



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
International Conference**

**Date:
May 7**

Beijing, China 2025

上合组织国家的科学研究：协同和一体化 国际会议

参与者的英文报告

International Conference “Scientific research of the SCO countries: synergy and integration”

Part 1

2025年5月7日，中国北京
May 7, 2025. Beijing, PRC

Proceedings of the International Conference
**“Scientific research of the SCO countries: synergy
and integration”** - Reports in English

(May 7, 2025. Beijing, PRC)

DOI 10.34660/conf.2025.87.42.049

这些会议文结合了会议的材料 – 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。

作者对所引用的出版物，事实，数字，引用，统计数据，专有名称和其他信息的准确性负责

These Conference Proceedings combine materials of the conference – research papers and thesis reports of scientific workers. They examine technical, juridical and sociological aspects of research issues. Some articles deal with theoretical and methodological approaches and principles of research questions of personality professionalization.

Authors are responsible for the accuracy of cited publications, facts, figures, quotations, statistics, proper names and other information.

CONTENTS

ECONOMIC SCIENCES

俄罗斯联邦边境地区

Border regions of the Russian Federation

Kazantsev Sergey Vladimirovich.....9

工业旅游：工业遗产的新视角及其对区域发展的影响

Industrial tourism: a new look at industrial heritage and its impact on regional development

Trofimova N.V......17

设计思维是优化酒店客户体验的一个因素

Design thinking as a factor in optimizing customer experience in hospitality

Degtyareva Yana Vladimirovna, Germanchuk Alla Nikolaevna.....23

经济社会化：一种概念方法

The socialization of the economy: a conceptual approach

Kotov Yevgeny Valeryevich29

人口职业化是国家经济政策社会化的一个要素

Professionalization of the population as an element of socialization of state economic policy

Rozhniatovskaia Anastasiia Andreevna35

使用监控工具构建和管理声誉和形象风险的机制

Mechanism for structuring and managing reputation and image risks using monitoring tools

Mundzhishvili Irina Igorevna.....41

JURIDICAL SCIENCES

非法开采水生生物资源犯罪案件侦查情况

Situations of criminal investigation in cases of crimes related to illegal extraction of aquatic biological resources

Voronin Sergey Eduardovich.....47

俄罗斯合伙融资制度的演变

On the evolution of the institution of partnership financing in Russia

Vildanova Marina Mikhailovna58

POLITICAL SCIENCES

教育与现代世界的新一代——全球和区域趋势：政治学家的观点

Education and the new generation in the modern world - global and regional trends: a political scientist's view

Proskurina Elena Aleksandrovna.....65

PEDAGOGICAL SCIENCES

语用语言教学法基础

Foundational tamouls of pragmalinguodidactics

Sadirova Dinara Sadikovna, Isyanov Ravil Gennadiyevich.....70

PHILOSOPHICAL SCIENCES

美学和哲学传统中的美与真

Beauty and truth in the aesthetic and philosophical tradition

Borsiakov Yuri Ivanovich, Proskurina Lyudmila Konstantinovna.....79

HISTORICAL SCIENCES

西安青龙寺樱花：文化符号的跨国演变

Cherry blossoms at Qinglong temple in Xi'an: cross border evolution of cultural symbols

Xiang Yiyuan.....85

PSYCHOLOGICAL SCIENCES

青少年对婚姻适应的性别认知

Gender perceptions of youth about adaptation in marriage

Nabiev Timur Erikovich, Gafarova Irina Gennadiyevna, Agzamova Malika Muratovna.....89

最容易造成童年创伤的性格

The most traumatic childhood personalities

Efanova Ksenia Yuryevna.....95

ART HISTORY

合唱表演的音乐象征意义《约翰受难曲》J. S. 巴赫

Musical symbolism of choir performances "St. John Passion" J. S. Bach

Makeeva Zhanna Robertovna.....99

BIOLOGICAL SCIENCES

学生感知噪声听觉和视觉信息时脑血循环的生理特征

Physiological features of brain blood circulation of students during perception of noisy auditory and visual information

Klykov Anton Vladimirovich.....105

MEDICAL SCIENCES

人工通气对3.1~7岁急性脑衰竭患儿心肌需氧量昼夜节律的影响

The effect of artificial ventilation on the circadian rhythm of myocardial oxygen demand in acute cerebral failure in children aged 3.1-7 years

Muhitdinova Hura Nuritdinovna, Mirzayeva Adiba Damirovna, Manapova Nodira Halilovna 114

人工通气对3.1~7岁儿童急性脑供血不足自主神经调节昼夜节律的影响

The influence of artificial ventilation on the circadian rhythm of autonomic regulation in acute cerebral insufficiency in children aged 3.1-7 years

Muhitdinova Hura Nuritdinovna, Babajanova Zumrat Omarovna, Alauatdinova Gulhan Inyatdinovna 123

咖啡因对学生体能表现的影响

Effect of caffeine on physical performance of students

Ananiev Vladimir Nikolaevich, Prokopyev Nikolai Yakovlevich, Ananiev Georgy Vladimirovich, Ananieva Olga Vasilievna, Pashkina Irina Valerievna, Gurtovoy Elisey Sergeevich 132

胶原海绵与同种异体成纤维细胞对缺血性皮肤缺损修复形态结构的影响

Morphological structural components of regenerating ischemic skin defect under the influence of collagen sponge with allofibroblasts

Baranovskiy Yuriy Gennadievich, Shapovalova Yelena Yurievna, Kutuzova Liliana Alexeevna, Baranovskiy Alexey Gennadievich 139

传染病流行病学的某些领域

Certain areas of epidemiology of infectious diseases

Smetanin Viktor Nikolaevich, Smetanina Galina Petrovna 145

心源性休克后慢性心力衰竭患者成功撤离儿茶酚胺的预测因素

Predictors of successful weaning from catecholamines in patients with chronic heart failure after cardiogenic shock

Zhimspaev Damir Mukhambetovich, Murzabaev Ramzil Yunirovich, Minochkin Pavel Ivanovich 153

面部按摩对皮肤干燥脱皮患者皮肤屏障功能恢复的影响研究

Study of the impact of facial massage on the restoration of skin barrier function in patients with dryness and flaking

Katshani Nina Vladimirovna 158

CHEMICAL SCIENCES

金属合金电极电解熔盐过程中的质量传递

Mass transfer during electrolysis of molten salts with electrodes made of metal alloys

Mikhalev Yuri Glebovich 162

TECHNICAL SCIENCES

圆顶抗震结构设计方法

Methodology for designing dome-shaped, earthquake-resistant structures

Ivanova Anastasia Petrovna, Vasilyeva Marina Anatolyevna,

Mezhueva Larisa Vladimirovna, Piskareva Tatiana Ivanovna171

建筑工程系统中智能窗的信息处理

Processing information on smart windows in engineering systems of buildings

Gunko Nikita Maksimovich, Ivanova Anastasia Petrovna,

Deligirova Victoria Viktorovna, Rakhimova Natalia Nikolaevna179

PHYSICAL AND MATHEMATICAL SCIENCES

用该方法创建和生产“溶胶-凝胶”复合材料

Creation and production of a composite substance "sol-gel" by the method

Atambekova Aigerim Kenjebekovna186

AGRICULTURAL SCIENCES

春软小麦新育种材料Milturum和Ferrugineum的产量与品质

Productivity and grain quality of new breeding material of spring soft wheat varieties Milturum and Ferrugineum

Stepanova Natalia Alexandrovna, Sidorenko Vladimir Sergeevich,

Yandubaykin Evgeniy Evgenievich.....192

中部黑土地地区集约化有机农业大豆植株有效植被管理技术

Effective techniques for managing the vegetation of soybean plants for intensive and organic farming in the Central Black Earth region

Semenov Alexey Sergeevich, Stepanova Natalia Alexandrovna,

Starikova Zhanna Viktorovna.....197

DOI 10.34660/INF.2025.64.21.027

俄罗斯联邦边境地区
BORDER REGIONS OF THE RUSSIAN FEDERATION^{1*}

Kazantsev Sergey Vladimirovich

Doctor of Economics, Chief Researcher

Institute of Economics and Industrial Engineering,

Siberian Branch of the Russian Academy of Sciences,

Novosibirsk, Russia

ORCID ID: 0000-0003-4777-8840

注释：自2014年以来，俄罗斯联邦的社会和经济发展一直处于多方面制裁不断加强以及敌对国家试图在国际上孤立俄罗斯的背景下。为了在这种环境下以及任何其他内外条件下实现长期成功发展，分析俄罗斯联邦的外部环境至关重要。本文作者试图评估俄罗斯与外国接壤行政区划实体的经济发展。

关键词：俄罗斯联邦；发展；经济活动；行政区划实体；边境地区。

Annotation. *Since 2014, the society and economy of the Russian Federation have been developing in a context of dynamically tightening multifaceted sanctions and the attempts of states hostile to the Russian Federation to isolate Russia internationally. For long-term successful development in such an environment, as well as in any other external and internal conditions, it is essential to analyze the external context of the Russian Federation. The author t author tried to assess the economic development of the Russia's administrative-territorial entities bordering on foreign States in this paper.*

Keywords: *The Russian Federation; development; economic activities; administrative-territorial entities; border regions.*

In his speech at the plenary session of the St. Petersburg International Economic Forum on June 17, 2022, V.V. Putin warned: “We will face many challenges, risks, and factors that are difficult to predict and anticipate today².”

