, about the rules for the functioning of language units in speech, the ability with the help of this system to understand other people's thoughts and express their own judgments in oral and written form are central to the key competencies in the study of the disciplines "Foreign language (Russian)", "Main language (Russian)". This is the basis without which communication is impossible. Nevertheless, one should not forget that foreigners learn the language in order to understand Russian people and adequately respond to their speech [3; 4; 5]. And although communicative competence is not spelled out in the standard, language learning is subordinated precisely to its formation. The leading role of communicative competence with the interconnectedness of the rest is reflected in the goal of the "Foreign language" discipline - teaching the main aspects of language and types of speech activity for the formation of communicative competence among foreign students. Communication is impossible without basic knowledge of speech etiquette. How to say hello, say goodbye, and thank a person - this should be taught from the first days of training, in preparatory courses. Students, starting from the first year, should have an idea of the situations in which one or another word can be pronounced, about the stylistic attribution of words and texts. Students need to be taught to communicate not only in everyday life, but also in actual situations of educational and professional fields of activity. In practice, it turns out that the entire educational process is subordinated to this: at each lesson, students are included in dialogues and polylogies, in the study of all disciplines, intercultural professionally oriented situations are simulated, especially in senior courses.

A foreigner should be able to implement communicative tasks adequately to his social status in various socially and psychologically significant communica-

tion situations, not only in the social, but also in the socio-cultural, official and business spheres. In this case, the topic of conversation should be determined by both the personal and social needs of the speaker. The list of goals and objectives already contains complexity, which is expressed not only in a combination of competencies, but also in reliance on various types of speech activity, as well as in the subordination of the process of teaching Russian as a foreign language to the future professional activity of students.

At the Transbaikal State University, for students studying in the direction of "Philology" (profile "Applied Philology"), all conditions are created for the optimal formation of competencies. Classes in the Russian language are conducted in small subgroups of 10-15 people, as a result of which the teacher has the opportunity for individual work with each student.

The formation of competencies is based on the activity approach, which involves learning through practice. At the same time, individual educational trajectories are built, background knowledge is used, intersubject connections are established.

Freedom in the choice of educational material allows the teacher to widely apply background knowledge in the classroom, to expand the scope of knowledge by referring to other subjects. In Russia, the teacher himself chooses not only the methodology, teaching methods, but also the textbook, which he considers optimal for studying the discipline. It may be a federal publication, but often the manuals are created by the teachers themselves in strict accordance with the standard and the program of the discipline. For example, the textbook, which students use to study the main language (morphology), includes texts that allow expanding the background, including regional, knowledge about Russia. It also contains texts with a regional focus. From them, students can learn some information about the nature, climate, history of Zabaykalsky Krai [1].

It is generally accepted that the process of forming competencies in a foreigner mastering the Russian language is carried out only in the classroom, during the development of disciplines. However, this is not the case: a student studying the Russian language accumulates knowledge continuously, including during extracurricular work, the main goal of which is an integrated approach to the formation of communicative, sociocultural, and linguistic competencies. At the same time, the formation of students' creative abilities is also of great importance [2].

The variety of manifestations of extracurricular work dictates a variety of tasks:

- to reveal the creative and intellectual potential of foreign students;
- to popularize the cultural achievements of the peoples of Russia;
- to promote spiritual and cultural values, language and literature;
- to reveal the peculiarities of the Russian mentality;
- to show the intellectual potential of the Russian people.

Creation of conditions for the development of a creative and intellectual personality through the transformation of Russian cultural and scientific traditions; modeling the Russian linguocultural situation by representing the spiritual values reflected in Russian cinema, in the works of classical and modern Russian-language literature, can make a certain contribution to the process of forming a favorable opinion of foreigners for Russia. That is why extracurricular work is often given a significant place in the system of teaching Russian to foreigners [6].

In the process of implementing extracurricular work, the following problems are solved:

- problems of intercultural interaction and tolerance;
- problems of optimizing intercultural interaction;
- problems of formation of students' linguistic, communicative, socio-cultural competencies;
- problems of creating conditions for the formation of a creative personality.

The directions and forms of extracurricular work are diverse. The main forms can be considered individual, group, mass. Individual forms include work on an FQP, scientific report or article, abstract, term paper. This form is included in the curriculum and is considered mandatory. An important role in the formation of competencies is played by forms that are of a mass or group nature - various scientific conferences, circles, quizzes, creative events, which are organized by the Department of Russian as a Foreign Language at Transbaikal State University and help students not only to replenish their knowledge of the Russian language, but also to exist comfortably in a new cultural environment for them.

Students enter the university and face one of the most important problems - the problem of adapting to new living conditions and learning. They have to adapt to the mentality of the Russian people, immerse themselves in a different culture. Even for those who know Russian well, it can be difficult to establish an optimal communication process in the first months of life in Russia.

During this period, the department has developed activities that allow students to quickly adapt to new language and cultural conditions. The complex of classroom and extracurricular activities leads to the gradual introduction of various models of the Russian-speaking space. In extracurricular time, students are introduced to Russian cultural traditions, show the sights of Chita, students, together with teachers, visit museums and exhibitions. All this in combination makes their life in Russia rich in cultural events, vivid and memorable.

The teachers of the RFL Department of Transbaikal State University do not just introduce students to the world of the Russian word, they strive to make their life in Russia interesting and eventful. It is for this purpose that scientific and educational conferences are organized, various contests and quizzes, Russian Language Weeks, Olympiads and concerts are held.



Students and advanced listeners of the courses take an active part in the international student conference "Philological Education and the Modern World", which is annually held at the Faculty of Philology and Mass Communications of Transbaikal State University. The Department of Russian as a Foreign Language organizes 2 annual scientific conferences in cooperation with the Hulunbuir Institute (Hailar, China). The international scientific-practical conference "Russian language in modern China" is taking place in Hailar, and the international scientific conference "Interpretation of the text: linguistic, literary and methodological aspects" - in Chita. Foreign citizens have the opportunity to declare their scientific achievements, to determine for themselves points of growth and learning prospects.

Very often, listeners and students who come to Russia, in the first months of their stay, feel constrained, constricted, afraid to make a mistake because of their little experience of communication with Russians. Therefore, many out-of-class events are liberating in nature. Contests, festivals, quizzes, games are the main forms of creative activities. The events that were prepared for the Russian Language and Culture Centers in China, and then held for Tbsu students, included the Literary "Living Room", "Presentation of Russian Painting Works", "Evening of Russian Romance", "Russian Classical Music", "Video Tours Zabaykalsky Krai", "Russian Language and Culture Festival". A concert program is often presented at festive events. Foreigners sing, dance, play musical instruments, recite poetry. There are no winners here - all contest participants are awarded.

The Literary Lounge is interesting because it gives students and listeners the opportunity to get acquainted with the work of Russian poets. At such events, which are always marked by high spirituality, the works of A.S. Pushkin, M. Yu. Lermontov, S.A. Yesenin, A.A. Akhmatova and other poets are read by teachers and students. This event gives foreigners an insight into not only Russian literature, but also Russian culture in general.

Foreign students usually get a no less vivid idea of the spiritual component of the Russian people during presentations of works of Russian painting and Russian music. At the holidays of the Russian language and culture, Russian songs, poems are played, excerpts from Russian films and cartoons are presented.

The RFL Tbsu department annually hosts events such as the celebration of the Day of the formation of the PRC, the holiday of national cuisine, the celebration of the Russian New Year, the celebration of the New Year according to the Chinese calendar, the celebration of Maslenitsa, Easter, the expressive reading competition, etc.

Every year in May, the Department of Russian at Transbaikal State University organizes the "Week of the Russian Language". As a rule, Olympiads, reading contests, educational conferences, wall newspaper contests, concerts are held within the framework of the Week. The expressive reading competition is usually

of particular interest to students. In 2017, it was titled "Ah, Sixties!" and was dedicated to the memory of E. Yevtushenko and B. Akhmadullina. In 2018, poems of a military theme were sounded, and in 2019, the guys recited "Eugene Onegin" by heart. Students not only read expressively - they selected the appropriate musical accompaniment, prepared presentations.

Most of the students come to Chita under agreements concluded with partner universities. On the basis of some of them, the Centers for the Russian Language and Culture, created by Transbaikal State University under the auspices of the Russkiy Mir Foundation in 2013, were opened. Active work is carried out in the Centers of the Hulunbuir Institute (Hailar) and the Manchurian Institute of the University of Inner Mongolia. The events held at the Centers allow students to learn the peculiarities of the Russian world before arriving in Russia, thus, the adaptation period begins in China.

Periodically, the best foreign students become participants in the All-Russian Olympiad in Russian as a foreign language at the Peoples' Friendship University of Russia (Moscow), showing a high level of knowledge of the Russian language and Russian literature, as evidenced by numerous letters of thanks. The department actively cooperates with the Zabaykalsky Krai Scientific Universal Library named after A.S. Pushkin and the Regional Children's Library. G.R. Graubina. Events dedicated to the work of Trans-Baikal writers, which are held in the children's library, are held with the active participation of our students. The department organizes educational excursions to the museums of Chita, movie screenings in cinemas, visits to the Zabaykalsky Krai drama theater. Every year, students take part in the celebration of the Days of Slavic Writing, in the Trans-Baikal International "UN Model" game, which is an example of tolerance and intercultural interaction.

Of course, the pandemic has made adjustments to the work of the department: in 2020, classes with students are held online on the ZOOM platform, but the basic principles of working with students remain the same. On November 20, ZOOM successfully hosted a joint scientific and practical conference of Hulun Buir University (PRC) and Transbaikal State University "Russian language in modern China", in which Chinese students and undergraduates took part.

So, in Russian universities in all specialties and areas of bachelor's degree, students develop a complex of knowledge, skills, abilities of a general cultural, general professional and professional nature. Out-of-class work in combination with classroom studies can be an effective way of developing the competencies necessary for communication in the Russian-speaking environment. Such a complex of competencies allows the university to graduate a professional - an educated person with extensive special and general cultural knowledge, capable of applying it in practice.

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在同义的基础上使用结合成对的单词对, 以此为母语人士和双语者建立沟通桥梁

**WORKING WITH ASSOCIATIVE PAIRS OF WORDS COMBINED  
ON THE BASIS OF HOMONYMY AS A WAY TO FORM  
COMMUNICATION BRIDGES FOR NATIVE SPEAKERS AND  
BILINGUALS**

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抽象。本文讨论了在同义的基础上结合使用关联词对的方法, 并描述了在母语者和双语者之间形成沟通桥梁的方法之一。在工作的理论部分中, 确定了建立联系和交流桥梁的两种主要方法: 通过隐喻或通过隐喻在每个人的词汇元素之间形成大量化合价。旨在通过词汇单位价系统提高操作速度的练习可以显著提高本国语言和外语的思维速度, 以及以目标语言解释源语言的元素的速度, 这对于双语沟通能力的发展。在这项工作的过程中, 以母语为母语的人发展了灵活性和思维速度, 并形成了新的思维模式。搜索单词的过程是基于同音现象启动的, 该现象与母语使用者在交流过程中无关。这种做法使双语者可以更深入地研究语言思想, 从而有助于语言素养的发展。

关键字: 交际和沟通的桥梁, 学习外语, 心理语言学, 同名。

**Abstract.** *The article discusses the methodology of working with associative pairs of words, united on the basis of homonymy, and describes one of the ways of forming communication bridges among native speakers and bilinguals. In the theoretical part of the work, two main ways of creating associative and communicative bridges are determined: through metaphorical or through metanymic formation of a large number of valencies between the elements of the vocabulary of each individual. Exercises aimed at developing the speed of operations with the system of valences of vocabulary units significantly increase the speed of thinking in the native and foreign languages and the speed of interpreting the elements of the source language in the target language, which is especially valuable for the development of communication skills in bilinguals. In the process of this work, native speakers develop flexibility and speed of thinking, as well*

*as the formation of new thinking models. The process of searching for words is launched based on the phenomenon of homonymy, which is irrelevant for a native speaker in the process of communication. This practice allows bilinguals to dive deeper into the linguistic mentality, which in turn contributes to the development of linguistic flair.*

**Keywords:** *associative and communicative bridges, learning a foreign language, psycholinguistics, homonymy.*

The formation of communicative skills is a complex and lengthy process, which includes the improvement of general thinking techniques, such as the operations of analysis-synthesis, generalization, concretization, classification, etc. One of the criteria for the successful mastering of communication skills and abilities can rightfully be considered the speed of processing perceived and issued information in the process of communication, as well as the speed of orientation in the communicative space, taking into account the time, place and participants in the communicative situation. Of great importance for increasing the speed of orientation in the communicative space is the developed structure of associative-communicative bridges, which allows you to feel free in the process of communicating with any interlocutor in a conversation of any complexity. This ability develops in a person for quite a long time, it needs constant support, since it tends to atrophy the system of associative links, which are often born and fixed at the subconscious level, on the periphery of the thought process.

In turn, the system of communication links for building the structure of associative-communicative bridges is based on such basic concepts as *association* and *associative field*.

According to the definition of the Great Psychological Dictionary, an **association** can be considered a natural connection that arises in the experience of an individual between two contents of consciousness (sensations, representations, thoughts, feelings, etc.), which is expressed in the fact that the appearance in the mind of one of the contents entails and the emergence of others [1, p. 58]. The **associative field** (in the terminology of Sh. Balli) is built on the basis of combining certain groups of associate words around the stimulus word [5, p. 381], or represents the broadest lexical formation, including words united by associative links in the widest range <...> amorphous lexical formation with blurred and hardly distinguishable boundaries [3, p. 131].

Thus, for the formation of a large number of associative fields, it is necessary not only to have a wide vocabulary of the language, both native and foreign, but also to be able to use it, that is, to be able to quickly select the linguistic units necessary for a given communicative situation, and to feel the system well valencies of each nominative unit (word or phrase) for optimal perception and construction

of the utterance.

According to R.O. Jacobson, the communicative process can develop in the direction of two different semantic lines: one can lead to the other through similarity, or through contiguity [6, p. 88]. As is known, the words of any language are for the most part polysemy and the development of polysemy is directly related to the evolutionary process of the language, as well as to the historical processes of the environment where this language functions. At the same time, the figurative meaning of the word also develops on the basis of one of two directions: transfer by similarity, which in linguistics is briefly called a *metaphor* [2, p. 533], and contiguity transfer, called *metonymy* [2, p. 540].

In accordance with this, we can say that there are two main ways of forming associative-communicative bridges: through metaphorical or through metanymic formation of a large number of valences between the elements of the vocabulary of each individual. Exercises aimed at developing the speed of operations with the system of valences of vocabulary units significantly increase the speed of thinking in the native and foreign languages and the speed of interpreting the elements of the source language in the target language, which is especially valuable for the development of communication skills in bilinguals. Later in the language, on the basis of polysemy, **homonymy** usually develops – "sound alignment of various linguistic units, the meanings of which are not related to each other" [5, p. 344]. It should be noted that in ancient languages, as dictionaries show, the phenomenon of homonymy borders on polysemy.

In some types of brain diseases - aphasias - there is a partial or complete destruction of the ability to form in a person's speech the ability to metaphorical or metanymic transfer of meaning. This phenomenon can also be diagnosed and restored using certain methods of psychocorrection, but this is material for a separate scientific study.

**Purpose of this paper** – to give an idea of the method of working with associative pairs of words, united on the basis of homonymy, as a way of forming communication bridges among native speakers and bilinguals.

When working on the formation of communication bridges among native speakers and bilinguals, homonymy becomes an indispensable tool. The essence of the technique is as follows: the values of the homonym are considered (as a rule, the two most obvious are selected), an associative relationship is established between the values.

For example, the homonym «свет» has two meanings: 1. the world, i.e. «обойди весь белый свет»; 2. society – «высший свет». A pair of words is created, connected by an associative connection: мир – общество.

The student (native speaker, bilingual) is asked to guess the homonym encrypted in such a pair. An important condition for creating such associations is the

use of only two words; in some cases, a qualifying third word is allowed. Addressing a larger number of words will result in a splitting of the spectrum of possible meanings, which will create additional difficulties. Associative pairs can suggest, as an answer to only nouns, but also adjectives and verbs.

Homonymous associative pairs can be divided by levels of difficulty, as students overcome a simple level, move on to more complex ones. The greatest difficulties, especially among bilinguals, are associated with associative pairs based on colloquial speech and playful parallels, as a rule, understandable to a native speaker of the same language.

Here are examples of homonymous pairs of different difficulty levels. Initial level – the simplest connections:

поваренная – нота = соль

Соль – table salt i.e. "Sodium chloride in grains, is used as a seasoning for food" [4, v. 4, p. 375], and the second meaning of the homonym - "one of the notes of the musical scale" [4, v. 4, p. 376]. An associative pair is created from two words that convey the meaning of homonyms as accurately as possible.

хлеб – ребёнок = крошка

The dictionary edited by Ushakov combines two meanings of the word "крошка" in the text of one article: "1. the smallest part of anything, mostly bread. 2. Baby, a child" [4, v. 1, p. 1527]. In this case, the author of the dictionary perceives homonymy as a manifestation of polysemy.

ткань – дорога = полотно

For the word "полотно" the explanatory dictionary notes eight meanings, the first and fourth in this case made a pair: "1. Piece, cut of fabric <...> 4. Railway embankment, track" [4, v. 3, p. 540]. The phrase "дорожное полотно" contains a metaphor, but it is moving further and further from the direct literal meaning, so we can talk about the phenomenon of homonymy.

When working with such pairs, the student gets used to finding matches, the most important process of forming new skills of perceiving the meaning of words takes place. Communicative bridges are being built that make it possible to form the flexibility of thinking.

The medium level of difficulty assumes a deeper immersion in the topic and the implementation of independent work. In pairs of words of this group, polysemous connections are becoming weaker, more and more figurative meanings of words come to the fore, i.e. metaphors are becoming more and more detailed. To recognize and understand such associative pairs, it is necessary to rely on the linguistic instinct of a native speaker, i.e. understanding how these words and concepts are combined with others - linguistic valence.

хлеб – бесчувственность = черствость



The dictionary notes two meanings of the word "черствость": "1. Dried, hardened bread. 2. fig. Soulless, unresponsive" [4, v. 4, p. 1268] about a person. The semantic affinity in this pair of words is based on the linguistic valence of each of the selected words: "stale bread" and "insensitive, stale person."

страдательный – ломбард = залог

A similar principle applies to this pair: "страдательный залог" and "в ломбард что-либо можно сдать в залог".

барабанная – вычисления = дробь

The fast, rhythmic beat of drumsticks on the surface of the instrument is called "барабанная дробь", and solving examples with fractions – calculations.

танк – бабочка = гусеница

Гусеницы – a special arrangement of the wheels of a tank, a butterfly is formed from a caterpillar - this connection of homonyms excludes metaphor.

Associative homonymous correspondences of the middle level are designed to consolidate a new skill. At this stage, it is assumed as homework with a dictionary of homonyms and composing your own pairs based on meanings. In most cases, different students will create the same pairs, since working with a dictionary of homonyms presupposes stereotyped thinking. The simplest pairs will be formed based on the lexical meaning of words, without taking into account the context.

Joking and colloquial homonymous connections are obvious to a native speaker and extremely difficult for a foreigner. Working with them is most productive in the case of bilinguals, since solving them requires deep immersion in spoken language.

птичка – пометка = галочка

You can make notes in the margins in the text "поставив галочку", a graphic symbol that vaguely resembles a bird in the sky. Галки – are birds. Such a chain is difficult for someone who is excluded from the language context.

рыбешки – монетки = мелочь

In the sentences "У меня в кармане много мелочи" and "Рыбак хотел поймать крупную рыбу, но наловил много мелочи" there is a homonymy, which can be regarded as arising on the basis of a metaphorical connection: both fish and coins are silvery

рыба – затрещина = лещ

Often the cuff is called a slap, and even more often you can hear the phrase "дать леща" meaning "hit the back of the head with your palm". At the same time, "лещ" – "fish of the carp family" [4, v. 2, p. 53].

жадность – земноводное = жаба

Another tricky example. When a person is sorry to spend money on an object, he can say "меня жаба душит". This expression is idiomatic. Why a toad? Probably, here you can trace a reference to the diagnosis, which in the common



people was called "грудная жаба" - angina pectoris. But the exact etymology of this expression is not clear. "A toad - a tailless amphibian with warty skin" [4, v. 1, p. 841].

This level is the most difficult for bilinguals and those for whom Russian is not their native language, since there is an appeal to the spoken layer of vocabulary, associative links are not obvious to a foreigner.

### **Conclusions**

The methodology presented in this article for working with associative pairs of words, united on the basis of homonymy, reveals one of the ways to form communicative bridges among native speakers and bilinguals.

In the process of this work, native speakers develop flexibility and speed of thinking, as well as the formation of new thinking models. Thus, the process of searching for words is launched based on the phenomenon of homonymy, which is irrelevant for a native speaker in the process of communication. The technique also contributes to the development of linguistic flair and the rupture of established patterns of thinking, since it lies outside the usual metaphor for a native speaker. As a result of the work, the active vocabulary is replenished.

This practice allows bilinguals to dive deeper into the linguistic mentality, which in turn contributes to the development of linguistic flair. There is a formation of new categories of thinking (according to the principle of the contiguity of writing and sound). In the process of working with homonyms, acquaintance with idiomatic expressions occurs, which helps to understand their structure and allows, on the basis of this, to build a system of associative fields between the elements of the language system. In addition, this technique contributes to the replenishment of vocabulary through new groups of similar words (homonyms).

It is possible to consider the use of practice in the study of Russian as a foreign language, provided that the skills of thinking in Russian are formed. The practice can be effective in getting acquainted with the homonymy of the Russian language, as a way of memorizing and activating communicative bridges.

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P.E.手稿遗产中的少量民间文学艺术 Sheshkina: 翻译功能  
**SMALL GENRES OF FOLKLORE IN THE MANUSCRIPT HERITAGE  
OF P.E. SHESHKINA: TRANSLATION FEATURE<sup>1</sup>**

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抽象。 本文涉及彼得·埃菲莫维奇·谢什金 (Peter Efimovich Sheshkin) 的手写材料，这些材料是带有民族志笔记的笔记本，是曼西人的民间传说文本。 这些文本以曼西语编写，部分翻译为俄语。 在本文中，我们确定了文本翻译的功能和问题。

关键字：曼西语，翻译，民俗小流派，功能。

**Abstract.** *The article deals with the handwritten materials of Peter Efimovich Sheshkin, which are notebooks with ethnographic notes, folklore texts of the Mansi people. The texts are written in Mansi and partially translated into Russian. In the article, we identified the features and problems in the translation of texts.*

**Keywords:** *Mansi language, translation, small genres of folklore, features.*

The Mansi language is very rich in idiomatic expressions, proverbs and sayings that are constantly found both in the folklore of the people and in works of art, respectively, in the everyday communication of the Mansi. Mansi idioms are very diverse, difficult enough to study and translate, since, being an integral attribute of folklore, an attribute of the culture of a given people, they reflect the life of the nation to which they belong, this is the way of thinking and the character of the people. There are practically no works on the research and study of Mansi idiomatic expressions. Basically, folklorists and researchers were engaged in collecting material on other genres. Although this type of paremia is very diverse, they are, as it were, outside the time space. Indeed, no matter what time we live, proverbs and sayings will always remain relevant, always in place. They reflect the rich historical experience of the people, ideas related to work, life and culture of people. The correct and appropriate use of proverbs and sayings gives speech a unique originality and special expressiveness.

<sup>1</sup>*This work was carried out with the financial support of the RFBR, project № 20-512-23001\ 20 "Dialogue of languages in the handwritten heritage of the Mansi collector P. Ye. Sheshkin: identification, analysis and representation."*

A huge amount of material on Mansi folklore and, in particular, on paremias was collected by P.E. Sheshkin, Mansi gold, a master and just a good person [1]. Throughout his life, he was engaged in the collection of folklore, made sculptures from wood, and composed songs. He was left with a unique handwritten material that required processing and translation.

A feature of the creative heritage of P.E. Sheshkin is a recording of texts in two languages: in Mansi and partial translation into Russian. The language of the original has preserved the original samples of Mansi folk speech, folklore, which allow one to present the features of the traditional Mansi worldview. The pairs he collected deserve special attention. A language that is truly unique. Such samples at the present stage are no longer used. When decoding the materials of P.E. Sheshkina, we faced a number of problems. One of the main problems is discrepancies, both in spelling and in the author's translation. For example, here's an excerpt from a song:

*Ань сагың аги атың пуңкен  
Атэ сар щёпиталэкелын  
Маньыг(а) кер лургын сагыгкве  
Уликем ос сагыглалэкен*

Let us first present the translation of the author himself. It sounds like this:

Braided girl, weave braids  
Fix the hair in your head  
Weave ringing braids, dear.

Many words were written down by Peter Efimovich, in the form he heard them, he did not put down longitude (specific signs of the Mansi alphabet) in the words. For a complete and clear picture, we present the corrected text, in the format required by the spelling rules and as is customary in the Mansi literary language:

*Ань сагың аги атың пуңкен  
Атэ сар сёпиталэкелын  
Маниг(а)кёр лургын сагыгкве  
Ўликем ос саг(ыг)лалекен*

Interlinear translation will sound like this:

Now a girl with braids, with a hairy [having hair] head  
Which you did not even tidy up to begin with  
(My) dear, (your) braids are with the ringing of iron  
Now weave praise into them.

Such discrepancies in the translation of the author himself can be attributed to the fact that P.E. Sheshkin, had only primary education. Although for his time, Pyotr Efimovich was a fairly literate and wise man. During his studies at school, textbooks on the Mansi language were printed in the Latin alphabet. Much later they were translated into Cyrillic, but also without the inclusion of specific Mansi

letters (that is, without longitude). Therefore, the first pupils who studied with such textbooks were guided mainly by their knowledge and pronunciation.

Longitude not entered in the manuscripts of P.E. Sheshkin, also complicated the semantic translation of texts. In some words, where there is no longitude, the meaning of the sentence was lost or had a different meaning. Let's give an example of such a sentence: *Түре, сома атырын халталахты* 'The lake is breaking like the sky (clearing up)' (this is the first translation). The second meaning was assumed to be: 'Throat/voice fades like an echo'.

So, in the Mansi language in some words, if the vowel length is not set, then the meaning of the word changes, for example, *түр* 'lake' and *түр* 'throat', there are also polysemous words and homonyms. For example, the word *саль* has three meanings: 1) pity, sorry; *Сускент, сома саль ёл-хәйтумли* 'You look as if pity falls down (upon you)'; 2). shawl; *Сускент, сома саль ёл-хәйтумли* 'You look like your shawl is sliding down'; 3). goldeneye (duck). *Сускент, сома саль ёл-хәйтумли* 'You look like a duck coming down'. In such cases, we paid attention to the context of the proposal or the subject matter of the proposal. All the collected material was classified by the author himself according to themes and genres. This has greatly contributed to our work.

When translating Mansi texts, we also took into account the correct word order in the sentence. If you make a mistake, then the meaning of the saying was lost changed, different from the original sounding, the original meaning. For instance, *Ур сагыт, сома кәраль ййв хõльт лёлёгыт* 'The braids of the mountains, stand like poles for the corral of deer'. In the texts of P.E.Sheshkin there was a different word order: *Сагыт урыт, сома кәраль ййв хõльт лёлёгыт*. Then this sentence is inconsistent with the translation he proposed himself. Taking into account precisely the phrase *сагыт урыт* 'braids of the mountains', then the sentence would have a different form: *Сагын урыт, сома кәраль ййв хõльт лёлёгыт* 'Mountains with braids, stand like corral poles'. The form of the lexeme *сагыт* was changed, which was in the plural (compare *саг* 'braid'), to *сагын* 'with braids' – the directional case. Next example: *Мән тай, сома колувныл кон ты хартавёв* 'And we, as if from the house to the street are carried (literally dragged)'. In the author's text, the letter in the word *колувыл* was missing, if translated correctly, it would mean 'by home' – instrumental case. According to the author's translation, this word should be written in the directional case *колувныл* 'from home'.

If we found it difficult to translate proverbs or sayings, we also turned to other dialects of the Mansi language and found similar equivalents. If they were not there, then they watched them in Russian or Khanty languages. The appeal to these languages is due to the fact that the Khanty language is closely related, and Russian is dominant in our region. If there was no such turnover, you have to select a similar option, but with a different basis, for example, parts of speech could be changed.

It should also be borne in mind that the stylistic or emotional coloring did not always coincide. For example, if in the Mansi language there are no phraseological units that are more or less equivalent to the original phraseological unit, then they looked for words corresponding in meaning and color, the so-called one-word partial equivalents of phraseological units. In addition, most often in the Mansi language there are several sayings with a similar meaning, which convey the same essence as the Russian or Khanty version. When choosing, we were guided by the most approximate lexical homogeneity.

When decoding and translating the manuscript heritage of P.E. Sheshkin, we also took into account the fact that we were carriers of different dialects of the Mansi language and that the years of P.E. Sheshkin - 1930 - 1981, fell into the period when the Mansi language was not yet at the stage of extinction and the number of native speakers was not yet as limited as at the present stage. So, in the manuscripts of P.E. Sheshkin, we have recorded words that are not in modern dictionaries of the Mansi language, for example, words for the letters Ч and Ш. We have given an example of some words in the table.

*Table 1. Comparison of lexical units in the Mansi language*

by P.E. Sheshkin (Middle Sosva dialect)	Dictionary by E.I. Rombandeeva (Ivyvinsky dialect)	Dictionary by T.P. Bakhtiyarova (Upper Lozvinsky dialect)	translation
чайтыс	сягытыс	щӓгытыс	rejoice
чопыр / щопыр	сӓпыр	щӓпыр	a wood grouse
чалтегум/ шалтегум	сялтӓгум	щалтӓгум	to come in

In addition to our own knowledge of the Mansi language, we used the dictionaries of E.I. Rombandeeva and E.A. Kuzakova [2], T.P. Bakhtiyarova [3]. The dictionaries of B. Munkachi and B. Kalman [4], A. Cannisto [5] rendered great assistance in translation. For example, in a sentence like this: *Хӓталӓ, сома самаиц / самаим пӓт хурина*. We first translated this word as ‘big-eyed, scaly’, from the word сам ‘1.eye; 2.scales’, but the meaning of the sentence was incorrect, incomprehensible, i.e. ‘Sun looks like a big-eyed cauldron? scaly cauldron? maybe the author meant patterned’. We found the translation of the word in the dictionary by B. Munkachi and B. Kalman. The translation of the word means ‘rusty, red’. Thus, we have found the appropriate translation: The sun is like a rusty / rusted cauldron.

When working with texts, words were also recorded, the translation of which was not found or not known, and words, the translation of which in the modern Mansi language has a different meaning. For instance: *луптыц ййв* in the modern dictionary means ‘deciduous tree’, the author translates it as ‘larch’, *волац* ‘dignified, honorable’, in the author's translation ‘rude, ill-mannered’.

The results of our work can be used in the preparation of bilingual dictionaries and indexes of folklore motifs, typical places and epic formulas, for which a translation technique is required, which makes it possible to identify the nature of translated units, compare them, trace variations, as well as conduct a comparative study of the structure of folklore texts of various traditions.

As you know, the issues of adequate reflection in translation of the figurative means of the language, as well as the preservation of style in translation, have always been the most difficult and controversial.

Translation of various kinds of images, each of which performs its function in the language of folklore works, from language to language requires great skill, helping to preserve or modify the original emotional and aesthetic information or that special meaning that each specific image carries.

The lexical figurative means and the problems of their translation, the peculiarities of the collector's language in this study were analyzed on the basis of the manuscript heritage recorded, partly translated into Russian by a remarkable sculptor, a native of the village of Lombovozh (Berezovsky district, Khanty-Mansi Autonomous Okrug-Yugra), Peter Efimovich Sheshkin (1930-1981).

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借助表达句法手段创造科幻作品的节奏模式

**THE CREATION OF A RHYTHMIC PATTERN OF A SCIENCE  
FICTION WORK WITH THE HELP OF EXPRESSIVE SYNTACTIC  
MEANS**

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抽象。 本文重点讨论英语中的科幻小说文本中表达句法手段的特殊性。对所考虑文本的文体分析表明，诸如倒装，句法平行性和同质元素的重复之类的表达方式创造了科幻作品的句法节奏，从而使小说文本的内聚力得以形成，并且是文学作品的要素之一。 散文作品的表现力。 对句法节奏的特定功能的分析得出以下结论：所述手段的主要功能之一是作为小说作品影响目标的实现的最重要文本部分的前台和强调功能。

关键词：科幻作品，节奏，表达句法手段，倒装，句法平行性，衔接。

**Abstract.** *The present article concentrates on the peculiarities of expressive syntactical means functioning in a science fiction text in the English language. Stylistic analysis of the text under consideration showed that such expressive means as inversion, syntactic parallelism and repetitions of homogeneous elements create syntactic rhythm of a science fiction work that provides for the shaping of cohesion of a fiction text and is one of the factors of a literary prose work expressiveness. Analysis of specific functioning of syntactic rhythm provides for arriving to the conclusion that one of the main functions of the said means is the function of foregrounding and emphasizing the most important text components that is an implementation of the fiction work influence aim.*

**Keywords:** *work of science fiction, rhythm, expressive syntactic means, inversion, syntactic parallelism, cohesion.*

Over the years of philological science existence the attention of the scientists was concentrated on the study of the specific features of a literary text, analysis



of its categories and properties. N.A. Nikolina points out the creative nature of the intertextual reality explaining it by the fact that it was created by the author's imagination and creative vitality and so, it has a conditional, fictional nature. The world described in a literary text correlates with the reality only indirectly, it depicts, interprets and transforms the reality according to the author's intention [7]. It is obvious that to implement the author's intention the whole arsenal of means is used that, in its turn, should be correctly grasped by the information recipient for its proper decoding.

Thus, in interpretation and stylistic analysis of a literary text that represents according to L.G. Babenko a sophisticated linguistic sign one should take into consideration the linguistic units of various levels [2]. In its turn, a linguistic unit features expressiveness that provides for its capability to perform in a communicative act as a means of subjective expression of the speaker's attitude to the content.

Professor O.V. Alexandrova rightly states that: "Expressiveness as a general linguistic category touches upon all spheres of the language and an arsenal of its expressive means is boundless" [1, p.7]. Using various means to convey the expressiveness the author picks out a particular utterance, gives it an emotional strength and thereby draws the reader's attention to it. Thanks to it an expressive function of a language is implemented that is first of all related to the communication of emotions.

The present article is dedicated to the functional capabilities of some units of expressive syntax, which O.V. Alexandrova determines as "the theory of composing an expressive speech" [1, p.8], in the works of science fiction, especially the capability of syntactic elements to create the rhythmic pattern of a literary text. Rhythm as a way of a structural organization of a matter, as a factor contributing to the integrity of the text reveals itself in syntax being associated **with the** movement based on reiterations and regularities and creating the isotopy of the plane of expression [3]. Multiple studies proved the fact that syntax is the main organizing beginning of a speech product. From all the elements that make an utterance meaningful, syntax is the most important since it controls the order of getting the impressions and conveys the relations behind the chains of words.

Various studies of the rhythmical system of a literary text carried out within the framework of the theory of expressive syntax and decoding stylistics in linguistic-poetic field of the text allow to describe the speech rhythm as the most significant semantic and structural component of a fiction work. Noted scientist and linguist B.V. Tomashevsky considered that "rhythm arises from the syntactic system of speech" [8, p.95]. In his turn, V.M. Zhirmunsky suggested that rhythmization of prose is based "primarily on artistic regulation of syntactic groups and on the elements of repetition and syntactic parallelism" [5, p. 131 ].

Thus, it is the rhythm-syntactic arrangement of the text that is one of the most

important ways to implement the main functions of a language - communication and artistic influence. It emphasizes the individual style of the author and serves as a powerful means of enhancing the expressive effect in the literary text.

Let's admit that a science fiction work is a literary work, i.e. a product of the writer's choice of "the area of reality" and a reflection of his individual cognitive process [6].

The works of the genre under study become more and more popular due to the desire of the modern society to mentally lose touch with reality, and immerse in another reality where, mainly, the future is described. It is generally acknowledged that science fiction works are mainly the works about the future addressed to the contemporaries (future is described for the present) [4]. Let's here agree with the opinion of K.G. Frumkin who notes that "Science fiction is an element of civilizational dynamics – just because in a dream a human needs are satisfied earlier and better than in the result of scientific and technical development" [9, p. 16].

Forecasting the ways of civilization development science fiction authors to a large extent become the prophets but, unfortunately, not in all cases the future is bright, authors warn us about the consequences of military conflicts with the use of nuclear weapons, a lack of attention to the environmental problems, uncontrolled medical experiments and many other things.