Modern Russia shares borders with 18 countries. The study, the results of which are presented in this work, had two objectives: to assess the importance of

^{1*} The paper was prepared according to the research plan of the IEIE SB RAS for 2025, the project “Methods and models for substantiating the strategy for the development of the Russian economy in a changing macroeconomic reality”. Project No. 5.6.6.4. (0260–2021–0008).

² URL: <http://kremlin.ru/events/president/news/68669>

groups of border regions of the Russian Federation for the economy of the Russian Federation and to show the dynamics of selected indicators of significance (importance) in 1998–2022. In 2024, there were 44 border regions of the Russian Federation out of 89. Since the study covers the period from 1998 to 2022, the Donetsk People's Republic (DPR), Luhansk People's Republic (LPR), Zaporizhzhia, and Kherson regions are excluded, and the Voronezh and Rostov regions are added. Due to the lack of statistical data, the Republic of Crimea and the city of Sevastopol, as well as Samara region, are not considered because of the small length of the state border (70 km with the Republic of Kazakhstan). As a result, the sample of border regions includes 39 subjects. The data from the Federal State Statistics Service of Russia (Rosstat) were used as sources of information.

Six of the 39 regions of the Russian Federation are classified as regions with low socio-economic development (there are 10 such regions in total³), 39 are included in the list of 44 geostrategic⁴ regions, and 3 are part of the 28 territories with advanced socio-economic development⁵. Border regions are present in all military districts⁶ of the Russian Federation.

The main security threats in the border areas of the Russian Federation are outlined in the Foundations of the State Border Policy of the Russian Federation:

“a) Territorial claims of some neighboring countries and the possibility of conflicts and incidents on the state border associated with them;

b) Claims by foreign states and transnational corporations to strategic resources of the Arctic and the Far East;

c) Increased economic and demographic influence of foreign states on certain border areas with low levels of socio-economic development;

d) Intelligence and other activities of foreign special services and organizations aimed at destabilizing the socio-political situation in certain border areas due to unresolved socio-economic problems, religious and ethnic contradictions, and separatist manifestations among the population in these areas;

e) Attempts to infiltrate Russian territory by members of international terrorist and extremist organizations, participants in illegal armed groups, as well as individuals who are banned from entering the Russian Federation;

f) Cross-border crime related to illegal migration, smuggling of weapons, ammunition, explosives, and toxic substances, narcotics, psychotropic substances and their precursors, material and cultural valuables, as well as illegal extraction and sale of aquatic biological resources;

³ URL: https://www.economy.gov.ru/material/news/pravitelstvo_utverdilo_finansirovanie_dlya_realizatsii_individualnyh_programm_razvitiya_regionov_s_nizkim_urovнем_socialno_ekonomicheskogo_razvitiya.html

⁴ URL: <https://docs.cntd.ru/document/552378463>

⁵ URL: <http://government.ru/docs/all/142378/>

⁶ URL: <http://www.kremlin.ru/acts/bank/50360>

g) The risk of natural disasters, technological catastrophes, epidemics, epizootics, and their potential cross-border spread in border areas of the Russian Federation and certain neighboring countries⁷”.

We will assess the significance of the selected border regions for the economy of Russia based on 11 macroeconomic indicators. These include indicators characterizing productive forces (annual average number of population, thou. persons (Pop), average annual number of employed in the economy, thousand people (U), fixed assets in economy, end of year, mln. roubles (F)), overall development level (Gross Regional Product, bln. roubles (X)), scientific potential (research and development personnel, thou. persons (R)), infrastructure (operational length of paved routes of federal, regional or inter-municipal and local significance, km (Cr), operational length of public railway tracks, km (Rr)), purchasing power demand (M), exports (Ex), imports (Im), and others.

From 1998 to 2022, the share of the studied economic indicators of the selected border regions of the Russian Federation ranged from 18% to 48% of the total volume (*Table 1*), indicating their importance for the domestic economy. However, for 9 out of the 11 macroeconomic indicators, the share in 2022 was lower than in 2013.

From 1998 to 2022, the highest shares were recorded for the length of public roads (Cr) and railways (Rr), the population (L) and the number of employed people (U), and the monetary income of the population (M).

Table 1.

The ratio of the indicators' values of the border regions of Russia to the indicators' values of the Russian Federation in 1998, 2013 and 2022, percent

Year	L	U	R	X	I	F	Cr	Rr	Ex	Im	M
1998	42.6	37.5	17.9	23.2	27.7	36.2	44.5	44.7	25.8	24.5	27.5
2013	39.8	37.3	17.4	28.5	34.7	28.6	45.2	48.0	20.8	18.9	32.7
2022	38.0	37.0	18.0	26.3	27.9	26.9	44.2	47.6	19.0	17.9	32.7

Source: compiled by the author according to Rosstat's data. URL: <https://rosstat.gov.ru/storage/mediabank/tri-2020.xlsx>

Note: The values of indicators “Exp” and “Imp” are given for 2021.

According to *Table 1*, significant changes occurred from 1998 to 2013 (before the introduction of anti-Russian sanctions): the shares of 5 indicators increased, while 6 decreased. After 2013, the values of 9 indicators decreased.

⁷ URL: <http://www.kremlin.ru/acts/bank/43004>

For further detailing the significance of the analyzed regions of the Russian Federation, they need to be grouped based on the foreign countries they border and their geographical location (*Table 2*).

Table 2.
Groups of Russian Border Regions and Neighboring Countries

Group Number	Russian regions	Neighboring countries
1	Republic of Karelia, Kaliningrad, Leningrad, Murmansk and Pskov regions	Kingdom of Norway, Republic of Finland, Republic of Estonia, Republic of Latvia, Republic of Lithuania, Republic of Poland
2	Belgorod, Bryansk, Voronezh, Kursk and Rostov regions	Ukraine (excluding Crimea and Sevastopol)
3	Krasnodar Territory, Republics: Dagestan, Ingushetia and North Ossetia – Alania; Kabardino-Balkarian, Karachay-Cherkess and Chechen Republics	Republic of Abkhazia, Republic of Georgia, Republic of South Ossetia, Republic of Azerbaijan
4	Astrakhan, Volgograd, Orenburg, Saratov, Kurgan, Tyumen (excluding Yamalo-Nenets Autonomous Okrug and Khanty-Mansi Autonomous Okrug), Chelyabinsk, Novosibirsk and Omsk regions; Republic of Altai, Altai Krai	Republic of Kazakhstan
5	Republic of Altai, Trans-Baikal, Primorye and Khabarovsk Territories, Amur Region, Jewish Autonomous Region	People's Republic of China (PRC), Democratic People's Republic of Korea (DPRK)
6	Republics: Altai, Tuva, Buryatia; Trans-Baikal region	Mongolia
7	Kamchatka Krai, Sakhalin Region, Chukotka Autonomous Okrug	USA, Japan

Source: compiled by the author.

We will evaluate the average significance of a region in each group. To do this, we will divide the shares of all the studied indicators for each group by the number of regions in that group. The resulting values will be taken as indicators of the significance of one (average) region of the group based on the analyzed indicators.

According to the calculations, in 2022, the most significant was the average region of group 2 (border with Ukraine). Following it in descending order are the average regions of group 4 (border with Kazakhstan), group 1 (border with Norway, Finland, Estonia, Latvia, Lithuania, and Poland), and group 3 (border with Abkhazia, Georgia, South Ossetia, and Azerbaijan). The list is closed by the average region of group 7, which borders the USA and Japan (*see Figure 1*).

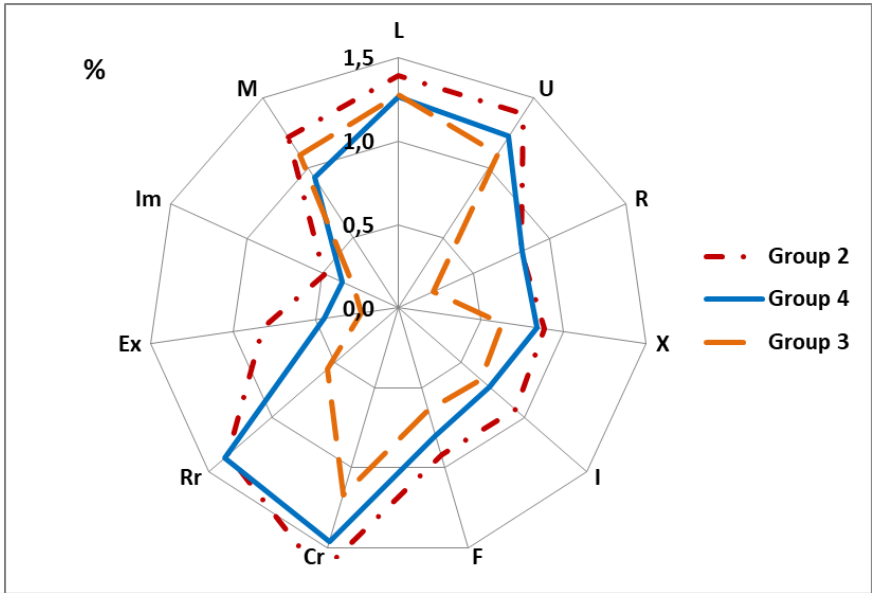


Figure 1. The Ratio of Indicators of Average Region to Total Volume in Russia in 2022, %

Source: compiled by the author.