A vivid confirmation of the aforesaid is a story "The Pedestrian" by R. Bradbury. The story tells us about not so remote from the modern reader future, the time of action is strictly marked with the absolute time marker - 2053 that is given at the very beginning of a short story. The author is pessimistic in his descriptions and reasoning. In such future people practically do not come out into the street devoting their time to watching endless TV broadcasts. They do not read magazines and books so the profession of a writer to which the main character belongs is no longer in demand. In such a society it is not accepted to go for a walk, not accepted to be a writer which is equal to be unemployed, not accepted to be single and also not accepted to turn on the light in the evening. The main character is different from the others that is why one autumn evening he is arrested by a police car, a robot as we can understand, because nobody is inside. Here R. Bradbury once again convincingly shows the negative consequences of the technical progress for the contemporary society and, as usually, acts as a prophet. We all know that the current generation really stopped reading fiction, stopped thinking, and, contrary to watching TV, that is the favorite pastime in the author's story, spends most of the time in virtual reality.

Analyzing the expressive capabilities of the syntactic units used in the text under study, first of all it is necessary to discuss the phrases, the sequence, in which they become organized.

*To enter out into that silence that was the city at eight o'clock of a misty eve-*

*ning in November, to put your feet upon that buckling concrete walk, to step over grassy seams and make your way, hands in pockets, through the silences, that was what Mr. Leonard Mead most dearly loved to do [10].*

The use of homogeneous parts of speech, homogeneous objects expressed with the help of phrases with the infinitive connected asyndetically, moreover, semantically identical, contribute, first of all, to intertextual cohesion. The use of stylistic inversion foregrounds to the strong position of the text an important component of information – the rheme, thus stressing the importance of what is going on for the subsequent development of the text, namely: evening walks of the main character along the quiet city are his main hobby that, as we shall discover later, makes him different from the other members of the society. Moreover, such walks are of systematic, regular nature that is proved by the following text fragment with the use of repeated compound predicates connected by means of polysyndeton comprising the modal verb “would”, designating the action phase and further parallel repetition: *He would stand upon the corner of an intersection and per down long moonlit avenues of pavement...he would stride off...[10].*

It is evident that such walks are a pleasure for Leonard Mead. The use of syntactic stylistic units here creates the effect of some uniformity, regularity of narration, smoothness of the rhythmical arrangement of the initial part of the text devoted to the hobby of the main character that, in its turn, evokes the thought about calm and peace of the world where the main character lives, however this idea subsequently dissipates.

The behavior of the main character contradicts the society where there is no place for communication, friendship, love. It is the society of people enchained to the TV screens, totally

under control of the state. Leonard Mead vainly tries to understand them and the questions he asks the society are rhetorical and he does not wait for any answer:

*‘Hello, in there,’ he whispered to every house on every side as he moved. ‘What’s up tonight on Channel 4, Channel 7, Channel 9? Where are the cowboys rushing, and do I see the United States Cavalry over the next hill to the rescue?’*

The emotional tension of the main character becomes apparent in the dialogue of Leonard Mead with the police in the culmination of the whole story:

*‘Your name?’ said the police car in a metallic whisper. He couldn’t see the men in it for the bright light in his eyes.*

*‘Leonard Mead,’ he said.*

*‘Speak up!’*

*‘Leonard Mead!’*

*‘Business or profession?’*

*‘I guess you’d call me a writer.’*

*'No profession,' said the police car, as if talking to itself*" [10].

The rhythm of this extract may be characterized as abrupt, nervous, pulsating. The author wants to show the indifference of the authorities to the destinies of people, their rejection of the different point of view. To create "the nervous, tense effect" Bradbury uses short unextended sentences. The rhythm-syntactic arrangement of the final dialogue is notable for its brevity and laconism of syntactic elements which contribute to the dynamism of the whole work.

A modern serious-minded reader apprehending the images of the future that are new to him will certainly think over the received information and will decode the meaning of the work correctly. According to R. Bradbury the current work done by the science fiction writers today can change the future. In order not to have the pessimistic look towards the future we need to solve now the major problems of today.

As a result of the study it has become clear that the direct means of isotopy of expression plan are inversion, syntactic parallelism and repetition of homogeneous elements.

Analysis of specific functioning of stylistic inversion and repetitions provides for arriving to the conclusion that one of the main functions of the said means is the function of foregrounding and emphasizing the most important text components that is an implementation of the fiction work influence aim.

Contributing to structural regularity and semantic integrity of the text, inversion, syntactic parallelism and repetitions are the important means ensuring cohesion of the work of fiction.

All the aforementioned means are the components of the style and individual artistic method of the writer, they carry the author's ideas and according to the author's message shape their expressive-syntactic rhythm in the fiction work.

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网络成瘾水平高的青少年的人格取向  
**PERSONALITY ORIENTATION OF ADOLESCENTS WITH A HIGH  
LEVEL OF INTERNET ADDICTION**

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抽象。 本文致力于解决网络成瘾程度高的青少年人格定位问题。 这篇文章提出了一项旨在识别具有高度网络成瘾水平的青少年的个性取向的研究。 研究的对象是人格的取向，研究的主题是具有高度网络成瘾水平的青少年的人格取向。 为了实现此目标，使用了以下方法：进行测试以识别网络成瘾水平K. Young, A. E. Zhichkina; V. Smekalov和M. Kucher; “个性取向”问卷; 诊断教育动机取向的方法学T. D. Dubovitskaya。 进行了实证研究，提出并分析了获得的结果，并提出了结论。

关键词：人格倾向，人格，青少年，网络成瘾。

**Abstract.** *The article is devoted to the problem of the orientation of the personality of adolescents with a high level of Internet addiction. The article presents a study aimed at identifying the personality orientation of adolescents with a high level of Internet addiction. The object of the study was the orientation of the personality, the subject of the study was the orientation of the personality of adolescents with a high level of Internet addiction. To achieve this goal, the following methods were used: a test to identify the level of Internet addiction K. Young, A.E. Zhichkina; questionnaire "Personality orientation" V. Smekalov and M. Kucher; methodology for diagnosing the orientation of educational motivation T. D. Dubovitskaya. An empirical study was carried out, the results obtained were presented and analyzed, and conclusions were formulated.*

**Keywords:** *personality orientation, personality, teenager, internet addiction.*

### **Introduction**

Currently, computer technologies have a deep impact on the psyche and consciousness of a teenager, leading to a violation of their socio-psychological adaptation. Internet addiction leads to decreased school performance and worsens

health [1]. As a result, an individual value system is formed that diverges from the generally accepted one [2]. Teenagers interacting with the Internet are in great danger, as they represent the most unprotected audience, because they are less able than adults to filter the wave of information that falls on them from the Internet. The adolescent period is traditionally associated with profound transformations in the development of the personality of a teenager. In adolescence, important transformations take place in the personality, in the orientation of the personality. According to L.S. Vygotsky, it is in adolescence that intense changes in behavior occur over a relatively short period of time [4]. In fact, the main task of a teenager is to become an adult, but the starting point on this path is the "social situation of the child's development" [5]. It is the system of relations between the adolescent and the environment that determines change. The modern information society has a wide impact on the teenager's relationship system. The relevance of the research problem is due to the fact that the orientation of the personality is of great importance in a person's life. It is interesting to see the features of the orientation of the personality of a teenager with a high level of Internet addiction. This topic is relevant, because the study of the orientation of the personality is most in demand, especially now, with the period of active use of the Internet.

**The object of the research** is personality orientation.

**The subject of the research** is the personality orientation of adolescents with a high level of Internet addiction.

**Purpose of the study:** to reveal the characteristics of the orientation of the personality of adolescents with a high level of Internet addiction.

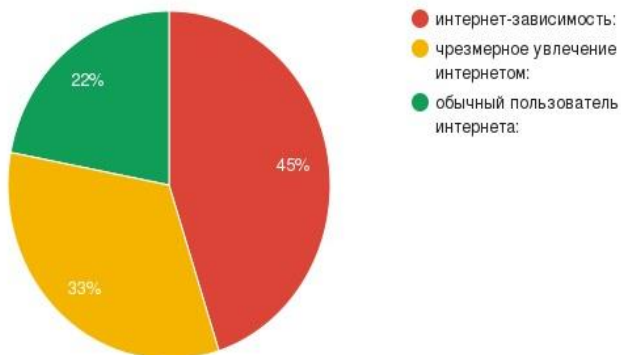
#### **Research methods and techniques**

The research was carried out using the following methods: theoretical analysis of the literature, testing, questionnaires, qualitative and quantitative analysis of the data obtained. The study was carried out using the following methods: a test to identify the level of Internet addiction K. Young, A.E. Zhichkina; questionnaire "Personality orientation" V. Smekalov and M. Kucher; methodology for diagnosing the orientation of educational motivation T.D. Dubovitskaya [3].

#### **Main part. Results**

The study was conducted among teenagers in the city of Irkutsk. The study involved 60 adolescent children.

At the initial stage of the study, we examined the level of adolescents' dependence on the Internet using the K. Young test. The results of diagnostics by the method of K. Young are presented in figure 1.

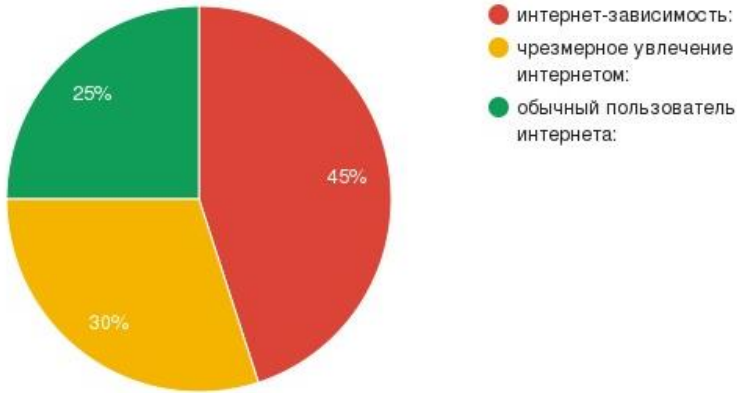


*Fig. 1. Internet addiction level according to K. Young test results*

Analyzing the data of K. Young's test, we can conclude that 22% of the subjects are absolutely not inclined to Internet addiction. Teenagers who are not prone to Internet addiction are optimistic, socially active and have a positive attitude towards other people, have friends, including the opposite sex. A computer for them is something like a hobby: they may be interested in searching remote databases to obtain any information, study, for cognitive purposes, or, for example, to play role-playing group games. Excessive hobby for the Internet was found in 33% of the subjects. The sum of the points received in the answers of these adolescents indicates the possibility of problems and speaks of a predisposition to the development of computer addiction. Teenagers prone to Internet addiction use the Internet mainly for communication purposes, i.e. for communication, meeting other people, recreation. Social networks give a teenager the opportunity to feel that he has many friends, that he can feel like a part of a group, talk about what hurts him for a living, i.e. can manifest itself in a way that is still difficult for him in life. High levels of Internet addiction were found in 45% of the subjects. The high level of Internet addiction is expressed in the daily visit of the majority of the respondents to the global Internet, exceeding the planned time of visiting the Internet (on average 10-20 hours per week), neglect of personal affairs due to the use of the Internet. Internet addicted adolescents show an inability and active unwillingness to distract themselves from the Internet, even for a short time, and even more so to stop working on the Internet. With forced distractions from the Internet, adolescents develop annoyance and irritation, obsessive thoughts about the Internet during such periods. Internet addicted adolescents are willing to lie to friends and family, downplaying the length and frequency of Internet use, avoiding or seeking to reduce physical activity, justifying this by the need to complete urgent matters related to the use of the Internet.



Let us illustrate the data by the method of A.E. Zhichkina in Figure 2.

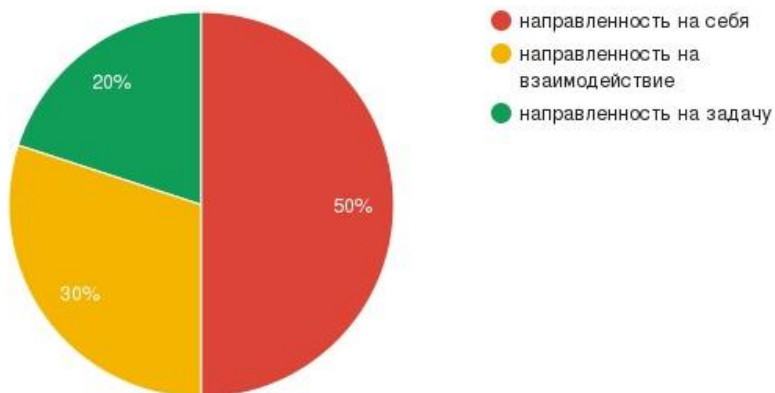


*Fig. 2. The level of Internet addiction based on the results of A.E. Zhichkina*

Analyzing the data according to the method of A.E. Zhichkina, it can be concluded that 25% of the subjects are absolutely not inclined to Internet addiction. The sum of points obtained in the answers of these teenagers indicates the absence of Internet addiction. The rest of the respondents showed a tendency towards Internet addiction. Excessive hobby for the Internet was found in 30% of the subjects. The sum of the points received in the answers of these adolescents indicates the possibility of problems and speaks of a predisposition to the development of computer addiction. A high level of Internet addiction was found in 45% of the subjects. These adolescents have been diagnosed with serious internet problems that can be resolved with the help of a specialist.

A high level of Internet addiction was found in 45% of adolescents using both methods.

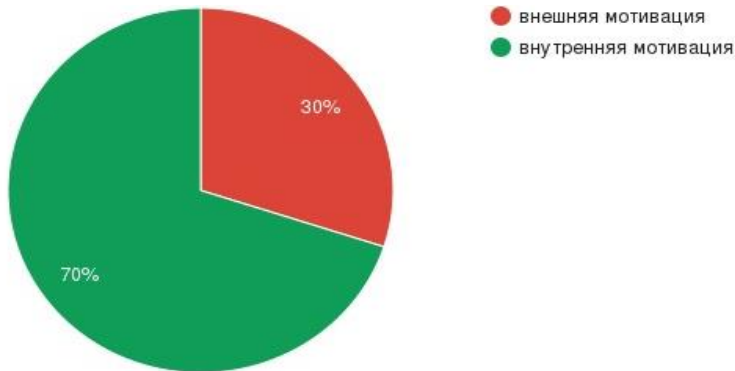
For the further stage of our research, we took a group of adolescents with a high level of Internet addiction and, according to the methodology "Personality Orientation" by V. Smekalov and M. Kuchera, obtained the following results, which are reflected in Figure 3.



*Fig. 3. The results obtained in the diagnosis of the study of "Personality orientation" V. Smekalov and M. Kuchera*

Figure 3 shows that 50% of the subjects have a personality orientation. Such adolescents are dominated by the motive of their own well-being, striving for personal superiority, prestige. Such students are most often busy with themselves, with their feelings and experiences and do not react much to the needs of people around them. In their studies, they see, first of all, an opportunity to satisfy their claims and ambitions. Characterized by aggressiveness in achieving status, imperiousness, a tendency to rivalry, irritability, anxiety. 30% of the subjects have a collectivist orientation. In such adolescents, the need for communication prevails. Such students strive to maintain good relationships with classmates and friends, show interest in joint activities. Characterized by the provision of sincere help to people, an orientation towards social approval, the need for affection and emotional relationships. 20% of the subjects are task-oriented. In such adolescents, the predominance of motives generated by the activity itself, enthusiasm for the process of activity, disinterested desire for knowledge, mastering new skills and abilities. Characterized by an interest in solving problems, doing the job as best as possible, striving to achieve the greatest productivity, the ability to defend in the interests of the point of view, which he considers useful for completing the task.

Further, in a group of adolescents with a high level of Internet addiction, we carried out the methodology "Directions of educational motivation" by T.D. Dubovitskaya. The results are shown in Figure 4.



*Fig. 4. The results obtained in the diagnosis "Orientation of educational motivation" T. D. Dubovitskaya*

Figure 4 shows that for 70% of the subjects, internal motives are personally significant in nature, are conditioned by a cognitive need, pleasure received from the process of cognition and realization of their personal potential. The dominance of intrinsic motivation is characterized by the manifestation of high cognitive activity of such students in the process of learning. Mastering the teaching material is both the motive and the goal of learning. Students are directly involved in the learning process, and this gives them emotional satisfaction.

For 30% of the subjects, mastering the content of school subjects is not the goal of learning, but is a means of achieving other goals: obeying the requirements of a teacher or parents, receiving praise, recognition from friends, etc. meaninglessness of what is happening or their activity is forced. The content of academic subjects is not personally significant.

### **Conclusion and findings**

At the initial stage of the study, we examined the level of Internet addiction among adolescents. We have identified a group of teenagers with a high level of Internet addiction. Further in this group, we investigated the orientation of the personality of adolescents and the orientation of educational motivation of adolescents. Summing up the results of our research, we received the following results:

Most of the tested adolescents with a high level of Internet addiction have a personality orientation. Such adolescents are dominated by the motive of their own well-being, striving for personal superiority, prestige. The smallest number of test adolescents with a high level of Internet addiction are task-oriented. In such adolescents, the predominance of motives generated by the activity itself, passion for the process of activity, disinterested striving for knowledge, mastering new skills and abilities.

For most of the tested adolescents with a high level of Internet addiction, internal learning motivation is characteristic, internal motives are personally significant in nature, are conditioned by the cognitive need, pleasure received from the process of cognition and realization of their personal potential. Mastering the teaching material is both the motive and the goal of learning. Students are directly involved in the learning process, and this gives them emotional satisfaction. For the smallest number of test adolescents with a high level of Internet addiction, external learning motivation is characteristic, that is, mastering the content of academic subjects is not the goal of learning, but serves as a means of achieving other goals: obeying the requirements of a teacher or parents, getting praise, recognition from friends, etc. students, as a rule, are alienated from the learning process, show passivity, experience the meaninglessness of what is happening, or their activity is forced.

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进入成年的年轻妇女的家庭职业类型和对亲子关系的满意度  
**TYPES OF FAMILY CAREERS AND SATISFACTION WITH  
PARENT-CHILD RELATIONSHIP OF YOUNG WOMEN ENTERING  
ADULTHOOD**

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注解。本文研究了成年女性在家庭领域与自我实现有关的生活计划。假定亲子关系的经历和对父母关系的满意程度将决定家庭职业在个人生活中的位置。已经确定了三种针对年轻女性的职业规划：1) 家庭无限期推迟，这意味着不是短期内甚至没有这种愿望就建立家庭； 2) 在不久的将来建立家庭，这意味着在不久的将来建立家庭； 3) 家庭在可预见的计划中，这意味着在没有明显的家庭创建时间视角的情况下，有计划的家庭职业。该研究获得的数据证实了以下假设：即将在不久的将来组建家庭的年轻女性的特征是对与父母的关系最满意，与父母互动的情感背景更加积极，他们的支持和接受。

关键词：家庭事业，亲子关系，成年

**Annotation.** *This article investigates the life plans of young women in relation to self-realization in the family sphere during adulthood. It is assumed that the experience of a parent-child relationship and their satisfaction with relationship with parents shall determine the place of a family career in the life priorities of an individual. Three types of career planning for young women have been identified: 1) family postponed for an indefinite period, which means creating a family not in the short term or even the absence of this desire; 2) family in the near future, meaning the creation of a family in the near future; 3) family in foreseeable plans, which means that there are plans for a family career in the absence of an obvious time perspective of a family creation. The data obtained in the study confirm the following hypothesis: the young women who are going to start a family in the near*

*future are characterized by the greatest satisfaction with their relationships with their parents, a more positive emotional background of interaction with them, a feeling of their support and acceptance.*

**Key words:** *family career, parent-child relationship, entering adulthood*

Planning a family career at the stage of entering adulthood can certainly be seen as designing a life path. This process is of particular importance for young women: changes in the role of women in society inevitably leads to changes in the preferences and life plans of young women. One of the most remarkable trends in modern Russia is the postponement of childbirth to a later age: the fertility rate (live births per 1000 women of a given age) among 20-24 year-old women in 1990 was 156.5, in 2018 - 78.4; among 35-39 year-old women in 1990, the birth rate was 19.4, in 2018 - 39.7 (Russian Statistical Yearbook, 2019). In psychological studies, various negative trends in the development of family and parenting are recorded, in particular: negative attitude and unwillingness with regard to future parenting (Mukhina N.V., Belogai K.N., 2007), large number of somatic disorders of women (infertility, miscarriage) (Khломov K., 2009), deployment of the practice of deliberate parenting abandonment (Langdridge D. Sheeran P., Connolly K.J., 2005; Zakharova E., 2014), desire to delegate maternal responsibilities of caring for a child to others (Zakharova E., 2014), inharmony and distortion of the ideas of parenting among young people (Zakharova E. etc., 2019; Karabanova O., Molchanov S., 2017). There is a need for modern studies of planning family and professional careers in young men and women, especially during adulthood, their correlation, understanding of the factors influencing them.

Our **purpose** was to study the relationship between satisfaction with parent-child relationships and characteristics of the intra-family situation with the types of planned family career. We assumed that satisfaction with parent-child relationships is a significant factor in family planning as a developmental task for young women. Accordingly, with different options for planning a family career, significant differences in satisfaction with parent-child relationships should be identified. We set the following tasks: 1) identifying the types of family career planning; 2) the study of satisfaction with parent-child relationships and the current family situation, depending on the type of family career planning.

**Methods and sampling.** The following methods were used in the study: the author's questionnaire "Life plans - family and professional careers" and the author's questionnaire "Satisfaction with relations with parents." The sample consisted of 158 female university students in the cities of Moscow and Penza, ages between 22 and 26.

**Results:** on the basis of cluster analysis, three types of family career planning were identified (excluding professional career): 1) *family postponed for an indefi-*

nite period (28,5% respondents), which means creating a family not in the short term or even the absence of this desire, there are no clear plans for a family career, the locus of control of family career is internal; 2) *family in the near future* (42% respondents), meaning the creation of a family in the near future, no family priority, but rather the balance of family and career, there are clear plans for a family career, the locus of control of family career is external; 3) *family in foreseeable plans* (29,5% respondents), the priority of family relations, there are plans for a family career, in the absence of an obvious time perspective for creating a family, the locus of control of family career is internal. It should be noted that the following leading motives for creating a family were recognized by the respondents of all the selected groups - the motive of love, trust and mutual understanding, that is, psychological intimacy and closeness. For young women from the second group who are going to start a family in the foreseeable future, the motive of safety and security is more significant than for other groups (T-criterion,  $p < 0.05$ ). The motive for realization in the family, family relations, is significantly expressed in the third group (“family in plans”), compared with the first group of young women who are not going to start a family in the foreseeable future (T-test,  $p < 0.05$ ). The high significance of the motives for raising children and parenting is characteristic of respondents who are going to start a family in the near term, compared to young women from the third group, for whom the family is certainly in plans, but not close (T-test,  $p < 0.05$ ).

The characteristics of satisfaction with parent-child relationships for each of the identified clusters, which differ by the type of family career planning, are presented below (Table 1).

**Table 1.** Characteristics of satisfaction with parent-child relationships among young women with different types of family career planning

Family career planning type	Family postponed for an indefinite period N=45		Family in the near future N=66		Family in foreseeable plans N=47	
	Av.	St.dev.	Av.	St.dev.	Av.	St.dev.
Emotional tone	8,82	1,87	10,30	1,44	9,08	2,17
Conflictness	6,26	1,05	6,84	0,63	6,12	1,34
Consent	8,64	1,47	9,68	1,30	8,55	2,01
Desire to distance	9,20	1,76	10,69	1,30	9,14	2,39
Support	6,53	1,39	7,24	1,03	6,40	1,97
Relationship in childhood	9,06	1,87	10,59	1,60	8,70	2,33
Global satisfaction	16,11	2,08	18,15	1,90	15,97	3,39

Pairwise comparison of the significance of differences between groups on the scales of satisfaction with parent-child relationships at a given point in time revealed the following. Young women who plan to start a family in the near future and have clear, detailed plans for a family career significantly differ from the remaining groups in all indicators of the methodology *Satisfaction with relations with parents*. They are characterized by: global satisfaction with relationships with parents, a more positive emotional background of interaction with them now and greater satisfaction with relationships in childhood, they feel the support of their parents, agreement with them on basic issues. All these indicators significantly distinguish these respondents from young women from both remaining groups (T-test,  $p < 0.01$ ). At the same time, it is important that the indicators of conflict in relations with parents in this group are also significantly higher than in the remaining sample, as is the desire to distance themselves from the parental family. Perhaps this is what predicts the desire to start their own family as soon as possible. Otherwise, global satisfaction with relationships with parents allows one to speak more freely about the desire to achieve age-specific goals. But we should note that against the background of a favorable emotional background of interaction and relations with parents, young girls have a positive attitude towards this potential possibility of family relations, striving to realize it in the near future. The groups of young women identified by us who are not going to start a family in the near future (“postponed family” and “family in foreseeable plans”) do not differ significantly in any of the indicators identified in this methodology.

**Discussion:** The relevance of the study of the life plans of young women in relation to self-realization in the family sphere during adulthood is due to the need to identify the reasons for the low priority of motherhood, reduce the attractiveness of marriage and family relations. The hypothesis of our research was the assumption that satisfaction with parent-child relationships, family situation, will determine the place of family career in the life priorities of the individual. The data obtained in the study, on the whole, confirm the hypothesis put forward: for those young women who are going to start a family in the near future, they are focused on family relationships, have clear plans for a family career, are characterized by the greatest satisfaction with relationships with parents, a more positive emotional background of interaction with them, feeling their support and acceptance.

**Results:**

1. The analysis of the plans' types of the young women for a family career during adulthood reveals variability, which is found in the desire to start a family in the foreseeable future (42% of respondents), the presence of plans to create a family in general (29.5%) and postponing the creation of a family for an indefinite period or unwillingness to create one (28.5%).

2. Global parental satisfaction forms the basis for family career plans for the immediate future.



3. For young women planning to start a family in the near future, satisfaction with relationships with parents in childhood, a feeling of their support, a positive emotional background of interaction, along with the desire to distance themselves, are characteristic.

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牙科和口腔外科使用肉毒杆菌毒素A的治疗指征

**THERAPEUTIC INDICATIONS FOR USAGE OF BOTULINUM TOXIN  
A IN DENTISTRY AND ORAL SURGERY**

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抽象。 我们的文章介绍了肉毒杆菌毒素A在医学上的用途，尤其是在牙科和口腔外科手术中。 我们的小组综合了有关肉毒杆菌毒素的历史，其生物化学及其在面部区域细微使用肉毒杆菌毒素注射的信息。

关键词：肉毒杆菌毒素；神经蛋白 肌肉 腺体 磨牙症 历史。

**Abstract.** *Our article describes the usage of botulinum toxin A in medicine, especially in dentistry and oral surgery. Our group synthesized information about the history of botulinum toxin, its biochemistry, and its nuanced usage of botox injections in the facial area.*

**Keywords:** *botulinum toxin; neuro protein; muscles; glands; bruxism; history.*

## 1. Introduction

Botulinum toxin, which was initially known only as the most poisonous substance known, is an efficient pharmaceutical product, used commercially for medical and cosmetic purposes.

In 1980, Alan B. Scott and his colleagues were the first who used botulinum toxin as a pharmaceutical agent: they injected the substance into the ocular muscles of a monkey with strabismus. In 1982, Dr. Jean Carruthers took part in clinical investigation of treatment of strabismus and blepharospasm by botulinum toxin and by accident discovered new cosmetic effects of the toxin. In 1992, William J. Binder started the usage of botulinum toxin for treatment and prevention of migraine. Nowadays, botulinum toxin is used in almost each branch of medicine: ophthalmology, neurology, cosmetology, dermatology, dentistry, oral and cosmetic surgery, pediatrics, oncology, urology, and gynecology.

Botulinum toxin (or botox) can be nicknamed as a “poison of civilization” because humanity is to praise an unpleasant encounter with *Clostridium botulinum* for its toxin which we use for a myriad of purposes.

## 2. Biochemistry of botulinum toxin

*2.1 Structure of the toxin.* Botulinum toxin is a neuroprotein which is a metabolic product of a bacterial species *Clostridium botulinum*. The toxin is a protein complex which consists of the actual neurotoxic part, hemagglutinins, and one non-toxic part which stabilizes the structure of the molecule. Botulinum toxin can be divided by the serotype of bacteria: A, B, C1, C2, D, E, F, G, H. Types A and B are capable of causing disease in humans and are commonly used as therapeutic products. The type A is the most explored and the most efficient in terms of duration of action.

*2.2 Mechanism of Action.* Botulinum toxin chemically denervates striped muscles by blocking presynaptic proteins that transport vesicles of acetylcholine. The process of protein blocking is irreversible and usually takes about 30 minutes. After two months of the last botox injection, the process of formation of new axon endings commences in the sites where previously the blocking of acetylcholine receptors occurred, and results in sprouting (the formation of new neuromuscular junctions). Finally, the muscle contraction restores in 3-6 months after the injection of botulinum toxin.

## 3. Medical usage

*3.1 Contraindications.* Because of potential hypersensitivity, the contraindications for botox usage are:

- intolerance to the substance;
- during lactation period (insufficient data);
- affected administration area;
- blood-clotting disorder;

- myoneural diseases (Myasthenia gravis; Lambert–Eaton myasthenic syndrome);
- administration of anticoagulants;
- administration of aminoglycoside antibiotics;
- administration of drugs, increasing neuromuscular excitability (can aggravate action of neuro protein)

### 3.2 *Botulinum toxin in practice.*

3.2.1 *Craniomandibular Dysfunction.* Craniomandibular dysfunction is a common disease characterized by a variety of pathological diseases which affect temporomandibular joints (TMJ) and masticatory and mimic muscles. The most common sign of craniomandibular dysfunction is bruxism. This is a parafunctional disorder characterized by the contraction of masticatory muscles without control of the proprioceptive system during sleep, exercise load, intellectual work, and stress. The main cause of the muscle dysfunction is change in contraction activity, such as muscle hypertonia. Consequently, algescic zones of different size and density appear.

Excessive muscle activity leads to the muscle hypertrophy and increase in bulk and force, hypersufficient for mastication. This results in a variety of dental problems: hypersensitivity, wedge-shaped defect, pathological abrasion of teeth, alteration of periodontium, fracture of teeth roots, TMJ dysfunction, and fracturing of orthodontic reparations.

The main purpose of hypertonia treatment is the relaxation of masticatory muscles and elimination of muscle pain. Besides bruxism, headache is also a sign of masticatory muscles dysfunction.

3.2.2 “*Square Face.*” Functional state of masticatory muscles is linked to the configuration of the lower face, especially the problem like “square face.” The main signs of this pathology are prognathous mandibular angles, hypertrophy of masticatory glands, and angular face line.

The line and shape of the lower shape might be determined by the collocation of maxilla and mandible (their occlusion), the size and shape of mandible, and the state of masticatory muscles. Excessive activity of masticatory muscles leads to their hypertrophy which results in formation of “square face.”

3.2.3 *Gummy Smile.* The main reasons for gummy smile might be hyperactivity of mimic muscles which cause excessive gingival display and exposure of incisors, canines, and premolars. This aesthetic deficiency is also might be improved by injections of botox. There are four types of gummy smile, defined by the zone of excessive gingival display and muscle involvement:

I. Medial. The zone between canines displays for more than 3mm, with *m. levator labii superioris alaeque nasi* involved.

II. Lateral. The zone behind canines displays for more than 3mm, with *m. levator labii superioris alaeque nasi* and *zygomaticus major* involved.

III. Multimodal excessive gingival display along its entire length, with *m. levator labii superioris alaeque nasi*, *zygomaticus major*, and other mimic muscles involved.

IV. Asymmetrical gingival display on one side, caused by the hyperactivity of *m. levator labii superioris alaeque nasi* or *m. zygomaticus major* on one side.

3.2.4 *Frey's Syndrome*. Frey's syndrome, also known as auriculotemporal nerve syndrome, is a neuropathy of auriculotemporal nerve. Usually this syndrome has following symptoms: sudorrhea and hyperemia near the region of parotid gland while eating and after surgery. It appears that Frey's syndrome is secondary in terms of abnormal reinnervation of sweat glands and vessels of auriculotemporal and great auricular nerves by parasympathetic fibers which usually innervate parotid glands.

Botox is usually injected into the affected zone subdermally. Absence of sweat and other symptoms is observed occasionally. First results showed that injections of botox lead to the suppression of perspiration and does not have any severe side-effects. Another advantage of the therapy is the almost complete absence of invasion. Still, the effect of botulinum toxin is not permanent; therefore, additional injections must be carried out. The continuance of the effect from botox usually takes 9-12 months.

3.2.5 *Hypersalivation*. Hypersalivation is an excessive saliva accumulation. Hypersalivation might occur as a result of neurogenic disorder of saliva secretion (both psychogenetic and mechanical) or as a somatic disorder. This pathology might have paroxysmal or permanent nature. Hypersalivation occurs in cases of extra- and normal secretion of salivary glands, depending on parasympathetic or sympathetic mechanisms, which cause fluidus or dense saliva secretion respectively.

There are several rules for injections in salivary glands. Injections in submaxillary salivary gland has to be carried out under ultrasound investigation in order to evade diffusion or direct infiltration of the toxin into genioid and digastric muscles. Each salivary gland must have 3-4 markings for injections. For blocking of parotid salivary glands, botulinum toxin is injected subdermally in the region of large masticatory muscle, avoiding burying.

3.2.6 *Bell's Palsy*. Bell's palsy is a type of facial nerve paralysis that results in a temporary inability to control the facial muscles on the affected side of the face, accompanied by paroxysmal cramp. Symptoms may include muscle twitching, closure of the eyelids, facial skewness, weakness, or total loss of the ability to move one or rarely both sides of the face. Other symptoms include ptosis, a change in taste, and pain around ears. Typically symptoms appear over 48 hours. Bell's palsy can also trigger hyperacusis—an increased sensitivity to sound.

#### 4. Conclusion

The main mechanism of action of botulinum toxin is the blocking of nerve impulses which, thanks to the substance, do not reach muscles, causing complete relaxation of muscles, and this feature of botox is widely used in neurology.

Botulinum toxin therapy showed extremely high effectiveness in the treatment of non-volitional muscle contraction and non-motility of masticatory muscles. Injections of botulinum toxin allow to fix and relax muscles which causes amelioration or elimination of pain and spasms, enabling the activity of mimic muscles. Thus, botulinum therapy allows for multifunctional restoration of affected muscles.

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颌颌面局限性慢性疼痛综合征患者血管单位的组织形态学材料  
**HISTOMORPHOLOGICAL MATERIAL OF VASCULAR UNITS  
IN PATIENTS WITH CHRONIC PAIN SYNDROME WITH  
CRANIOVERTEBROFACIAL LOCALISATION**

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**Article Review**

In clinical practice, chronic lower back pain is often combined with comorbid pathology.

1. N. Svensson et al. (1983) were the first who studied connection between pain syndromes in low back and consequent cardiovascular risk factors. Their oc-



casual choice of 940 male patients aged from 40 to 47 years revealed nine pathological states correlated with low back pain: breast pang, pain in the calf muscles, shortness of breath on exertion, smoking, increased physical activity at work, increased physical activity in free time, anxiety and tension, fatigue at the end of the working day, stress [Low-back pain in relation to other diseases and cardiovascular risk factors / H. O. Svensson, A. Vedin, C. Wilhelmsson, G. B. Andersson // *Spine*. – 1983. – Vol. 8, № 3. – P. 277-285].

2. In the following series of authors, it was noted that LBP correlates with pathology of the respiratory system, diseases of the gastrointestinal tract [Low back pain comorbidity among male farmers and rural referents: a population-based study / S. Holmberg, A. Thelin, E. L. Stiernström, K. Svärd-sudd // *Ann Agric Environ Med*. – 2005. – Vol. 12, № 2. – P. 261-268; Hestbaek, L. Low back pain: what is the long-term course? A review of studies of general patientpopulations / L. Hestbaek, C. Leboeuf-Yde, C. Manniche // *Eur Spine J*. – 2003. – Vol. 12, № 2. – P. 149-165], musculoskeletal system (rheumatoid arthritis and osteoporosis), temporomandibular dysfunction [Does a dose-response relation exist between spinal pain andtemporomandibular disorders? / B. I. Wiesinger, H. Malker, E. Englund, A. Wänman // *BMC Musculoskelet Disord*. – 2009. – Vol. 10. – P. 28-28; Back pain in relation to musculoskeletal disorders in the jaw-face: a matched case-control study / B. Wiesinger, H. Malker, E. Englund, A. Wanman // *Pain*. – 2007. – Vol. 131. – P. 311-319], and cardiovascular, cerebrovascular diseases, headache / migraine [Comorbidity of low back pain: representative outcomes of a national health study in the Federal Republic of Germany / S. Schneider, S. M. Mohnen, M. Schiltenswolf, C. Rau // *Eur J Pain*. – 2007. – Vol. 11, № 4. – P. 387-397; Hestbaek, L. Low back pain: what is the long-term course? A review of studies of general patient populations / L. Hestbaek, C. Leboeuf-Yde, C. Manniche // *Eur Spine J*. – 2003. – Vol. 12, № 2. – P. 149-165].

3. Obesity can be seen as a precursor to the development of low back pain [Heuch, I. Body mass index as a risk factor for developing chronic low back pain: a follow-up in the Nord-Trondelag Health Study / I. Heuch, K. Hagen, J. A. Zwart // *Spine*. – 2013. – Vol. 38. – P. 133-139]. Pathophysiologically, obesity has both biomechanical and meta-inflammatory effects on the spine, maintaining chronic pain syndrome [Heuch, I. Body mass index as a risk factor for developing chronic low back pain: a follow-up in the Nord-Trondelag Health Study / I. Heuch, K. Hagen, J. A. Zwart // *Spine*. – 2013. – Vol. 38. – P. 133-139]. At the same time, obesity by the abdominal type is considered more dangerous for the development of LBP. Despite the fact that obesity often accompanies LBP, it is not always clear whether obesity is a cause or a consequence of LBP. [Impact of overweight and obesity on the musculoskeletal system using lumbosacral angles / N. O. Onyemaechi, G. E. Anyanwu, E. N. Obikli [et al.] // *Patient Prefer Adherence*. – 2016. – Vol. 10. – P. 291-296].

4. The presence of comorbid anxiety and depression worsens the prognosis in the presence of chronic LBP [The association of comorbidities, utilization and costs for patients identified with low back pain / D. P. Ritzwoller, L. Crounse, S. Shetterly, D. Ru-blee // *BMC Musculoskelet Disord.* – 2006. – Vol. 7. – P. 72-72; The influence of multisite pain and psychological comorbidity on prognosis of chronic low back pain: longitudinal data from the Norwegian HUNT Study / A. L. Nordstoga, T. I. Nilsen, O. Vasseljen [et al.] // *BMJ Open.* – 2017. – Vol. 7, № 5. – P. 315-312].

5. According to the authors [Heuch, I. Associations between serum lipid levels and chronic lowback pain / I. Heuch, K. Hagen, J. A. Zwart // *Epidemiology.* – 2010. – Vol. 21. – P. 837-841], high serum cholesterol and triglyceride levels lead to a higher incidence of BNS. Autopsy data showed a marked association between atherosclerotic aortic lesions and degeneration of intervertebral discs in the lumbar region, as well as between spinal artery stenosis and LNS during life. [Kauppila, L. I. Atherosclerosis and disc degeneration/low-back pain--a systematic review / L. I. Kauppila // *Eur J Vasc Endovasc Surg.* – 2009. – Vol. 37, № 6. – P. 661-670]. According to separate neuroimaging studies, it was noted that in patients with LBD, according to CT angiography, atherosclerotic calcifications of the abdominal aorta are much more common than in patients of a similar age in the control group (55% versus 21%) [Association of atherosclerosis with low back pain and the degree of disc degeneration / M. Kurunlahti, O. Tervonen, H. Vanharanta [et al.] // *Spine.* – 1999. – Vol. 24, № 20. – P. 2080-2084]. Moreover, the degree of lumbar artery stenosis is associated with the intensity of back pain and pain in the legs. [Three-year follow-up of lumbar artery occlusion with magnetic resonance angiography inpatients with sciatica: associations between occlusion and patient-reported symptoms / M. Kurunlahti, J. Karppinen, M. Haapea [et al.] // *Spine.* – 2004. – Vol. 29, № 16. – P. 1804-1808], which is confirmed by experimental studies with lumbar artery embolization, where the most frequent complications were severe pain in the lower back with muscle spasm and acute scoliosis on the side of the lumbar artery occlusion. Symptoms were associated with paraspinal muscle infarction and resembled acute radiculoischemia [Doppman, J. L. Paraspinal muscle infarction. A painful complication of lumbar artery embolization associated with pathognomonic radiographic and laboratory findings / J. L. Doppman, G. Di Chiro // *Radiology.* – 1976. – Vol. 119, № 3. – P. 609-613.]. According to some studies, the coefficient of fatty infiltration of the muscle that straightens the spine in the upper lumbar region is directly proportional to the presence and intensity of pain in the lumbar region. [MRI-defined paraspinal muscle morphology in Japanese population: The Wakayama SpineStudy / T. Sasaki, N. Yoshimura, H. Hashizume [et al.] // *PLoS One.* – 2017. – Vol. 12, № 11. – P. 187-765.].

6. Several hypotheses suggest the existence of a so-called "inflammatory phenotype", manifested by a tendency to depression and a combination of other characteristics, including chronic pain, metabolic syndrome, cardiovascular disease and obesity. [Slavich, G. M. From stress to inflammation and major depressive disorder: a social signaltransduction theory of depression / G. M. Slavich, M. R. Irwin // Psychol. Bull. – 2014. – Vol. 140. – P. 774-815]. From modern hypotheses, we can mention the role of direct glycation (post-translational modification, different from enzymatic glycosylation) of proteins which may underlie the general pathophysiological mechanism of chronic LBP and cardiometabolic risk factors [Ahmed, U. Possible role of methylglyoxal and glyoxalasein arthritis / U. Ahmed, P. J. Thornalley, N. Rabbani // Biochem. Soc. Trans. – 2014. – Vol. 42. - P. 538-542.].

Thus, isolated back pain, especially in elderly patients, is extremely rare which dictates the need to pay attention to concomitant comorbid pathology in terms of the possible commonality of risk factors and pathogenesis, with the necessary diagnostic measures and the development of therapeutic approaches.

在病理形态学研究中，我们评估了47名尸体的法医学尸检数据，这些尸体年龄在40至79岁之间，死于不同原因。 主要组（第1组）包括33例以遗忘性慢性椎源性背痛为特征的病例。 其余14例（对照组）未显示遗忘性慢性痛觉恶性肿瘤的迹象。 两组在年龄和性别上均具有可比性。

**Abstract.** *Within the pathomorphological study, we assessed the data from medicolegal autopsies of 47 cadavers, aged between 40 and 79, who died of different reasons. The main group (Group 1) consisted of 33 cases characterized by anamnestic chronic vertebrogenic dorsalgia. The remaining 14 cases (control group) did not show any signs of anamnestic chronic algesic malignancies. Both groups were comparable within age and sex.*

### **Research and Methods**

During our research, we noticed gender differences consistent with age: male bodies prevailed between 40 and 59 years, after 60 years we observed gender parity, and from 70 years the female part was prevalent.

According to the data, death occurred mainly at home (37 cases), 6 cases of death were in the workplace, and the remainder (4 cases) was observed in transport. In 10 cases (30%) of Group 1 and in 5 cases (35%) of the control group, we revealed the mild case of acute alcohol poisoning (0.3%-1.5% of ethanol in blood).

Under sectional study after complete organ disembowelment, aorta of each body was dissected along its posterior surface, and the color of aorta interior surface, presence of any signs of atherosclerotic diseases and their characters were assessed. In both groups aged between 40 and 49 years, all patients had occasional fatty streaks in the aorta abdominal region, represented by yellow, bulk-like masses (stage one of atherosclerosis). Patients between 50 and 59 years had fatty streaks

and fibrous plaques in both aorta abdominal and thoracic regions (stage two of atherosclerosis). Patients older than 60 years had, besides fatty streaks and fibrous plaques along all interior surface, occasional exulcerations, hemorrhaging, and thrombotic masses in the aorta abdominal region (stage three of atherosclerosis). These lesions tended to generate near aorta bifurcation and its branches (lumbar, mesenteric, and renal). After 70 years, subjects had fourth stage of atherosclerosis: their aortas were dissected with “crunch” and were dense because of calcification. The area of atherosclerotic lesions was calculated with visual-planimetric method (Avtandilov G., Litvak A., 1972).

After the analysis of the gathered data, we inferred that patients from Group 1 with chronic low back syndrome had higher percentage of aorta atherosclerosis: more than 10% in each age category comparing to the data of the control group. Additionally, we noticed a greater difference in male patients of all ages and in female patients after 60 years. Atherosclerotic difference was observed more on the stage of formation of fibrous plaques and fatty streaks in the region of aorta bifurcation, including vertebral arteries.

After histodiagnosis of aorta fragments of all people older than 70 years, we could observe atherosclerotic calcification. In 15 cases (45%) of Group 1, calcification was accompanied by exulcerations and colored atheromatous plaques. In 12 cases (36%) of Group 1, thrombosis was registered. For the control group, the pathologies described earlier were observed in 4 cases (28.5%) and 3 cases (21%), respectively. The study of *musculus psoas major* revealed lipomatosis and fibrosis of vessels, registered in 28 cases (86%) of Group 1, which became more apparent when compared with 7 autopsies (50%) of the control group.

We also assessed the study of the lumbar cord and its spinal roots. After disembowelment of each organ, vertebral bodies were chiseled, and their content (fragments of spinal cord with dura and pia mater and spinal roots) was extracted.

The spinal cords histological data from Group 1 suggested following pathologies: thickening and fibrosis of vascular walls. According to 11 autopsies (63%) of Group 1 and 6 autopsies (43%) of the patients in the control group, fibrous plaques in arterial walls were present in the spinal cord matter (dura and pia matters) and blood vessels around spinal roots.

After we examined the structure of spinal roots, we noticed a clear difference between the fibrous stroma of myelin fibers in Group 1 and in the control group: the one in Group 1 was significantly apparent. It was distinguished with the help of histochemical coloring. These pathomorphological features of the first group (11 cases (33%)) are the signs of atrophy. In 25 cases (75%) of Group 1, we observed hematoxylin bodies as purple round masses with distinguishable lining, which were the signs of degeneration of white matter myelin. In contrast with the control group, only 6 cases (45%) had the same pathologies.

The level of intervertebral disc degeneration in both groups was connected with arterial stenosis near the discs, which were mainly noticeable in upper lumbar segments ( $P < 0.05$ ). During augmenting of atherosclerotic symptoms in aorta abdominal region, degeneration of intervertebral disc on each lumbar level increased. Thus, atrophic, sclerotic, and degenerative alterations in lumbar cord are interconnected with atherosclerotic changes in blood vessels.

### **Conclusion**

Analysis of autopsy data on cadavers of men and women aged 40-79 years with subsequent histological examination showed that there is a significant correlation between atherosclerotic changes in the aorta and lumbar arteries with atrophic and sclerotic changes in the large lumbar muscle and spinal roots of the lumbar spinal cord. Ischemia in atherosclerotic lesion of the lumbar feeding arteries causes degenerative changes in the white matter of the spinal cord, as well as the membrane of the spinal roots, being one of the main factors in the development and maintenance of both pain syndrome and degeneration of the intervertebral disc. An Association was established between the presence of chronic BNS during life and atherosclerotic changes in the aorta and lumbar arteries detected during autopsy, as well as the degree of fat infiltration of the paraspinal muscles. These pathomorphological changes were found in more than 90% of patients with a history of chronic dorsalgia during life, and exceeded the indicators of the control group. Significance of postmortem studies compared to other methods is higher since they allow to assess atherosclerosis directly, but the disadvantage still exists because we cannot get the in-life data directly, which, however, can be gathered from the testaments of relatives and medical documentation.

The results of the research allow to make a conclusion about the influence of atherosclerosis on the development and maintaining of pain syndrome through the whole life. In turn, the presence of chronic pain affects main values of metabolism because of disorder of neurohumoral regulation and other aspects of vital functions. Nonetheless, to reveal causal relationships between present comorbid pathological states and find efficient treatment of chronic dorsalgia, we led the next clinical study.

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氨基酸水平在双膦酸盐相关的颌骨坏死患者中的价值  
**THE VALUE OF AMINO ACID LEVEL IN PATIENTS WITH  
BISPHOSPHONATE-RELATED OSTEONECROSIS OF THE JAW**

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**抽象**

目的：确定双膦酸盐相关的颌骨坏死（BRONJ）和静脉给予双膦酸盐（iv. BPs）对BRONJ患者氨基酸值的影响程度。

材料和方法：双膦酸盐（BPs）是焦磷酸盐分子的合成类似物。它们抑制破骨细胞前体的分化，诱导破骨细胞凋亡，并刺激破骨细胞抑制因子的释放。双膦酸盐常用于患有恶性肿瘤的患者，特别是老年患者，例如骨质疏松症，佩吉特氏病，骨转移，成骨不全症，异位骨化和BRONJ。然而，关于双膦酸盐和BRONJ如何影响人体氨基酸水平的问题尚待解决。因此，分析了与该主题相关的几篇文章。

结果：IV BP影响肾单位（例如肾小球）的结构，并导致或加重多发性肾功能衰竭（范可尼综合征；两种肾小球硬化；蛋白尿；氨基酸尿）。这一发现表明，用双膦酸盐治疗的患者尿液中所含蛋白质和氨基酸的含量超过正常



范围。通过计算还原型谷胱甘肽（GSH）与氧化型谷胱甘肽（GSSG）之间的比例可以揭示出BRONJ患者倾向于具有氧化应激（OS），从而减少了脂质，蛋白质和氨基酸等分子的含量。

结论：IVBPs和BRONJ可显著降低氨基酸值水平。

关键词：双膦酸盐相关的颌骨坏死；氨基酸；肾毒性双膦酸盐；静脉内给药；唑来膦酸唑来膦酸盐伊班膦酸。

### **Abstract**

**Objectives:** *To identify the level of influence of bisphosphonate-related osteonecrosis of the jaw (BRONJ) and intravenous administration of bisphosphonates (iv.BPs) on the value of amino acids in patients with BRONJ.*

**Material and Methods:** *Bisphosphonates (BPs) are synthetic analogues of a pyrophosphate molecule. They inhibit the differentiation of osteoclast precursors, induce osteoclast apoptosis, and stimulate the release of osteoclast inhibitory factors. Bisphosphonates are commonly used in patients, especially in elderly patients, with malignancies, such as osteoporosis, Paget's disease, bone metastases, osteogenesis imperfecta, heterotopic ossification and BRONJ. Still, the question of how bisphosphonates and BRONJ affect the level of amino acids in the human organism is open. Therefore, several articles related to the topic were analyzed.*

**Results:** *Iv.BPs impact the structure of kidney units, such as glomeruli, and cause or aggravate multiple renal failures (Fanconi syndrome; both types of glomerulosclerosis; proteinuria; aminoaciduria). This finding suggests that uria of the patients treated by bisphosphonates contains proteins and amino acids in quantities surpassing the normal range. Patients with BRONJ tend to have oxidative stress (OS), revealed by the calculations of the ratio between reduced glutathione (GSH) and oxidized glutathione (GSSG), reducing therefore the content of molecules like lipids, proteins, and amino acids.*

**Conclusions:** *Iv.BPs and BRONJ decrease the level of amino acid value significantly.*

**Keywords:** *bisphosphonate-related osteonecrosis of the jaw; amino acids; nephrotoxicity; bisphosphonates; intravenous administration; zoledronic acid; zoledronate; ibandronate.*

## **1. Introduction**

Bisphosphonates are synthetic analogs of inorganic pyrophosphate, characterized by two carbon to phosphorus bonds:  $(HO)_2(O)P-C(R_1)(R_2)-P(O)(OH)_2$ .

Bisphosphonates are usually used in patients with osteoporosis, Paget's disease, osteogenesis imperfecta, bone metastases caused by different types of cancer, heterotopic ossification, and BRONJ, especially in elderly patients. The first clinical description of BRONJ was made in 2003 by Marx et al. It spurred numerous reports worldwide where BPs were used. In general, iv.BPs shows higher incidence of

BRONJ but a large variation ranging from 0% to 28% has been reported depending on the specific type of BPs used, single or multiple BPs used simultaneously or sequentially, duration of therapy, and the condition for which BPs were administered. In addition, oral BPs have also been associated with BRONJ, although at much lower percentage (less than 4%). Since bisphosphonates can induce severe consequences, involving many organs and systems, such as urinary system (proteinuria, Fanconi syndrome etc.), it is obvious that they impact the human metabolism, and our first aim was to look closer on the dynamic of amino acid level in the organism during iv.BPs and BRONJ. This information is still incomplete, but crucial for the future understanding of biochemistry of BRONJ and therefore its treatment.

## 2. Material and Methods

*2.1. Data Sources and Search Strategy.* To learn whether the level of amino acids in patients with BRONJ fluctuates or alters, we analyzed several articles on different topics concerning iv.BPs in order to look at the problem from different angles. We searched for sources in the PubMed and PMC libraries in English and French published until June 2020. The keywords used were “bisphosphonate-related osteonecrosis of the jaw,” “amino acids,” “nephrotoxicity,” “bisphosphonates,” “intravenous administration,” “zoledronic acid,” “zoledronate,” “ibandronate.” References in each article were searched to identify missed studies.

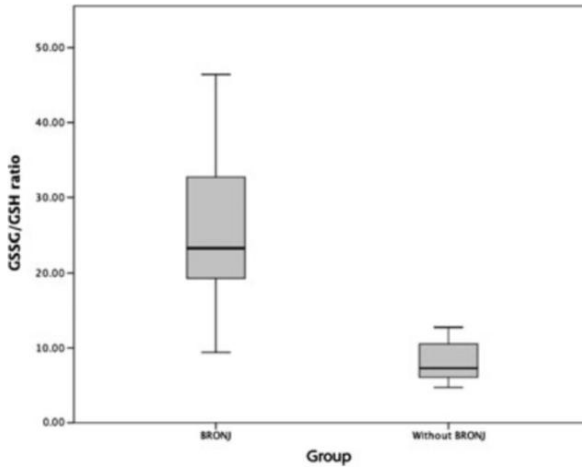
*2.2. Eligibility Criteria and Study Selection.* We included the studies that involved human subjects, with experimental or observational design (cross-sectional or longitudinal), and assessed any disease or health state as primary event.

*2.3. Analysis of the Information.* After removing the duplicate records, we screened the relevant studies from the references retrieved from the databases, reviewing the titles and abstracts. We obtained the full texts of the relevant studies to assess for inclusion or exclusion in this study. The author name, publication year, study design, country, population included (age group, sex), sample size (subjects included in the study), biological sample, main outcome, results, and conclusion related to the value of amino acid level were extracted from each included study. We found a great number of studies that use nephrotoxicity of bisphosphonates and OS changes during BRONJ and iv.BPs. The topics included in this review are (i) Acquired Fanconi Syndrome Induced by Zoledronic Acid; (ii) Massive proteinuria and acute renal failure after oral bisphosphonate; (iii) oxidative stress changes and the GSSG/GSH ratio during BRONJ.

## 3. Results and Discussion

*3.1. BRONJ and OS changes.* Since Jose Bagan et al. studied whether OS changes are present in patients with BRONJ, it is known that BRONJ dramatically increases the ratio GSSG/GSH which points to a severe OS. They measured the

ratio GSSG/GSH in serum and saliva in three groups of patients: Group 1 consisted of 24 patients with BRONJ who had received ivBPs, Group 2 comprised 20 patients who had received ivBPs but did not have any symptoms of BRONJ, and Group 3 was an age-matched control group, formed from 17. They selected only patients with breast cancer or multiple myeloma for inclusion in Groups 1 and 2. All of these subjects had been treated with intravenous zoledronic acid (iv.ZA) (4-mg doses every 4 weeks).



**Figure 1.** Differences in GSSG/GSH ratio between the groups with and without BRONJ. BRONJ, Bisphosphonate-related osteonecrosis of the jaws

According to Fig.1, the mean serum and saliva levels of GSSG and, consequently, the GSSG/GSH ratio were higher in Group 1 than in two other groups. Au contraire, serum and saliva GSH levels were lower in patients with BRONJ than in controls. Also, serum and saliva levels of GSSG and the GSSG/GSH ratio were higher in the group treated with iv.BPs, but without BRONJ than in Group 3 (Table 1). Thus, according to this study, we can infer that iv.BPs, iv.ZA in this case, cause significant OS changes in both groups who received treatment, especially in patients with BRONJ.

It is well-known that OS changes impact the metabolism of the human body, which is demonstrated in the review article of Martha A. Sánchez-Rodríguez and Víctor Manuel Mendoza-Núñez. They studied how diverse diseases and malignancies fluctuate the values of OS. They introduced a term of Oxidative Stress Index (OSI), a measure of oxidative damage which can be calculated as the ratio percentage of total peroxides present to the total antioxidant potential. As far as

OSI is the measurement of total peroxides or hydroperoxides, which are the oxidation products of several molecules, such as lipids, proteins, and amino acids, we inferred that OS changes discussed in the article of Jose Bagan et al. decrease dramatically the level of amino acids in the organism, oxidizing them into peroxide ions. Therefore, BRONJ and iv.BPs decrease the value of amino acid level in the patient's organism.

**Table 1** Main levels of oxidative stress measurement in serum and saliva

Groups	Cases	Mean	Standard deviation
Serum_GSH (nmol/mg)			
1	22	17.93	6.44
2	19	22.13	1.64
3	13	27.29	5.04
Saliva_GSH (nmol/mg)			
1	24	14.15	4.74
2	20	16.93	1.45
3	17	20.33	1.91
Serum_GSSG (nmol/mg)			
1	22	4.05	1.26
2	19	1.84	0.55
3	13	1.28	0.86
Saliva_GSSG (nmol/mg)			
1	24	0.40	0.10
2	20	0.31	0.09
3	17	0.16	0.07
Serum_GSSG/GSH% ratio			
1	22	24.79	9.36
2	19	8.41	2.74
3	13	5.06	4.38
Saliva_GSSG/GSH% ratio			
1	24	3.23	1.37
2	20	1.84	0.59
3	17	0.82	0.33

3.2. *Bisphosphonates and Nephrotoxicity.* Among many articles related to bisphosphonates, those about nephrotoxicity and renal failure caused by iv.BPs stood out. The case of massive proteinuria and acute renal failure after oral administration of bisphosphonates (or.BPs) was discussed by Naoto Miura et al. A patient, a 61-year-old Japanese man, who already had renal issues (focal segmental glomerulosclerosis, FSGS), was treated by steroids (prednisolone). The patient's amount of daily urinary protein decreased from 15.6 g to 2.8 g. An oral bisphosphonate (alendronate sodium) was used in order to prevent steroid-induced osteoporosis, but within two weeks of or.BPs, the urinary protein level increased rapidly up to 12.8 g, with acute renal failure. After discontinuing the oral alendronate, the patient underwent six cycles of hemodialysis and four cycles of apheresis. Urinary volume recovered to the normal range, with urinary protein disappearing completely within 40 days. In this case, we cannot deny the possibility that mas-

sive proteinuria occurred coincidentally after the administration of oral bisphosphonates, but the possibility still remains that or.BPs to a patient with FSGS, who already had cell renal structure abnormalities, may have aggravated podocyte cell function and produced massive proteinuria. Therefore, we can infer that, because of renal failure, proteinuria accompanied by aminoaciduria reduced the level of amino acids in the patient's organism.

**Table 2** Urinary Amino Acid Analysis

	$\mu$ mol/day	Normal range
Taurine	435.8	322.2-5214.5
Phosphoethanolamine	16.5	31.0-110.0
Urea	46.6	130.3-493.2
Aspartic acid	11.6	$\leq$ 12.7
<u>Hydroxyproline</u>	<u>518.7</u>	ND
<u>Threonine</u>	<u>2580.7</u>	79.9-528.3
<u>Serine</u>	<u>3126</u>	208.8-1020.0
<u>Asparagine</u>	<u>1813.9</u>	60.7-372.3
<u>Glutamic acid</u>	<u>269.5</u>	11.3-42.7
<u>Glutamine</u>	<u>11402</u>	207.0-1357.3
<u>Sarcosine</u>	<u>164.2</u>	$\leq$ 99.0
$\alpha$ -Amino adipic acid	TR	16.7-118.6
<u>Proline</u>	<u>1711.9</u>	ND
<u>Glycine</u>	<u>10981.4</u>	652.1-3670.6
<u>Alanine</u>	<u>10349.7</u>	141.2-833.9
<u>Citrulline</u>	<u>492.3</u>	13.5-55.6
<u><math>\alpha</math>-Aminobutyric acid</u>	<u>68.4</u>	$\leq$ 27.1
<u>Valine</u>	<u>1638.4</u>	24.8-82.2
<u>Cystine</u>	<u>1009.2</u>	23.7-170.9
Cystathionine	12.6	TR-44.7
<u>Methionine</u>	<u>175.9</u>	TR-20.2
<u>Isoleucine</u>	<u>303.5</u>	7.5-23.5
<u>Leucine</u>	<u>505.2</u>	24.6-89.3
<u>Tyrosine</u>	<u>2176.5</u>	50.6-308.4
<u>Phenylalanine</u>	<u>1115.8</u>	27.2-110.2
$\gamma$ -Amino $\beta$ -hydroxybutyric acid	ND	ND
$\beta$ -Alanine	92.1	TR-153.0
$\beta$ -Amino-iso-butyric acid	159.6	TR-1623.9
$\gamma$ -Aminobutyric acid	ND	ND
Monoethanolamine	289.8	195.3-606.2
Homocystine	ND	ND
Histidine	1855	436.4-2786.5
3-Methylhistidine	109.2	113.4-480.9
1-Methylhistidine	494.7	59.3-2816.2
Carnosine	TR	$\leq$ 87.6
Anserine	28.2	$\leq$ 231.4
<u>Tryptophan</u>	<u>482</u>	20.7-150.7
Hydroxylysine	10.2	$\leq$ 22.9
<u>Ornithine</u>	<u>447.8</u>	6.9-43.9
<u>Lysine</u>	<u>2034.7</u>	51.6-1639.6
<u>Arginine</u>	<u>160.1</u>	11.6-54.8

Tetsuhiro Yoshinami et al. conducted more precise study with serum and urine analysis. The case report: a 61-year-old woman with metastatic breast cancer was diagnosed with acquired Fanconi syndrome. Fanconi syndrome is characterized by multiple transport defects in the renal proximal tubules. This dysfunction leads to renal losses of glucose, protein, amino acids, bicarbonates, uric acid, and some electrolytes such as sodium, potassium, calcium, and phosphate. In the present case, renal diabetes, proteinuria, hypophosphatemia, and some other electrolyte

abnormalities were found, which strongly suggested Fanconi syndrome. The cause of this syndrome was most likely iv.ZA (Zometa), which had been induced at a dose of 4 mg over 15 minutes weekly because of malignancy-associated hypercalcemia.

Diagnosis of Fanconi syndrome was confirmed by the demonstration of hyper-aminoaciduria (Table 2). Eighteen out of twenty main amino acids are in excessive concentrations, so we can presume that iv.BPs causes a large loss of amino acids and aggravate renal failure.

### Conclusion

We made a review of the state of the knowledge about the value of amino acid level in patients with BRONJ or who received iv.BPs.

BRONJ and iv.BPs alter OS by fluctuating several parameters, such as theGSSG/GSH ratio, reducing the quantity of amino acids because of their oxidation. Also, iv.BPs and or.BPs induce or aggravate renal failure, causing aminoaciduria and proteinuria, and therefore decreasing significantly the level of amino acids in the patient's organism.

Thus, we can conclude that BRONJ and administration of bisphosphonates result in the overall decrease of amino acids in the blood and cells.

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小儿先天性疱疹的临床表现  
**CLINICAL MANIFESTATIONS OF CONGENITAL HERPES IN CHILDREN**

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抽象。 这组作者观察到生命的第一个月中有69名儿童患有单纯疱疹病毒引起的先天性感染。 在通过PCR方法对材料进行研究的基础上建立诊断；ELISA检测特异性IgM和IgG抗体的诊断滴度。

关键词： 宫内感染，先天性疱疹

**Abstract.** *the Authors observed 69 children of the first month of life with a congenital infection caused by the herpes simplex virus. The diagnosis was established based on the study of the material by PCR method; detection of diagnostic titers of specific IgM and IgG antibodies by ELISA.*

**Keywords:** *intrauterine infections, congenital herpes*

Herpes simplex virus infection is an infection caused by viruses of the Herpesviridae family, in particular - herpes simplex viruses (HSV) type 1 and 2. According to the classifications of the International Committee on Taxonomy of Viruses HSV are classified as Alpha viruses (alphaherpesvirinae). This is a totally (sub-totally) common disease with a predominantly latent course or lesions of the skin and mucous membranes [1, 2, 3, 4].

Congenital herpes simplex infection (P35.2 Congenital herpes simplex virus infection) is characterized by wide polymorphism and is detected at birth or in the first 24-48 hours of a newborn's life.

There are five clinical forms of herpes infection in the neonatal period [1,2]:  
- congenital herpes;

- localized mucocutaneous;
- disseminated;
- generalized;
- isolated (encephalitis, meningoencephalitis); as well as residual phenomena (paresis, epilepsy, neurological deficit, developmental delay, etc.).

**Congenital herpes** (antenatal transplacental infection) - fetal birth, premature birth, IUGR, central nervous system damage (microcephaly, hydrocephalus, calcifications in the brain), skin scars, microphthalmia, hepatosplenomegaly. There may be limb hypoplasia (cortical dwarfism). Thrombocytopenia, early neonatal bacterial sepsis are characteristic. Herpetic skin rashes are rare. The frequency of congenital herpes is 1:200,000 - 40,000 [2]

Purpose of the work: to study the structure of clinical manifestations of congenital herpes in children.

Material and methods of research: The research was carried out on the basis of GBUZ Penza "Oblast Children's Clinical Hospital named after N.F. Filatov" in the period 2000-2018.

Infants of the first month of life with suspected congenital herpes simplex virus infection were examined. To verify the pathogen, the methods of enzyme immunoassay (ELISA) and polymerase chain reaction (PCR) were used.

Research results: As a result of the examination, 69 children were identified with congenital infection caused by herpes simplex viruses. Among the examined were 34 girls and 35 boys.

There were 28 patients with congenital herpes (15 girls and 13 boys), with a localized mucocutaneous form - 4 children.

Disseminated neonatal herpes was diagnosed in 8 cases, generalized infection - in 29 patients. Isolated lesions of the central nervous system (cerebral form) were not found among the examined patients.

When studying the clinical manifestations of congenital herpes, it was found that damage to the nervous system was diagnosed in 100% of cases, including: muscle hypotension - in 15 children (53.5%), dystonia - in 2 (?), muscle hypertonia - in 7 (25%), hyporeflexia - in 15 (53.5%), convergent obliquity - in 3 (10.7%), tremor in 8 (8.5%), nystagmus - in 2 (7.1%). 6 children (21.4%) had hydrocephalic syndrome, 1 (3.6%) had microcephalic, signs of intracranial hypertension were found in 11 children (39.2%).

Neurosonographic examination of the brain revealed: cysts of the choroid plexuses and periventricular areas (28.5%), calcifications of the brain (10.7%), angiopathies (14.2%), thickening of the vascular plexuses (25%), plexus deformities (17, 8%), thickening of the thalamus (21.4%), thickening of the periventricular zones (17.8%). Intraventricular hemorrhages were found in 17.8% of children. Signs of dilatation of the ventricular system of the brain were diagnosed in 57.1% of patients.

From the side of the cardiovascular system, heart defects were diagnosed in 9 children (32.1%), myocarditis - in 1 (3.6%), also in 6 children (21.4%) cardiopathy with disturbances in rhythm and conduction was noted.

The defeat of the respiratory system was diagnosed in 13 children (46.4%), including: pneumonia (7.1%), pneumothorax (3.6%), bronchitis (7.1%), pneumopathy (7.1%), atelectasis of the lungs (21.4%).

Damage to the liver and spleen was found in 9 children (32.1%). Among them, hepatitis in 1 child (3.6%), hepatomegaly - in 1 (3.6%), splenomegaly - in 1 (3.6%), hepatosplenomegaly - in 6 (21.4%).

On the part of the urinary system in 2 cases (7.1%), urinary tract infection was diagnosed in 1 (3.6%) - metabolic nephropathy.

The defeat of the gastrointestinal tract was detected in 3 children (10.7%), including enterocolitis (3.6%) in 1 child and in two children intestinal dysbiosis (7.1%).

Other clinical manifestations were: purulent meningitis in 1 child (3.6%), sepsis in 1 child (3.6%), hemorrhagic syndrome also in 1 (3.6%), conjunctivitis - in 4 (14.2%), anemia - in 5 (17.8%). Specific lesions of the skin and mucous membranes were not observed in any child.

Conclusions: Thus, the clinical manifestations of one of the forms of congenital infection caused by the herpes simplex virus - congenital herpes - are not specific and diverse, but are characterized by damage to the nervous system in 100% of cases.

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先天性李斯特菌病的诊断, 临床和病理形态学特征  
**DIAGNOSIS AND CLINICAL AND PATHOMORPHOLOGICAL  
FEATURES OF CONGENITAL LISTERIOSIS**

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抽象。 作者观察了孕妇和儿童李斯特菌病。 该诊断是根据细菌学和血清学方法确定的。 提供了我们对李斯特菌病各种样本的研究数据, 包括尿液培养, 孕妇宫颈管涂片, 新生儿的血液, 尿液, 皮肤和脐带涂片以及胎盘样本。 使用细菌学方法 (在营养培养基上培养), 血清学方法 (被动血凝反应) 以及死亡胎儿, 新生儿和胎盘的内部器官的病理解剖学研究。 根据获得的数据, 疾病门诊的分析和病理解剖学研究的结果, 描述了从无症状携带者到广义形式的李斯特菌病的各种形式。

关键词: 宫内感染, 李斯特菌病。

**Abstract.** *The Authors observed pregnant women and children with listeriosis. The diagnosis was established on the basis of bacteriological and serological methods. Data from our own studies of various samples for listeriosis, including urine cultures, smears from the cervical canal of pregnant women, blood, urine, skin and umbilical wound smears in newborns, as well as placenta samples, are presented. A bacteriological method (culture on nutrient media), a serological method (passive hemagglutination reaction), and a pathoanatomic study of the internal organs of dead fetuses, newborns, and placenta were used. Based on the data obtained, the analysis of the disease clinic and the results of pathoanatomic research, various forms of listeriosis are described, from asymptomatic carriers to generalized forms.*

**Keywords:** *intrauterine infections, listeriosis.*

Listeriosis is an acute infectious disease with fever, intoxication and polymorphic clinical symptoms caused by *Listeria monocytogenes*.

Listeriosis is characterized by a wide range of clinical manifestations. Most often, clinical forms associated with damage to the central nervous system, manifested by meningitis or meningoencephalitis, are detected. Endocarditis accounts for 5-10% of listeria infections in adults. Acute gastroenteritis is described with epidemic outbreaks of listeria sepsis and with damage to the nervous system. In addition, such clinical manifestations of listeriosis as skin infection, liver and spleen abscesses, pneumonia, myocarditis, osteomyelitis, joint inflammation, etc. are detected [1]. The main forms of listeriosis are: glandular; gastroenteric; nervous; septic; bacteriocarrier. Listeriosis of pregnant women and newborns is distinguished separately [2]. It is also known that the most effective antimicrobial therapy for listeriosis is the use of ampicillin and aminoglycosides.

The greatest danger of listeria infection is for pregnant women and newborns. Compared to other women, pregnant women are 10 times more susceptible to listeriosis [3]. It causes miscarriages, stillbirth, development of fetal malformations, as well as meningitis, sepsis and pneumonia in newborns. Newborn deaths due to listeriosis account for 0.4-4% of the total number of perinatal autopsies. Microscopically, granulomas (so-called listeriomias) are observed, in the center of which there are foci of necrosis with a large number of listeria, and along the periphery - histiocytes, monocytes, lymphocytes [4].

Purpose of the study: examine the prevalence of listeriosis among pregnant women and newborns and the features of its clinical manifestations.