Note: The values of indicators “Ex” and “Im” are given for 2021.

Judging by the 11 macroeconomic indicators considered, the border regions are economically less significant than the central (non-border) regions of the Russian Federation⁸ (Figures 2, 3).

⁸ Moscow and St. Petersburg are excluded from the list of central (non-border) subjects of the Russian Federation. The indicators of these cities and all other subjects of the Russian Federation differ significantly (are statistical outliers).

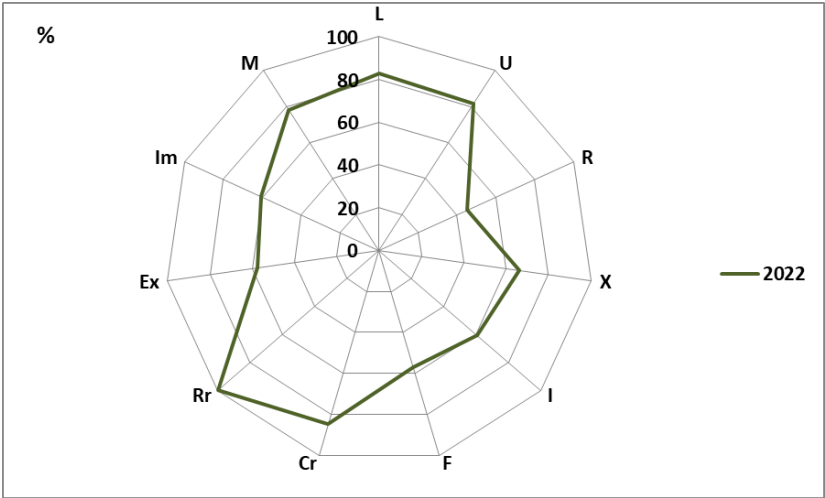


Figure 2. The Ratio of Indicator Values of Russia's border regions to Central Regions, %

Source: compiled by the author.

Note: The values of indicators “Ex” and “Im” are given for 2021.

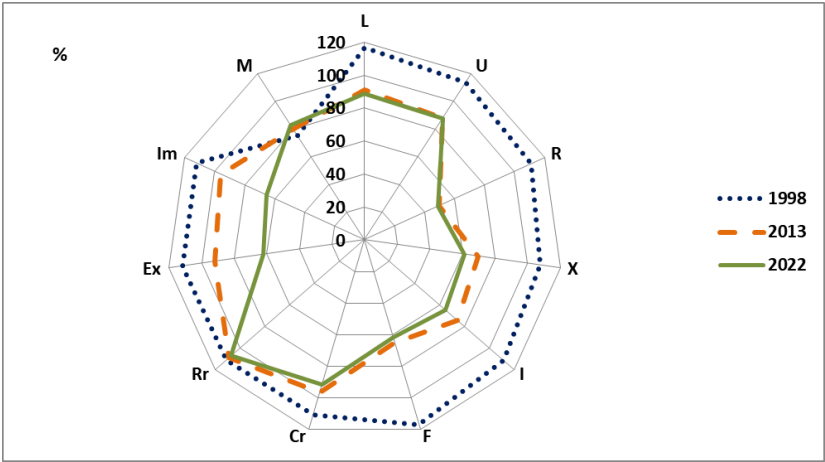


Figure 3. The Ratio of Average Indicators of Regional Groups to Nationwide Indicators in 2022, %

Source: compiled by the author.

Note: The values of indicators “Ex” and “Im” are given for 2021.

When ranking the border regions of the Russian Federation in descending order of average shares of the considered indicators, the top five in 2022 were: Krasnodar Krai, Rostov, Chelyabinsk, Novosibirsk, and Leningrad regions. The list is concluded by the Karachayevo-Chircassian, Republic, the Republics of Ingushetia, Tuva, and Altai, and the Chukotka Autonomous Okrug. These data slightly differ from those provided by analysts from the Russian Information Agency (RIA) (*Table 3*).

Table 3.
Top and Bottom Five in Ranking of Russian Border Regions, 2022

Ranking based on 11 macro indicators	Ranking by the values of the final RIA ratings
Top five	
Krasnodar Territory Rostov Region Chelyabinsk Region Novosibirsk Region Leningrad Region	Krasnodar Territory Leningrad Region Tyumen Region without Khanty-Mansiysk Autonomous Okrug and Yamalo-Nenets Autonomous Okrug Rostov Region Chelyabinsk Region
Bottom five	
Karachay-Cherkess Republic Republic of Ingushetia Republic of Tuva Republic of Altai Chukotka Autonomous Okrug	Chukotka Autonomous Okrug Altai Republic Karachay-Cherkess Republic Republic of Ingushetia Jewish Autonomous Region Chukotka Autonomous Okrug

Source: compiled by the author.

In both cases, the top five includes two subjects of the Russian Federation from group 4 and one each from groups 1, 2 and 3.

Conclusion

It appears that in the context of global hybrid wars, it is necessary to forecast various scenarios, promptly identify challenges, dangers, and threats, and respond accordingly. We must be prepared for various developments, consider all risks related to national security and defense, and have action plans to prevent the emergence of new aggressive entities at the borders. In the case of emergencies, urgent measures must be taken.

Inside Russia it is necessary to protect not only military facilities, but also civilian ones, to have action plans in place to prevent the emergence of new threats

on the country's borders and to take preparatory and urgent measures in border regions in the event of emergencies.

In the event of hostile, terrorist, or aggressive actions, it is important to prepare in advance for retaliatory measures that can cause unacceptable damage to those responsible for such actions.

Outside the Russian Federation, every effort should be made to prevent the emergence of an atmosphere that is dangerous to the country, including Russophobia and "color revolutions", primarily in bordering States, and the transformation of these States into enemies of the Russian Federation.

DOI 10.34660/INF.2025.74.61.028

UDC 338.2

工业旅游：工业遗产的新视角及其对区域发展的影响

INDUSTRIAL TOURISM: A NEW LOOK AT INDUSTRIAL HERITAGE AND ITS IMPACT ON REGIONAL DEVELOPMENT¹

Trofimova N.V.

Candidate of Economic Sciences, Leading Researcher

Institute of Strategic Research of the State Budgetary Scientific

Institution Academy of Sciences of the Republic of Bashkortostan,

Ufa, Russia

注释：工业旅游，即游客参观现有或历史工业遗址，正成为区域发展中日益重要的工具。本文探讨了工业旅游的关键方面及其在区域经济和社会发展中的作用，并分析了俄罗斯及其他国家类似项目的实施经验。特别关注了在数字化和人们对工业遗产日益增长的兴趣背景下工业旅游的发展前景。

Annotation. *Industrial tourism, which is a visit by tourists to existing or historical industrial sites, is becoming an increasingly important tool in the development of territories. The article examines the key aspects of industrial tourism, its role in the economic and social development of regions, and analyzes the experience of implementing similar projects in Russia and abroad. Particular attention is paid to the prospects for the development of industrial tourism in the context of digitalization and growing interest in industrial heritage.*

Introduction. In the context of globalization and increased competition between regions, the search for new tools to attract investment, tourists and increase the recognition of the territory is becoming an urgent task [1]. Industrial tourism, which combines educational, cultural and entertainment elements, allows not only to popularize industrial enterprises, but also contributes to the formation of a positive image of the region. The article examines the possibilities of industrial tourism as a tool for territorial development, and offers recommendations for its effective implementation.

Research methodology. The research is based on data from regional tourism development programs, reports from tourism organizations, and the results of surveys of tourists and experts. Comparative analysis methods were used to assess the experience of different regions.

Industrial tourism, as a specialized form of tourism, focuses on visiting industrial facilities, enterprises and territories in order to become familiar with production processes, the history of industry and technological achievements. This type of tourism is becoming increasingly popular both in Russia and abroad, stimulating the economic development of regions and contributing to the preservation of industrial heritage.

This type of tourism may include excursions, master classes, seminars and other forms of interaction with production processes.

Industrial tourism in Russia has shown steady growth between 2014 and 2024, reflecting growing interest in industrial heritage and modern manufacturing processes. However, collecting accurate statistics covering the full range of industrial sites and tourist flows is challenging due to the lack of a centralized accounting system.

According to the Agency for Strategic Initiatives (ASI), interest in industrial tourism in Russia increased by 20-30% annually from 2018 to 2022. This is due to the development of infrastructure at industrial enterprises, the creation of excursion programs and marketing efforts [3].

Despite the lack of consolidated statistics, individual studies and reports allow us to estimate the volume of industrial tourism in various regions. For example, in the Sverdlovsk region, one of the pioneers of industrial tourism, the number of visits to industrial facilities increased by 15% in 2023. Similar trends are observed in the Tula, Nizhny Novgorod and Chelyabinsk regions.