Materials and methods: Since 2011, according to the sanitary rules of the joint venture 3.1.7. 2817-10 "Prevention of listeriosis in humans" [5] based on Penza OCCH after N.F. Filatov studied various samples for listeriosis, including cultures of urine and cervical smears of pregnant women, cultures of blood, urine, cerebrospinal fluid in newborns, as well as samples of the placenta. The bacteriological method was used - inoculation on nutrient media: nutrient medium "Oxford agar" (RCP, St. Petersburg), Fraser broth (RCP St. Petersburg), NAL (nutrient agar for isolation and cultivation of *Listeria* and NBL (nutrient broth for isolation of *Listeria*) produced by FBIS "SSC AMB" Rospotrebnadzor of Russia, Obolensk) with selective additives, blood agar, Giss media with rhamnose and xylose, semi-liquid nutrient agar with 1% glucose. A serological method was also used - ELISA using an enzyme-linked immunosorbent assay for detecting IgG antibodies to listeria ("Lytech" Co. Ltd., Moscow), postmortem examinations of the internal organs of dead fetuses, newborns and placenta were carried out. A bacteriological examination for listeriosis was carried out in 5725 pregnant women and parturient women (5323 examinations of smears from the cervical canal, 2117 - urine cultures, 402 - smears from the placenta and placenta discharge). In addition, 1638 newborn

infants with suspected intrauterine infection were examined (bacterial culture of skin swabs - 1638 children, swabs from the throat and contents of the tracheobronchial tree - 933 children, umbilical wound swabs - 46, eye swabs - 802, blood cultures - 30, urine cultures - 20, cerebrospinal fluid - 6).

Results of the study: *Listeria* was found in 11 out of 5725 pregnant women in smears from the cervical canal (0.19%) and in three newborns out of 1638 examined in the blood and contents of the tracheobronchial tree (the specific gravity was also 0.19%). In postmortem examinations (74 stillborn children and 109 who died in the neonatal period) *Listeria* and specific "listeriomas" were found in two (1.9%) cases.

Analysis of pregnancy outcomes in 11 patients showed that in 7 cases (42.4%) childbirth ended in the birth of a healthy full-term baby, however, weakness in labor was noted (9.09%), a prolonged anhydrous period (18.2%), and polyhydramnios. (9.09%), umbilical cord entanglement (18.2%). In two cases, the pregnancy ended in preterm labor at 33-35 weeks. All children tested negative for listeriosis. In one case, a child was born with a congenital blue-type heart defect in a serious condition (transferred to the cardio center, so there is no data on the presence or absence of congenital listeriosis).

One pregnant woman at 28 weeks of age developed a clinic of acute pyelonephritis and was diagnosed with antenatal fetal death; *Listeria monocytogenes* was isolated in a smear from the cervical canal and during urine culture. In the pathological examination, *Listeria monocytogenes* was isolated from the lungs of the deceased fetus and placenta, and specific granulomas ("listeriomas") were found in the internal organs of the deceased fetus (brain, lungs, liver, spleen, intestines). The patient received a course of antibiotic therapy with ampicillin in two cycles with an interval of 1.5 months according to the recommendations [2]. As a result of repeated studies for listeriosis, the tests were negative.

In three premature babies, *Listeria* was found in a skin smear. A more in-depth examination of these patients and their mothers did not reveal organ pathology and the presence of *Listeria* in other environments.

*Listeria* was also found in the blood and contents of the tracheobronchial tree in three patients with generalized intrauterine infection. All patients were diagnosed with congenital listeriosis, generalized form (children's septic granulomatosis). Examination of the mothers of these patients also revealed *Listeria* in a smear from the cervical canal and a diagnostic titer of antibodies to *Listeria* in the blood (above 1:200 in PHAR). However, one case of generalized intrauterine infection was fatal. During the life of this patient (age at the time of death - 28 days), the clinical diagnosis was made: Congenital listeriosis, generalized (septic) form (purulent meningitis, ventriculitis, focal confluent pneumonia with a risk of destruction, hepatosplenomegaly with the formation of hepatitis, carditis, systemic

inflammatory reaction syndrome. Complications: IVH II-III degree, leukomalacia, internal hydrocephalus. Multiple organ failure: RF of the III degree, CHF III stage, ARF. Anemia of the I-II degree, hypotrophy of the I degree. Pathological examination also revealed specific granulomas in various organs and tissues of the deceased child.

In the existing clinical classification of listeriosis, the pulmonary form is not distinguished. But in our clinical practice, we observed the development of destructive pneumonia in a child with a generalized form of listeriosis. We present this clinical observation. Child Boy A., 9 months old, was admitted to the regional hospital with a cough, runny nose, increased breathing, body temperature up to 38°C. From the anamnesis it is known that he was ill for a week, received amoxiclav on an outpatient basis. However, the condition did not improve, the child was hospitalized with signs of pulmonary heart failure, intoxication, intestinal paresis; in the ICU was intubated, transferred to mechanical ventilation. On radiography of the chest cavity: total darkening on the right, displacement of the mediastinum to the left with signs of hydrothorax. A pleural puncture was performed, a turbid yellow liquid was obtained. In the analysis of blood - leukocytosis (from  $37.5$  to  $51.2 \times 10^9$  L) with a neutrophilic shift (n-58), an increase in ESR up to 55 mm/h, a drop in the hemoglobin level to 81 g/l. According to the severity of the condition, for further treatment, the child was transported in an intensive care vehicle to the regional children's hospital. Breathing was weakened in the posterior regions, more on the right; various moist rales, muffling of heart sounds, tachycardia up to 156 per minute were determined; hepatosplenomegaly; pronounced clinical and laboratory manifestations of the syndrome of systemic inflammatory reaction and multiple organ failure. MSCT of the chest cavity organs and clinically diagnosed with right-sided focal-confluent destructive pneumonia, complicated by purulent exudative pleurisy and atelectasis of the lower lobe of the right lung. *Listeria monocytogenes*, sensitive to amoxicillin, cefepime, cefotaxime, meropenem, ofloxacin, was isolated from the contents of the bronchi and pleural cavity. Treatment: thoracoscopy was performed twice, decortication of the right lung, sanitation and drainage of the right pleural cavity; infusion therapy, adequate antibiotic therapy, intravenous immunoglobulin, ambroxol, viferon, symptomatic therapy, fresh frozen plasma transfusion, ultraviolet and laser blood irradiation. The state of health improved, on the 9th day the child was extubated, on the 11th day he was transferred to the surgical department, on the 29th day he was discharged in a satisfactory condition.

Conclusions: 1. Thus, the prevalence of listeriosis among those examined in POCCH was 0.9% among pregnant women and 0.9-1.9% in fetuses and newborns who died in the neonatal period. 2. The detection of *L. monocytogenes* in clinical material from pregnant women requires specific etiotropic therapy, as well as ob-

servation of the fetus and examination of the children born. 3. Transient detection of listeria on the skin in children does not require specific treatment, but requires additional examination and diagnostic monitoring of patients. 4. The generalized form of listeriosis can manifest itself as a predominant destructive process in the lungs; with etiological verification of the inflammatory process in the lungs, an examination for listeriosis is necessary. Identification of listeria in the contents of the tracheobronchial tree and pleural cavity in pneumonia allows confirming the etiological role of listeria in the development of respiratory diseases.

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抗同毒性药物在预防心血管系统疾病中的用途  
USE OF OF ANTIHOMOTOXIC MEDICATIONS IN PROPHYLAXIS OF  
CARIDIO-VASCULAR SYSTEM DISORDERS

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注解。 吸烟是发展心血管疾病的主要危险因素之一，尤其是在女性更年期和男性更年期期间。

除了增加各种心血管疾病发展的风险外，吸烟还大大增加了患肺部，内分泌和其他疾病的风险，结果导致人过早死亡[1, 2, 6]。 烟草依赖的治疗应由任何专业的医生，尤其是家庭医生进行。

治疗的有效性取决于吸烟强度，吸烟和戒烟的动机，烟草依赖程度，包括医生的建议，行为和药物治疗[3, 4, 5, 12, 15, 17-19, 23 ]。

关键词：吸烟，ICD，Nux Vomica Homaccord，预防心血管疾病。

**Annotation.** *Smoking is one of the major risk factors for development of cardiovascular diseases, especially during menopause in women and andropause in men.*

*In addition to elevated risk of various cardiovascular diseases development, smoking also greatly increases the risk of developing of pulmonary, endocrine and other diseases and, as a result, lead to premature death of a person [1,2,6]. Treatment of tobacco dependence should be carried out by a physician of any specialty and especially a family physician.*

*The effectiveness of treatment depends on the degree of smoking intensity, motivation to smoke and to quit smoking, the degree of tobacco dependence and includes doctor's advice, behavioral and pharmacological therapy[3,4,5,12,15,17-19,23].*

**Keywords:** *smoking, ICD, Nux Vomica Homaccord, prevention of cardiovascular diseases.*

## **Introduction**

In recent years, the number of cardiovascular diseases tends to increase. Among them, ischemic cardiac disease and insult are the most important [1,2,6].

Many risk factors play an important role in the development of ischemic cardiac disease (smoking, hyperlipidemia, diabetes mellitus, obesity, etc.).

Therefore, only the prevention of these diseases can help to eliminate such a situation.

During initial prophylaxis, the physician usually deals with patients who do not have a complaint, but there are various risk factors in these pseudo "healthy" patients. One of the main risk factors is smoking.

Elimination of risk factors plays an important role in improving the quality of preventive measures. Individuals with three main risk factors are usually identified during the anamnesis: obesity, elevated blood pressure, and smoking[4,8,9,12].

In the past, people with cardiovascular disease were found to have a bad habit, such as smoking, although this indicator was very low in women. However, today this risk factor also is no longer the last among women.

Tobacco smoking is a unique significant social phenomenon with a proven pathogenic effect on human health, multiplying the risk of developing of many diseases. And paradoxically, tobacco is officially allowed to be sold everywhere, access is free, and it is actively advertised by tobacco manufacturers.

At the same time, there is no strong work performed by state and public programs aimed at preserving the health of the nation, promoting smoking cessation.

Rapid addiction to tobacco consumption (6-7 times faster than alcoholic drinks) and a high level of smoking are determined by pronounced nicotine addiction - the binding of nicotine to acetylcholinergic receptors in the brain, the activation of which leads to the release of dopamine and noradrenaline, a change in the psycho-emotional sphere, a feeling of pleasure, arousal, an effect on the lipid metabolism[10,11,13].

These effects determine the status of comfortable feeling, form mental and physical dependence, because of which the consumption of nicotine while smoking tobacco is referred to the classic types of drug addiction [14,16,21].

As smoking is the most common risk factor for CVD, this has already become a major problem and requires special attention[21 ].

Diagnosis of nicotine dependence degree is performed by the using of the Fagestrem score test. This is important because the right tactics and methods of smoking cessation are chosen correctly.

The degree of nicotine dependence is calculated by the sum of the scores.

0-2 - very weak dependence

3-4 - weak dependence

- 5 – moderate dependence
- 6-7 – high dependence
- 8-10 - very high dependence

The patient is asked a series of questions to calculate the scores.

All smokers are advised to give up smoking and, if necessary, nicotine replacement or other medical treatment is recommended[3-5,7 ]. Sometimes sedative and other symptomatic therapy is prescribed, and if there is a physiological dependence - special medication treatment is prescribed [12,15-19,23].

Although there is a wide range of medications to smoking cessation, the searching for the ways to overcome this problem is still relevant.

Since chemotherapeutic medications have many side effects, the use of non-pharmacological medications is advisable. In this regard, the antihomotoxic medication Nux-Vomica Homaccord produced by German “Heel” company is of interest[20,24,25 ].Nux Vomica Homaccord is an antihomotoxic preparation.

*Special indications:*

When taking homeopathic medicines, existing symptoms may temporarily worsen (initial complication). In this case, the medication is stopped and a doctor is consulted.

The medication contains ethyl alcohol (35% by volume).



**Ingredients:** Drops: 100 g cont.: Nux vomica D2, Nux vomica D10, Nux vomica D15, Nux vomica D30, Nux vomica D200, Nux vomica D1000, Bryonia cretica D2, Bryonia cretica D6, Bryonia cretica D10, Bryonia cretica D15, Bryonia cretica D30, Bryonia cretica D200, Bryonia cretica D1000 0.2 g each; Lycopodium clavatum D3, Lycopodium clavatum D10, Lycopodium clavatum D30, Lycopodium clavatum D200, Lycopodium clavatum D1000, Citrullus colocynthis D3, Citrullus colocynthis D10, Citrullus colocynthis D30, Citrullus colocynthis D200 0.3 g each. Contains 35 vol.-% alcohol.

*Interaction:* Does not exclude the use of other medications.

*Storage:* Store in a dry, dark place at a temperature of 15 ° C -5 0 ° C.

*Expiration date:* 5 years.

**The purpose of the research:**

To study the effectiveness of Nux-Vomica Homaccord, produced by Heel company, in the elimination of smoking negative effect as key risk factor in the prevention of cardiovascular diseases.

**Materials and methodology:**

In order to eliminate the risk factor as cigarettes smoking in the prevention of cardiovascular diseases, 32 practically healthy patients aged of 45-60 years who smoked 1 pack of cigarettes per a day ( $20 \pm 2$  units) were examined and all patients were divided into 2 groups. Complaints of all patients before treatment were: fatigue, sleep disturbances, bad breath, headache, dizziness, decreased ability to work.

The I-control group included 10 patients who were recommended only smoking cessation.

The II-main group included 22 patients who were given Nux Vomica Homaccord 10 drops 3 times a day, 30 minutes before eating, in addition to smoking cessation.

In I group (control), only 2 examined persons (20%) were able to reduce the quantity of smoking, and their symptoms were significantly reduced. However, another 8 persons (80%) of patients were unable to reduce the quantity of cigarettes and their symptoms remained unchanged.

In II group (main), 4 of persons examined (18.1%) were able to give up smoking completely, 12 persons (54.6%) of them halved the number of cigarettes smoked, and in 6 persons (27.3%) the progress.

**Results:**

The analysis of the results got shows that Nux Vomica Homaccord has a positive effect on the elimination of unpleasant symptoms caused by smoking, which is one of the main risk factors in the prevention of cardiovascular diseases, and will help these patients to give up the smoking completely in the future.

**Conclusion:** Considering the above mentioned information, we can conclude that the use of Nux Vomica Homaccord can be recommended to eliminate the unpleasant symptoms of smoking, which is one of the main risk factors in the prevention of cardiovascular diseases, and can be useful in completely smoking cessation in future.

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纠正女性荷尔蒙紊乱中的血压  
**CORRECTION OF BLOOD PRESSURE IN HORMONAL DISORDERS  
IN WOMEN**

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注解。 更年期疾病，包括妇女的动脉高压问题，在全世界范围内都存在，尤其是在阿塞拜疆。

正是在女性一生中，从生命的生殖阶段过渡到老年。 卵巢逐渐失去功能 [1]。

在更年期的早期症状中，血管舒缩症状并不重要：畏寒，心动过速，排汗增加，脑循环障碍和高血压。

为了使上述疾病正常化，通常使用激素替代疗法，其目的是替代卵巢功能紊乱的荷尔蒙。 各种药物也可用于纠正血压 [18, 20 - 22]。

关键词：动脉高压，更年期，卵巢综合症，激素紊乱。

**Annotation.** *The problem of climacteric disorders, including arterial hypertension in women, is relevant all over the world, and in particular in Azerbaijan.*

*It is during this period of a woman's life that the transition from the reproductive phase of life to old age occurs. The ovaries gradually lose their function [1].*

*Among the early symptoms of menopause, vasomotor symptoms are of no small importance: chills, tachycardia, increased perspiration, impaired cerebral circulation and hypertension.*

*To normalize the above mentioned disorders, hormone replacement therapy is usually used, the purpose of which is to replace the disturbed hormonal function of the ovaries. Various pharmacological agents are also used to correct blood pressure [18, 20-22].*

**Keywords:** *arterial hypertension, menopause, Ovarium compositum, hormonal disorders.*

**Material and methodology.** *We performed an ambulatory study of the effectiveness and possibility of Ovarium Compositum use for the prevention of arterial hypertension during menopause in 38 women aged of 45-55 years. All patients were divided into 2 groups:*

*Group I - (control) included 18 women with arterial hypertension, taking hypotensive medication Rileys Plus at a dose of half a tablet (lisinopril 20 mg hydrochlorothiazium 12.5) in the morning and evening.*

*Group II (main) included 20 women in the period of menopause, who, along with Rileys Plus, were prescribed intramuscular injections of Ovarium Compositum 2 times a week.*

**Research results:** *After 4 months in group I, BP stabilization was achieved in 50% of women, while in group II, BP stabilization was achieved in 87% of women. They also had a decrease in the severity of subjective complaints. An interesting fact is that in group II, 60% of women after 2 months of treatment were able to reduce the dose of Rileys Plus by ½ tablet without reducing the hypotensive effect.*

**Conclusions:** *The obtained data indicate the effectiveness of the use of hypotensive therapy for correcting the hypertension in women during menopause and allow us to recommend the use of this medication for durable stabilization of the process.*

## **Introduction**

The problem of climacteric disorders, including arterial hypertension in women, is relevant all over the world, and in particular in Azerbaijan.

This is due, firstly, to an increase in lifetime and a sharp decrease in the birth rate. Analysis of the references indicates that in 10 years approximately 46% of women will be over 45 years old.

It is during this period of a woman's life that the transition from the reproductive phase of life to old age occurs. The ovaries gradually lose their function [1]. The reproductive function decreases or completely stops, the nature of the menstrual cycles changes, or they completely stop.

Symptoms of an estrogen deficiency state - menopausal syndrome - may also appear. Menopause usually occurs at the age of 50. Menopause is soon followed by the postmenopausal period, which ends at 65-69 years.

Among the early symptoms of menopause, vasomotor symptoms are of no small importance: chills, tachycardia, increased perspiration, impaired cerebral circulation and hypertension.

To normalize the above mentioned disorders, hormone replacement therapy is usually used, the purpose of which is to replace the impaired hormonal function of the ovaries. Various pharmacological agents are also used to correct BP [18, 20–22]. Hormonal disorders cause pressure surges as follows: in menopause, the



quantity of estrogen decreases sharply and this, of course, negatively affects the walls of blood vessels. As a result, they lose their tone and become less elastic, the blood flow to the brain is disturbed and, therefore, the supply of oxygen decreases.

Disruptions in the movement of blood through the vessels are the result of progesterone, the amount of which also decreases sharply during menopause, normal blood transport is disrupted due to the fact that it is inspissated.

One of the serious pathological conditions in menopause is development or aggravation of arterial hypertension. An increase in blood pressure before middle age is more often observed in men, while in women it is noticed after 50 years [3-6,14-17]. As a result of all this, hypertension is occurred.

The heartbeat becomes more frequent and symptoms of chronic fatigue and drowsiness, irritability appear. Sometimes hypertension is temporary, due to some kind of stress, which can be reversible. However, even if they return to normal, this is already a signal for urgent measures. In this case, medication therapy is used. Currently, there are a huge number of medications to normalize BP [18, 20].

These are mainly diuretics, ACE inhibitors, beta-blockers and medications that block calcium channels [21,22]. Sometimes several medications are used at the same time, as well as the regime of work and rest and of course the diet is observed.

In minor deviations in BP, it is possible not to use hypotensive medications, it is enough just to optimize the daily regimen and follow a low-salt diet [11,12,22].

It is known that early diagnosis of hypertension and promptly initiated, pathogenetically justified continuous treatment is the key to successful prevention of cardiovascular complications [7,10,13,23]. The choice of a hypotensive medication for the treatment of hypertension in women during menopause depends on its effect on the main pathogenetic links of the clinical syndrome: insulin resistance, increased SAS activity, and the development of primary IHA.

It is important that these medications do not affect metabolism so negatively.

Despite the wide range of hypotensive medications, they all definitely have one or another side effect, the main of which are: drowsiness, dry mouth, dizziness, an expressed hypotension, prohibition of alcohol consumption while taking them [8,9]. Considering the above mentioned information, the searching for new non-medicamentous preparations that do not have or have minimal side effects is still relevant. In this regard, antihomotoxic medications produced by German company "Heel" are of interest. These medications are interesting for their large range of bioregulatory action, the absence of side reactions, and the possibility to achieve a modulating effect. AHT treatment is based on the principles of homeopathy and the doctrine of homotoxicology [1,22]. Unlike to allopathic medications, AHT preparations have no side effects, they have a broad bioregulatory effect and provide a modulating effect. In addition, antihomotoxicological (AHT) thera-

py can be prescribed along with allopathic therapy [6,22]. Of great interest for the prevention of blood pressure disorders during menopause are the possibilities to use AHT medications, namely Ovarium Compositum [24,25].

**Description of the preparation:** Ovarium compositum, Solution for injection

*Composition:* 100 ml contain: Ovarium D8, Placenta D10, Uterus D10, Salpinx D10, Hypophysis D13, Cyripedium D6, Liliun tigrinum D4, Pulsatilla D18, Aquilegia vulgaris D4, Sepia D10, Lachesis D10, Apisinum D8, Breosotum D8 Ipecacuanha D6, Mercurius solubilis Hahnemanni D10, Hydrastis D4, Acidum cisaconiticum D10, Magnesium phosphoricum D10 no 1 ml.



*Indications for use are:* stimulation of protective functions, functions of glands and connective tissue in dysmenorrhea, parametritis, myometritis, endometritis, enuresis (in girls), in menopause, indomitable vomiting, insufficiency of the anterior lobe of the pituitary gland in women, vulvar craurosis, mastodynia, osteomalacia, menorrhagia, as well as with various metabolic disorders, including senile ones.

*Contraindications:* are not known.

*Side effects:* In increased salivation, stop to use the medication.

*Combined use with other medications:* No peculiarities.

*Dosage:* In acute cases, use every day, in other cases 1-3 times a week, 1 ampoule subcutaneously, intramuscularly, intradermally, intravenously if necessary.

*Release form and packaging:* The package contains 5, 10, 50 or 100 ampoules of 2.2 ml.

*Brief description of indications for the use of individual components of the preparation:*

*Ovarium suis:* disorders of ovulation functions, for example, dysmenorrhea, amenorrhea, menorrhagia; climacteric disorders and discharge, including osteoporosis.

*Placenta suis:* dysmenorrhea, peripheral circulatory disorders.

*Uterus suis:* dysmenorrhea.

*Salpinx suis:* dysmenorrhea, infertility due to inflammation of the fallopian tube.

*Hypophysis suis:* dizziness; disorders of enzymatic functions, pituitary obesity, dystrophy, loss of ovarian function, menstruation and ovulation disorders, chronic

arthrosis and primary chronic polyarthritis, connective tissue disorders, growth disorders, dysmenorrhea, lactorrhoea, neurodermatitis and other skin diseases.

*Cypripedium pubescens*: insomnia.

*Lilium tigrinum*: lowering of the uterus during menopause, inflammation and pain in the female genital organs, nervous disorders of the cardiovascular system, depression, irritation.

*Pulsatilla*: inflammation and disorders of the female genital organs, inflammation of the vagina with discharge; regulatory disorders; disorders during pregnancy and lactation; headache, insomnia, mental and nervous disorders, depression.

*Aquilegia vulgaris*: nervous insomnia (especially in menopause).

*Sepia*: various disorders of the female genital organs, headache, insomnia, exhaustion, mental disorders and depression (especially during menopause).

*Lachesis*: complaints during menopause, nervous disorders and depression.

*Apisinum*: inflammation and diseases, accompanied by accumulation of fluid in the tissues and body cavities; allergies.

*Kreosotum*: inflammation of the mucous membrane of the genitourinary organs, age-related diseases.

*Bovista*: uterine bleeding (especially during menstruation), dysmenorrhea, Fluor albus.

*Ipecacuanha*: bleeding of the mucous membrane, nausea and vomiting, incl. indomitable vomiting.

*Mercurius solubilis Hahnemanni*: inflammation of the mucous membrane of the genito-urinary organs; diseases accompanied by exhaustion.

*Hydrastis*: mucosal suppuration, ulceration, polyps.

*Acidum cis-aconiticum*: affects the oxidation-redox systems and the citric acid cycle; in immune weakness, angina pectoris, tachycardia; pain in bones at night, incl. in the spine (involutional osteoporosis); a sharp change in mood, depression.

*Magnesium phosphoricum*: regular pain.

**Material and methodology.** We conducted an ambulatory study of the effectiveness and possibility of Ovarium Compositum use for the prevention of arterial hypertension during menopause in 38 women aged 45-55 years. All patients were divided into 2 groups:

*Group I* - (control) included 18 women with arterial hypertension, taking hypotensive medication Rileys Plus at a dose (Lisinopril- 20 mg hydrochlorothiazium- 12.5) ½ of a tablet in the morning and evening.

*Group II* (main) included 20 women in the period of menopause, who, along with Rileys Plus, were prescribed intramuscular injections of Ovarium Compositum 2 times a week.

**Research results:** After 4 months in group I, BP stabilization was achieved in 50% of patients, while in group II, BP stabilization was achieved in 87% of pa-

tients. They also had reduced subjective complaints. An interesting fact is that in group II, 60% of women after 2 months of the treatment were able to reduce the dose of Rileys Plus by ½ tablet without reducing the hypotensive effect.

**Conclusions:** The data obtained indicate the effectiveness of the use of AHT therapy for correcting an arterial hypertension in women during menopause and allow us to recommend the use of this medication for a persistent stabilization of the process.

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年轻的心理健康专家在COVID-19期间的焦虑, 抑郁和相关应对策略  
**ANXIETY, DEPRESSION AND ASSOCIATED COPING STRATEGIES  
IN YOUNG MENTAL HEALTH SPECIALISTS DURING COVID-19**

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**抽象**

背景2019年冠状病毒病 (COVID-19) 已影响到正常生活的各个方面, 包括身心健康。在大流行期间, 包括年轻的精神卫生专家在内的卫生保健专业人员处于发展不同精神状态的高风险中。

目的确定由于Covid-19相关情况而在年轻的精神卫生专业人员中出现焦虑/抑郁症状的可能性。为了找到发展中的焦虑/抑郁症状与最常用的应对策略之间的可能关联。

方法: 采用局部HADS和COPE量表, 于2020年4月底在塞尔维亚国家精神病学和麻醉学医学研究中心的受训人员进行横断面研究。参加是匿名和自愿的。在统计分析中, 使用了描述统计, 频率分布, 斯皮尔曼等级相关系数。

结果与抑郁症人群相比, 受训者的抑郁症状评分更高而焦虑症状评分更低。COPE显示, 受训学员中最常见的压力应对策略是积极的重新诠释和成长 (平均±标准差= 13.72±2.309), 计划 (13.69±2.653) 和积极应对 (13.60±2.251)。较少使用的策略是拒绝 (7.19±2.506) 和物质使用 (6.58±3.67)。发现HADS焦虑和抑郁量表与COPE量表之间存在正相关和负相关。焦虑症状与注意力集中和发泄之间存在正相关 ( $r = 0.499, p \leq 0.01$ ), 否认 ( $r = 0.483, p \leq 0.01$ ), 药物滥用 ( $r = 0.514, p \leq 0.01$ )。

结论我们发现, 早期职业专家较少使用与焦虑应对策略正相关的方法。

关键字: 焦虑, 抑郁, 跨学科研究, 生活变化事件, 压力障碍。

**Abstract**

**Background** The coronavirus disease 2019 (COVID-19) has affected all aspects of regular life, including mental and physical health. During the pandemic, health care professionals, including young mental health specialists are at the high risk of developing different mental conditions.

**Aims** To determine the possibility of developing anxiety/depression symptoms among young mental health professionals due to Covid-19 related situation. To find possible correlations between developing anxiety/depression symptoms and the most used coping strategies.

**Methods** A cross-sectional study was conducted among trainees of the Serbsky National Medical Research Centre of Psychiatry and Narcology at the end of April 2020, using localised HADS and COPE scales. Participation was anonymous and voluntary. In statistical analysis, descriptive statistics, frequency distribution, Spearman's rank correlation coefficient were used.

**Results** Compared with the population level of depression, trainees had higher depression symptom scores and lower anxiety symptom scores. COPE showed that the most common stress-coping strategies among examined trainees were positive reinterpretation and growth (mean  $\pm$  standard deviation = 13.72 $\pm$ 2.309), planning (13.69 $\pm$ 2.653) and active coping (13.60 $\pm$ 2.251). Less used strategies were denial (7.19 $\pm$ 2.506) and substance use (6.58 $\pm$ 3.67). Both positive and negative correlations between HADS anxiety and depression subscales and COPE subscales were found. There was positive correlation between anxiety symptoms and focus on and venting of emotions ( $r = 0.499, p \leq 0.01$ ), denial ( $r = 0.483, p \leq 0.01$ ), substance use ( $r = 0.514, p \leq 0.01$ ).

**Conclusion** We found that early-career specialists less tend to use these positively related to anxiety coping strategies.

**Keywords:** Anxiety, Depression, Cross-Sectional Studies, Life Change Events, Stress Disorders.

## Introduction

The coronavirus disease 2019 (COVID-19) has affected all aspects of regular life, including mental and physical health.

During the pandemic, health care professionals are at the high risk of developing different mental conditions. Many reports found potential risk factors for insomnia, anxiety, depression, obsessive-compulsive symptoms, and somatization. [1,2] Adequate working conditions and health protection is essential for health care workers. [1] At this time early-career specialists providing help during the pandemic situation are an essential resource of mental health [3] and they can be even at a greater risk of developing different stress reactions due to lack of experience. Even in regular time rates of burnout [5,6] and depression [5-9] are higher among medical students, residents, and early career psychiatrists.

In stressful situations, different coping strategies can be used. Coping is an individual's "constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" defined by Folkman [4].



The COPE inventory is a multidimensional inventory that was created by Carver in 1989 to assess the different coping strategies people use in response to stress. The inventory consists of statements that participants review and score. Problem-focused and emotion-focused copings are the two main components of the inventory. Russian version of COPE (Rasskazova - Gordeeva - Osin) consists of 60 items combined in 15 scales.

## **Methods**

### **Research Sample**

We conducted a cross-sectional study at the Serbsky National Medical Research Centre of Psychiatry and Narcology. We provided an email link to an electronic survey to all trainees including first and second-year residents in psychiatry, psychotherapy, addiction medicine, forensic psychiatry, sexology, and all Ph.D. students, 81 in total.

### **Study Procedures**

Participation was voluntary and anonymous. Surveys were conducted via Google Forms ([www.docs.google.com](http://www.docs.google.com)). We choose HADS to assess depression and anxiety symptoms and COPE to identify and define coping skills trainees used in emergency situations associated with Covid-19.

All participants completed surveys at the end of April, 2020, during emergency changes due to the Covid-19 situation like involuntary home isolation and major changes of the studying process (emergency online education system, lack of practice). Nationwide lockdown influenced medical society all over the world and especially trainees and early career specialists. Due to unpredictable changes in studying (graduation postponed) and working conditions (possibility of working in a front line with Covid-19), they are at greater risk of burnout and developing depression and anxiety symptoms.

Ethics approval for this study was not required due to local (the Serbsky National Medical Research Centre of Psychiatry and Narcology) ethical committee recommendation. This decision was made because the data was collected anonymously and voluntarily via online-services.

### **Measurements**

Coping Styles. In a number of studies, the reliability and validity of COPE, as well as its factor structure, were demonstrated [11]. There are 15 coping styles that can be used by participants and can be evaluated with COPE. 60 items define 15 coping styles subscales, with four survey items assessing each coping strategy. Each of these styles is described by four survey items. COPE is one of the most commonly used measures of coping within the population. There are three main groups of constructive coping strategies: appraisal-focused, problem-focused, and emotion-focused strategies [10]. Problem-focused coping strategies are more effective in regular situations you can control on the other hand emotional-focused



coping strategies in situations you can not. There are several studies confirmed that problem-solving strategies associated only with coping effectiveness for high-control episodes [13]. Each strategy evaluated and defined by COPE falls under one of these three main groups. Participants selected the degree to which they had used each type of coping (1 = “not at all,” 2 = “a little bit,” 3 = “a medium amount,” and 4 = “a lot”).

**Psychological Distress.** We measured psychological distress with the Hospital Anxiety and Depression Scale (HADS) [12] which is widely used among the population to measure anxiety and depression. It consists of two 7-item subscales (14 items total) with 4-point Likert-type response options, assessing depression and anxiety symptoms during the past week. Scores on each subscale range from 0 to 21, with higher total and subscale scores indicating worse psychological distress. Scores from 0 to 7 correspond to a normal condition (absence either anxiety or depression), 8 to 10 indicate borderline (case), and 11 to 21 indicate an abnormal (case).

### **Analytic Approach**

The main goal of our study was to evaluate relationships between participants’ scores of both HADS and COPE. Therefore, the following research questions were specifically addressed to:

- 1 Did the current Covid-19 related situation affects the participants’ mental condition and can it be the cause of developing anxiety/depression symptoms?
2. Which coping strategies are used by mental health specialists most often?
3. Is there any correlation between developing anxiety/depression symptoms, and the most used strategies among young mental health specialists?

Descriptive statistics were performed for continuous variables, and frequency distribution was used to define the distribution of categorical variables.

We determined correlations between scale scores using Spearman’s rank correlation coefficient with a two-tailed significance level set at  $\alpha = 0.01$ . SPSS V.14.0 (IBM Corporation, 1 New Orchard Road, Armonk, New York 10504-1722, United States) was used to perform the statistical analysis.

## **Results**

### **Sample**

Research survey was completed by all trainees of the Serbsky National Medical Research Centre of Psychiatry and Narcology (81 early-career specialists). Table 1 shows a sample of demographic and clinical characteristics. Approximately two-thirds of the sample were female (69.1%), and the mean age was 26.22 years old (SD = 2.748). Participants were primarily single (71.6%). All participants had the same education level. The mean HADS Depression score was 8.20 (SD 1.971), this result means higher cases than in the population (mean  $\pm$  standard deviation =  $5.1 \pm 0.04$ ) [16] and indicates the borderline case (subclinical depression). A high score of depression symptoms was observed in 14 (17.3%) of the respondents, a

borderline level in 32 (39.5%), and a normal level in 35 (43.2%). The mean HADS Anxiety score was 4.43 (SD 3.542). This result is lower than in the population (7.5±0.06) [16] and indicates the normal condition. We found a high score of anxiety symptoms in 5 (6.2%) of the respondents, a borderline level in 10 (12.3%), and a normal level in 66 (81.5%). Every eighth person (12.3%) didn't have either of the anxiety symptoms.

**Table 1.** Sample characteristics

	N (%) N=81
Age (MD±SD)	26.22 ± 2.748
Gender	
Male	25 (30.9)
Female	56 (69.1)
Maritalstatus	
Married	17 (21)
Divorced	3 (3.7)
Single	58 (71.6)
Cohabitation	3 (3.7)
Measurements	M ± SD
HADS-Depression (range 0-21)	8.20 ± 1.971
HADS-Anxiety (range 0-21)	4.43 ± 3.542
COPE	
F1 Positive reinterpretation and growth	13.72 ± 2.309
F2 Mentaldisengagement	9.17 ± 2.719
F3 Focus on and venting of emotions	11.21 ± 2.906
F4 Use of instrumental social support	11.98 ± 3.041
F5 Activecoping	13.60 ± 2.251
F6 Denial	7.19 ± 2.506
F7 Religiouscoping	7.30 ± 3.942
F8 Humor	11.57 ± 3.225
F9 Behavioraldisengagement	7.99 ± 2.879
F10 Restraint	10.57 ± 2.454
F11 Use of emotional social support	12.01 ± 3.444
F12 Substanceuse	6.58 ± 3.670
F13 Acceptance	12.88 ± 2.786
F14 Suppression of competing activities	11.49 ± 3.079
F15 Planning	13.69 ± 2.653

COPE showed that the most common stress-coping strategies among examined trainees were those focusing on the problem: positive reinterpretation and growth (mean ± standard deviation = 13.72±2.309), planning (13.69±2.653) and

active coping (13.60±2.251). Far fewer trainees used strategies such as denial (7.19±2.506) and substance use (6.58±3.67).

Table 1 shows how often were particular stress-coping strategies used in the study group.

### Relationships between coping strategies and depression/anxiety symptoms

We found both positive and negative correlations between HADS anxiety and depression subscales and COPE subscales. There was positive correlation between anxiety symptoms and mental disengagement ( $r = 0.394, p \leq 0.01$ ), focus on and venting of emotions ( $r = 0.499, p \leq 0.01$ ), use of instrumental social support ( $r = 0.364, p \leq 0.01$ ), denial ( $r = 0.483, p \leq 0.01$ ), behavioral disengagement ( $r = 0.341, p \leq 0.01$ ), use of emotional social support ( $r = 0.381, p \leq 0.01$ ), substance use ( $r = 0.514, p \leq 0.01$ ). Also, behavioral disengagement positively correlates with depression symptoms ( $r = 0.393, p \leq 0.01$ ). There was no statistically significant negative correlation between anxiety symptoms and COPE subscales, though it was between depression symptoms and positive reinterpretation and growth ( $r = -0.328, p \leq 0.01$ ), active coping ( $r = -0.314, p \leq 0.01$ ). Table 2 reports the correlations between coping, anxiety, and depression.

*Table 2. Correlation between COPE and HADS subscales*

COPE subscale	HADS			
	Depression		Anxiety	
	r	p-value	r	p-value
F1 Positive reinterpretation and growth	-,328**	,003	-,120	,285
F2 Mentaldisengagement	,198	,076	,394**	,000
F3 Focus on and venting of emotions	-,018	,871	,499**	,000
F4 Use of instrumental social support	-,177	,115	,364**	,001
F5 Activecoping	-,314**	,004	-,108	,337
F6 Denial	,149	,185	,483**	,000
F7 Religiouscoping	-,061	,586	,202	,071
F8 Humor	-,136	,224	-,078	,489
F9 Behavioraldisengagement	,393**	,000	,341**	,002
F10 Restraint	,039	,727	,083	,464
F11 Use of emotional social support	-,049	,665	,381**	,000
F12 Substanceuse	,173	,124	,514**	,000
F13 Acceptance	-,209	,061	,045	,688
F14 Suppression of competing activities	-,175	,118	,072	,521
F15 Planning	-,134	,234	,004	,975

\*\* . Correlation is significant at the 0.01 level (2-tailed).

## **Discussion**

### **Main findings**

Our study showed that young mental health specialists had a higher score of depression symptoms than in the general population of the Russian Federation, which can be considered as an impact of major life-changes due to the Covid-19 situation in Russia. The score of anxiety symptoms was nearly two times lower than in the population. The most common coping strategies used by trainees were positive reinterpretation and growth, planning, and active coping. The level of anxiety positively correlated with series of coping strategies such as mental disengagement, focus on and venting of emotions, use of instrumental social support, denial, behavioral disengagement, use of emotional social support, and substance use. This set includes copings both from problem-focused and emotion-focused groups. We found that early-career specialists less tend to use these positively related to anxiety coping strategies.

### **Comparisons with other studies**

A lot of researches showed significant impact on medical students' and early career professionals' mental health. Medical student mean resilience was lower than in a general population [17] even in regular time. Mental health workers, especially in early career stage are at great risk of developing different mental conditions [1,2]. Prevalences of psychological distress amongst medical students [14] and the risk of developing anxiety and depression were found [5-9].

The correlation between depression and anxiety symptoms and coping strategies was widely observed using different scales. One of the cross-sectional surveys by using self-rating anxiety scale (SAS), self-rating depression scale (SDS), and the simplified coping style questionnaire (SCSQ) found that a positive coping style can be a protective factor for anxiety, depression, and suggesting that a positive coping style is helpful in resisting negative emotions. [15]

Research conducted during Covid-19 situation on Russian population showed increased to moderate levels of anxiety and also a lot of concerns associated with anxiety, distress (risk of social isolation" and the "possible lack of medication for daily use"). [18]

### **Strengths and limitations**

The main strength of our study is that we observed mental health condition of young mental health specialists. Moreover, we examined how early-career specialists cope with Covid-19 related situations. Our goal was to determine the correlation of levels of anxiety and depression and coping strategies during the pandemic. Transparency of inclusion and exclusion criteria as well as the use of validated Russian versions of the questionnaires is also strong points in the research.

Participants were assessed by self-reported questionnaires to gather data, which is prone to respond (e.g. social desirability, extreme response) and recall

(e.g. inaccurate memory) biases. Moreover, the fact that the study was performed in only one institution does not allow us to generalize the findings to the entire mental health practitioner population in Russia. Additionally, the characteristics of the participants from each specialisation (psychiatry, psychotherapy, addiction medicine, forensic psychiatry, sexology) may have had an impact on the results due to studying specific subjects.

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研究胆石症发病率的新方法  
**NEW APPROACHES TO STUDYING OF CHOLELITHIASIS  
MORBIDITY**

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概要。 在乌德穆尔特共和国的成年人口中，已显示出明显的趋势，即肝脏病理的一般发病率增加。 由于趋势预测的结果，未来几年肝脏疾病的发病率将继续增加。 在肝脏病理学中，由于代谢过程，胆汁分泌功能受损，胆汁产生过饱和和胆固醇，这是在胆囊中形成结石的基础。

对肝脏疾病动态的研究可以预测未来几年胆石症的发病率会增加。 尽管经常观察到胆石症的无症状病程，但如果未及时诊断出该病并且未及时进行结石形成的预防性治疗，则会导致严重的，常常危及生命的并发症。

关键词：胆结石病，慢性肝病，预后，趋势模型。

**Summary.** *Among the adult population of Udmurt Republic, a clear tendency has been revealed for an increasing of the general morbidity of the liver pathology. Due to the results of trend forecasting, increasing of the liver diseases morbidity will continue in the coming years. In liver pathology, bile secretory function suffers, as a result of metabolic processes, bile produces supersaturated cholesterol, which is the basis for stone formation in the gall bladder.*

*A study of the dynamics of liver disease allows predicting an increasing in cholelithiasis in the coming years. Despite the fact that the asymptomatic course of cholelithiasis is often observed, if this disease is not diagnosed and the preventive treatment of stone formation is not carried out in time, it can lead to the development of serious, often life-threatening complications.*

**Keywords:** *gallstone disease, chronic liver disease, prognosis, trend modeling.*

In recent years, there has been a continuous increasing of the morbidity of cho-

lithiasis (CL) approximately twice every 10 years in absolutely all countries of the world, while more than 10% of the world's population suffers from CL [1, 2]. However, it should be noted that the frequency of CL varies in very wide intervals and depends on a number of contributing factors: place of residence, ethnic and national characteristics, and others [3, 4].

In the population of the Udmurt Republic (UR), the total morbidity of CL from 2010 to 2015 was in average 97.3 per 100 thousand of adult population in men, 333.8 per 100 thousand of adult population in women, that is, CL occurs in every 13-15 men and in every 3-4 women.

High morbidity, its continuous growth in all developed countries of the world, and involvement of the working-age population allow evaluate CL as particularly significant disease in society [5]. However, it is problematic to identify real indicators of the CL morbidity for a number of reasons. First of all, CL is often asymptomatic: 15-20 % of the adult population have gallstones, while only 4-20 % of them have clinical manifestations of the disease [3, 6, 7, 8, 9]. Further, CL is diagnosed as a nosological form only at stages 2 and 3 (at the stage of lithogenesis and at the stage of relapses of chronic calculous cholecystitis).

It is known that bile becomes lithogenic not in the gallbladder, but is released from the liver. Liver diseases often lead to a violation of the bile composition and the development of biliary sludge (BS), that is a manifestation of the early (pre-stone) stage of CL [1]. In connection with the above facts, the obtained data from the study of the liver diseases morbidity can become the most important parameters in the prognosis of the CL prevalence.

**The aim of our work** was to predict the growth of CL on the basis of studying the dynamics of liver disease morbidity.

#### **Materials and methods**

98 patients with various chronic liver diseases were examined in clinical conditions. The calculation of the required number of observations was based on the calculation of the sample size with the level of statistical power of the study  $p=0.80$  and was performed using statistical software packages Statistica 6.1 from Stat Soft, which allow evaluating the sample population as corresponding to the normal distribution. The age of patients ranged from 21 to 60 years, the average age was  $43.4 \pm 3.3$  years. There were 36 males (36.7 %) and 62 females (63.3%).

When patients were included in the study, the inclusion and exclusion criteria were taken into account. Criteria for inclusion of patients in the study:

1. Patients male and female aged 20-60 years who have liver disease.
2. Availability of signed informed consent.

Criteria for excluding patients from the study:

1. Pregnancy and lactation.
2. Severe condition.



3. Oncological diseases.
4. Mental disorders.
5. No signed informed consent.

To verify the diagnosis, in addition to clinical data, results of instrumental and laboratory research methods were used. All patients were tested for bilirubin and blood transaminases using the Cormay Livia analyzer, the presence of markers of viral and autoimmune hepatitis was determined by the IFA method, and ultrasound examination of the hepatobiliary system was performed on the SONIX OP device (Canada). 76 patients underwent liver elastography using AIXPLORER analyzer (France), 58 patients underwent FibroMax test to exclude fibrosis and cirrhosis of the liver. In 43 cases, data from computed tomography of the abdominal cavity on a General Electric machine (China) were also used. All examined patients underwent multi-fractional duodenal tubing followed by macroscopic and microscopic examination of bile, determination of its physical and colloidal properties and biochemical composition.

The total levels of bile acids (BA), cholesterol (C), and phospholipids (FL) were studied in the cystic and hepatic portions of bile obtained by multifractional duodenal tubing, and the coefficients of bile lithogenicity were calculated: the cholato-cholesterol coefficient (CCC) and the phospholipid-cholesterol coefficient (FCC) [10].

All the results of the study were compared with the data of the control group, which consisted of 52 practically healthy individuals in age from 21 to 60 years.

The results were analyzed using statistical processing programs Microsoft Exel 2010 and PSPP. The normality of the distribution was checked using the Kolmogorov-Smirnov and Shapiro-Wilk criteria, and the distribution was close to normal. Due to the distribution close to normal, parametric statistical methods were used in the study. The data is presented as  $M \pm SD$ . When evaluating the statistical significance of differences ( $p$ ) and comparing quantitative indicators in the two groups, the Student's criterion ( $T$ ) was used. Differences between groups were considered statistically significant if the null hypothesis of no difference between groups ( $p$ ) was  $< 0.05$ .

After the clinical study of patients, statistical data of common and primary liver diseases morbidity in the UR were studied over the past 10 years (2008-2018). For this purpose, official statistics data were analyzed, including indicators taken from the information and analytical collections "Medical and demographic indicators and deep analysis of the population's health", "Basic indicators of the population's health in the UR", prepared by the Republican medical information and analytical center of the Health Ministry of the UR.

Statistical forecasting (trend modeling) was used in the work. The models were built using the Microsoft Exel 2010 program in a polynomial trend. The model is

characterized by accuracy and adequacy. The model is adequate if it is distributed according to the normal law, and its residual component is independent and random. This property of the model was checked using the R criterion:

$$R^2=1-SSE/SST,$$
$$SSE=\sum(Y_i-\hat{Y}_i)^2$$
$$SST=(\sum Y_i^2)-(\sum Y_i)^2/n$$

where  $Y_i$  is the actual value of the studied indicator,  $\hat{Y}_i$  is the model value, and  $i=1\dots n$ . If the criterion value is close to one, the model is considered adequate.

### Results

Among the examined patients, in 36 ones (36.7 %) liver steatosis was diagnosed with, in 42 (42.9%) - chronic hepatitis, and in 20 (20.4%) liver cirrhosis in the compensation stage. Verification of the diagnosis of chronic hepatitis was performed using ultrasound investigation of the hepatobiliary system, increased transaminase activity in blood tests, the presence of markers of viral and autoimmune hepatitis, and alcohol consumption in hepatotoxic doses (in the anamnesis). The diagnosis of liver cirrhosis was established on the basis of cirrhotic changes in the liver on ultrasound examination, 4 degree of fibrosis according to Metavir on elastography, the presence of characteristic changes in complete and biochemical blood tests. According to comorbidity, the pathology of the small intestine and pancreas was predominant among diseases of the digestive system. Between the concomitant diseases of other organs and systems, the leading place is given to cardiovascular pathology – it was in 38 patients (39.2 %). This fact can be explained by the development of one of the common pathogenetic mechanisms of cardiovascular diseases, liver diseases and CL - atherogenic dyslipidemia.

In the examined patients, ultrasound investigation of the gallbladder revealed manifestations of BS in 53.06% of cases – microlithiasis, putty-like bile, in microscopic examination of bile in 72.6 % of cases crystals of C and calcium bilirubinate were found, that are signs of the I (pre-stone) stage of CL. In addition, in 100% of patients with BS were found disturbances of the physical and chemical properties of bile portions "B" and "C", presented in table 1. Compared with the control group, the content of BA and FL, which are stabilizers of colloidal properties of bile, was reduced, while the level of C was increased, and there was a decrease in the coefficients of bile lithogenicity - CCC and FCC. Consequently, in 53.06 % of patients with liver diseases who have stage I (pre-stone) of CL, the probability of stone formation in the gallbladder was quite high.

**Table 1.** Indicators of the biochemical study of bile in examined patients with biliary sludge

Indicators	Group of control (n=52)	Patients with liver diseases (n=98)	Normal data	P
cholesterol (mmol/l) portion B	7,56±0,07	26,34±0,65	5,2-15,6	0,00082
portion C	3,63±0,06	16,21±0,52	1,3-2,8	0,00013
bile acids (mmol/l) portion B	54,33±0,14	30,22±0,47	57,2-184,6	0,004
portion C	20,76±0,20	15,24±0,58	17,4-52,9	0,006
phospholipids (mmol/l) portion B	3,90±0,03	1,98±0,05	3,2-4,1	0,00035
portion C	0,39±0,003	0,23±0,02	0,35-0,4	0,00042
cholato-cholesterol coefficient (units) portion B	7,15±0,07	1,52±0,10	8,5-7,8	0,00031
portion C	6,14±0,10	1,13±0,05	7,1-6,3	0,00063
phospholipid-cholesterol coefficient (units) portion B	0,51±0,01	0,10±0,01	0,61-0,26	0,00052
portion C	0,11±0,001	0,04±0,003	0,26-0,14	0,00012

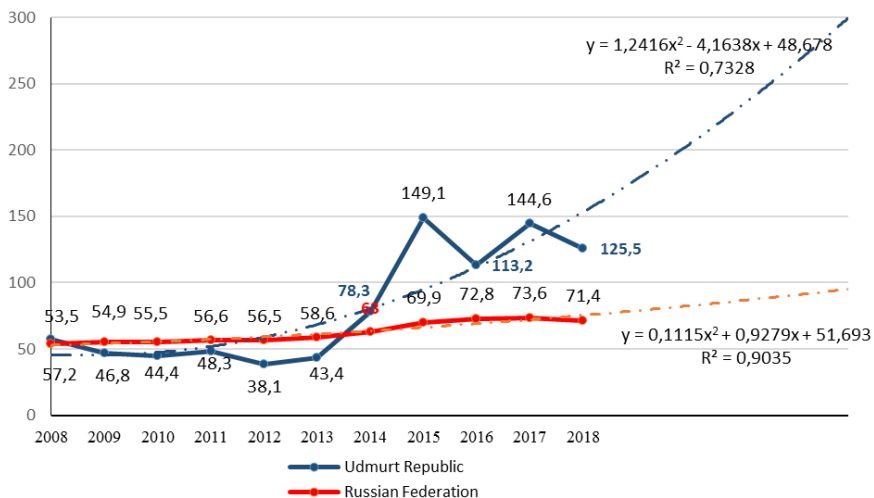
Note: n - number of observations; p – the significance of differences between the indicators in the control group and in patients with liver diseases.

Over the past 10 years it was marked high growth of the liver diseases morbidity: in UR common morbidity of liver pathology increased in 1.69 times, while in Russia the same data grew in 1.26 times. While the annual growth of the common liver diseases morbidity in UR ranged from 3.2 % to 23.16 %, in Russia – from 1.05 % to 4.2 % (table. 2).

**Table 2.** Dynamics of the general morbidity rate per 100 thousand population for liver diseases

Class of diseases	Observed Dates (year)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Liver Diseases in the Udmurt Republic	461,6	444,5	429,0	464,7	480,1	479,0	623,4	641,9	774,7	821,1	783,6
Liver diseases in the Russian Federation	349,0	357,1	360,9	365,3	370,0	379,5	391,9	398,6	416,1	428,0	441,4

Using the trend modeling method, we can transfer the morbidity rates to the future (Fig. 1). We can see that in the near future, a significant increase of common liver disease morbidity is predicted both in the UR and in the Russian Federation in whole.



**Fig. 1.** Prediction for 5 years of the dynamics of the general morbidity of liver diseases in the Udmurt Republic and the Russian Federation (per 100 thousand population)

**Discussion**

The higher morbidity of liver diseases in the UR than in the Russian Federation in a whole is possibly due to the worse economic situation than in neighboring regions and, as a result, the presence of a greater number of risk factors for liver steatosis (food with a predominance of flour and sausage products, "jamming" and alcohol consumption under stress) [11]. The current unfavorable situation in liver morbidity can lead to increasing of CL morbidity, since the disturbance of the bile-forming function of hepatocytes and the production of lithogenic (oversaturated by C) bile is considered among the main links involved in the pathogenesis of cholesterol cholelithiasis [12, 13]. Cholesterol oversaturation of bile is a consequence of a pathological occurrence of complex metabolic processes taking place in the liver, the main of which are increase the activation of hydroxy-methyl-glutaryl-coenzyme-A-reductase, contributing to increase the formation of cholesterol or a decrease in the activity of C-7альфа hydroxylase, leading to decreasing of the bile acids synthesis [14].

The results obtained by us are consistent with the literature data [5]: in the liver portion of bile, the content of BA and FL, which are stabilizers of colloidal properties of bile, was reduced, while the content of C was increased, as a result, a decrease in the coefficients of bile lithogenicity - CCK and FCC was revealed.

Already supersaturated bile is transported from the liver to the gallbladder as part of micelles and vesicles. Undoubtedly, the role of the gallbladder in the processes of stone formation is indisputable: in a good functional state of the gallbladder, as a result of its contraction, all agglomerated vesicles and micelles with bile flow come to the duodenum, and in a decreasing of the contractility of the gallbladder, subsequent crystal growth is initiated, and BS is formed [7]. However, factors associated with functional disorders of hepatocytes and leading to bile oversaturation are fundamental in starting lithogenesis [15].

Therefore, the results of the study of the morbidity of liver pathology can be decisive indicators in predicting of CL morbidity. We consider that it is necessary to spend early diagnostics of CL in all patients with liver pathology (ultrasound, multi-fractional duodenal probing followed by macroscopic, microscopic examination of bile, determination of its physical and colloidal properties and biochemical composition), which is not given due attention today.

### **Conclusion**

Summarizing the data obtained, it can be noted that over the past 10 years (from 2008 to 2018), a clear trend of increasing the common morbidity of liver disease has been revealed among the adult population of UR. According to the results of trend forecasting, the increase of liver disease morbidity will continue in the coming years. In liver pathology, the bile secretory function suffers, as a result of violation of metabolic processes, bile is produced supersaturated by C, which is the basis for stone formation in the gallbladder.

The study of the dynamics of liver disease morbidity makes it possible to predict the growth of CL in the coming years. Despite the fact that there is often quite an asymptomatic course of CL, if this disease is not diagnosed and preventive treatment of stone formation is not carried out in time, this leads to the development of serious, often life-threatening complications.

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在机体发生Covid感染的情况下，涉及糖缀合物的凝集素和类凝集素样保护性相互作用的途径

**PATHWAYS OF LECTIN AND LECTIN-LIKE PROTECTIVE INTERACTIONS INVOLVING GLYCOCONJUGATES IN CASES OF COVID INFECTIONS IN ORGANISM**

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抽象。评估了包括机体代谢产物，益生菌蛋白质，补体，蛋白质激素和血管紧张素-肾素系统等关键贡献者凝集素系统在内的人体代谢物细胞凝集素超系统的抗病原性和抗肿瘤潜力。益生元具有针对不同疾病类别的广泛的极具前景的潜力。它们被表征为识别糖缀合物的网络内的偶联系统。益生元根据不同类型组织和器官之间粘膜开放腔内的功能性代谢轴起作用。凝集素超级系统为稳定，延长和改善诸如元/后生物，益生元和糖缀合物来源的药物等效效应器的保护作用提供了古老的基础。保护性凝集素系统的作用涉及与其他识别和效应器作用系统（抗体，细胞因子，补体，抗生素，化疗药物）协同作用。超级系统直接或间接识别病毒和其他病原体的作用在伴随Covid的疾病实例中有所描述。根据蛋白质-糖缀合物之间的关系和相互作用，指出了设计抗病毒疫苗的因素和方法。讨论了保护性超级系统组成部分的前景。不同的凝集素类型识别系统作为生物体中的超级系统的表达和调控可被视为在细胞-代谢物沟通水平上开发新的健康个体或个体健康标准的新途径。

关键字：益生元；新冠肺炎；凝集素系统；糖缀合物；疫苗



**Abstract.** *Antipathogen and antitumor potential of metabolite-cellular lectin supersystem of human organism including key contributor lectin systems such as postbiotics, probiotic proteins, complement, protein hormones and angiotensin-renin systems was evaluated. Postbiotics possess a broad extremely perspective potential against different groups of diseases. They are characterized as a coupled system within a network recognizing glycoconjugates. Postbiotics act according to functioning metabolic axes within mucosal open cavities among different type tissues and organs. Lectin supersystem serves the ancient basis for stabilization, prolongation and improvement of protective action of such effectors as meta/postbiotics, prebiotics and drugs of glycoconjugate origin. The action of protective lectin system involves cofunctioning to other systems of recognition and effector action (antibodies, cytokines, complement, antibiotics, drugs for chemotherapy). The action of the supersystem recognizing viral and other pathogens directly or indirectly is described on examples of diseases accompanied with Covid. On the basis of protein-glycoconjugate relationships and interactions, factors and ways of designing antiviral vaccines are indicated. Prospects of protective supersystem constituents are discussed. Expression and modulation of different lectin type recognition systems as supersystem in organism can be considered as a new way for development of new criteria for health of individual or contingents of individuals at the level of cell-metabolite communications.*

**Keywords:** *postbiotics; Covid-19; lectin systems; glycoconjugates; vaccines*

Bio-recognition - the main initiating event in the functioning of human defense systems. The human body provides for the coordinated action of its own protective and microbial-symbiotic systems that recognize and bind pathogen-associated targets [3, 4, 6]. Examples of such metabolite-cellular defense systems can serve as innate immunity (complement and blood clotting systems, cytokine network, angiotensin-renin-blood pressure support system), and also symbiotic/ probiotic microbiocenoses. Protein hormones (cytokines with a broad spectrum of action) together with receptors form a glycoconjugate-recognizing (GC) defense system. Probiotic microorganisms exhibit evolutionarily developed properties useful for humans, producing a range of metabolic postbiotics. The latter include products of the life activity of symbiotic / probiotic microorganisms.

They include not only low-molecular (antimicrobial peptides, including bacteriocins), but also high-molecular substances, compounds and their complexes such as adhesives and enzymes, biosurfactants (BS), exopolymer compounds (EPS), cell wall components (proteoglycans) and probiotic lectins (PL) [1, 5, 7]. The biological properties of postbiotics are diverse and vary in sets of postbiotic systems (PS) [1, 5, 7, 32-35].

Lectins include proteins, their (oligo)peptide derivatives of non-immunoglob-



ulin nature, as well as complexes that recognize and bind carbohydrates and GC (natural or their synthetic polymer analogues, [www.lectinity.com](http://www.lectinity.com)), initiating activities against infections and pathologies caused by them [3, 4]. Lectins regulate the human metabolism, exhibit the properties of metabolomebiotics and are communicators. They are involved in a network of metabolites-cellular and intercellular relationships, strengthening the immune system.

**The aim is** to present modern ideas about protective postbiotic and other systems of non-immunoglobulin nature against diseases accompanied by *Covid* on the basis of our own results and literature data.

**Therapeutically significant postbiotics and PS [5, 7, 33, 34].**

An analysis of the literature indicates the usefulness and effectiveness of postbiotics (their combinations as PS coupled in a productive final action) against a wide range of different diseases initiated by pathogenic bacteria and viruses or in connection with hereditary and acquired metabolic disorders in the body. So, postbiotics make a health contribution in cases of enterocolitis, dysbiosis, food, allergies (interfering with normal vaccination), hepatitis, neurodegenerative diseases, hair loss, pathologies related to insulin and antibiotic resistance, disorders of fat and other metabolism.

PS of lactobacilli and bifidobacteria are the most studied. According to our data, antimicrobial action of *Acilact* can be implemented with the participation of PS – peroxide-reductase products under conditions of oxidative stress, caseinate products - at the level of action of the peptides and on the background of reducing allergenicity and PS involving sets BS (their generation depends on the strain). One of the *Acilact* strains (K3III24) is the dominant source of pronounced amounts of bacteriocin-like complex forms. Bifidobacteria, in addition to the production of BS (involved in the delivery of peptides), are characterized by varying images of PS, represented as strain-dependent sets of EPS (cleaved by endogenous depolymerases) with delayed antimicrobial action.

The action of postbiotics is realized in the metabolically directed axes [7, 32, 45, 58, 59] - with a generalized formula for the implementation of postbiotics "Biotoxes of mucosal cavities of the intestinal tract - Other types of tissues and organs". The metabolic relationships of intestinal postbiotics with the liver, kidneys, lungs, brain, skin, and blood are established (it is possible to postulate the expansion of connections with other organs and tissues). PS are characterized as multi-functional and multi-vector, pleiotropic and multi-directional. They include immunomodulatory, anti-inflammatory, antitumor, anti-allergenic (the latter in cases of, for example, fermentolysis of polymer allergens with hydrolases), regulating the production of cytokines and other important types of effectors. The directed axial nature of the functioning of the metabolic network implies recognition of characteristic targets (including GC-containing ones) by postbiotics. The func-

tioning of PS, including lectin type ones, is similar to the GC-dependent functioning of the PL and PL-GC networks (further recognition of GC types is modified in complexes with PL is possible) of the mucosal biotope.

**The main areas of PS research include the following:**

\*Transition from empirically established multi-action of postbiotic fractions (probiotic culture fluid supernatants) to identification of the relative contribution of mono/bi/ multicomponent postbiotics and PS to the effector result.

\*Construction of a new substation with the use of specific directional and predictable fermentation (selected types and combinations of isolated enzymes or enzymes in probiotic cultures).

\*Development of technologies for using fractions of bacterial cell walls and their components as PS in combination with prebiotics.

\*The use of PS in the prevention and accompanying treatment of diseases (systemic, primary and secondary, including autoimmune) and their combinations, including microbial and viral nature (including *Covid*).

\*Expanding the consideration of groups of diseases and pathologies when using a single type of postbiotic or PS to detail and further standardize the multi-action of the drug.

\*Unlimited expansion of taxonomic and strain composition as sources of potentially new synergistic PS against the background of solving the problem of minimizing and optimizing the required PS.

\*Transplantation of intestinal microbiomes as sources of combined PS for accompanying therapy [59].

\*Study and application of eukaryotic PS (yeast origin, with the leadership of the available and industrially significant genus *Saccharomyces*), including those with antifungal potential [7, 37].

\*Design and use of synergistic combinations of PS with phytobiotics, innate immunity factors (cytokines, cytokine-like proteins, complement, pattern-recognizing receptors (PRR), and metabolites) [7].

\*Use of enzymebiotics (when considering communicative probiotic bifunctional enzymes with lectin and adhesive domains/(sorption modules) for polysaccharides and GC as postbiotics) [31].

\*Use of postbiotics products of microbial Trp and Tyr metabolism (for example, the use of the Acilact (and its strains) and probiotic bifidobacteria cultures potential [33, 34]).

\*Use of PS against diseases involving eukaryotic pathogens such as *Candida* and *Protozoa* origin [7, 32, 49].

\*Study of the PS impact on viral diseases using examples of rotavirus (RV) diarrhea, viral hepatitis (C and related variants), viral pneumonia (RSV), and *Covid* pneumonia [10, 11, 18, 25, 41, 48, 53, 60].

\*Use of PS against tumor cell cultures and to prevent the development of tumors *in vivo* [7, 9, 42, 47].

\*Use of PS (synergistic and partially alternative) in connection with side effects of antibiotics [7, 43].

\*Postbiotics against oxidative stress in tissues and organs (in the regulation of the enzymatic antioxidant system of the blood, intestines, and liver) [7].

\*Development and application of PS in connection with children's diseases [7, 38, 54].

\*Development and application of PS in connection with food allergies [7, 40].

\*Development of medical biotechnologies for designing PS:

- at the level of the controlled cell-wall fragmentation application;

- based on a GC with a known structures;

- - based on micro/ nanoparticles and vesicle carriers of PS.

\*Study of the PS effect on vaccines due to the PS multi-action [7, 20, 56] in aspects of:

- surface cell proteins of Gram-positive bacteria as components of PS and communication ingredients of vaccines;

- vaccines and immunomodulatory postbiotics;

- postbiotics in conditions of vaccine action (maintaining the natural normal level of metabolism);

- vaccines as GC, including those operating with the participation of the PS protection.

### **Prospects for the study and application of postbiotics**

Glycosylation and production of GC are important factors in the development of vaccines and humanized glycoproteins [8, 20]. Promising sources of synergistic sets of mucosal antimicrobial postbiotics involved in the GC recognition and binding serve human intestinal bifidobacteria and lactobacilli cultures. Individual postbiotics and PS that interact with GC exhibit the properties of lectins.

The linked network nature of the PS action indicates broad prospects for the PS using. The following aspects of studying and applying postbiotics in the future are of interest:

\*Search and investigation of new types and combinations of PS.

\*Lectins as sources of postbiotics and PS with potential for therapy [5, 33].

\*Development and application of PS in connection with solving fundamental problems of science:

- expanding functions of cellular immunity according to communication network of axial and other metabolic type defense systems common to the body;

- strengthening of biotrophic infra - and signal functioning structures that are antagonistic to pathogens and pathogenesis factors, participation in the creation of highly resistant to pathogenic factors of age-related relationships of PS and body

defense systems;

- multivalent compensation by the PS network for insufficient antibody protection;

- establishment (including empirically – for culture supernatant and its fractions) of promising PS compositions in connection with the tasks;

- study of the following PS action mechanisms:

- organ systems of open cavities: deeper detailed considered directions/ relationships between the intestine compartments; between intestines and urogenital tract, intestines and oropharynx;

- in cases of disease initiated by a viruses;

- in cases of diseases initiated by eukaryotic pathogens ([49], our data);

- typing of metabolic axes (typing of the network metabolomes with establishment of a set of co-functioning biochemical markers functionally linked within PS studied or tested);

- construction of functional food (search of key (co)factors), including composition of nutrient media or food additives, to enhance existing activities and/or regulate/switch activities in a given/wishable direction (against group of diseases, normalization of the type of metabolism, etc. [7]);

- ordering the action of postbiotics in the PS based on their interaction with GC in order to develop therapeutic/(therapeutically significant) and synergistic with antibiotics PS [5, 33, 34].

### **The effects of protective non-immunoglobulin systems of the body against pathologies and diseases due to the presence of *Covid***

*Covid* viruses (SARS-CoV-1, SARS-CoV-2 and other groups of beta-1-*Covid*) cause *Covid-19* diseases, are able to affect almost any (all) organs, show multifunctionality/ multi-action in target damage, act on vascular systems and cause rapid and, in some cases, significant amplification and adverse modification of existing chronic and systemic diseases. Therefore, it is particularly important to take into account the multi-functional multi-organ pathology-recognizing body defense systems that act as deep communications for superstructure anti-pathogenic attacks [1, 2, 5].

*The role of glycans in initiating and amplifying diseases in the presence of coronaviruses, including Covid variants* [8, 12, 14, 17, 20, 23, 24, 29, 41, 55, 58].

Marked high potential of the diversity of Lectin—Glycans/Glycosphingolipid interactions and their regulation in interprotein recognition processes involving carbohydrates as a co-receptor and co-determinant in the dissemination *Covid* in the body, as in cases of the SARCS CoV-2 lectin-like S-glycoproteins [29].

Examples of the mutual recognition by natural GC - glycoproteins (envelope spike [Spike] trimer S-protein) of the *Covid* virus shell and receptor binding domain (RBD) of another glycoprotein - angiotensin-converting enzyme-2 - ACE-2

(Angiotensin-converting enzyme 2, EC 3.4.17.23) on alveolar epithelial cells to assess the contribution and role of GC (for example, non-protein configurations of glycans) and carbohydrates in the recognition and binding of *Covid*, including under interactions of lectins and GC. Upon contact with ACE-2 hydrolase, the protein S is cleaved into non-covalently bound S1 and S2 subunits, which are important for virus entry into the cell. Contact events are regulated by the density of the glycan layer and the variety of N-glycosidically bound (Asn-) and O-glycosidically bound (Ser/Thr-) glycans (including the ratio of complex and oligomannoside types of glycans) on the surface of both interacting glycoproteins (up to 40% of the protein surface) [8, 14, 17, 24, 41, 58]. Glycans affect the conformation of glycoproteins and form epitopes of corrective interaction in contacts. This is used in the design of vaccines against *Covid* [17, 23]. The protein-S glycan shield serves as a therapeutic target for influencing the *Covid* molecular machine, for inactivating the virus, and for producing viral particles for use as vaccines [17]. In connection with the design of vaccines, it should be considered, for example, the effect of negatively charged diacetylated sialoglycans (Neu5,9Ac2- $\alpha$ -R) of the complex type in the protein S, as well as the enhancement of the effectiveness of the protein-S-based vaccine in the presence of an additional glycoengineering alpha-galactosyl epitope (Gal- $\alpha$ 1-3Gal- $\beta$ 1-4GlcNAc-R) [8, 23].

As another way to combat *Covid*, it should be considered the construction of nanosurfaces loaded with antiviral polysaccharides (potential PS, including those with minimal chemical modifications) by "layer-on-layer"/ regulation of protein masking [41]. At the same time, in relation to the interaction of the *Covid* glycoprotein with a single binding site of ACE-2 in respect of penta- and longer-eikoligosaccharides of heparin (acidic sulfated glycosaminoglycan), they have the ability to prevent the interaction of *Covid* with human cells against the background of maintaining a normal blood-clotting system (the system includes a lot of lectins such as ficolins and others) [19, 50, 55]. The association of ACE 2 imbalance with dysbiosis (i.e., with a violation of the distribution and functioning of normal PS in mucosal biotopes) is considered as one of the key factors of low recovery in *Covid* patients of varying age [51].

Another example of the involvement of intermolecular lectin-GC interactions in the spread of *Covid* infections is the involvement of the viral control —protein-virion-associated receptor – destroying lectin hemagglutinin esterase dimer acting on multivalent GC in binding of the coronaviral protein S to the beta 1-receptor of host cells [12]. As a result, the coronavirus adapts to the human/ patient respiratory tract glycome (the ability to switch protein-carbohydrate interactions).

When the SARS-CoV-2 protein S1 is expressed in the affected lung, the inhibitory receptor lectin NKG2A/CD94 is modulated on NK cells and the HLA-E/NKG2A pathway corresponding to the specific cascade intercellular reception of

large-scale T-cell counteraction to viruses is activated using a variety of attacking specific cellular subpopulations of innate immunity [4, 13].

Individual functional features/differences in the recognition of human cells of very similar SARS-CoV-2 and SARS-CoV (serve vaccine candidates) were noted [27]. These include affinity for the cell receptor and the immunological ability of the virus to invade: a) RBD of the SARS-CoV-2 protein S is characterized by a greater affinity for the ACE2 receptor in comparison with SARS-CoV; b) RBD of the SARS-CoV-2 protein S can be located in one —up| and two —down| conformations, which indicates a predominant adaptation of the virus against the host's supracellular immune supervising.

*Protective effects of complement system in relation to and against pathologies and diseases burdened by the presence of Covid* [16, 21, 26, 28, 31, 39, 57].

In *Covid* patients, systemic complement activation is registered, especially expressed within classical and lectin pathways, which leads to severe pulmonary insufficiency against the background of increased patient mortality [26]. Therefore, a general strategy to combat *Covid*-associated diseases is to target the whole or limited functioning of the complement system.

Consumption of C4 and/or C3 in the body with *Covid* infections leads to a decrease in normal levels of these complement components [16, 21, 26]. This is expressed in a decrease in the deposit of C4b (from C4) or C3b (from C3) fragments on the CR1 complement receptor lectin and the deposit of C4d (from C4) fragment in red blood cells of patients with *Covid-19* [26, 30]. *Covid-19* infections cause a greater decrease in blood flow levels of lectin-like components C4 and C3 (C4/C3) compared to SLE status. Both types of the disease lead to the development of antiphospholipid syndrome (AFS) and, as a consequence, thrombosis (therefore, it is possible to increase the syndrome in patients with SLE in the presence of *Covid* infection in the body) [16, 38].

Patients with SARS-CoV-2 and SARS-CoV-1 are characterized with significantly increased activity of the lectin complement pathway [26], reduced blood serum mannan-binding protein (MBP – another lectin of the complement system) through the viral activation of protease MASP-2 in complex with MBP, which initiates lectin complement pathway and generate C3-convertase (EC 3.4.21.43) by cleavage of C4 (additional consumption of C4/C3 in the body) and C2 [21, 28, 30]. The coordinated action of complement with the blood clotting system was observed at the level of a variety of MBP and MASP variants (including the use of the same basic molecular forms of lectins and MASP-type ingredients that make up complex lectins) [50], which should increase the variety and effectiveness of anti-virus attacks. As a result, a supramolecular ensemble is formed that further lyses any cells opsonized with the virus. In addition to the lectin pathway, C4/C3 is consumed in the classical and alternative complement pathways, which ultimately

(in all variants of these shunt pathways) lead to lysis of affected cells.