The experience of regions in developing industrial tourism demonstrates a variety of approaches and strategies, determined by the specifics of industrial heritage, geographical location and socio-economic conditions. Thus, the Sverdlovsk region, which has a developed metallurgical industry, successfully implements projects to create tourist routes based on historical plants and operating enterprises. An example is the “Demidov Route”, which includes a visit to the Nvyansk and Nizhny Tagil plants, which helps popularize the history of the mining civilization of the Urals.

The Republic of Tatarstan demonstrates successful experience in developing industrial tourism, focusing on the petrochemical complex. The region’s enterprises, such as Nizhnekamskneftekhim and TAIF-NK, not only attract thousands of tourists, but also actively participate in educational initiatives, promoting technical professions.

Nizhnekamskneftekhim is the largest petrochemical enterprise in Russia, which is visited by more than 7,000 tourists annually. Excursions to the enterprise include:

- Introduction to modern technological processes such as the production of polymers, synthetic rubbers and other petrochemical products.

- Visiting innovative laboratories where new materials and technologies are being developed.
- Demonstration of the company's environmental initiatives aimed at reducing its impact on the environment.

Nizhnekamskneftekhim actively cooperates with educational institutions, organizing excursions for students and schoolchildren. Every year, more than 20 educational events are held at the enterprise, which are attended by about 1,000 students.

TAIF-NK is another key industrial tourism destination in Tatarstan. The company specializes in oil refining and production of high-quality petroleum products. It is visited by about 5,000 tourists annually. Excursions include:

- Introduction to the process of oil refining and production of fuel, oils and other petroleum products.
- Visit to modern production facilities equipped with advanced technologies.
- Interactive programs that allow tourists to gain a deeper understanding of oil refining processes.

TAIF-NK also actively participates in educational initiatives, organizing excursions and master classes for students of technical universities.

St. Petersburg and the Leningrad Region, with their rich industrial heritage and modern production facilities, are actively developing industrial tourism. The basis of this direction is shipbuilding and machine-building enterprises, which play a key role in the region's economy.

St. Petersburg, as the cradle of Russian shipbuilding, offers unique excursions to the largest shipyards, such as the Admiralty Shipyards and the Baltic Shipyard. Tourists can see the process of building ships and submarines, get acquainted with the history of shipbuilding, starting from the era of Peter the Great, and learn about modern technologies used in this industry. Of particular interest are excursions to nuclear icebreakers, which demonstrate Russia's achievements in the development of the Arctic.

The Leningrad Region also actively attracts tourists to machine-building enterprises such as the Kirov Plant and the Leningrad Metal Plant. These excursions are attended by about 5,000 people per year. Tourists can see the process of manufacturing heavy machinery and power equipment, as well as learn about the contribution of these enterprises to the development of Russian industry.

The region pays special attention to educational programs for schoolchildren and students. Excursions to industrial facilities are supplemented by lectures, master classes and interactive activities that help young people better understand the specifics of engineering professions and industrial specialties. For example, Izhorskiye Zavody annually hosts more than 50 educational events attended by about

2,000 students. Such programs promote technical education and help schoolchildren decide on their future profession.

In Krasnoyarsk Krai, industrial tourism is focused on energy and mining enterprises. One of the most popular sites is the Krasnoyarsk Hydroelectric Power Station, which is visited by more than 15,000 tourists annually. Excursions include an introduction to the process of generating electricity, a visit to the machine room and an observation deck with a view of the dam and reservoir.

Also popular are excursions to open-pit coal mines, such as the Borodinsky Open-Pit. This site is visited by about 8,000 people a year. Tourists can see the coal mining process, get acquainted with modern technologies and learn about the role of the coal industry in the region's economy.

In the Novosibirsk region, industrial tourism is also developing on the basis of energy enterprises. The Novosibirsk hydroelectric power station annually receives more than 10,000 tourists. Excursions include a visit to the machine room, acquaintance with the history of the construction of the hydroelectric power station and the process of electricity generation.

In addition, excursions to mining enterprises such as the Sokolov-Sarbai Mining and Processing Plant are popular in the region. This facility is visited by about 5,000 people per year. Tourists can see the process of iron ore mining and enrichment, as well as learn about the modern technologies used in this industry.

Educational programs for schoolchildren and students are also actively developing in Krasnoyarsk Krai and Novosibirsk Oblast. For example, more than 30 educational events are held annually at the Krasnoyarsk Hydroelectric Power Station, which are attended by about 1,500 students. These programs include lectures, master classes, and interactive sessions that help young people better understand the specifics of engineering professions and industrial specialties.

Successful implementation of industrial tourism projects requires a comprehensive approach, including the development of attractive tourism products, the creation of the necessary infrastructure and active promotion of the region in the domestic and international markets. Interaction with enterprises, authorities and travel agencies plays an important role in ensuring high quality service and safety of visitors.

In the Yaroslavl region, industrial tourism is developing on the basis of food industry and mechanical engineering enterprises. Excursions are organized to the Svoboda factory, where the processes of cosmetics and perfume production are demonstrated, as well as to the Yaroslavl Motor Plant, which introduces visitors to engine-building technologies. Such initiatives contribute to the diversification of the region's tourism offer and attracting various categories of tourists.

The experience of the Vologda Region demonstrates the successful use of industrial tourism to promote local brands and crafts. Tours of enterprises producing

Vologda lace and wood products allow visitors to get acquainted with the unique technologies and traditions of the region. This helps preserve cultural heritage and stimulates the development of small and medium businesses.

To increase the efficiency of industrial tourism, it is necessary to take into account international experience. For example, in Germany, industrial tourism has been successfully developed based on the coal and steel industry facilities of the Ruhr region, which have been converted into museums and cultural centers. The study of such cases allows us to adapt best practices to Russian conditions and create competitive tourism products [2].

Industrial tourism in Russia has significant potential for further development. Unique objects, rich history and modern technologies make the regions attractive for both Russian and foreign tourists. The successful experience of already implemented projects can be scaled up.

The development of industrial tourism abroad demonstrates a number of successful practices that can be adapted and applied in other countries. In particular, Germany, a country with a rich industrial heritage, has successfully transformed abandoned industrial sites into attractive tourist destinations. An example is the Ruhr area, where old mines and factories have been transformed into museums, cultural centers and entertainment complexes, attracting millions of tourists annually.

The UK also has considerable experience in developing industrial tourism. Museums located on former industrial sites, such as the Museum of Science and Industry in Manchester, showcase the history of industrialisation and technological progress. The success of these sites is due to interactive exhibits, educational programs and an emphasis on cultural heritage.

In the United States, industrial tourism is reflected in visits to operating factories such as Boeing and Ford plants. Organized tours allow visitors to learn about the manufacturing process, technology, and innovation. In addition, many historic industrial sites such as mines and factories have been converted into museums and tourist attractions, offering visitors a unique experience of immersion into the past [3].

Successful examples of industrial tourism development abroad demonstrate the importance of preserving industrial heritage, integrating educational and entertainment elements, and actively involving local communities. Adapting and applying these practices can contribute to the development of industrial tourism in the Russian Federation, promoting economic growth, preserving cultural heritage, and raising awareness of the history of industrialization.

In the context of digitalization and growing interest in industrial aesthetics, industrial tourism has significant prospects. Key areas of development are:

- Development of unified standards for organizing excursions to industrial facilities

- Implementation of virtual and augmented reality technologies to create interactive excursions;
- Creation of interregional tourist routes;
- Development of specialized tourist routes that unite several industrial facilities;
- Creation of educational programs for schoolchildren and students based on enterprises;
- Promoting industrial tourism through social media and digital platforms.

References

1. Genenko O.N., Posokhova N.V., Bovkunova Y.V., Kushchenko E.S. *Industrial tourism as a factor in increasing the tourist attractiveness of a region//Innovation and investment.* – 2020. –No. 10. – P. 207-210.
2. Kozlova O.A. *Industrial tourism in increasing the investment attractiveness of the region//Economics and Business: Theory and Practice.* – 2024. –No. 7 (113). – P. 134-137.
3. Konstantinova A.S., Panchenko O.L. *Industrial tourism: features and development prospects in Russia//Kazan Bulletin of Young Scientists.* – 2022. – V. 6. –No. 3. – P. 82-91.

DOI 10.34660/INF.2025.80.98.029

设计思维是优化酒店客户体验的一个因素
**DESIGN THINKING AS A FACTOR IN OPTIMIZING CUSTOMER
EXPERIENCE IN HOSPITALITY**

Degtyareva Yana Vladimirovna

*Candidate of Economic Sciences, Associate Professor,
Head of Department*

Germanchuk Alla Nikolaevna

*Doctor of Economic Sciences, Full Professor
Donetsk National University of Economics and Trade named
after Mikhail Tugan-Baranovsky,
Donetsk, Russia*

摘要. 在俄罗斯市场数字化进程加快、竞争加剧的背景下，设计思维对于发展具有竞争力的服务至关重要。本文论证了客户至上、创造力和系统化原则的结合，能够有效解决包括酒店业在内的复杂综合问题，因为以客户为中心的方法和个性化服务有助于提升客户体验并开发创新解决方案。本文还指出，将该方法应用于俄罗斯酒店业的具体情况，并借鉴国际先进经验，将有助于提升企业竞争力并促进创新型经济的发展。

关键词: 设计思维、客户至上、客户体验、创新、酒店业。

Abstract. *In the context of progressive digitalization and increased competition in the Russian market, design thinking is of paramount importance for the development of competitive services. The article substantiates that the combination of the principles of customer focus, creativity and systematization makes it possible to effectively solve complex, integrated problems, including in the hospitality industry, since customer-oriented methods, personalization of services contribute to improving customer experience and developing innovative solutions. The article also determines that the adaptation of this methodology to the specifics of Russian hospitality, taking into account advanced international experience, will increase the competitiveness of enterprises and stimulate the development of an innovative economy.*

Keywords: *design thinking, customer focus, customer experience, innovation, hospitality industry.*

Over the past few decades, society has undergone fundamental changes caused by the widespread introduction of digital technologies into economic activity and the rapid progress of technological innovation.

In the context of increasing competition, the development of competitive services is becoming an increasingly difficult challenge for enterprises facing exponentially growing consumer demands. This, in turn, necessitates not only the provision of high-quality products, but also the formation of a personalized and unique empirical experience.

In this context, the customer-oriented design thinking methodology is one of the most effective approaches to the development of innovative services, since it allows enterprises to more deeply analyze the needs of the target audience and create solutions that meet these needs, thereby strengthening their competitive position.

In modern scientific literature, including among the Russian scientific community, there is a growing interest in the concept of design thinking, which is due to its potential for solving complex, interdisciplinary problems and innovative development. The definition of this concept in Russian scientific literature is an emerging area of research, which is characterized by a variety of approaches and definitions.

The importance of user orientation and the applied aspect of the approach in solving specific problems facing Russian companies and organizations is noted by many scientists. Thus, many authors define design thinking as a methodology focused on solving problems through empathy, experimentation and iterative prototyping, which corresponds to the classical understanding of design thinking proposed by IDEO and the Stanford School of Design [1, pp. 57-58].

Some scientists emphasize the role of design thinking in the development of professional qualities and define it as a tool for forming professional competence based on the integration of theoretical knowledge and practical skills in the process of creating innovative solutions.

However, most authors consider design thinking as a systemic approach to innovation, including the stages of empathy, problem definition, idea generation, prototyping and testing [1, pp. 61-68]. Thus, the conducted analysis of the definitions of “design thinking” proposed by Russian authors and scientists allowed us to highlight such key aspects as user orientation and practical focus, creativity and idea generation, systematicity and innovation. It should be noted that research in the field of design thinking has transformed traditional design practices by combining professional and applied aspects of activity with empirical data and the needs of end users. This evolutionary approach, based on the principle of Human-Centered Design, is used in various fields, stimulating the development of innovative solutions based on the real needs of the target audience. Examples cover

product development, service design, socially oriented projects and other areas. The integration of empathy and iterative prototyping is a key element of the solution development process, ensuring that functionality and aesthetics meet user requirements.

Thus, design thinking is a new approach to service design based on innovation and creativity, which focuses on a common approach to solving any problems and tasks applicable to various areas, be it product development or process organization, and also focuses the team's attention on the end consumer, contributing to the creation of valuable proposals during innovation initiatives. Among the various features of design thinking, it is worth noting a creative approach to problem solving that promotes innovation, collaboration within the organization to solve problems of improving products or services, and a focus on the emotional component of consumer experience [1].

Design thinking is based on a comprehensive approach that includes fundamental principles, methodological tools and a consistent process organization that create a synergistic environment for the development of innovative and creative solutions. The principles of design thinking form a progressive paradigm for solving problems, which requires specialists to master a specific type of thinking aimed at generating innovative ideas and approaches, a deep understanding of the needs of end users and the involvement of consumers in the process of creating a unique value proposition. The key here is the interaction of stakeholders and the coordinated work of the project team to achieve breakthrough innovations. Design thinking as a process for designing innovative services uses a variety of techniques and methods, methods and methodologies. In marketing practice, the following are especially used: customer journey maps demonstrating the user's experience of interaction with the service; stakeholder diagrams defining the participants in the process and their key interests; value chains identifying the sources of added value of a product or service; visualization methods transforming abstract ideas and concepts into specific prototypes for testing and evaluation. Design thinking is a process organized in certain stages aimed at creating customer-oriented solutions. The first stages involve an in-depth analysis of the needs and values of the target market in accordance with the principles of customer centricity. Then prototypes of services are developed, which provide for optimization or a new solution to the identified problems. At the prototyping stage, the concept is visualized. Subsequent testing of prototypes helps to identify shortcomings and make the necessary adjustments to ensure that the solution meets the needs of users and clients. The final stage is the implementation of the developed solution.

A distinctive feature of this process is its iterative nature, which provides for a high degree of adaptability and the ability to continuously improve the developed solutions based on maximum compliance with the requests and needs of target segments.

Design thinking as a process consists of six stages [3], the main goal of which is the development of innovative and creative solutions to create a positive empirical experience of consumers (Fig. 1).

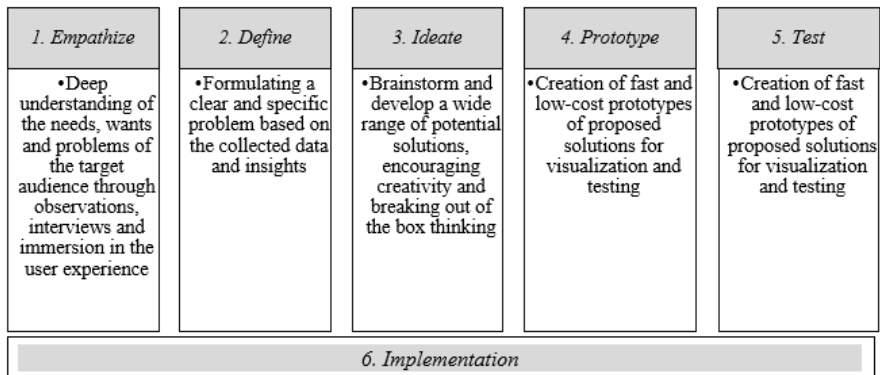


Figure 1. Design Thinking Stages

Design thinking is increasingly used in various industries and sectors of the economy, including the hospitality industry. In Russia, where there is a steady trend towards increased competition among accommodation establishments, the use of design thinking concepts is becoming an important factor in ensuring competitive advantages and optimizing consumer experiences.

The key areas of design thinking implementation in the hospitality industry are:

- development of innovative services and products that meet current customer needs;
- optimization of customer experience at all stages of interaction with the enterprise (from booking to room or restaurant service) and personalization of offers;
- creative problem solving and development of non-standard approaches to business process management;
- increasing staff efficiency and reducing operating costs;
- formation of a strong brand based on the value proposition of the target audience.

At the present stage, some hotel enterprises successfully apply design thinking in their activities. For example, Marriott Hotels uses design thinking to develop new concepts for rooms and public areas, and Hilton Hotels uses it to optimize the booking process and customer service. The Ritz-Carlton hotel chain uses a specialized CLARITY system to systematically record individual preferences of visitors, including pillow selection, gastronomic preferences and personal excur-

sion programs, thereby providing customized services. The CitizenM hotel uses a mobile application to control lighting and temperature parameters in rooms, as well as to order dishes, which significantly simplifies customer interaction with the hotel complex; interactive panels in the rooms help reduce the workload of staff and speed up the service process. There are also a number of examples of design thinking implementation in the Russian hotel industry. For example, the Radisson Collection Hotel, Moscow (formerly the Radisson Royal Moscow) uses guest preference analysis in its operations to personalize offers. Based on information about previous visits and bookings, orders for food services and additional services, individual recommendations and special offers are formed in order to increase guest satisfaction and stimulate repeat sales and bookings.

As an example of creating innovative solutions, we can cite the Azimut Hotels chain, which has implemented the concept of “smart rooms” with the ability to control lighting, temperature and multimedia systems using a mobile application. This innovative idea was formed by studying the needs of consumers of tourist services, for whom convenience, integration of advanced technologies and adaptation of conditions to individual preferences are important.

Also, based on the principles of design thinking, the Holiday Inn Express chain of hotels implemented a staff training program. Hotel employees were trained in methods of empathic research, idea generation and solution prototyping in order to generate more effective ways to solve everyday problems and improve interaction with guests.

Also, examples of the successful application of design thinking are Russian hotels: the St. Regis Moscow Nikolskaya hotel, which created unique concierge services that meet the individual needs of guests, including the organization of exclusive excursions and events; the Four Seasons Hotel Lion Palace St. Petersburg hotel, developed an innovative customer complaints management system, which significantly reduced the time it took to resolve problems and increased guest satisfaction; the Heliopark Hotels & Resorts chain, which has developed new restaurant and bar concepts that focus on creating a unique atmosphere and gastronomic experience for guests. At the same time, despite the growing popularity of design thinking in the hotel business, its implementation in accommodation facilities in the Russian Federation faces a number of problems. These include: a lack of qualified specialists in the application of design thinking methods, conservatism of the corporate culture in some enterprises, and limited financial resources for research to develop innovative and creative solutions.