Thus, C4/C3 manifests itself as a —basis for superstructure<sup>ll</sup> - key multifunctional system in demand in various shunt cascades of metabolic-cellular complement reactions, which can adapt to identified pathogen images by switching and reorienting protective responses (economization and universalization of responses is achieved using a minimum number of participants in lectin recognition in nodal cascades of divergence and convergence of the metabolomebiotic network).

*Therapy strategies* usually consist in limiting/ switching complement activation by partially disabling selective cascades of reactions in the complement metabolic-cellular network, including in connection with the linked functioning of the coagulation/ thrombosis system (the system taking into account the *Covid* action status). Therapeutically significant in cases with *Covid* infections may be inhibition of the development of C3-related reactions and blocking of the C5 complement component, which prevents hyperinflammation and thromboinflammation in patients with *Covid* [38]. Options for limiting the effect of complement in patients due to *Covid* exposure to factors B and H (the latter is a typical (Sialic acids)–binding lectin with fine and superfine pattern specificity) are considered [57].

*Impact of erythropoietin (EPO) in relation to Covid infections* [22, 36, 44, 45].

EPO, namely, a system of multiple forms that can interact with GC and exhibit a wide range of network interactomic biological activities, including through GC-sensitive cellular reception in many organs (lungs, liver, heart, brain, and others), is a candidate for accompanying/ supporting/ counteracting/ adjuvant therapy of patients with *Covid* variants [22, 36, 44, 45]. Since EPO functions as "more than an erythropoiesis hormone" (it participates in an extensive network of reactions with cellular receptors of other functional purposes, but involving the recognition and binding of GC), it is possible to implement tissue antiapoptotic effects, especially in organs affected by *Covid-19* [36].

*The protective role of PS in preventing the spread and amplification of Covid infections in the body* [10, 11, 25, 41, 46, 60].

The relationship between dysbiosis in the body and the status of pathology (type of disease, its progression, age characteristics) in the presence of *Covid* infections is considered [10, 25, 51, 60]. The directions of antiviral action of PS are emphasized in accordance with the metabolic axes "Gut—Lungs" and "Gut—Brain" [10, 11, 25, 46]. Thus, in the "Gut—Lung" direction, the microbiome is involved in cross-talk in cases of patients not only with *Covid*, but also (possibly against the background of) chronic obstructive pulmonary disease (COPD), cystic fibrosis, lung cancer, respiratory allergies, and asthma [46].

Other metabolic axes of the anti-cancer effect of PS are also possible, since *Covid* infections are able to affect almost any organs and tissues. The prospects of PS in the direction of "Intestine—Prostate" remain open (men are more suscep-



tible to diseases with *Covid*, diseases are accompanied by infertility, hair loss), which involves the participation of the transmembrane bifunctional protease "Serin-2" (TMPRSS2) [52].

Postbiotics have the potential to serve as biomarkers of metabolism adequate to the current status of *Covid* disease. Along with regulatory polysaccharides and EPS, acidic postbiotic microbial oligosaccharides and their derivatives seem to have the potential for anti-*Covid* action, similar to animal-derived oligosaccharides, as in the case of heparin [41]. In general, there are prospects of PS in preventing the spread of coronaviral and other types of viral infections in the body, as well as combinations of infections burdened by the presence of *Covid*, in the development of therapeutic and preventive strategies and preparations against groups of diseases.

The ways of effective health-supporting effects of a non-immunoglobulin GC-recognizing super-system with postbiotic and probiotic responses to the presence of lectin-GC-relationships of *Covid* and other viral infections in the body discussed above open up reserves for the design of antiviral vaccines [15, 20, 27].

**Conclusions.** The above data indicate that in the case of a PS:

1. Postbiotics act as PS (co-function within PS), which is expressed in countering groups of diseases (determining the composition of groups and directions of metabolic axes are under development). Acting in the direction of functionally linked metabolic axes, PS increase the safety of the body, increase the resistance of microbiocenoses of biotopes, tissues and organs to pathogenic and other environmental stress factors.

2. PL serve promising sources of therapeutically significant PS and other health-supporting types of PS. Highly molecular PS (mainly enzymes and their modulators, EPS and BS, polysaccharides and peptidoglycans) involved in the conversion rearrangement of PS compositions are promising.

The body's metabolic-cellular defense systems are coordinated hierarchically and synergistically in a single super-system of defense with probiotic and postbiotic effects. Antibody/ immunoglobulin systems act as superstructures based on basic non-antibody systems. On examples of *Covid* infections, pathologies and diseases, the protective potential of the healthy human/ patient metabolites-cellular super system is demonstrated.

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聚丙烯和改性的Na<sup>+</sup>-蒙脱土复合材料的热性能  
**THERMAL PROPERTIES OF COMPOSITES BASED ON  
POLYPROPYLENE AND MODIFIED Na<sup>+</sup>-MONTMORILLONITE**

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抽象。 通过在“江苏新大科技股份有限公司”的双螺杆熔体挤出机中混合制备的聚丙烯改性蒙脱土基复合材料。 DSC和TGA确定了热性能。 耐火性由氧指数和火焰传播参数决定。 结果表明，与未填充的聚丙烯复合材料相比，熔体指数增加，结晶度和燃烧时间降低，火焰传播速度降低。

关键字：N, N-二氮杂硅酰胺，复合材料，聚丙烯，改性的Na<sup>+</sup>-蒙脱土。

**Abstract.** *Composites based on polypropylene modified montmorillonite prepared by mixing in a twin-screw melt extruder of the company "JiangsuXindaScience & Technology". DSC and TGA determined the thermal properties. The fire resistance by oxygen index and the parameter of flame propagation. It is shown that compared with the unfilled polypropylene composite melt index is increased and the degree of crystallinity and the burning time of the flame propagation speed decreases.*

**Keywords:** *N,N-diacylacrilamide, composite, polypropylene, modified Na<sup>+</sup>-montmorillonite.*

### **Introduction**

Currently, there is an increased interest of researchers in obtaining new polymer nanocomposite materials with improved physicochemical and physicomechanical properties based on polymers and layered silicate materials, in particular montmorillonite (MMT). The creation of nanocomposites is complicated by the poor compatibility of organic and inorganic components, as well as the need to

select the optimal conditions for dispersion of the silicate filler. An earlier attempt was made to solve this problem by modifying the clay by introducing surfactants into its structure, in particular, quaternary ammonium compounds with different lengths of the N-alkyl substituent [1-4]. Such organoclay makes it possible to destroy agglomerates formed as a result of adhesion of individual crystallites of layer silicate. Surfactant adsorption increases the hydrophobicity of clay, thereby improving the penetration of polymer macromolecules into interplanar spaces.

An analysis of the literature data shows that in [5-9] devoted to the problem of producing nanocomposites based on various types of polar polymers (polyesters, polyamides, and others) and montmorillonite modified with quaternary ammonium bases, there is a possibility to obtain intercalated and exfoliated structures when polyolefins succeed, the obtaining of nanocomposites is more modest [10, 11].

In this regard, our work aimed to obtain modified sodium montmorillonite using N,N-diallylacrylamide, structurally different from the previously studied types of quaternary ammonium bases [12, 13], and to research the effect of layered silicates on the thermal properties and structure of composites based on polypropylene.

### **Experimental**

Studies were conducted on a homopolymer of polypropylene brand PPG 1035-08 (hereinafter PP).

N,N-diallylacrylamide (DAA) was obtained by alkylation of acrylamide with allyl chloride according to the procedure described in [12, 13].

The activated Na<sup>+</sup> form of montmorillonite (Na<sup>+</sup>-MMT) was prepared from natural clay from the Herpegezh deposit (Russia, Kabardino-Balkarian Republic) according to the method [14], the cation exchange capacity of the clay was 95 mEq/100 g of clay. The presence of Ca<sup>2+</sup> cations was controlled by absorption bands in the IR spectra characteristic of calcite.

Modified Na<sup>+</sup>-MMT-DAA was obtained by adsorption on Na<sup>+</sup>-MMT of a 30% aqueous solution of DAA.

Composites were prepared by adding 3-7 wt. % modified organoclay to PP polymer. Dry component mixtures were prepared, then the melt was performed on a Jiangsu Xinda Science & Technology twin-screw extruder with a screw diameter of 20 mm at a temperature of 210-230 °C and a screw rotation speed of 120-150 rpm.

Then the extrudates were granulated and used to make the appropriate samples for research.

Test specimens were obtained by injection molding on a Ray-Ran Polestest machine at a material cylinder temperature of 230-240°C, a mold temperature of 100°C and a shut-off pressure of 8 bar.



Physical and mechanical tests were conducted according to the methods: melt flow rate (MFR) - GOST 11645-73; Izod impact strength - GOST 19109-84; modules of elasticity, ultimate strength, and elongation break on specimens in the form of a double-sided blade with dimensions according to GOST 112 62-80. The tests were conducted on a universal testing machine Gotech Testing Machine CT-TCS 2000, production Germany, at a temperature of 293 K and a strain rate of  $\sim 2 \cdot 10^{-3} \text{ s}^{-1}$ .

To study thermal stability, we used thermogravimetric analysis (TGA) on a PerkinElmer TGA 4000 instrument, conducted in air at a heating rate of  $10^\circ\text{C}/\text{min}$ .

The temperature and the heat of fusion (or crystallization) of the samples were measured on a Perkin Elmer DSC 7 differential scanning calorimeter (DSC) (heating rate  $20 \text{ deg} \cdot \text{min}^{-1}$ ) heating-cooling-heating in an air atmosphere.

Shore microhardness measurements according to Shore (scale D) were performed according to GOST 24 621-91 on a Hildebrand hardness tester and after 1 s (maximum HB) and 15 s (HB after voltage relaxation) of the sample under load. At least five microhardness measurements were performed in different places of the sample surface at a distance of at least 6 mm from the point of the previous measurement. The arithmetic average of at least five measurements was taken as the test result. Samples for measuring HB had a cylindrical shape with a diameter of 40 mm and a height of 5 mm.

## Results

It was previously established, for the formation of intercolated and exfoliated organoclay structures it is necessary to use a cationic modifier with at least 16-18  $\text{CH}_2$  groups in the main fat-aliphatic chain [3] at an optimal concentration of 25-75 % wt. % of cation exchange capacity (CFU) Clay. At the same time, it was possible to increase the elastic modulus of PE (by 50 %), the ultimate strength (by 20 %) and increase the barrier properties of nanocomposites [11], and the elastic modulus of PE (by 75 %) [15]. The authors of [16-23] noted that the use of a layered filler as a flame retardant significantly reduces (by 30-50 %) the rate of heat release during the burning of composites relative to an unfilled polyolefin.

The structure of the Na<sup>+</sup>-MMT modifier used by us differs in structure from the previously used surfactants as clay modifiers.

The effectiveness of the modification of the composite was evaluated by changing the physicomechanical properties (tabl. 1). Table 1 shows the mechanical characteristics for composites with different contents of organoclay.

When PP is filled with 3 wt. % organoclay, the toughness increases by 8%, the flexural modulus increases by 35.37%, the tensile modulus by 20.42%. In the case of filling 5% by weight of organoclay with PP, the toughness decreases slightly, the flexural modulus increases by 40%, the tensile modulus increases by 24.65%. When PP is filled with 7 wt.% organoclay, the impact strength decreases,

the flexural modulus increases by 42.10%, the tensile modulus by 28.36%. In all cases, the elongation decreases. The intercalated structure formed in the composite suggests a change in the conformation of the molecular chains of polypropylene, which leads to a denser packing of interfacial regions compared to a bulk polymer matrix. The resulting composites can be used as structural materials, the most optimal are the addition of 3-5 wt.% organoclay in PP.

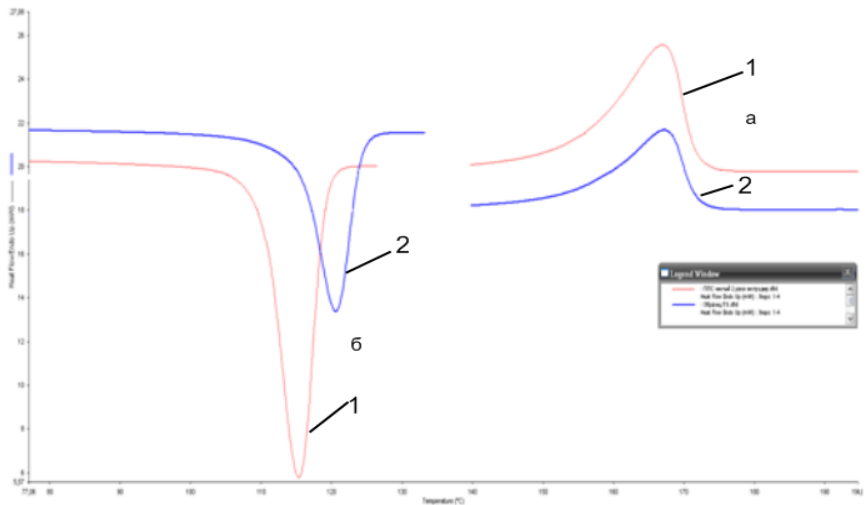
*Table 1. Mechanical properties of composites*

Composition	MFI g/10 min	Shore hardness number, D 1/15c	Izod impact strength, J/m <sup>2</sup> (notch/without notch)	Modulus of flexure mPas	Extensional modulus mPas, (1/10) mm/min	Creep limit mPas	Elongation, ε, %	Rupture strength, mPas
PP indust.	6,12	69/63	4000	800	900/1050	28,5	724	28,5
PP(ext)	5,9	69/65	46500 /2953	950	1100	29,5	550	29,5
PP (ext twice)	5,73	61/56	42412/2685	1014	1058/1131	29,3	414	29,3
PP +3 % organoclay DAA	5,16	61/59	34929/5602	1176	1163/1345	30	454,6	30
PP + 5 % organoclay DAA	5,26	61/56	34912/4766	1241	1174/1364	30.2	254,6	30.2
PP +7 % DAA	4.86	61/56	37938/3773	1192	1218/1306	29,3	202,8	29,3

\*- data obtained without notch with pendulum energy 5.5 J/m<sup>2</sup>

\*\* - 5.5 notch data with pendulum energy 5.5 J/m<sup>2</sup>

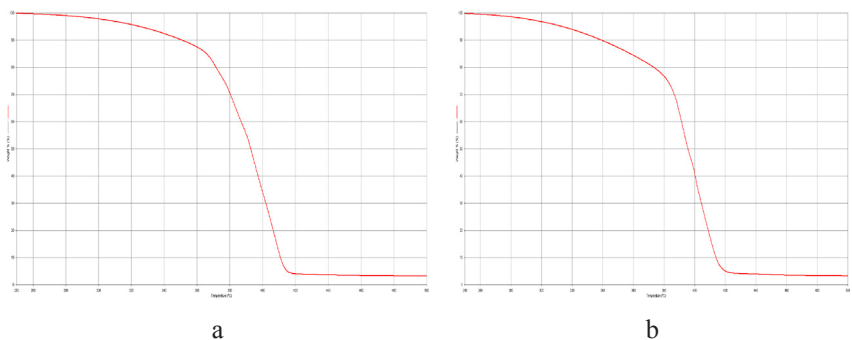
We are aware that the crystallization and recrystallization processes of a polymer are influenced by the nature, size, shape and concentration of the filler. Figure 1 shows the melting endotherms of PP and composite, when PP is filled with 7 wt.% organoclay.



**Fig. 1.** DSC curves of melting (a) and crystallization (b) of PP (1) and a composite with filling of 7 wt. % organoclay (2)

Maximum melting points have small numerical differences: for the PPP and the specified composite are 166.920°C and 167.340°C, accordingly. However, a decrease of crystallinity is observed: for PP  $\chi = 0.42$  and the specified composite  $\chi = 0.30$ , which indicates an increase in the proportion of amorphous structure.

The thermal stability of the nanocomposite was determined by the TGA method (Fig. 2).



**Fig. 2.** TGA curves of PP (a) and composite (b)

TGA curves for pure PP and composite have the same shapes up to 420°C. At a temperature of 340°C, mass loss is observed for pure PP – 17 %, while for a composite – 10 %. The introduction of organoclay into the polymer improves the thermal stability of the composite. The mass of the residue at 600°C increases along with content of organoclay.

The flammability of the composites was evaluated by the parameters of the flame propagation velocity  $v$  and the burning time of the samples (Table 2).

*Table 2. Thermal characteristics of composites*

Content	KI	$v$ burning mm/s (mm/min)
PP ind.	17,3	0,567/34,13
PP+ 3 % organoclay	19,0	0,483/28,92
PP + 5 % organoclay	20,2	0,438/26,29
PP + 7 % organoclay	20,4	0,429/25,14

As can be seen from table 2 with the introduction of 3-5 wt. % Modified Na<sup>+</sup>-MMT + DAA in PP, a decrease in the flame propagation rate by 74-79 % is observed. The slowing down of the burning rate of the composite is associated with the limitation of the diffusion of air oxygen into the material due to the presence of a barrier layer created by plane MMT particles. The presented data are consistent with the results previously obtained in [24, 25].

### Conclusion

Therefore, the thermal, mechanical property assessments and fire resistance of the composites allow us to conclude that N,N-diallylacrylamide, which structure differs from the previously used surfactants, works as a modifier. The type of modifier packing in Na<sup>+</sup>-MMT contributes to the formation of an intercalated structure of composites and provides an increase in the elastic modulus, impact strength, thermal stability, and lower combustibility.

### Acknowledgements

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UDC 541.6

丙烯酸 $\alpha$ -卤代共聚物与N-乙烯基吡咯烷酮和N,N-二烷基氨基乙基甲基丙烯酸酯  
的化学转化

**CHEMICAL TRANSFORMATIONS OF ACRYLIC ACID  $\alpha$ -HALOID  
COPOLYMERS WITH N-VINYLPYRROLIDONE AND N,  
N-DIALKYLAMINOETHYLMETHACRYLATE**

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注解。本文介绍了在有机环境下，在胺化剂存在下， $\alpha$ -卤代丙烯酸和N-乙烯基吡咯烷酮的共聚反应结果。所得共聚物的IR光谱证实了胺化反应。研究了还原合成的聚合物水溶液粘度的依赖性，并观察到“聚电解质溶胀”。合成的胺化聚合物在室温下与二价金属卤化物形成内部络合物。

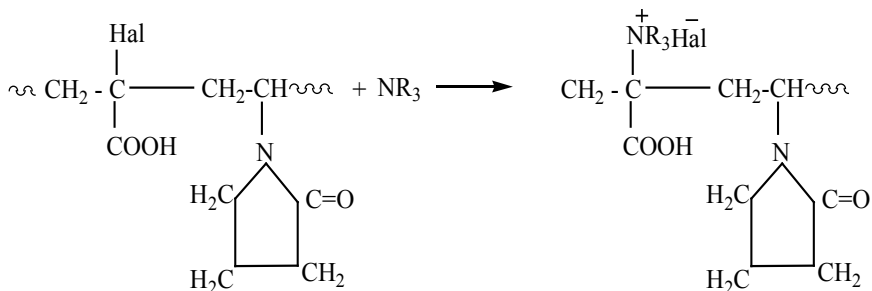
关键词：水溶性聚电解质共聚丙烯酸N-乙烯基吡咯烷酮胺化

**Annotation.** *The paper presents the copolymerization results of  $\alpha$ -halogens acrylic acid and N-vinylpyrrolidone in the presence of aminating agents at low temperatures in an organic environment. The IR spectra of the obtained copolymers confirm the amination reaction. The dependences of the reduced synthesized polymers aqueous solutions viscosity were studied and a “polyelectrolyte swelling” was observed. The synthesized aminated polymers form internal complex compounds with divalent metal halides at room temperature.*

**Keywords:** *water soluble polyelectrolytes, copolymerization, acrylic acid, N-vinylpyrrolidone, amination.*

High molecular weight compounds containing reactive groups are widely used in the process of chemical transformation of polymers in order to modify the properties and improve the operational characteristics of materials. [1-5]. In this work, the processes of acrylic acid $\alpha$ -halogens ( $\alpha$ -HAC) interaction with N-vinylpyrrolidone (NVP) presented with aminating agents (trimethylamine, pyridine,

triethylamine) in an organic environment at low temperatures are considered. As a result, water-soluble products are formed due a reaction according to the following scheme:



where  $\text{NR}_3$  – trimethylamine, pyridine, triethylamine.

It was revealed that during the interaction the amidation reaction of the acrylic acids carboxyl group with the formation of a carbonium ion occurs. In IR spectra this process is marked by a shift of the absorption band of the  $\text{C} = \text{O}$  carboxyl group from  $1730 \text{ cm}^{-1}$  to  $1610 \text{ cm}^{-1}$ .

The IR spectra of the obtained aminated copolymers show the absence of an absorption band in the region  $810$  and  $610 \text{ cm}^{-1}$ , related to  $\text{C}-\text{Cl}$  and  $\text{C}-\text{Br}$  bonds, which confirms the completeness of amination reactions. At the same time, the appearance of a new absorption band in the region  $2650 \text{ cm}^{-1}$ , characteristic for ammonium salt groups and absorption bands in the region  $1620-1660 \text{ cm}^{-1}$ , corresponding to vibrations of the pyridine ring. The identity of water-soluble polyelectrolytes is confirmed by UV spectra, where absorption bands characteristic of quaternary ammonium groups was observed in the range of  $257-258 \text{ nm}$  (aminated with pyridine) and  $256 \text{ nm}$  (aminated with trimethylamine).

Due to the high reactivity of the chlorine atom and bromine, the amination process proceeds quickly at room temperature. The duration effect of the reaction on the amination process was investigated. When using trimethylamine and pyridine, the amination process is accompanied by higher yields compared to triethylamine, and the resulting water-soluble polyelectrolytes have a high exchange capacity and reduced viscosity. The difference in yields is explained by steric difficulties caused by the volumetric ethyl groups of triethylamine (Table 1).



**Table 1**

*The dependence of the physicochemical properties of polyelectrolytes based on copolymers of  $\alpha$ -chloroacrylic acid with N-vinylpyrrolidone by nature of an aminating agent*

Amination agent	Polymer yield, %	$\eta_{\text{red}}$ 0,5 % solution dl/g	Content Cl % by 0,1 n AgNO <sub>3</sub>		Exchanging capacity mEq/g	
			Found	Calculated	Found	Calculated
Trimethyl-amine	86,7	6,3	12,2	12,8	3,5	3,6
Pyridine	85,1	3,95	11,9	12,0	3,2	3,3
Triethylamine	40,5	–	9,9	11,1	3,01	2,1

Temperature 298K, duration 14,4 · 10<sup>3</sup>s. The reduced viscosity of a 0.5% copolymer solution is 0.66.

The reduced aqueous solutions viscosity concentration dependence of synthesized polymers is concave. Apparently, one of the specific features of polyelectrolytes is affected, the so-called “polyelectrolyte swelling,” the cause of the electrostatic repulsion of the same charged units of the polymer chain containing ammonium groups. [6-8]

The state of polyelectrolyte macromolecules in solution is greatly affected by the concentration of hydrogen ions, which is associated with a change in the charge and hydration of the macromolecules. The dependence of 0.5% aqueous solutions of the aminated copolymers of  $\alpha$ -HAC with NVP on the pH of the medium passes through a maximum. Starting from pH 3.0–3.5, the viscosity curve goes up noticeably.

The maximum is reached at pH 7.4–7.7, afterwards with an excess of alkali occurs a decrease in viscosity. The maximum viscosity in a slightly alkaline medium is explained by the fact that in this region the macromolecules are straightened due to the repulsion of the charged like dissociated of macromolecules copolymers ionogenic groups. The dependences of the reduced synthesized polymers aqueous solutions viscosity on the concentration of polymers in the presence of a strong electrolyte, potassium chloride, and is linear, due to the creation of a dense shielding “coat” around the ions of macromolecules. The characteristic viscosity of the obtained ammonium polymers solutions increases in the conversion depth, which is associated with partial structuring at deep degrees of conversion.

The potentiometric titration of the aminated  $\alpha$ -HAC copolymers with NVP shows that the synthesized products are amphoteric, although the acid properties are less pronounced.

The synthesized aminated copolymers of  $\alpha$ -HAC acid with NVP are capable of complexation. When synthesized complexing polyelectrolytes are added to the iodine solution, an instant precipitation of the polymer complex with iodine is observed. The pronounced iodine selectivity is apparently due to the presence of a lactam ring with a quaternary ammonium group in the structure of the copolymer. The exchange capacity for iodine is 6.0 mEq/g (copolymer aminated with trimethylamine), 7.7 mEq/g (copolymer aminated with pyridine). According to preliminary results, iodine complexes are stable, do not undergo sublimation, iodine is well fixed when the materials are impregnated with a solution of the complex.

Due to the content of the electrodonor nitrogen atom in its structure, the synthesized aminated polymers based on copolymers of  $\alpha$ -HAC with NVP can form intracomplex compounds with halides of divalent metals ( $\text{Cu}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Co}^{+2}$ ). Polymer complexes were obtained by direct interaction of ammonium polymers with calculated amounts of salts of divalent metals at room temperature. [9-22]

The methods of IR and EPR spectroscopy were used to study the structure of synthesized polymer complexes, which can be stabilizers for polymeric materials, in particular, polyvinyl chloride. The stabilizing effect was determined by studying the thermal stability of a polyvinyl chloride sample with a polymer stabilizer on a Paulik, Paulik, and Erdey derivatograph at a heating speed of 5 deg / min., As well as by studying the kinetics of dehydrochlorination of polyvinyl chloride at a temperature of 453 K.

Thermogravimetric curves show that the beginning of decomposition of the stabilized polymer is observed at a temperature of 495 K, and that of an unstabilized polyvinyl chloride sample at 473 K. In this case, the rate of thermooxidative destruction slows down somewhat compared to the rate of destruction of the initial sample. Apparently, the increase in the effectiveness of the stabilizing effect of the synthesized polymer metal-containing complex is explained by the presence of lactam cycles, ammonium groups and a decrease in the volatility of the polymer stabilizer at high temperatures.

Therefore, by the chemical conversion of  $\alpha$ -HAC copolymers with NVP, water-soluble polyelectrolytes with high exchange capacity and stabilizing properties were synthesized and the behavior of their aqueous solutions was studied.

In order to obtain new ammonium copolymers containing active reactive functional groups and studies of their properties, the reactions of the formation of copolymers resulting from the interaction of  $\alpha$ -bromacrylic acid ( $\alpha$ -BAC) with N, N-dimethylaminoethyl methacrylate (DMAEMAC) and N, N-diethylaminoethyl methacrylate (DEAMAC) are considered at temperatures 323–343K in the presence of a radical initiator. New ammonium copolymers with a high molecular weight and active reactive functional groups have been obtained. The structure and structure of the obtained copolymerization reaction products were studied by IR and NMR spectroscopy and elemental analysis.

To study the effect of the initial comonomer ratio on the composition of the resulting copolymers, the reaction was conducted in a wide range of initial monomer concentrations. It was noticed that during the copolymerization of  $\alpha$ -BAC with DEAMAC, the formation of an azeotropic copolymer occurs when the content of  $\alpha$ -BAC is 30 mass. % and DEAMAK - 70 mol. %, and for the  $\alpha$ -BAC system - DMAMAK -35:65 mol% (Table 2.)

**Table 2**

*The dependence of the composition of the copolymer on the ratio  $\alpha$ -BAC ( $M_1$ ) with DMAMAK ( $M_2$ ) and DEAMAK ( $M_2$ ) from the composition of the initial mixture*

Initial ratio of monomers, mole %		Outcome, %	Content Br, %	Copolymer composition, mole %	
$M_1$	$M_2$			$m_1$	$m_2$
$\alpha$ -BAC– DMAEMAC					
25	75	6,0	14,9	29,24	70,76
40	60	5,2	16,0	31,00	69,0
50	50	6,8	18,2	34,37	65,63
60	40	7,1	20,3	35,0	65,0
75	25	9,1	22,5	42,25	57,75
$\alpha$ -BAC– DEAMAC					
25	75	4,5	15,7	32,72	67,38
40	60	7,2	16,2	35,2	64,8
50	50	6,8	17,3	36,0	64,0
60	40	4,8	19,5	42,3	57,7
75	25	7,3	22,3	59,5	40,5

The influence of various factors on the copolymerization of  $\alpha$ -BAC with dialkylaminoethylmethacrylates was studied, and it was found that with an increase in temperature and concentration of the starting monomers, the yield and intrinsic viscosity of the synthesized copolymers increase. The rate of the copolymerization reaction at a temperature of 323–343 K follows the Arrhenius equation based on the activation energies calculation, which is 77.33 kJ/mol for the  $\alpha$ -BAC – DAMAK system, 75.24 kJ/mol for the  $\alpha$ -BAC system – DEAMAK .

Therefore, as a result of the copolymerization of  $\alpha$ -BAC with dialkylaminoethyl methacrylate, cross-linked polymers are formed. The resulting crosslinked polymers containing ionic groups were used as ion exchange resins.

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CARBEX工艺—一种用于乏核燃料后处理的新型水化学技术  
**CARBEX PROCESS – A NOVEL HYDROCHEMICAL TECHNOLOGY  
FOR SPENT NUCLEAR FUEL REPROCESSING**

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抽象。 本文简要介绍了碳酸盐介质中乏核燃料再处理新替代方法的最新成就和可能性-CARBEX工艺。

关键词：核废燃料，放射性废物，水化学技术，碳酸盐水溶液系统

**Abstract.** *The article briefly presents the latest achievements and possibilities of a new alternative method of spent nuclear fuel reprocessing in carbonate media – CARBEX process.*

**Keywords:** *spent nuclear fuel, radioactive waste, hydrochemical technology, carbonate aqueous systems*

In 2008, the concept of the CARBONATE EXtraction (CARBEX) process, a new technology for the hydrochemical reprocessing of spent nuclear fuel (SNF) in carbonate media was introduced [1]. This concept is based on two key processes: the oxidative dissolution of SNF in aqueous carbonate solutions in the presence of hydrogen peroxide [1–3] and liquid–liquid extraction (LLE) purification of uranium and/or plutonium from impurities of fission products (FPs) soluble in carbonate media using quaternary ammonium compounds (QACs) as an extractant [4]. The CARBEX process was developed, as an alternative method to the PUREX process, which is widely used in SNF reprocessing technology. Replacing nitric acid with sodium or ammonium carbonate in the CARBEX process will reduce the fire and explosion hazard of LLE processing of highly active solutions, the corrosiveness of the medium to equipment and extractant, and the volume of liquid radioactive waste (LRW), at all stages of SNF reprocessing. The difference in the solubility of lanthanides and actinides in carbonate media can increase the selectivity of their

separation during the dissolution of SNF and their subsequent LLE reprocessing.

At present, the concept of the CARBEX process includes the following sequence of technological operations [5]: 1) oxidation of the fuel composition at elevated temperature (voloxidation); 2) alkaline treatment of voloxidized SNF to remove cesium, molybdenum and other alkali soluble FPs; 3) oxidative dissolution of SNF in carbonate solutions during ultrasonic treatment; 4) LLE purification of uranium and plutonium from carbonate solutions with methyltrioctylammonium (MTOA) carbonate or (methyltrialkyl( $C_7H_{15}$ – $C_9H_{19}$ )) ammonium (MTAA) carbonate in a hydrocarbon diluent; 5) collective precipitating stripping of carbonate compounds of uranium and plutonium; 6) the preparation of powders and tablets of  $UO_2$  and  $PuO_2$  from carbonate compounds of uranium and plutonium for fabricating the fuel of fast and thermal neutron reactors.

The CARBEX process provides purification of carbonate solutions from the FPs and their recycling with the regeneration of sodium carbonate salts in the form of  $NaHCO_3$  by saturation of solutions with  $CO_2$  or ammonium, during the distillation of gaseous  $NH_3$  and  $CO_2$  from solutions, as well as the solidification and immobilization of the solid residue of FPs in glass-like or ceramic matrices.

Studies on the kinetics of the oxidative dissolution of  $U_3O_8$  in aqueous solutions of  $Na_2CO_3$ – $H_2O_2$  [6] and the currently available literature data [2,3,7,8] made it possible to determine the optimal conditions for the dissolution of uranium oxides in carbonate media. The literature data on the oxidative dissolution of surrogates and irradiated [9] uranium oxide SNF confirm the possibility of complete conversion of uranium to carbonate solutions. The use of hydrogen peroxide determines the chemistry of the dissolution of  $UO_2$  and  $U_3O_8$ . In the process of dissolution of uranium oxides, hydrogen peroxide oxidizes U(IV) to U(VI) and is involved in the formation of mixed U(VI) peroxy-carbonate compounds, which can be mainly represented as  $[UO_2(O_2)_x(CO_3)_y]^{(2-2x-2y)}$  (where  $x=1-3$ ,  $y=3-x$ ). As the concentration of U(VI) increases, resulting compounds become polynuclear:  $M_4[(UO_2)_2(O_2)_2(CO_3)_2]$  and/or  $M_6[(UO_2)_3(O_2)_2(CO_3)_4]$ . The solubility of peroxy-carbonate complexes of U(VI) is more than 4 times higher than that of carbonate complexes of U(VI). This allows you to get solutions with a concentration of U(VI) up to 200 g/L, which greatly improves the efficiency of the subsequent extraction purification of uranium from FPs. However, hydrogen peroxide does not oxidize neptunium, plutonium, americium, and curium in carbonate solutions to the higher oxidation states, which requires the use of oxidizing agents of a different nature, for example, persulfates, percarbonates, and others.

The LLE stage of the CARBEX process includes two types of extraction: exhaustive – for the complete extraction of uranium and plutonium, and refining - for their purification from FPs. A study of the LLE chemistry of U(VI) by MTOA carbonate showed that carbonate or peroxy-carbonate complexes are extracted into

the organic phase, depending on the composition of the initial carbonate solution. A similar situation is observed in the case of plutonium complexes, although the chemistry of extraction of carbonate and mixed compounds of this element has not yet been studied in sufficient detail. Exhaustive extraction of U(VI) with MTAA or MTOA carbonates allows the 99.9% of uranium to be extracted from solutions after the oxidative dissolution in 4–6 stages of countercurrent extraction. At the same time, refining extraction from U(VI) carbonate solutions concentrated with MTOA carbonate makes it possible to achieve value for purification coefficients of uranium from FPs equal  $10^5$ – $10^6$ , depending on the nature of the impurities. These indicators are significantly higher than those in precipitation methods proposed in [2,3] and are close to those of the industrial PUREX process.

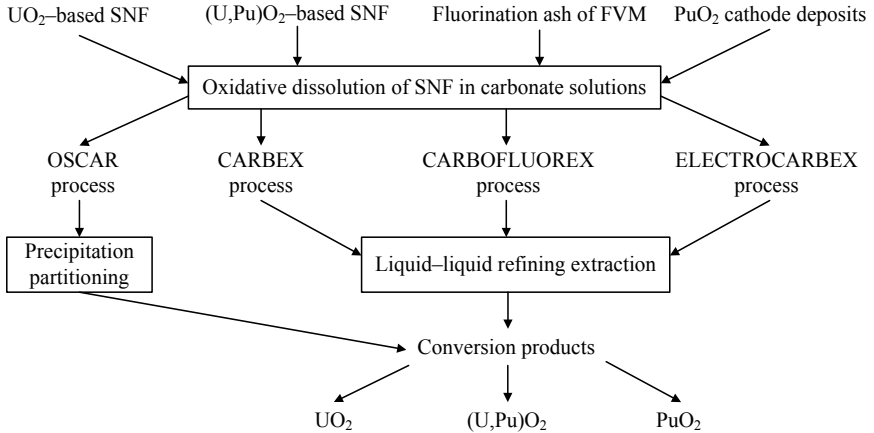
One of the options for replacing exhaustive extraction of uranium and plutonium from carbonate solutions can be the deposition of their hydrolyzed products or hydrolytic polymers with a change in the pH of the carbonate solution. After dissolving the separated precipitates in a carbonate solution, it is possible to carry out extraction purification from FPs impurities. At the end of the extraction purification step, the precipitating stripping with concentrated solutions of ammonium carbonate and/or bicarbonate. In this case, uranium and plutonium transfer into the solid phase in the form of carbonate or oxycarbonate sparingly soluble compounds, which, after calcination in a reducing atmosphere, form ceramic grade  $UO_2$  and/or  $PuO_2$  powders suitable for fabricating nuclear fuel.

Based on the CARBEX process, hybrid reprocessing methods can be developed, allowing a more complete and efficient extraction of valuable components from SNF. In the fluoride volatility method (FVM) of SNF reprocessing [10], solid fluorides residue (in the form of powders or ashes) are formed, containing in solid form some fluorides U(IV), U(VI), Pu(IV) and Pu(VI), which can be converted (additionally recovered) to a carbonate solution and purified from FPs impurities in the extraction process. A feature of the carbonate–fluoride solutions obtained in this case is the corrosion inactivity of fluorine. The powders of uranium and plutonium oxides obtained as a result of such a combined process contain no more than 0.05% fluorine, and the purification coefficients U (VI) from FPs fluorides reach values  $\sim 10^6$ . In accordance with the use of extraction from carbonate–fluoride solutions, this option was called the CARBOFLUOREX process.

Another option for hybrid SNF reprocessing is the combination of electrochemical separation of  $PuO_2$  or  $UO_2$  from melts at the cathode ( $PuO_2$  cathode deposits) followed by its anode dissolution in carbonate solution and extraction purification of Pu(VI) and/or U(VI) from impurities. The development of the concept of the CARBEX process and its application to the reprocessing of various types of SNF or radioactive waste made it possible to propose a set of processes whose main stages are the transfer of the target components of SNF to carbonate



solutions with subsequent precipitation or LLE treatment of related impurities, Figure 1.



**Figure 1.** Set of SNF reprocessing concepts on the basis of the CARBEX process

In all proposed schemes, the final products of reprocessing are powders of uranium dioxide, plutonium dioxide or their mixtures, which makes it possible to unify the refining stages of their production. At the same time, the dissolution of certain initial types of SNF or radioactive waste requires the development of unique conditions necessary for the transfer to the solution of a particular component. Beyond the concept of the CARBEX process, the problems of the isolation of minor actinides – neptunium, americium, curium, as well as the partitioning of caesium and strontium, iodine and technetium have so far been taken. However, these embodiments can be sufficiently effective in handling carbonate or carbonate alkaline solutions.

Therefore, the hydrochemical LLE reprocessing of SNF in carbonate media is a new promising area of nuclear chemical technology that can significantly reduce the amount of radioactive waste, improve the ecology of reprocessing, simplify the process as a whole and reduce the cost of separating fissile materials of spent fuel.

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冷冻化学合成过程中控制抗菌药物双氧水纳米形态的粒径和相组成的控制  
**CONTROL OF THE PARTICLE SIZE AND PHASE COMPOSITION OF  
NANOFORMS OF THE ANTIBACTERIAL DRUG DIOXIDINE IN THE  
PROCESS OF CRYOCHEMICAL SYNTHESIS**

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抽象。 抗菌药物的大小和结构改性采用冷冻化学方法，该方法是通过结合载气流形成分子蒸气流，然后在冷至80 K的表面上冷凝物质分子而制得的。 使用这种方法，进行了抗菌药物二氧化物的纳米形式的合成。 据记录，药物的分子结构在冷冻化学尺寸和结构修饰过程中保持不变。 发现随着载气流量(CO<sub>2</sub>)值的增加，低温化学改性的二氧化亚胺的粒径有规律地减小，晶体结构发生变化。

关键词：药物的大小和结构修饰，冷冻化学联合方法，药物的纳米颗粒和纳米形式，双氧水。

**Abstract.** *The size and structural modification of antibacterial drug substance was made using cryochemical method, The method was made by the formation of molecular vapor flow combined with a carrier gas stream, and followed by condensation of substance molecules on a cold down to 80 K surface. Using this method, the synthesis of nanoforms of the antibacterial drug dioxidine was carried out. It is recorded that the molecular structure of the drug remains unchanged during cryochemical size and structural modification. A regular decrease in particle size and change in the crystal structure of cryochemically modified dioxidine with an increase in the value of the carrier gas flow (CO<sub>2</sub>) was found.*

**Keywords:** *size and structural modification of drugs, combined cryochemical method, nanoparticles and nanoforms of drugs, dioxidine.*

## 1. Introduction

The aim of this work is to develop methods of cryochemical synthesis of nanoforms of drugs with predetermined size and structure characteristics, on the example of the antibacterial drug dioxidine.

The need to develop new drugs is determined by the fact that well-known, long-established drugs do not meet modern requirements today. However, the creation and testing of new molecular forms of drugs (drug discovery) require not only huge material costs, reaching several billion dollars, but also large, reaching several years, the time spent on conducting various clinical and preclinical tests, at the cost of which are human lives.

From this point of view, another approach is more promising, which is to increase the effectiveness of known medicines and improve methods of their targeted delivery (drug delivery). This can be achieved, for example, by reducing the particle size of the active drug up to the nanoscale state [1], as well as by synthesizing new or obtaining previously known thermodynamically metastable polymorphic modifications in the form of kinetically stable forms [2].

The size is of primary importance, since the size parameters largely determine the bioavailability of the drug [3]. For example, reducing the particle size of the antigonadotropic drug dibazole in an aqueous suspension from 10 microns to 169 nm led to an increase in absolute bioavailability from  $5.1 \pm 1.9\%$  to  $82.3 \pm 10.1\%$  [4]. Increasing bioavailability allows you to reduce the therapeutic dose and, consequently, possible side effects.

The effect of polymorphism – the existence of a substance of the same molecular structure in several crystalline forms-is currently the subject of close attention of both scientists and health surveillance services, since when the polymorphic modification changes, both the physicochemical (melting point, density, thermodynamic stability, solubility and dissolution rate) and therapeutic (bioequivalence, bioavailability, etc.) characteristics of drugs change [4-9]. Thus, the ability to control the phase composition of crystalline drugs is extremely important for biomedical applications.

## 2. Experimental technique

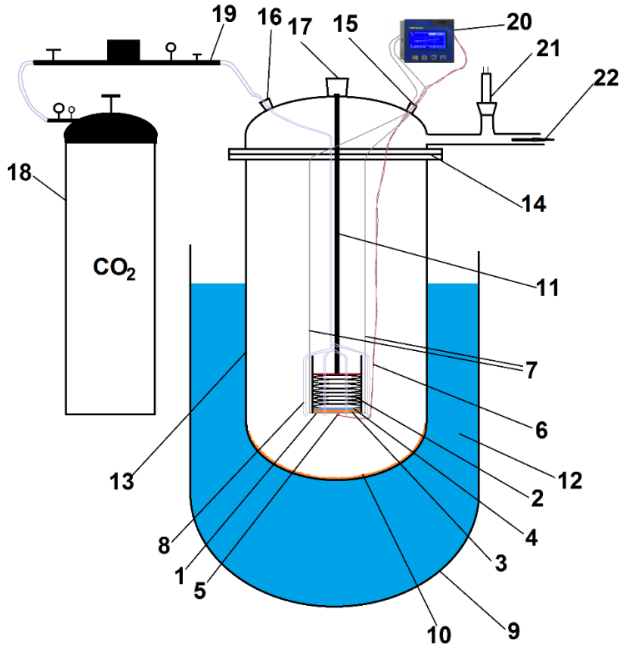
### 2.1. Original material

Dioxidine substance produced by Mir-Pharma (Moscow, Russian Federation) (98.9%) was used without further purification. The original dioxidine is a 1:1 monohydrate whose crystal structure is known (SOKGAA Cambridge Structural Database file) [10]. The average particle size according to BET-surface area measurements is  $5700 \pm 1200$  nm.

### 2.2. Installation diagram for cryochemical synthesis of drug nanoforms.

Cryochemical synthesis of dioxidine nanoforms was performed by a combined method, including sublimation of the initial dioxin, combining the molecular flow of the substance with the flow of the carrier gas, and joint low - temperature con-

densation of the flows of the substance and the carrier gas. For the sublimation of the original pharmacopoeia dioxidine, special grid sublimators were used, the design of which is described in the patent [11]. As a carrier gas, carbon dioxide was used, which is almost completely condensed on the surface, cooled by liquid nitrogen. The scheme of the installation for cryochemical synthesis is shown in Figure 1.



**Figure 1.** Diagram of the cryochemical synthesis unit by sublimation - joint low-temperature condensation:

1 - a metal grid heated by electric current flowing through it; 2 - spring that presses the layer of the original drugs to the metal grid; 3 - a layer of the original drug substances pressed against a metal grid; 4 - a rod that serves for evenly pressing the layer of the initial drugs to the metal grid; 5 - junction of a thermocouple used for measuring the temperature of a metal grid; 6 - copper - constantan thermocouple designed for measuring the temperature of a metal grid; 7 - network wires connected to a metal grid; 8 - comb designed for uniform distribution of the flow of carrier gas-CO<sub>2</sub>; 9 - Dewar vessel with liquid nitrogen; 10 - layer of a mixture of a cryomodified drugs with solid carbon dioxide; 11 - pin that regulates the position of the sublimator in the height of the submerged reactor; 12 - liquid nitrogen; 13 - vacuum-operated submersible reactor; 14 - movable vacuum con-

nection; 15 - vacuum input for thermocouple and network wires; 16 - vacuum inlet for CO<sub>2</sub> carrier gas flow; 17 - vacuum input for the pin that regulates the position of the sublimator in the height of the submerged reactor; 18 - metal cylinder with carbon dioxide; 19 - gas flow regulator; 20 - temperature controller; 21 - vacuum sensor; 22 - access to the vacuum system.

During the cryochemical modification of dioxidine, the only variable parameter was the flow of the carrier gas-CO<sub>2</sub>. All other conditions, namely, the temperature of the metal grid (140 °C), the temperature of the cooled surface (-196 °C), the geometric location of the sublimator and the nozzles for supplying carbon dioxide in the reactor, were unchanged. The surface area on which the combined low-temperature condensation of dioxin and carbon dioxide flows was carried out was approximately 100 cm<sup>2</sup>.

### 2.3. Characterization techniques

#### 2.3.1. UV-Visible Spectra

UV-visible absorption double beam spectrophotometer “Jasco V-770” (JASCO Corporation, Tokyo, Japan) in the range of 300–600 nm at room temperature was used to scrutinize the spectra of different forms of dioxidine in aqueous solutions and for spectrophotometric determination of dioxidine concentrations.

#### 2.3.2. FTIR Spectra

The FTIR spectra were recorded on a Tenzor II FTIR spectrometer using the A225/Q platinum ATR (Bruker GmbH, Mannheim, Germany).

#### 2.3.3. X-ray Powder Diffraction

X-ray powder diffraction measurements were carried out at Rigaku D/MAX-2500, Rigaku, Japan,  $\lambda = 1,54056 \text{ \AA}$ ).

#### 2.3.4. Scanning electron microscopy (SEM)

SEM measurements were performed on a scanning electron microscope QUANTA 650 FEG

#### 2.3.5. BET-surface Area Measurements

The BET surface area (S) of samples was defined using the surface analyzer assembled on the basis of gas-chromatograph “Chrom 5”. Average dioxidine particle diameters (d) of the samples were calculated as  $d = 6/(\rho S)$ , where  $\rho$  is a density of dioxidine substance.

### 3. Results and discussion

According to date of UV/Vis spectrophotometry, in the course of cryochemical modification, there is no change in the molecular structure of dioxidine, since UV/Vis spectra of aqueous solutions of the initial and cryochemically modified dioxidine are identical. Data on the phase composition and average particle sizes of dioxidine nanoforms obtained by cryochemical method are shown in table. 1. These data indicate a brightly expressed dependence of the size and structural characteristics of the synthesized nanoforms on the value of the carrier gas flow- $\text{CO}_2$ .

*Table 1. Structural and dimensional characteristics of cryochemically modified dioxidine*

Flow rate of $\text{CO}_2$ , mol/h	Rate of $\text{CO}_2$ , condensation, molecules*s <sup>-1</sup> *sm <sup>-2</sup> *10 <sup>-16</sup>	The ratio of a rate condensation $\text{CO}_2$ /dioxidine	Phase composition	Specific surface area, S/m, m <sup>2</sup> /g	Particle size
0	0,0	0	T:H = 7:1	9,6	414±80
0,2	1,4	1,85	T:M = 2:1	33	120±24
0,45	3,1	4,16	T:M = 1 : 1	34	118±23
1,00	7,0	9,24	T:M = 1 : 1,5	37	108±22
1,5	10,5	13,88		43	93±20
4,5	31,4	41,63	T:? = 3:2	71	56±11
7,5	52,3	69,40		71	56±11
10,0	69,7	92,50	T:? = 3:2	78	51±10

The sample obtained by sublimation-condensation of dioxidine in the absence of a carrier gas contains an almost pure Triclinic (T) phase with small additions of the 3:1 crystalline hydrate [12]. Previously, to obtain the T-phase, it was required to heat the dioxidine crystalhydrate obtained by freeze-drying at 120 °C for 8 hours [39]. During such temperature exposure, the sample loses the properties of nanoforms, since the particles of the drug are enlarged.

Samples obtained at small and medium carrier gas flows contain only Triclinic (T) and Monoclinic (M) phases, and the ratio of these phases regularly changes when the carrier gas flow changes – with an increase in the flow, the M – phase content increases-from 33% at a flow of  $1.4 \cdot 10^{16}$  molecules\*s<sup>-1</sup>\*cm<sup>-2</sup> to 60% at a flow of  $7.0 \cdot 10^{16}$  molecules\*s<sup>-1</sup>\*cm<sup>-2</sup>.

The crystallographic parameters of known polymorphic modifications of dioxidine and its crystalline hydrates are shown in table 2.

*Table 2. Crystallographic characteristics of polymorphic modifications of dioxidine*

Polymorph modification	Triclinic (12)	Monoclinic (12)	Hydrate 3 : 1 (12)	Hydrate 1 : 1 (10)
Empiric formula	$C_{10}H_{10}N_2O_4$	$C_{10}H_{10}N_2O_4$	$C_{10}H_{10}N_2O_4 \cdot 1/3H_2O$	$C_{10}H_{10}N_2O_4 \cdot H_2O$
Crystallographic system	Triclinic	Monoclinic	Orthorhombic	Monoclinic
File	T	M	H	SOKGAA
Space Group	P-1	$P2_1/c$	Pbca	$P2_1/n$
a, Å	7.3194 (7)	9.1709 (9)	18.0035(15)	8.091(2)
b, Å	8.0774 (8)	15.3486 (14)	31.8369(19)	6.768(2)
c, Å	8.9872 (8)	7.0367 (7)	10.2555(12)	18.370(6)
$\alpha$ , deg	71.516 (11)	90	90	90
$\beta$ , deg	70.815 (9)	110.316 (12)	90	91.72(3)
$\gamma$ , deg	79.317 (12)	90	90	90
V, Å <sup>3</sup>	473.98 (8)	928.873 (16)	5878.2	1005.4(5)
Z	2	4	24	4
Diffractionmeter	ID22, ESRF	ID22, ESRF	ID22, ESRF	Syntex P2 <sub>1</sub>
Wavelength, Å	0.399996 (3)	0.399996 (3)	0.399996 (3)	0,71073 ( $\lambda$ MoK <sub><math>\alpha</math></sub> )
$\rho_{calc}$ , g/cm <sup>3</sup>	1.557	1.589	1,547	1,59

Samples obtained at high values of the carrier gas flow, along with the T-phase, contain a new unidentified phase, and the phase composition of the samples ceases to depend on the value of the carrier gas flow.

The average particle size of cryochemically modified dioxidine samples regularly decreases with an increase of the rate of carbon dioxide condensation – from  $414 \pm 80$  nm in the absence of a carrier gas flow, to  $51 \pm 10$  nm with a rate of  $6.97 \cdot 10^{17}$  molecules $\cdot$ s<sup>-1</sup> $\cdot$ cm<sup>-2</sup>.

The dependence of the average particle size of cryochemically modified dioxidine on the size of the carrier gas flow is probably due to the competition of nucleation mechanisms - heterogeneous surface and homogeneous gas-phase. In the absence of a carrier gas, the stationary concentration of dioxin molecules- $1.5 \cdot 10^{21}$  molecules/m<sup>3</sup>, corresponds to the conditions of the "Maxwell gas", whose thermal conductivity does not depend on the concentration. Therefore, the heat exchange

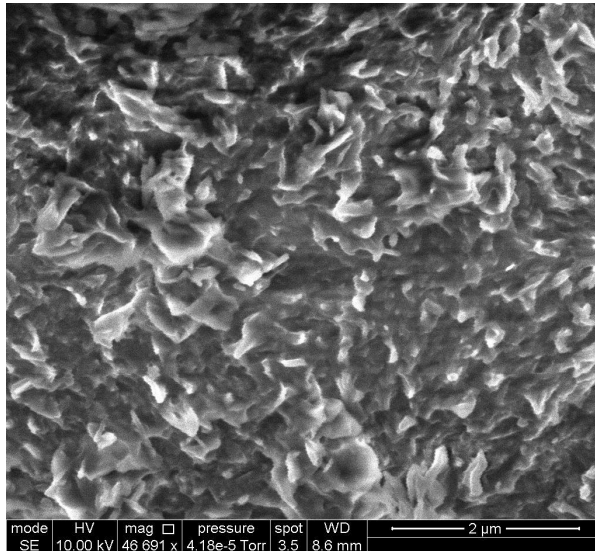


between the cooled surface and the molecular flow of dioxin is carried out by the mechanism of thermal conductivity. It is very likely that the cooling rate of the dioxin molecular flow is insufficient for effective homogeneous gas-phase nucleation, so the nucleation and growth of dioxin crystallites is carried out by a less effective surface heterogeneous mechanism.

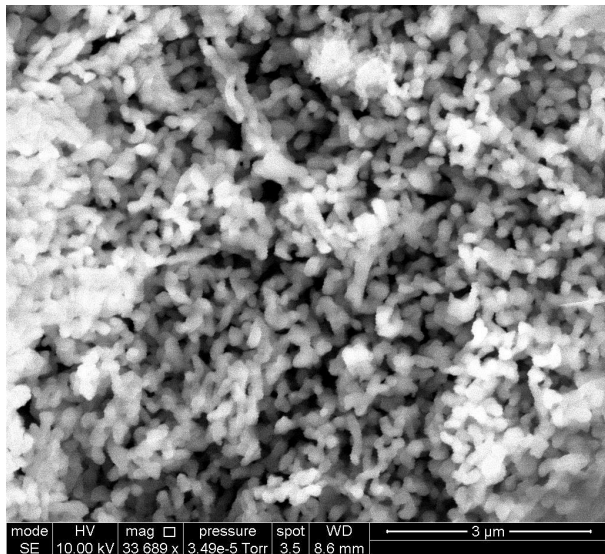
The use of a carrier gas leads to a significantly faster cooling of the dioxin molecular flow as it moves towards a cold surface. It is achieved both by convective mixing of molecular flows – the "hot" flow of dioxin and the relatively cold flow of carbon dioxide, and by higher thermal conductivity of the molecular mixture of dioxin and  $\text{CO}_2$ .

An increase in the value of the carrier gas flow leads to more efficient cooling of the dioxidine molecular flow. In this case, the contribution of the homogeneous gas-phase mechanism to the processes of nucleation and crystal growth increases, which leads to a decrease in the average particle size of cryochemically modified dioxidine. At a certain value of the carrier gas flow, the contribution of the homogeneous gas-phase mechanism approaches one hundred percent, and its further increase does not lead to a change in the average particle size, which is consistent with experimental data.

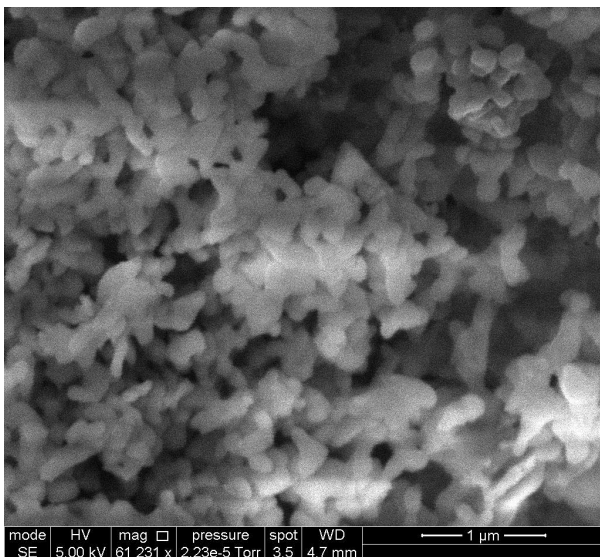
These assumptions are confirmed by SEM micro photos of samples of cryochemically synthesized dioxidine nanoforms shown in Figures 2-4.



*Figure 2 SEM micro photo of a dioxidine sample obtained in the absence of a carrier gas ( $\text{CO}_2$ ) flow.*



*Figure 3 SEM micro photo of a dioxidine sample obtained with a carrier gas ( $\text{CO}_2$ ) flow of  $7.0 \cdot 10^{16}$  molecules $\cdot\text{s}^{-1} \cdot\text{cm}^{-2}$ .*



*Figure 4 SEM micro photo of a dioxidine sample obtained with a carrier gas ( $\text{CO}_2$ ) flow of  $7.0 \cdot 10^{17}$  molecules $\cdot\text{s}^{-1} \cdot\text{cm}^{-2}$ .*

A micro photograph of a cryochemically modified dioxidine sample obtained in the absence of a carrier gas (Figure 2) does not show individual particles, but the surface of the sample has a complex relief with many small details. This pattern indicates that the nucleation and growth of a new phase in the absence of a carrier gas (CO<sub>2</sub>) flow proceeds through a heterogeneous surface mechanism. The characteristic size of the terrain irregularities is 200-1000 nm, which is consistent with the estimate of the average particle size of the sample determined by the adsorption method - 414±80 nm.

The micrograph of a sample of cryochemically modified dioxidine obtained with a carrier gas flow of 7.0\*10<sup>16</sup> molecules\*s<sup>-1</sup>\*cm<sup>2</sup> (Figure 3) clearly shows individual particles whose size lies in the range of 100 – 200 nm. The average particle size determined by the adsorption method for this sample is 108 ± 22 nm. Taking into consideration, that the resolution of the microscope does not allow to recognize the subtle details of the observed morphology of nanoparticles it can be argued that for this sample the SEM results correlate well with the estimate of the average particle size obtained by adsorption method.

The micrograph of a cryochemically modified dioxidine sample obtained with a carrier gas flow of 6.97\*10<sup>17</sup> molecules\*s<sup>-1</sup>\*cm<sup>2</sup> (Figure 4) shows well individual particles whose size lies within 100 – 200 nm. Smaller individual particles are not visible in micrographs. The average particle size determined by the adsorption method for this sample is 51±10 nm. Probably, the nanoparticles formed under these conditions, which have a high surface energy, partially agglomerate, preserving their individuality to some extent. The resolution of the scanning electron microscope does not allow us to recognize the fine details of the morphology of such conglomerates.

The dependence of the phase composition of cryochemically synthesized dioxidine nanoforms on the carrier gas flow is probably due to the more efficient adsorption of CO<sub>2</sub> molecules on the surface of the M phase compared to the T one. The reason for this is probably that in the monoclinic phase, one of the N-oxide groups does not participate in the formation of hydrogen bonds, therefore, a system of free functional groups is created on the surface of the monoclinic phase, with which carbon dioxide molecules can enter into specific intermolecular interactions.

In turn, more efficient adsorption of CO<sub>2</sub> molecules on the surface of the M phase leads to a decrease in its surface energy compared to the T phase. From the classical theory of nucleation is known the formula [13]:

$$J = C * \exp\left(-\frac{\Delta G^*}{kT}\right); \quad \Delta G^* = \frac{16}{3} \frac{\pi \sigma^3 v_1^2}{(kT \ln S)^2}$$

Here  $J$  is the nucleation rate,  $C$  – pre-exponential factor, slightly dependent on temperature and supersaturation,  $S$  – supersaturation,  $\sigma$  – surface energy,  $v_1$  is

the volume occupied by one molecule in condensed phase,  $k$  is the Boltzmann constant. This formula implies an extremely sharp dependence of the rate of nucleation on the surface energy.

#### 4. Conclusions

As a result of cryochemical synthesis by sublimation-joint low-temperature condensation with carbon dioxide, were obtained dioxidine nanoforms that are identical in chemical structure to the original pharmacopoeia dioxin (according to UV/Vis spectrophotometry), but differ in solid-phase structure.

It was found that an increase in the flow of carrier gas-CO<sub>2</sub> leads to a regular decrease in the average particle size of the drug.

It is established that according to powder x-ray diffraction phase analysis (p-XRD), the phase composition of the obtained samples depends on the value of the carrier gas flow – CO<sub>2</sub>. It was found that samples obtained at high values of the carrier gas flow contain a new unidentified phase.

The results obtained open up the possibilities of cryochemical methods for the synthesis of nanoforms of drugs with a given particle size, as well as for controlling their phase composition.

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UDC 338.47: 656

L90, L91, L92, L98, L99, O18, R00, R28, R40, R42, R48

回到大丝绸之路的最初目标

## RETURN TO THE ORIGINAL GOALS OF THE GREAT SILK ROAD

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抽象。这项工作致力于解决大丝绸之路沿线的陆上铁路走廊的可能性，这些关税与海上关税具有竞争性。正在研究解决此问题的必要措施。使用数学建模的方法，获得了沿着GSR的这种运输的财务特征。运输成本的结构已经确定。显示了在GSR方向上最多运输一半的陆上运输的基本可能性。

关键词：运输走廊，大丝绸之路，运输成本，能源成本，土地经济，海运和铁路运价，数学模型。

**Abstract.** *The work is devoted to the issues of the possibility of overland railway corridors along the Great Silk Road with tariffs that are competitive with sea ones. The necessary set of measures for solving this problem is being studied. Using the methods of mathematical modeling, the financial characteristics of such transportation along the GSR were obtained. The structure of transportation costs has been determined. The fundamental possibility of overland transportation of up to half of the traffic in the direction of the GSR is shown.*

**Keywords:** *Transport corridor, Great Silk Road, transportation costs, energy costs, land economy, sea and rail tariffs, mathematical model.*

### Introduction

Recent events around the Chinese Belt and Road Initiative (hereinafter BRI) [1] show a steady shift in preferences for building trans-Eurasian corridors towards sea routes. Instead of the original plans to build new modern high-performance tracks from scratch, existing rail routes are increasingly being used, which are only undergoing modernization and measures to improve their performance.

The main reason for the shift in sentiment in favor of sea routes is the strong price differential: about \$ 1000-1500 per container for sea transportation versus \$ 4500-6000 by train in recent years. As practice shows, such an important factor as the speed of cargo delivery plays a very insignificant role when choosing a route.



Moreover, the BRI project itself is increasingly blurring its transport focus. The issues of creating political alliances, financing of various economic projects come to the fore. [2]. It got to the point that countries began to appear in the BRI that did not even have land connections with the routes of the historic Great Silk Road (hereinafter GSR). For example, a number of African countries. This fundamentally changes the very essence of the project, which was initially considered as a land-based alternative to the existing sea communications.

Meanwhile, at the beginning of the XX century, H. Mackinder [3] made a forecast about the transition of the world economy from the sea type to the land one. However, more than a century has passed, but this prediction has not yet come true. The article analyzes the reasons for such a development of events, and shows the fundamental possibility of making rail transportation along the GSR routes as cheap as sea analogues. And thus return to the original meaning of the Great Silk Road.

The launch of a full-fledged transport corridor in the direction of GSR is also extremely important from a military-political point of view, as a backup communication option in case of complications in relations between China and the United States, since this may lead to blocking of sea traffic in the Indian Ocean by American aircraft carriers.

### **Dominance of shipping**

In recent years, about 12-14 million containers per year have been transported along the sea route from China to Western Europe. [4]. Overland transportation in the same direction is only a few hundred thousand, i.e. only a few percent. As mentioned above, this skew is due to economic reasons, since the current rail tariff is about three times higher than the sea one.

Part of the difference in tariffs is due to technological reasons. So one ship can take on board several hundred thousand tons of cargo, while a conventional railway train carries about 2-3 thousand tons. This leads to economies of scale, such as staff costs, administration, etc.

Separately, we would like to emphasize that in case of land transportation there are additional costs for the railway itself and its maintenance. First of all, these are depreciation costs. At the same time, there are no such types of expenses for sea transportation, since the use of the sea is free, except for certain narrow channels and straits, as well as ports. This difference is fundamentally unavoidable at the level of physical phenomena and therefore will always lead to higher costs of railway transportation.

Often in the transport literature you can find the statement that the main source of costs for transportation by all modes of transport is energy. However, it can be shown that this is only partially true. In the works of B.V. Drozdov [5, 6] it was shown for the first time that on most typical routes from eastern China to

Western Europe, the physical energy consumption is approximately equal for both rail and sea transport. This is due to the fact that although rail transportation is approximately two to three times more expensive, the routes themselves are approximately the same time shorter.

**Table 1.** Corridor characteristics Source. The works of B.V. Drozdov [5, 6], author's calculations [7]

Shipping	Length (km.)	Delivery time (days )	Energy consumption (mJ/t)	Energy cost (\$/container)
Railway China-Finland.	10,000	7 -12	1100	458
Maritime China - Finland.	21,000	28	1140	475
Railway South Korea - West. Europe	11,000	14	1210	504
Maritime South Korea - West. Europe	22,000	30	1195	498
Railway China - West. Europe	11,000	15	1210	504
Maritime Shanghai - Amsterdam	23,000	27-46	1249	520

In [7] the cost of energy in modern prices (2017 at the time of this writing) for transportation along the GSR was first estimated. Some of the calculation results are shown in table 1. The table shows that energy costs can be roughly estimated with a margin of \$ 500 for all the most common routes.

For maritime transport on the GSR routes, this is at least a third of the total tariff, i.e. rather the most important item of expenses. On the contrary, for railway transport this cost item is only about 10%, which is much less. Thus, the main share of the railway tariff is determined by other costs.

**Reduction of railway tariffs**

The last consideration shows that the high cost of railway tariffs is largely due not so much to the physics of the process as to artificial reasons that are determined by the characteristics of the modern economy. [8].

For example, most ships are assigned to international ports with minimal taxes. On the contrary, the Russian railway monopoly is one of the main employers and taxpayers in Russia.

It can be shown that with a sufficiently high traffic, for example, over 5 million containers per year, the cost of depreciation of the railway track is about a couple of hundred dollars in terms of the tariff of one container. This is a relatively small value that allows rail transport to compete with sea transport, since the depreciation of the railway is the only major item that does not exist in the cost structure of sea transport. All other costs have analogues for sea transportation, and therefore have comparable values in monetary and physical terms.



Such reasoning is already enough to draw a qualitative conclusion. There are significant prerequisites for reducing railway tariffs.

But this cannot be achieved by applying a small number of innovations. If this were so, then most likely something like this would have been implemented a long time ago. Instead, a large number of measures of fundamentally different types are required, which may be introduced by organizations or branches of government that are not related to each other. For instance, diplomatic departments, economic ministries, railway companies, legislative bodies. These will include administrative, tax, diplomatic, organizational and legislative measures. This requires that their actions are coordinated. Certain indirect issues are discussed in [9, 10, 11]. Separately, it is necessary to highlight purely railway innovations in the field of traffic control, formation of trains, tariffication, etc. [12].

Their implementation will require, among other things, political will, since they often contradict established economic practice. However, only in this case the proposed railway line can become self-sustaining in the sense that it will not require constant monetary injections from the state budgets, although with a number of benefits. And only in this case, the cost of railway transportation on the GSR direction can become competitive with sea transportation. And thus bring the BRI project back to its original goals.

#### **Mathematical model of financial results**

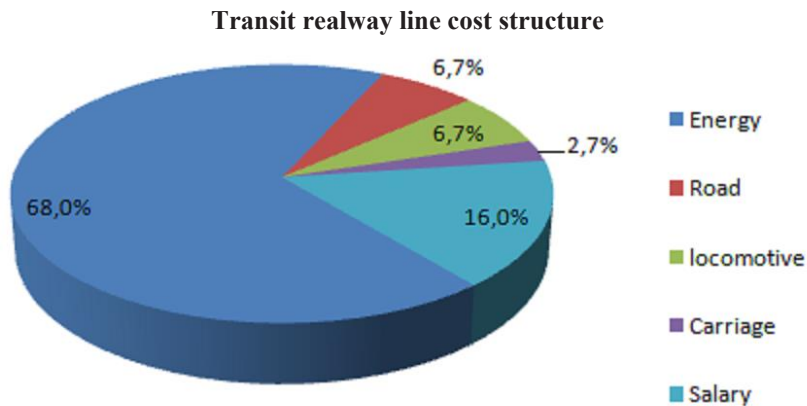
Since there are no railway lines that are under such a complex of regulation measures in the world at present, the only way to obtain quantitative estimates is through mathematical modeling. For this purpose, an extremely simplified model of financial results of the work of the company separated from the general railway network on the GSR route was created.

Within the framework of the model assumptions made, the main parameters of the functioning and operation of the main line along the GSR were calculated. First of all, the emphasis was on the study of the financial properties of transit.

The main result of the modeling is the determination of the marginal tariff. It turned out that due to its simplicity, primarily in management, and the reduction in the share of non-core activities, the proposed highway can show a significant reduction in the total tariff for transportation. [8]. Up to parity of prices with sea tariffs GSR for certain operating modes.

One of the implications of this result is that, in this case, the total traffic along the GSR can be expected to be split approximately equally between sea and land. This is especially true when considering the higher speed of railroad delivery. In this article, in the calculations, it was assumed that the traffic flow in terms of intensity is comparable to approximately half of the average annual volume of Chinese exports to Europe in 2010-2020. [4]. This traffic is very high intensity.

Of greatest interest is the cost structure. It is shown in fig. 1



*Fig. 1 The structure of the most significant costs of the transit line with high traffic. Per container.*

Due to the simplicity of the model, the diagram does not represent all costs, but only the largest ones. However, based on the usual practice of railway throughout the world, the unaccounted part of the costs seems to be insignificant. It cannot affect the conclusions drawn in the article. Moreover, such a cost profile will be adequate only in case of sufficient high traffic. The structure will look different on low-activity streams.

All costs can be conditionally divided into fixed and variable, depending on the amount of traffic. For example, with high traffic, energy costs are almost linearly dependent on the number of trains passing. In contrast, depreciation from track infrastructure is almost entirely a fixed cost. Although, of course, there are intermediate options that do not allow them to be unequivocally attributed to a specific group. Therefore, from the outset, it makes no sense to consider the absolute values of types of costs, since they significantly depend on traffic, and traffic, in turn, is determined based on the specifics of a particular highway: its tracing, the structure of demand for transportation, and population density.

As the figure shows, energy costs accounted for about two-thirds of all costs. Although energy costs decreased due to a decrease in the volume of atypical activities, not related to the transportation process, but at the same time, energy costs for core activities changed little. [7]. This is significantly more than in modern railways, which, as mentioned earlier, can only represent about 10% of the total tariff. But on the other hand, this still falls short of the share of energy costs for maritime transport, which, in theory, in certain directions and types of ships can reach up to 80%.

As discussed earlier, this is partly due to the cost of operating and maintaining rail tracks that are not available at sea. Therefore, in principle, rail transport cannot fully achieve the same high indicators as at sea.

The rest of the costs are minor in the general tariff, no more than 10% each. Although, given the scale of transportation, they are large in absolute terms, they will not determine the main dynamics of transportation prices.

### Conclusion

Railway tariffs are possible along the GSR corridors, which are competitive with sea transport tariffs.

For a qualitative reduction of railway tariffs, it is necessary to implement a significant set of measures of administrative, tax, diplomatic, organizational and legislative types.

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V. Ramensky的创意遗产：来自阿尔泰边疆区博物馆的藏品和私人藏品  
**CREATIVE HERITAGE OF V. A. RAMENSKY: FROM THE  
COLLECTIONS OF MUSEUMS IN THE ALTAI KRAI AND PRIVATE  
COLLECTIONS**

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抽象。 本文专门研究阿尔泰书画家，教育家，公众人物，俄罗斯著名艺术家弗拉基米尔·亚历山德罗维奇·拉蒙斯基教授的艺术和创作遗产，这些展览是通过一系列记忆展览的棱镜进行的，并揭示了他的意义 阿尔泰艺术和文化发展中的创造性活动。 还分析了阿尔泰边疆区博物馆和私人收藏中艺术家的收藏。

关键字：创意遗产，书籍艺术家，阿尔泰博物馆，阿尔泰艺术家，传统，书籍艺术，阿尔泰文化，弗拉基米尔·拉蒙斯基。

**Abstract.** *The article is devoted to the study of the artistic and creative heritage of the Altai book artist, educator, public figure, Honored Artist of Russia, Professor Vladimir Alexandrovich Ramensky, conducted through the prism of a series of memory exhibitions and revealing the significance of his creative activity in the development of art and culture of Altai. Also analyzed are the collections of the artist's works that are in the funds of the museums of the Altai Krai and in private collections.*

**Keywords:** *creative heritage, book artist, Altai museums, Altai artists, traditions, book art, Altai culture, Vladimir Ramenskiy.*

Vladimir Alexandrovich Ramenskiy is one of the largest figures of Altai culture in the second half of the XX - early XXI century. The life and work of the artist, teacher, public figure is inextricably linked with the Altai Krai.