Nevertheless, the potential for introducing design thinking into the Russian hospitality industry is considered very promising. As the number of hotel and accommodation facilities increases and they realize the benefits of this approach, we can expect further development and dissemination of advanced techniques that

help improve service standards, create a more attractive customer experience, and enhance the competitiveness of the Russian hotel industry as a whole. This, in turn, requires a deep understanding of the needs of the target audience and an iterative approach to prototyping and testing innovative solutions in the hospitality industry.

References

1. Andreev, G. S. *Design Thinking. Designing the Future: monograph* / G. S. Andreev // M.: De'Libri, 2020. – 104 p.
2. Germanchuk, A. N. *Innovative service: how design thinking helps to create services of the future* / A. N. Germanchuk, Ya. V. Degtyareva // *Economy and management in the service sector: current state and development prospects: Proceedings of the XXII International scientific and practical conference, St. Petersburg, February 04, 2025.* – St. Petersburg: St. Petersburg Humanitarian University of Trade Unions, 2025. – P. 21-22.
3. Glushchenko V.V. *Design thinking as a new way of innovation in traditional industries* // *Modern scientific research and innovation.* 2022. No. 12 [Electronic resource]. URL: <https://web.snauka.ru/issues/2022/12/99402> (date of access: 04/18/2025).

DOI 10.34660/INF.2025.34.55.030

经济社会化：一种概念方法

THE SOCIALIZATION OF THE ECONOMY: A CONCEPTUAL APPROACH¹

Kotov Yevgeny Valeryevich

*Candidate of Economic Sciences, Senior Research Officer
Donetsk Academy of Management and Public Administration,
Donetsk, Russia*

摘要. 本文分析了理解“经济社会化”概念的本质和内涵的科学方法。揭示了不同学者对该概念的解读特征。并阐述了作者对经济社会化的理解及其实施效果的评估标准。

关键词： 社会化、经济、社会公正、公共政策。

Abstract. *The paper analyzes scientific approaches to understanding the essence and content of the concept of “socialization of the economy”. Features of individual interpretations of the concept under study are revealed. The author’s understanding of the socialization of the economy and criteria for assessing its implementation are presented.*

Keywords: *socialization, economy, social justice, public policy.*

The state as a political and legal institution is created by society with one goal - to ensure safe conditions for the sustainable development of both the society itself and each of its members. Achieving this goal implies the state solving a set of tasks, among which the tasks that ensure priority satisfaction of the social needs of the individual over the economic results of economic entities and their associations are of particular importance. But, at the same time, it is necessary to take into account another condition associated with the fact that it is thanks to these economic results that the resource foundation is created for satisfying the social needs of the individual.

In this case, the state faces a difficult problem, the essence of which is how to ensure social development without compromising economic development and how to ensure economic development without infringing on social development. Modern models of public administration of the two named spheres - social and economic - are not able to effectively solve this problem. In practice, the state chooses one of the sides and, most often, this is economic development, which

automatically implies a limitation on the level of satisfaction of the social needs of the individual. This is a rational choice of a system that seeks to survive as a state, since the constant priority in ensuring social needs to the detriment of economic results leads at first to a decrease in the latter (economic results), and then to a complete dissatisfaction of the former (social needs).

In other words, the economic needs of the state are the only source of ensuring the satisfaction of the social needs of each individual and society as a whole. And, since no one removes the task of ensuring simultaneous economic and social development from the state, it is forced to “maneuver” between them, changing tactics, but not the strategy of their development. The purpose of the work is to identify conceptual features in understanding the essence and content of the concept of “socialization of the economy”

Materials and methods

The study used logical analysis and synthesis, methods of grouping and comparison in formulating the author’s definition, as well as assessing common approaches to understanding the term “socialization of the economy”.

Results and their discussion

Suggestions and recommendations related to solving such a fundamental problem were reflected in many scientific studies, the activity of which has significantly increased in recent years. The actualization of this problem and the intensity of its research are associated with the growing social needs of society in their qualitative, quantitative and nomenclature expression, which increasingly complicates the possibilities of state “maneuvering” between ensuring economic development and meeting social needs.

This led to the appearance in scientific works on this issue, or rather the revival, of such a term as “socialization of the economy”. Indeed, the need for socialization of the economy has been discussed for more than a hundred years. One of the first to understand this term was August Bebel, a Marxist and a prominent representative of the German and international labor movement, in his work “The Socialization of Society” [1]. He understood the socialization of the economy as a general expropriation of all means of production [1, p. 3]. Expropriation will create new fundamental foundations for production relations, which will ultimately eradicate the exploitation of man by man, and, therefore, ensure the socialization of economic relations. It is important to note that this approach to the interpretation of the concept under study was due not only to the status of A. Bebel. Incidentally, the term “socialization”, used not only by him, but also by J. Schumpeter, has three synonymous meanings in English – socialization, collectivization, and nationalization. Such variability in translation has left its mark on Russian-language scientific research related to the understanding of the term “socialization of the economy”.

The outstanding Austrian-American economist Joseph Schumpeter, who was closer in his political views to A. Bebel than to other political movements, understood the socialization of the economy as a transition to a socialist way of managing the economy. He pointed out that socialist management of economic processes and relations leads to the achievement of goals with fewer difficulties and losses and "... without the inevitable costs that are associated with attempts to plan progress under capitalist institutions" [2, p. 584]. Among modern researchers, the problems of socialization of the economy were considered in the works of scientists from the Moscow State University named after M.V. Lomonosov [3]. They considered this problem in the context of the potential transformation of the socio-economic formation. But, unlike J. Schumpeter, who believed that the socialist way of managing economic processes and relations should completely replace the capitalist one, Russian scientists stand on somewhat different principles. They believe that there can be no complete replacement of capitalist relations, but their evolution. New challenges, threats and opportunities, including those obtained in the course of scientific and technological progress, the development of society, will stimulate capitalist relations to socialize. That is, the capitalist mode of production will not disappear completely, as J. Schumpeter assumed, it will integrate socialist methods of management into its system. Capitalism as a modern socio-economic system of existence will remain, but will be forced to socialize, including reducing the share of private property, free market and competition, and increasing the share of socialized means of production, social responsibility and forced redistribution of income in favor of socially vulnerable groups of the population. At the same time, Russian scientists assume that the current management system, being transformed, will acquire such strong socialist characteristics that it will be possible to claim the emergence of a new second-generation socialism. In one of his works, one of the ideologists of this concept directly says that "... a return to the USSR is impossible and unnecessary. "Socialism of the 21st century must be different" [4, p. 38]. It should be noted that the work of these Russian scientists launched a galaxy of studies on this topic, which only emphasized the fundamental nature of their scientific work.

Above, we considered the interpretation of the concept under study from the standpoint of political economy, where it is more understood as a change in the socio-economic formation in a revolutionary or evolutionary approach. The interpretation of the concept of "socialization of the economy" from the standpoint of applied economics is less radical, since it is focused not on revolutionary, but on evolutionary principles of transformation of production and economic relations. All interpretations assume the preservation of the current set of production relations, the level of development of productive forces, social ties, and the political system. Socialization of the economy as a process occurs in the above conditions and is aimed at their correction or supplementation, but not replacement.

Most modern studies of the problem of socialization of the economy interpret it as a transition to prioritization of social parameters of the management activity of the state. Prioritization is expressed in the shift of target indicators of public administration towards "...social parameters of life and satisfaction of the needs of members of society" [5, p. 18]. The position of the cited authors is that the socialization of the economy is a process that ensures the integration of the private and public sectors of the economy in the production sphere with the aim of forming the priority of human development and the conditions of his life. As a result of such integration, the economic model of the state will acquire characteristics of high social orientation.

It should be noted that many Russian researchers of this issue also proceed from the fact that "socialization of the economy" and "socially oriented economy" are synonymous terms. This approach also forms a corresponding understanding of the mechanisms for implementing the socialization of the economy. All proposals are limited to recommendations aimed at changing the administrative-legal, organizational and information mechanisms, partly the economic mechanism in the area of developing new forms of business activities, regulating income, employment and professional training. Some experts note that the socialization of the economy is an endless process of transforming the market economy [6]. Such statements carry a double meaning. Firstly, they show that it is the market economy that is subject to transformation and no other. Secondly, that the market economy is, in principle, not transformable in the context of its socialization, since it never reaches its final state. In this regard, the question arises whether it is worth spending time and resources on its transformation if the result will not be achieved anyway. Of course, supporters of this approach will answer that it is worth it, since the socialization of the economy is a process, and any process can be improved indefinitely.

In this case, opponents will ask another question: the process can be improved indefinitely only in changing conditions, and a market economy is called such solely on the basis of a number of fundamental features inherent only to it. Therefore, a change in at least several of these features transforms the market system into some other one, in which the improvement of the process of socialization of the economy will continue. But this will already be a different system of production and economic relations, different from the market one. Thus, in the above statement there is a contradiction, the elimination of which is possible only in one of the cases: the improvement of the process of socialization of the economy in the system of market relations is final or its individual stages are no longer implemented in the market economic system.

The author's understanding of the content and essence of the concept of "socialization of the economy" comes from the management paradigm. In this regard, the socialization of the economy has several characteristics:

- is a controlled process;
- has a management goal - satisfying social needs without compromising the development of economic processes and relations;
- has a subject of management - the state represented by its authorities, and an object of management - economic processes and relations;
- has a dual goal - two interdependent subsystems are simultaneously subject to maximization - the social and economic subsystems; while the mandatory maximization of one (social) is carried out without compromising the other (economic).

Taking into account the results of the analysis, the author's experience in studying the problem of socialization of the economy, it should be understood as the process of ensuring the adoption and implementation of management decisions in the economic sphere based on the priority of achieving social goals. Socialization of the economy is aimed primarily at making the economy socially fair and subordinated to the interests of society.

For a clearer understanding of the above definition, it is necessary to explain several of its features. The priority of achieving social goals should not be achieved by ignoring the needs of economic development. Achieving social justice is more utopia than reality, and that is why a reservation was made about the subordination of the economy to the interests of society. In practice, this looks like this: if the state is faced with a choice of priority between the interests of a social group and the economic interests of enterprises, then the choice will definitely be made in favor of the former.

Since the socialization of the economy is a process, then, as for any process, in order to understand whether it is being implemented in the right direction and at the right speed, it is necessary to establish the criteria for this process. The criteria for the socialization of the economy are: an increase in public ownership of the means of production; increased government regulation of the economy, a high level of social justice in society (assessed through sociological surveys); a decrease in the Gini index.

Conclusions

The growth of society's needs, declining prospects for economic development within the framework of the modern socio-economic formation, and a decline in the effectiveness of public administration provoke an increase in the level of social tension and an increase in cases of social disobedience. One of the important areas of counteracting this is to accelerate the processes of socialization of the economy. The formation of economic processes and relations focused on a person will be supported by him (the person) consciously and voluntarily, and not forcibly. Such a symbiosis of the feedback of the two subsystems will reduce social risks and counter economic threats, as well as counter the desocialization of state economic policy, which will directly reduce the level of social tension in society and increase the level of its trust in the authorities.

Literature

1. Babel, A. *Socialization of Society*. Translated from German. – Kyiv: First Kiev Artel of Printing Business, 1905. – 122 p.
2. *Theory of Economic Development. Capitalism, Socialism and Democracy* / J.A. Schumpeter; [preface by V.S. Avtonomov; translated from German by V.S. Avtonomov, M.S. Lyubsky, A.Yu. Chepurensky; translated from English by V.S. Avtonomov, Yu.V. Avtonomov, L.A. Gromova, K.B. Kozlova, E.I. Nikolaenko, I.M. Osadchaya, I.S. Semenenko, E.G. Solovyova]. – Moscow: Eksmo, 2008. – 864 p.
3. Buzgalin A.V., Maslov G.A., Dzhabborov D.B., Barashkova O.V., Yakovleva N.G., Bulavka-Buzgalina L.A. *Socialization of capitalism: potential, contradictions, limits* // *Alternatives*. – 2018. – No. 4. – P. 33-67.
4. Buzgalin A.V. *Russian economy: poverty, stagnation and alternatives* // *Alternatives*. 2022. No. 2. P. 33-43.
5. *Socialization of the economy as a factor in the social development of a region* / G.F. Biglova, E.Yu. Bikmetov, L.A. Gerasimova [et al.]. – UFA: Institute of Social and Economic Research, Ufa Scientific Center of the Russian Academy of Sciences, 2019. – 298 p.
6. Nikiforov V.M. *On the Criteria of Socialization of the Modern Economy* // *Bulletin of the Saratov State Technical University*. – 2009. – No. 1(1). – P. 239-243.

DOI 10.34660/INF.2025.81.62.031

人口职业化是国家经济政策社会化的一个要素

**PROFESSIONALIZATION OF THE POPULATION AS AN
ELEMENT OF SOCIALIZATION OF STATE ECONOMIC POLICY**

Rozhniatovskaia Anastasiia Andreevna

Lecturer

Donetsk Academy of Management and Public Administration

摘要. 本文揭示了公民职业发展对国家的重要性以及劳动人口在加强社会经济体系中的作用。文中描述了既定的职业定义及其与专业技能的关系。通过回顾性分析，研究了苏联时期工人的工作态度和职业技能。文中比较了劳动过程组织（考虑和不考虑人为因素）对倾向于资本主义和社会主义管理模式的国家的影响特征。文中揭示了社会经济体系的可持续性对人口职业化和人力资本强化方向的组织工作的依赖性，并对正在建设中的俄罗斯联邦社会经济体系的新趋势做出了预测。

关键词：职业社会化、国家经济政策社会化、劳动、职业、工人、俄罗斯联邦。

Abstract. The article reveals the importance of professional development of citizens for the state and the role of the working population in strengthening the socio-economic system. A description of the established practice of defining professions and their relationship with specialties is presented. Using retrospective analysis, aspects of the attitude to work and professional skills of workers in the Soviet period are studied. A comparative characteristic of the effect of the organization of the labor process (with and without taking into account the human factor) is presented for countries gravitating toward the capitalist or socialist form of management. The dependence of the sustainability of the socio-economic system on the organization of work with the population in the direction of its professionalization and strengthening of human capital is revealed, and a forecast assumption is made about the emerging trends in the socio-economic system of the Russian Federation being built.

Keywords: professional socialization, socialization of state economic policy, labor, profession, worker, Russian Federation.

The conducted research allowed to formulate the author's definition of the concept of "professional socialization". It is proposed to understand it as "... a process that has stages, is not limited locally and occurs in specific periods of human life, which contributes to the development of a new perception of labor activity,

oneself as an employee and one's professional group" [2, p. 196]. The study continued with the definition and consideration of the phenomenon of a profession as one of the main components of professional socialization, an analysis of the socio-economic prerequisites for the professionalization of the population. Thus, in the domestic labor economy, a profession is understood as a set of acquired special labor skills, usually combined in one person and united by a common name (electrician, violinist, electric train driver, lighthouse keeper, etc.) [3, p. 17]. It is possible to determine exactly what professions exist in the country according to the approved List of professions. For example, in the Russian Federation, the List of professions of workers, positions of employees, for which vocational training is carried out, is currently in effect [1]. At the time of approval, it included 4915 blue-collar jobs and 166 white-collar jobs that required vocational training. You can also learn about jobs using current federal state standards for vocational education and individual laws describing special types of activity.

The purpose of the study is to reveal the importance of professional development of citizens for the state and the role of the working population in strengthening the socio-economic system through the presentation of the professionalization of the population as an element of socialization of state economic policy.

Materials and methods

The study used materials from Russian researchers in labor economics, official regulatory documents of the Russian Federation. The use of analysis, comparison, description, retrospective as the main methods allowed us to achieve a specific result, presented below.

Results and their discussion

Some jobs are divided into specialties. A specialty can be called a set of skills that exhausts the usual range of work activities of one person and has a specially assigned name for a specific area [3, p. 18]. Such definitions are very conditional and in everyday life for most people the concepts of profession and specialty are identical. Profession and specialty are largely historical concepts. They have been formed and developed over centuries as social labor has become more complex and divided, and each worker has gradually specialized in his chosen occupation. The number of professions and specialties has increased, while the range of labor skills inherent in them, on the contrary, has narrowed. And since professions from various historical periods have survived to the present day, the scope and degree of differentiation of the skills inherent in them are extremely different. Some of the most archaic professions have now occupied entire industries, for example, the profession of "farmer" in agriculture [3, p. 18].

There is also a popular opinion among society that a real profession or specialty is one that has been acquired through long-term training (at least one year or more). Therefore, the attitude towards activities obtained through short-term

courses or online courses is much less serious. This perception can be explained by the current education system in the CIS countries, where obtaining at least one profession is mandatory, guaranteed by the state, and in order to obtain an identification document, it is necessary to undergo a long period of training. It is necessary for a potential worker to acquire all the knowledge, skills and abilities to perform specific work functions. It is here that a clear orientation of the education system on the personal beginning of the profession, and not the subject result, can be traced. You can see what was done and how it was done by a person with a certain set of knowledge, skills, abilities, but you cannot weigh or express their quantity. That is, the classification of professions is based not on the material result of labor, but on the producer (worker) himself with all his professional characteristics. All groups of professions by similarities and differences in their inherent work skills are groups of producers and it comes from the idea of organizing people and their work, which, with joint private efforts, is capable of bringing a single result to the socio-economic system of society.

The question of the success of labor and professionalization in a workers' state is a question of the purpose and meaning of its existence [3, p. 49]. Confidence in the viability of states that gravitate toward socialism has always been based on the assertion that the most productive form of economy is the one that has a socialist basis. And the most productive states have always been able and can maintain their stability and survive various economic and political crises. An example is the situation that developed in the USSR after the victory of the proletariat and the task that was set by the new state apparatus - the complete and rapid identification of all the economic advantages of the new system and all the production capabilities inherent in it.