Childhood and adolescence of Vladimir Alexandrovich coincided with a dramatic period for the country in the 20-40s of the XX century. He was born on July 28, 1927 in China in the city of Hailar, where his father served as a station attendant on the Chinese Eastern Railway. Two years later, the family moved to Chita, and then to Altai. From the age of 14 Ramensky V.A. had to work as a car

mechanic in the Ozersk timber industry enterprise, in order to somehow help his mother. She was left alone with seven children, since in 1937 her husband and father of the family, Ramensky Alexander Evlampievich, was shot as an enemy of the people. Since then, the most difficult trials began for the family with the stigma of "the family of an enemy of the people", during the Great Patriotic War, hard working days in the deep rear. Vladimir Alexandrovich served for seven years (from May 1945), first in the Baltic States, and then on Sakhalin in the ranks of the Soviet army. At the end of his service, with the rank of sergeant of tank forces, Vladimir Aleksandrovich returned to Barnaul, worked as a car mechanic in the garage of the Stroygaz trust, and graduated from an evening school. At the same time he attended classes at the art studio of A.V. Ievleva at the "Transmash" club.

In 1953 Vladimir Alexandrovich entered the Kazan Art School. At that time V.A. Ramensky dreamed of becoming a painter. After graduating from college in 1957, Ramenskiy returned to Altai, worked in Barnaul as an artist-designer at the Krai party school, in an art fund, at a melange plant. In 1963, Vladimir Aleksandrovich entered the Faculty of Design of Printed Products at the Moscow Polygraphic Institute (now the Moscow State University of Printing Arts). Vladimir Alexandrovich did not have to study with V.A.Favorsky, the founder of the academy, the master at that time was already seriously ill. The faculty was taught by his students and associates: A.D. Goncharov, M.V. Bolshakov, P. Ya. Pavlinov, M.V. Miturich, N.N. Kupriyanov, L.A. Bruni. They sacredly kept the covenants of V.A. Favorsky, his attitude to the architectonics of the book as a single organism. The influence of great teachers is reflected in the early works of V.A. Ramensky. While still a student at the institute, in 1963, Vladimir Alexandrovich began to cooperate with the Altai book publishing house, and from 1968 to 1971 he was its art editor.

The creativity of V.A. Ramensky in the field of book graphics appears as a large-scale, integral phenomenon in the culture of the Altai Krai. V.A. Ramensky designed more than 200 books; he was the undoubted leader of Altai book graphics. The master played a leading role in the development of the art of the book. He managed to raise the publishing business to a new level, making the appearance of books published in Altai truly artistic. The creativity of V.A. Ramensky in the field of book graphics appears as a large-scale, integral phenomenon in the culture of the Altai Krai. The artist was fluent in all graphic techniques - etching, aquatint, cardboard engraving, zinc printing, ink and pen, watercolor, drypoint, etc. Throughout his creative activity, one of the key themes for the artist remained the theme of Altai, its nature and people [1]

In May 2017, Vladimir Aleksandrovich Ramenskiy passed away - a unique figure in Altai fine art. Leaving behind a wide and varied creative heritage that needs to be studied and popularized.

Starting from the anniversary of the artist's birthday, a series of exhibitions in memory of the artist's iconic places have been held in the Altai Krai. So, from July 28 to October 01, 2017 in the State Art Museum of Altai Krai the exhibition "V. Ramenskiy. Book artist".

The exposition featured 12 works from the museum's collection. These are illustrations for the story "Demzhai-Altaiian" by Ilya Mukhachev and illustrations for "Altai fairy tales", made in the second half of the 1970s-1980s.

"Exhibition "V. Ramenskiy. Book Artist" demonstrates a high level of professional skill of a mature artist, his virtuosity in the execution of details, an amazing ability to see the universal harmony in small things. Vladimir Alexandrovich Ramenskiy was a bright man with beautiful thoughts and soul, a great artist with a warm heart and a generous gift of a teacher, a great friend of the Art Museum. [3] The exposition is a tribute to the memory of the graphic artist, who would have turned 90 on July 28, 2017," - writes the curator of the exhibition, chief researcher of the State Art Museum, a member of the Union of Artists of Russia O.V. Sidorov. "The first personal exhibition of V.A. Ramensky took place 40 years ago at SAMAK, the curator of this exhibition was the art critic L.N. Shamina. It should be said that the funds of the State Art Museum of Altai Krai contain 111 works by V.A. Ramensky. The artist's work is widely and diversely presented in the museum, both chronologically and thematically, the collection began to form back in the 1970s with illustrations for the Primer. The works of Vladimir Alexandrovich are amazing, because you want to peer at them, they are diverse, multi-layered in meaning, standing by the work, every time you discover something new, some new meanings of life. " The State Art Museum of Altai Krai hosted 4 personal exhibitions of the artist, the last exhibition, which was opened in May 2008 under the symbolic title "Live and Remember".

The next exhibition in memory of "Vladimir Ramensky. Painter. Philosopher. Teacher" was held from October 20 to November 20, 2017 at the All-Russian Memorial Museum-Reserve of V. M. Shukshin in the village of Srostki, Altai Krai. The exposition of the exhibition includes works by the master from the collection of the museum-reserve: illustrations and drop caps for the collection of stories by V.M. Shukshin "Autumn" (1975), illustrations for the collection of stories by V.M. Shukshin "Distant winter evenings" (1977), illustrations for Altai fairy tales (1991-1996), drawing "By the lake" (1978). Illustrations for the 8-volume collected works of V.M. Shukshin 2008. In total, in the collection of the Museum-Reserve there are 38 works of V.A. Ramensky, one of the works - unique graphics - the Genealogical tree of the family of V.M. Shukshina, created by the artist in 2011, is on permanent display in the hall "World of Shukshin. Land and people". Also in the exposition of the exhibition were presented 27 works of the artist from the family collection.



The Shukshin theme for Vladimir Alexandrovich is unusually close, and he worked on it until the end of his life. The artist and writer were almost the same age, they experienced a difficult childhood and youth in the Altai villages associated with the tragic years of repression and wartime (in the 30s and 40s). V.A. Ramenskiy was not familiar with V.M. Shukshin, but communicated and corresponded with his mother M.S. Kuksina, when he worked on the first book by V.M. Shukshin "Autumn" - the first edition in the writer's homeland, published in the Altai book publishing house in 1976. Then V.A. Ramenskiy illustrated a collection of stories by V.M. Shukshin "Distant Winter Evenings" (1978), working in the Altai book publishing house. He returned to this topic again on his own initiative in 2000, creating a unique handwritten edition of one story by V.M. Shukshin with the same name. This book was published at the own expense of the artist, friends and relatives. In 2008, by order of the Office for Culture and Archives, the artist illustrated the collected works in 8 volumes, and in 2010 this collection was republished with additions in 9 volumes.

The long-term friendship of Vladimir Alexandrovich Ramenskiy with the staff of the museum V.M. Shukshina in the village of Srostki, served to create in the 80s of the 20th century an original exposition in the school building, this exposition under the leadership of Vladimir Alexandrovich Ramenskiy was brought to life by students of the Novoaltaisk Art School, this exposition served the museum until 2011. In 1990 V.A. Ramenskiy developed a sign for the V.M. Shukshin and, despite the fact that the name of this institution has changed, this sign is still used by the museum.

The next traveling exhibition in memory of Vladimir Alexandrovich Ramenskiy opened in the exhibition hall of the Institute of Architecture and Design on November 23 and continued to work until the end of the year. The opening of the artist's exhibition in the educational institution is a tribute to the pedagogical work of Vladimir Alexandrovich for many years. With the Institute of Architecture and Design AltSTU named after I.I. Polzunov, Vladimir Aleksandrovich Ramenskiy were connected by a lot, starting from the birth of the Department of Architecture and Design at the Faculty of Civil Engineering of Altai State Technical University in 1995, he went all the way of formation and development, which has already proven itself at the international level "Altai Design School". Vladimir Alexandrovich, as many art critics say, was the father of the founder of art and design education in Altai. Since 1971, teaching at the Novoaltaisk Art School, and since 1995, while working at InArchDiz as a professor until 2016, he made an invaluable contribution to the development of the highest level of this direction. For his teaching activities, V.A. Ramenskiy brought up many generations of graphic designers, designers, graphic artists, painters, thereby making an invaluable contribution to the development of the culture of the Altai Krai.



"Graphic line of life", under this name a retrospective exhibition in memory of the Honored Artist of Russia, artist of a book, graphic artist, teacher and public figure - Vladimir Alexandrovich Ramensky, opened on January 11, 2018 in the exhibition hall of the Museum "City".

The exhibition featured about 100 works, masterly performed by the master in various graphic techniques. These are illustrations of the early period, made mainly in the technique of ink, pen or gouache. The stage of mature creativity was represented by illustrations created in the most complex graphic techniques, such as etching, aquatint, cardboard engraving, zincography. The late stage of Vladimir Alexandrovich's creative work was presented in illustrative material, skillfully realized with the help of an ordinary gel pen. The exposition also includes easel works and unique graphics, full-scale drawings, travel sketches and sketches, born by the artist at various stages of creative activity.

Vladimir Ramensky entered the history of Altai art as the founder of book graphics. In this field, he worked for about sixty years. Many of his works are known to a wide audience. They can be seen not only in the exhibition halls. They have lived for decades in the hands of many generations of readers.

V. A. Ramensky's work in the field of book graphics appears as a large-scale, integral phenomenon in the culture of the Altai Krai. The master played a leading role in the development of the art of books in Altai in the 2nd half of the XX - early XXI century. The artist's book graphics have passed a long way of crystallization of the figurative system. The leading direction throughout the artist's activity in the field of books was the theme of the history and culture of Altai. The artist was attracted by the original appearance of nature and the national character of the Altai and Russian population of Krai. He perfectly mastered the entire range of graphic techniques, using the entire palette of expressive means of graphics in creating an image [1].

The next exhibition "Vladimir Ramenskiy. Teacher. Pupils. Colleagues", which took place in the memorial library. V.M. Bashunov, in the pavilion of contemporary art "Open Sky". Here, viewers could see not only the works of the master, but also his colleagues and associates in the Altai Book Publishing House and some students. The curator of this exhibition was the famous art critic L.N.Shamina, who also created the first solo exhibition for the 50th anniversary of the artist in the Altai Art Museum.

The exhibition turned out to be diverse in genres and areas of fine art, in technique of execution, in the chronological framework of the creation of their works by artists, but joyful in spirit and mood. Here one could see picturesque landscapes and drawings, portraits of V.A. Ramensky, executed in the technique of oil painting, woodcut, as well as made with graphite pencil. Illustrations for book editions coexisted with etchings, decorative compositions and unique graphics, watercolors and book installations.

All these works were united by the multifaceted and extraordinary personality of Vladimir Alexandrovich Ramensky. There is no such exhibition hall that could accommodate the works of all students and colleagues of Vladimir Alexandrovich, as he brought up and opened the way for many generations. His students became brilliant graphic artists, painters, decorators, designers, teachers, and even those who did not devote their lives to art, became just good people, as he sowed in their souls many humanistic qualities, such as love for the beauty of God's world, desire create, not destroy. Those who studied with him said that Vladimir Alexandrovich was more than a teacher for them, and the response for this was the endless gratitude and respect of many students and associates.

The exhibition featured the works of his colleagues from the Altai Book Publishing House: B.N.Lupachev, Yu. B. Kabanov, T. Ashkinadzi and L. Pastushkova.

The well-known graphic artist Yuri Borisovich Kabanov showed his early, colorful works, illustrations for the children's book "Curiosity". At the opening of the exhibition, Yuri Borisovich recalled how difficult it was, with a rather undeveloped printing technology of the Soviet period, for book artists who made illustrations for various publications. In addition to creating images, I still had to think over technological moments so that the work was not spoiled by not matching the colors on a one-color printing machine. Yuri Borisovich said: "The Altai book publishing house was very popular, but in order for this to happen, an art editor is needed. Ramensky was the artistic rector. By profession, I had nothing to do with books, all I did was drawing pictures, did some illustrations and that's it, but it's so serious that a book is a work, somehow I didn't think about it ... And when, when meeting with Ramensky we began to argue, and he says: "You see, there is a publishing house in Altai, and if it exists, then it must be recognized throughout the Soviet Union, there must be a certain person, there must be a style, there must be special qualities in the design of books when you just take a book and immediately understand that it was published in Altai." But, this is a very serious task! And Ramensky decided this case, we got together, talked, someone was indignant, someone helped, then, after all, he explained what it is - the art of a book. V.A.Ramensky, the only one who at that time had a professional education as a book artist, passed on to his colleagues the knowledge and experience that he gained at the school of V.A.Favorsky and, thank God, when Ramensky left the work of an art editor, Boris Nikitich took his place Lupachev, who also graduated from the Polygraphic Institute, continued this all. Vladimir Alexandrovich, created a whole school, this idea of the exhibition is simply brilliant, it corresponds to what he did, how and what he did, he created, in any case, a miracle - they began to recognize us! We began to participate in republican and international exhibitions, where we were even given medals for the Altai publishing house. Many thanks

to him and eternal memory to him! He is worth thinking about publishing a good book about his work and his life."

The next exhibition "The Artist and the Book" in memory of Vladimir Alexandrovich was held in the exhibition hall of the Altai Krai of the universal scientific library named after V. Ya. Shishkova. The exposition consisted of illustrations, title pages and short titles, bindings, endings and headpieces created by the artist for the works of Altai writers. The exhibition was able to be visited by a large number of the public, so it coincided with such an event as a biblio-night. Visitors were able to get acquainted with the books designed by the master and the works of the artist, such as: Binding, drop caps, short titles to the work of Georgy Yegorov "You are solona, earth". Gouache, paper, ink, pen. 1970; Drop caps, short titles to the works of Ivan Kudinov - "Outskirts", "Element". Ink, pen on paper. 1968; Binding of the work "Favorites" by Viktor Sidorov. Ink, pen, gouache on paper. 1987; Title, short titles of V. Sidorov's work "Favorites". Ink, pen on paper. 1987; "Poems" by Arzhan Adarov (illustration, ending, decoration). Ink, pen on paper. 1985; Illustrations to the work of V.M. Shukshin "Distant winter evenings". Engraving on cardboard. 1972; Illustration for the 8-volume collected works of Vasily Makarovich Shukshin. Gel pen on paper. 2009, Title page, illustrations for the work of Victor Keene "On the other side". Ink, pen on paper. 1968; Swinging title of the splash screen of the work "Friends expected and unexpected" by Nikolai Dvortsov. Ink, pen on paper. 1975; Illustration, ending and intro to the work of Leonid Merzlikin. Ink, pen on paper. 1987; Illustration for the work of Lev Vaganov "The Tale of the Taiga Shoemaker". Gouache on paper. 1965; Frontispiece and headpiece to the work "Pines illuminated by the sun" by Ivan Kudinov. Ink, pen on paper. 1969; Binding to the work of Georgy Yegorov "You are salty, earth". Gouache, paper, ink, pen. 1970; Illustration for the work of V. Ya. Shishkov "Taiga". Gouache, paper, ink, pen. 1969 and many others.

Vladimir Alexandrovich Ramenskiy was very friendly with the writers of Altai. As he said, with each of them, they began to dream of what kind of edition there would be when the book was "in the inkwell". With what love and respect the writers of the Altai organization treated the artist, you can judge by the congratulatory address they composed for his 50th anniversary:

Художник. Бородатый книгочей.  
 Души наставник. Воспитатель чувства...  
 Что толку в громком пафосе речей,  
 Когда Ты сам творец того искусства,

Которому бессмертье суждено,  
 поскольку всем от мала, до велика,  
 служила в мир, распахнутым окном,  
 художником оформленная книга.

А в мире том нет заданных вершин.  
И сколько б Ты не сделал сердцу мало.  
Вот почему «Букварь» и наш Шукшин,  
Твои победы и твои начала...

С годами все ответственнее груз,  
Труднее ноша, волос серебристей,  
Но все прочней и крепче наш союз,  
Союз пера и вдохновенной кисти!

*Altai writers.*

In the exhibition hall of the Altai Krai Universal Scientific Library. V. Ya. Shishkov's exhibition lasted until his next birthday on July 28, 2018. Thus, the cycle of exhibitions in memory of V.A. Ramensky, in the iconic places of the artist, lasted exactly a year, giving the opportunity to meet his friends, admirers of his work, students and remember the past, as well as to introduce and acquaint the younger generation with the artist's works.

Having worked for over a year, the series of exhibitions in memory of the artist, teacher, public figure has come to a logical conclusion. The works of Vladimir Alexandrovich Ramensky from the family collection returned to their monastery - to the artist's memorial workshop, which he created at the station Ozerki, Talmensky district, Altai Krai.

In 1989, Vladimir Aleksandrovich Ramenskiy began construction of his workshop at the station Ozerki, Talmenskiy district, Altai Krai in memory of his parents: Ramenskiy Alexander Evlampievich (1898-1938) and Ramenskaya (Vysotina) Evgenia Alekseevna (1897-1957), who had a difficult fate. Much time passed, and the artist wanted to return to his origins. Childhood friend Dmitry Starodubtsev suggested where to choose a place for a workshop. And this place was on the edge of the village, practically in the forest ... and there was a dump of household waste. For many more years, the artist and his family cleared the land of debris, and then the construction of the workshop began. Even during the construction process, it was a place of attraction. Many people from everywhere came to the artist in this blissful place. It so happened that the idea of opening the Department of Architecture and Design and the Altai branch of the "Union of Designers of Russia" originated there, in Ozerki. Vladimir Aleksandrovich was visited by his friend from Moscow - Nazarov Yuri Vladimirovich - the president of the All-Russian public organization "Union of Designers of Russia", so in 1995, by the fire and with a guitar, they decided to create the first in Altai Krai design direction of the highest level and the Altai organization "Union of Designers Russia", which Vladimir Aleksandrovich headed.

Often the students of the NSCS came to the artist's estate for the open air. Vladimir Alexandrovich studied there with the village children, taught them to write and draw, and told them what composition is. Many of them were able to enter and continued their studies both at the Novoaltaisk Art School and at the Institute of Architecture and Design of the Altai State Technical University. And, of course, the artist himself worked a lot there. He managed to create many wonderful works there, such as: V. M. Shukshin's handwritten book "Distant winter evenings", Altai primer "Tanyktos", easel compositions "Remembrance of the Pazyryks", "There was a war", illustrations for the 8-volume collection works of V. M. Shukshin, illustrations for the 2-volume collected works of V. S. Zolotukhin, illustrations for the book by A. D. Sergeev "Ivan Polzunov - Russian Inventor", watercolor triptych "Sunflowers. Infinity of Life" and many other works related to the late period of the artist's work. The artist painted until the last days. The last book he worked on was Boris Ukachin's story "It's still a long way to death", and it remained unfinished.

After the death of Vladimir Alexandrovich, the heirs decided to preserve everything that he had created and to establish a memorial workshop and the estate of V.A.Ramensky there. Everything remained there, as it was during the life of the artist, everything lives with him.

The studio contains an etching machine, numerous tools of the artist, his archive, consisting of letters and notes, a huge library, which contains very ancient books. And, of course, his etchings, watercolors, drawings, unique graphics, 220 works in total, the collection is varied both in chronology - starting from the 60s of the 20th century, ending with works in 2016 and subject matter, and in the technique of execution. Also, there is a large collection of 20th century graphics (more than 160 prints made in various graphic techniques), donated by friends of the artists, with whom they worked together at the creative dacha "Chelyuskinskaya" in the Moscow region.

The creative heritage of Vladimir Alexandrovich Ramensky, like many other remarkable masters of Altai art, should not sink into oblivion. The work of V.A.Ramensky in various aspects, his activity as a book artist, art editor, public figure has been little researched and can become a fruitful topic for further journalistic and scientific works.

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音乐中的传记，神话，传记

## THE HAGIOGRAPHY, MYTH, BIOGRAPHY IN THE MUSIC

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抽象。这篇文章分析了音乐家的生活发展，从全息术到科学传记。在第一个千年中，固定了希腊催眠术师的生活模式。与其他圣徒的传记相比，他们具有创造力特征。对作品的描述，指出与其他歌曲作者的关系，并强调依赖圣父作品的时刻。像在任何生活中一样，没有负面的人格特质和对作品的批判性分析。

直到十八世纪，俄罗斯精神作曲家的传记中都清楚地感受到了这些时刻，其中一部分在后来的传记中得以体现。

结论是，为了使这种航海神话成为真正的科学传记，有必要修改整个研究方法：除了选择确定预定模型的事件之外，还应该仔细寻找真正的传记，包括最“不便”的事实；拒绝传记中的传说，无论它们看起来多么美丽；搜索，彻底的比较研究和手稿的科学归因；不仅从教条和规范教会方面对作品进行分析，而且从音乐艺术本身（风格，流派，形式等）的角度进行分析。结果应该是创造一个客观的创作和生活轨迹图，对俄罗斯精神作曲家的音乐遗产进行深入的音乐理论和音乐历史研究。

关键字：传记，传记，英雄神话，科学传记，创造力的音乐历史分析。

**Abstract.** *The article analyzes the development of the life of musicians from hagiography to scientific biography. In the first millennium, the model of the life of the Greek hymnographers was fixed. In comparison with the hagiographies of other saints, there is a characteristic of creative traits; a description of the creations, indicating the relationship with other songwriters and highlighting the moments of reliance on the creations of the holy fathers. As in any living, there are no negative personality traits and critical analysis of the compositions.*

*These moments are clearly felt in the biographies of Russian spiritual composers up to the XVIII century, partly passing into biographies created in a later period.*

*It is concluded that in order for this kind of hagiographic myth to become a truly scientific biography, it is necessary to revise the entire research methodology: instead of selecting events that confirm a predetermined model, there should be*

*a careful search for genuine, including the most "inconvenient" facts; rejection of legends in biographies, no matter how beautiful they seem; search, thorough comparative study and scientific attribution of manuscripts; analysis of works not only from the dogmatic and canonical-church sides, but also from the point of view of the musical art itself (style, genre, form, etc.). The result should be the creation of an objective picture of the creative and life path, an in-depth musical-theoretical and musical-historical study of the musical heritage of Russian spiritual composers.*

**Keywords:** *hagiography, biography, mythologization of the hero, scientific biography, musical-historical analysis of creativity.*

My report is devoted to the history of biographical science - the traditions of hagiography and their implementation in biographies of a later time.

In the first millennium, the model of the life of the Greek hymnographers was fixed. The model included the following mandatory points.

1. Preface, which sets out the most important doctrinal provisions in relation to the hero of the story, for example, sets forth the dogmas of the Orthodox faith about the sufferings of Christ on the cross and His Resurrection;

2. The main story, which reveals a number of biographical features that emphasize the holiness of the ascetic:

- The origin of the saint is indicated from a pious and noble family (like, for example, St. Andrew of Crete) or, on the contrary, from a non-Christian environment (St. Roman the Slavic Songwriter);

- Special attention is paid to education - either brilliant, befitting a high position (St. Cosmas of Maium, St. John Damascene, St. Theodore the Studite), or, less often, the lack of serious education, which corresponds to the canon of holy "simpletons" (a vivid example is the hagiography Venerable Roman the Sweet Singer);

- The moment of choosing a life path (in faith and in ministry) is clearly distinguished, very often associated with serious difficulties (a classic example is the hagiography of St. John Damascene, who left the world after persecution and a miracle with the healing of his hand);

- The presence of the actual talent is very briefly noted, which is unambiguously interpreted as the calling of God. Undoubtedly, it included bright manifestations of musical abilities as one of the necessary conditions: for example, a beautiful voice (like in St. John Kukuzel), the gift of speech and tenderness of singing (like in St. Roman the Sweet Singer), and so on. However, all the musical data itself was considered not the main one, and their presence, even to a high degree, was not a measure of holy service. Talent as a gift from God, first of all, meant the ability to pray, to virtue, a zealous striving for the angelic dispensation of the soul made it possible to use the musical talents themselves in the right direction, and



sometimes made up for the lack of abilities. Miracle in the hagiography of St. Roman the Sweet Songwriter can serve as the best confirmation of this. Most of all, the emphasis is on the miraculous help of the Lord, the Mother of God or the saints - examples can be found in almost every hagiography, each of the episodes serves as a confirmation of God's chosen saint;

- There are very few biographical details in the hagiographies. This is due to several circumstances: first, the overwhelming majority of Greek hymnographers were monks and their life was concentrated within the walls of the monastery<sup>1</sup> and often poor in external events; secondly, there are very few documentary confirmations - entries in monastic books, eyewitness accounts; thirdly, from external circumstances, only those episodes were selected that confirmed the general concept of holiness: meetings with saints, pilgrimage trips, defense of the ideas of Orthodoxy, etc.

- The main focus is on the moral qualities of the songwriters. This is no coincidence. The bar of requirements for someone who would like to join the angelic choir was unusually high. According to the words of St. John Chrysostom, "a chaste soul, a vigorous mind, a broken heart, a firm thought, a clear conscience are required"<sup>2</sup>. Therefore, in the Hagiographies, it was often mentioned about prayer, zeal in the performance of obedience, humility, patience and other Christian virtues. These references were seen as evidence and arguments in the canonical veneration of saints.

- A righteous, peaceful, or martyr's death is necessarily marked, although accurate, documented data on the date of death may not be available;

3. In comparison with the hagiographies of other saints (martyrs, reverends, saints), the hagiographic monuments contain additional elements:

- Briefly or in detail, the chants and prayers created by the saints are listed, their general overview is given, indicating the liturgical books in which they are contained and the liturgical calendar to which they are dated. I will make a reservation that not all songwriters were simultaneously melods, that is, they simultaneously created a unique melody to the created song text. In many cases, the main thing was the text, it was supposed to be performed on the basis of traditional vowel patterns. The creation of new norms of singing is especially noted in the hagiographies of Ambrose of Mediolansky and John Damascene, Roman the Sweet Songwriter and John Kukuzel.

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<sup>1</sup>There is also a sufficient, albeit significantly smaller, in comparison with the monastic monks, number of hymnists-saints: bishops, metropolitans, patriarchs. Their singing works are always associated with concern for the beautification of the Church.

<sup>2</sup>Creations of John Chrysostom "Conversation on the 44th psalm in the book: John Chrysostom. Complete collection of works of St. John Chrysostom in 12 V. V.5, book 1. – M.: Parish of the temple of the Holy Spirit of the descent, 2006. – 704 P.

• A generalized description of creations and a brief description of the style features are provided. At the same time, the emphasis is on reliance on canonical norms, patristic traditions, rootedness in the monastic way of life, obedience to the statutes, relationship with the creations of canonized predecessors. The authorship problem deserves special comment here. His name did not always appear, it was encoded in an acrostic (as in the kontakion of Roman the Sweet Singer) or in an inscription (the creation of so-and-so). Therefore, both in the hagiographies and in scientific research, the number of creations is very different. For example, in various versions of the life and biographies of St. Roman Sladkopevets is named by the author in some cases 500, in others - 1000 kontakion and ikos. And Saint John of Damascus, who is considered the compiler of the Sunday Octoichus and the Typicon of Llavra, St. Sava the Sanctified, one of the creators of the canon genre, a reformer of liturgical poetry and music, is credited<sup>3</sup> with 531 irmos, 75 canons of the Menaion, 15 canons of Octoichus, 454 self-consonant stichera, 138 stichera like, 13 funeral stichera and 181 "eastern" stichera. However, the question of its authorship in scientific use to this day remains largely open. In addition, many chants existed in several versions, each of which was self-worth and equal to the rest. Many chants were not recorded at all, and were transmitted in very rough sketches, far from the final recording. This makes the process of scientific description very difficult.

• In view of the fact that the musical component was practically not recorded enough, attention in the description of the creations is paid mainly to the literary structure of chants: versification techniques, the type of foot and rhyme, the presence of an acrostic, a responsive, hypophonic or antiphonic way of performing.

As in any hagiography, there are no negative personality traits and a critical analysis of the compositions in the lives of songwriters.

This model has proven to be unusually viable. The moments listed in the hagiographies are not only preserved in the Russian versions of the hagiographies of the Greek saints, but are also clearly felt. They "shine through" in the biographies of Russian singers and, later, in biographical descriptions of spiritual composers up to the 18th century, partly passing into biographies created in a later period.

This is largely due to the fact that the hagiographies of Greek hymnographers in Russian culture were repeatedly set forth in sermons and the Four Menaion, and entered the life of Orthodox Christians as an important fund of knowledge. Gradually, by the beginning of the XVIII century, the necessity of re-exposing the hagiographies was realized, which was carried out in the multivolume collection of Hagiographies for every day of the year of St. Demetrius of Rostov, the creation of which can be regarded as a Christian and scientific feat.

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<sup>3</sup>According to a study published in 1931-1933 by Metropolitan Sophronius (Eustratiadis)

In the XVII-XVIII centuries, the biographies of Russian chantsters were still extremely poor and scarce, which is primarily due to the extreme scarcity of sources. Basically, these were lines in hagiographies and prefaces to newly composed services, less often biographies themselves, which contained brief information about the authors. In these cases, the existing facts were reduced either to an indication of family ties with other singers, or emphasized belonging to a particular school - Solovetsky, Pskov, Usolskaya. Documentary sources are also dry reports from monastic or Patriarch's expense books, which indicate an increase in salary, feed, grain, clothing, etc.

At the same time, in many even brief descriptions, continuity with the hagiographic canon is clearly traced. The moral component is still considered a necessary condition for the creation of church chants. It is emphasized that purity, holiness of behavior and thoughts are mandatory for writing an icon or chanting and performing a liturgical text. Often in the manuscripts there is a preface dedicated to prayerfully asking for God's blessing.

For a long time, the creations of the singers of Ancient Rus also appeared as anonymous, without designation of the author, as a humble offering to the Lord, the Mother of God and the saints. Representatives of this branch of spiritual culture, as before, designated, first of all, the liturgical primary source and the method of its reproduction. The following parameters were reflected: the type of chant ("demestvo", "big chant"), local tradition ("Chudovskaya", "Solovetskaya", "patriarch's clerks"), the historical stage of development ("early", "late"), holiday or the name of the rite of the Holy ("Dormition of the Most Holy Theotokos"), the date of the holiday, when the changeable chant is performed, the voice and the like.

The singer's name appeared not as a sign of authorship, but rather as a symbol of spiritual and church responsibility. The leading place was still assigned not to the talent of the master himself, but to God's grace. Only at the end of the XVI-XVII centuries, and not in every case the manuscripts contained a specific indication of authorship (there were notes of "the fasting man Ageev", "the Solovetsky elder Nikodim").

It should be noted that, in contrast to the Byzantine singers, the Old Russian singers predominantly created tunes for already existing canonical texts. The cases of the appearance of actually new prayers and, at the same time, tunes to them, are unique. Thus, Abbot Markelle Bezborody created not only many amazing chants to well-known liturgical texts, but also new integral hymnographic sequences - services to Nikita Novgorodsky, Nikita Pereyaslavsky, Joasaph of India, Makariy Kalyazinsky and Savva Storozhevsky.

Many chants existed in several versions, lists, each of which was self-valuable and equal to the rest. At the same time, not only did there not exist any final ver-

sion, but the singers themselves were sympathetic to the further metamorphoses of their chants.

Changes are also taking place in the approach to describing creations. Already contemporaries noted the skillfulness, skill of the singers - for example, it is mentioned as Isaiah (Ivan) Lukoshko could sing a text line with 17 "rozvods".

It is striking that a number of features of the hagiographic canon retained their significance in the biographies of a number of Russian spiritual composers, in particular in the second half of the XVIII century. Let us name, for example, the obligatory narration about an early vocation and successful church choir singing from childhood. This motive runs through the lives of most chantsters and spiritual composers, sometimes acquiring a distinctly legendary character.

The absence of negative personality traits in biographies also draws attention to itself. They are either kept silent about them, or there are justifiable reasons for controversial actions. On the contrary, high moral virtues, as well as churchliness, canonicity of chants are emphasized in every possible way.

The very close hagiographies, a panegyric assessment of the voice and sacred compositions, has become very common. The wonderful duskant of the young Bortnyansky, the angelic tenor of Artemy Vedel, the heavenly alto of the eight-year-old Pyotr Turchaninov - the list goes on.

The clear similarity with the hagiographies of Christ for the sake of the holy fools in the life of Artemy Vedel deserves a special talk. Contemporaries (first of all, his beloved disciple, Archpriest Peter Turchaninov) noted the unusually high spiritual qualities of the composer - a tendency to solitude, prayer, closeness to life of monastic rules, at the same time, complete disregard of everyday concerns, outward inconsistency of behavior with strangers, with complete clarity of reason with a few close ones, and, as a result, the rejection of the generally accepted canons of behavior, which led to his stay in the last years of his life in restraining homes for disabled.

In the XX century, the study of the life path and heritage of songwriters reached a new level. Obviously, there is a desire to transform hagiographic narrative into a genre of scientific research. Works on the **Greek** hymnographers A.P. Golubtsov, Archimandrite Cyprian (Kern), Archbishop Philaret (Gumilevsky), P. Petros, S.S. Averintsev, nuns Ignatia, and others clearly show the direction of these processes.

The emphasis is on the study of the hymnographic creativity of songwriters. Possible scientific attribution of chants and texts, comparison and analysis of their various lists. The relationship with the chants of predecessors, the works of contemporaries is explored. Thanks to the efforts of scientists, it becomes possible to compare, for example, two or three copies of one canon of the nun Cassia, a comparison of the canons of Joseph the Songwriter and Cosmas of Maium.

The literary style is analyzed in more detail and much more closely: the features of versification, features of verbal symbolism, the subtleties of working with the acrostic, specific phonetic, grammatical and syntactic techniques are highlighted.

Particular attention is paid to the dogmatic side of the creations: the subtle details of the disclosure of the dogmas about the Trinity, the incarnation of the Son of God, etc. are revealed in comparison with the interpretations of the holy fathers and other hymnographers. As a result, a kind of creative and spiritual genealogy of the singers is revealed.

At the same time, due to the poor availability of documents and the already mentioned parsimony of the event side of the life of the hymnographers, the biographical elements of the narrative associated with the facts and etc. change little.

The processes of the development of the hagiographic canon in the studies of the **Russian** hymnography of Bishop Benjamin (Maslov), M.F. Muryanov, Archbishop Filaret (Gumilevsky), nun Ignatia, F.Spasky are very similar.

In the analysis of texts, dogmatic and philological observations also take the main place, which make it possible to fit the work of Russian singers into the world Orthodox canonical hymnographic context.

Some new scanty biographic details are being clarified - mainly they relate to the date of taking the priesthood, transfer to a new position in a monastery, moving to another monastery and another city, as well as about rewarding, changing salaries, about monetary, book and sacrificial donations made to various churches and monasteries.

In modern **medieval** studies (I will especially highlight the works of Svetl. Georg. Zvereva, Nik. Pavlov. And Nat. Vladim. Parfentiev, Albina Nikandr. Kruchinina, Galina Andr. Pozhidaeva), attention is paid to the decoding of manuscripts, their attribution, archaeographic description, dating specification and comparative analysis different lists. It is the comparison of various manuscripts that makes it possible to clarify authorship, dating, and also, according to certain stylistic features, strengthen the evidence base for attribution. Banners and markings, fit writing are analyzed in detail, and their belonging to a certain type of chant and one or another monastic tradition is revealed.

A discussion about the artistic and historical value of the creations becomes possible - for example, Theodosius Spassky and Archimandrite Cypryan Kern expressed completely opposite value judgments about the activities of Markell Bezborodov. The analysis of the applied innovations and their assessment from the point of view of the ongoing musical and historical processes, etc. References to the holy fathers and theological discourses almost disappear. Priority is given to the decoding of specific monuments, their archaeographic description and analysis from medievalist positions. Thus, the biography acquires evidence, scientific solidity and depth.

Thus, we can conclude that the hagiographic canon, formed in the first millennium and inherited by Russian spiritual art, became one of the important cultural constants and had a significant impact on the process of studying the spiritual heritage of both Greek and Russian hymnographers. It was this model that in a number of moments became the prototype of scientific biography, the seed from which the richest heritage of many generations of Russian scientists - historians, philologists, musicologists - grew.

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