One of the most famous classics in domestic labor economics, S.G. Strumilin [3] in his detailed analysis of the situation of workers in Soviet times cited the assertion that in the development of a new form of economic activity, the choice was between three paths: intensification, mechanization and rationalization of labor. Based on the description of events and the data provided by the researcher, it is obvious that the choice was made in favor of labor intensification, since it is the most accessible and relatively easy to implement (examples - the fight against absenteeism, regular labor subbotniks, overtime work and the desire to exceed the work plan as much as possible, evening training with the aim of teaching new work skills to already working citizens). The movement for labor intensification came from below, from the workers themselves through their professional associations. After the introduction of incentive forms of payment, the intensity became even higher and factories, as the main creators of jobs, began to produce results that exceeded their usual indicators by 5-6 times. However, through a detailed analysis and comparison of data, S.G. Strumilin discovered that although the increase in

labor intensity had a colossal effect, strengthened the labor movement and gave society an ideological spirit, in terms of economic indicators the result did not exceed what it was under the initial capitalist economic system in 1913-1914 [3, p. 51]. Having assessed the state of labor from a psychophysiological point of view, the scientist established that in terms of nutrition, a worker in the new pure socialist system received energy (nutrition) of almost 46% of the previous norm, despite the fact that there were no food shortages or problems with rations. This was only a consequence of the fact that the expenditure of energy on the performance and volume of work was greater and more intense. Without the introduction of mechanization and rationalization, a socialist state always risks getting an extreme effect in the form of workers exhausted from their own heroism and excessive overwork. In this matter, it is difficult to compete with countries (capitalist), in which the mechanization of labor has become a common phenomenon, almost from the very first emergence of manufacturing, but they have the opposite problem - they have mechanized tools, but there are no professional employees capable of handling them, or they do not have enough understanding of the required work.

This circumstance formed the phenomenon of “headhunting” and attracting the most talented people from foreign countries. During the existence of the USSR, only the creation of the “iron curtain” situation helped to prevent this. After realizing the situation and making forecast calculations about the future socio-economic situation, the direction of scientific organization of labor (SOL) began to actively develop, which combined the urgent need for both mechanization and rationalization of labor. The effect obtained from the developments within the SOL allowed to level out the situation, removing the dependence of the economy on the ability of the human body to exceed its normal capabilities, and the “iron curtain” preserved personnel in the state. If the development of the history of the USSR had been somewhat different and the collapse had not occurred, then presumably the synergistic effect of combining the intensification, mechanization and rationalization of labor would have been amazing and unattainable for countries with a purely capitalist form of management. However, history does not know the subjunctive mood and the real position of the world order has acquired a stable capitalist character. Machine production and the emphasis on technology as a tool of labor have shifted the focus of attention from the human factor to the technical and innovative one throughout the world, depersonalizing the product of labor, the process of obtaining it and the need for professionalization. However, any technology and innovation is developed by a person, and shifting the focus from the social aspect of labor activity is a big mistake, which can be corrected for some time by attracting workers from other countries or special training, but this is only a short-term effect. As the popularity of capitalism spreads, the number of states capable of cultivating and training capable people for productive, creative

labor that overcomes its own limitations is becoming smaller. Without a socialist counterweight, there is a risk of getting a single world system capable only of mass production and mass consumption. At this point, we can turn to the situation of modern Russia and try to identify and characterize the trends that are developing in it in terms of the human factor. The new statehood of the Russian Federation, which has been built since 1991, can hardly be called absolutely gravitating toward capitalism or socialism. The majority of measures implemented within the framework of the general state policy are aimed at both the development of productivity, protection of private property and support of entrepreneurship at all levels, and at social support and protection of citizens, collectivization of means of production, the possibility of professional development of each person in any sphere. Two socio-economic systems, completely different in their essence, are united into one and the created conditions are trying to be adapted to both systems. One could assume that the result will be the formation of some hybrid version of the socio-economic system, but the poles of interests of capitalists and socialists are too multi-vector and this turns into an extremely difficult to regulate process. The most effective way to prevent disagreements and relieve tensions from a system that is trying to combine principles that are difficult to combine seems to be only the socialization of economic policy. Precisely economic policy, and not another, since the productivity of the state has always been and will remain at the forefront. Only by influencing this direction of policy will it be possible to shake the dogmas of capitalism, proclaiming tough competition and struggle for resources with minimal government intervention, and to strengthen the position of priority of public interests over state interests. Socialization of economic policy will allow to transform previously made blanks of public organization in the territory of the post-Soviet space into a new format of social system, where human capital (with proper handling and development) will be revealed with new force and will strengthen statehood to the highest degree. And the created opportunities for professional self-determination, professional socialization (as a private branch of socialization of economic policy) of citizens will become a solid foundation for the increase of human capital.

References

1. *On approval of the list of blue-collar professions and employee positions for which vocational training is carried out: order of the Ministry of Education of the Russian Federation dated July 14, 2023 No. 534* // Official Internet portal of legal information www.pravo.gov.ru. - URL: <http://publication.pravo.gov.ru/document/0001202308150007> (date of access: 04/23/2025).

2. Rozhnyatovskaya, A.A. *Semantic definition of professional socialization [Electronic resource]* / A.A. Rozhnyatovskaya // *Innovations and Investments*, 2025. – No. 2. – P. 194-197. – URL: <https://innovazia.ru/archive/61208/> (date of access: 04/23/2025).

3. Strumilin, S.G. *Problems of Labor Economics [Electronic resource]* / S.G. Strumilin // *Digital library Internet Archive*. - URL: https://archive.org/details/problems_ekonomiki_truda_1982/page/n3/mode/2up (date of access: 04/23/2025).

DOI 10.34660/INF.2025.38.72.032

使用监控工具构建和管理声誉和形象风险的机制
**MECHANISM FOR STRUCTURING AND MANAGING
REPUTATION AND IMAGE RISKS USING MONITORING TOOLS**

Mundzhishvili Irina Igorevna

Postgraduate student

National Research University of Electronic Technology (MIET)

摘要. 在数字化和无形资产对组织可持续发展日益重要的背景下，声誉和形象风险管理变得尤为重要。本文介绍了一种利用预测分析算法、人工智能（AI）和大数据处理技术构建和管理此类风险的成熟机制。该方法能够及早发现威胁并实施主动缓解策略，从而有助于增强公司在媒体领域乃至整个市场的可持续性。

关键词：运营风险；形象风险；主动管理；人工智能；预测分析；大数据；风险监控；数字声誉；风险管理；信息安全。

Abstract. *In the context of digitalization and the increasing importance of intangible assets for the sustainable development of organizations, the management of reputation and image risks is becoming particularly relevant. The article presents the developed mechanism for structuring and managing such risks using predictive analysis algorithms, artificial intelligence (AI) and big data processing technologies. The proposed approach provides early detection of threats and implementation of proactive mitigation strategies, helping to strengthen the company's sustainability in the media space and in the market as a whole.*

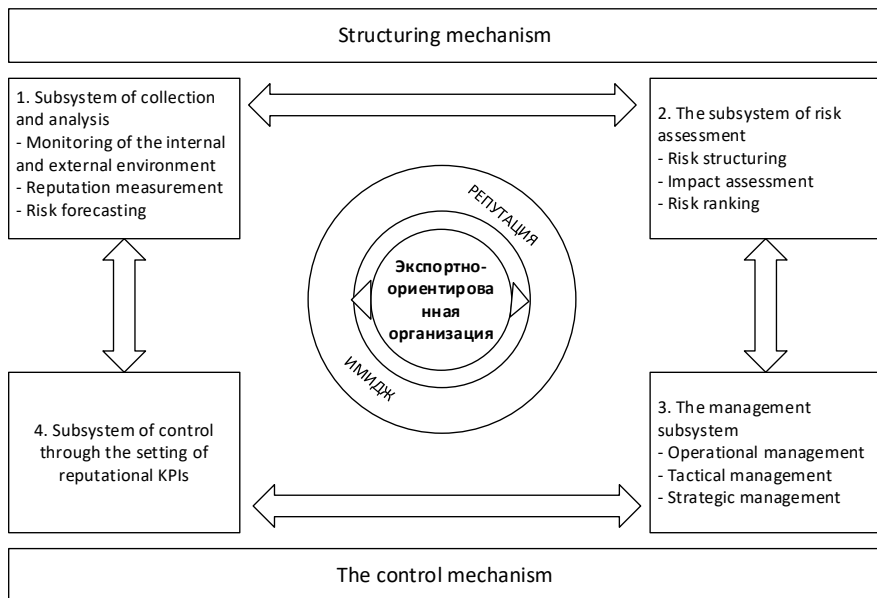
Keywords: *operational risks; image risks; proactive management; artificial intelligence; predictive analytics; big data; risk monitoring; digital reputation; risk management; information security.*

Modern organizations face an increasing number of reputational challenges due to the high speed of information dissemination and a multitude of digital channels [1]. Reputation and image risks become critical for strategic management. The lack of traditional methods of monitoring and analyzing risks requires the introduction of new technologies and approaches based on intelligent systems [6].

The developed mechanism for structuring and managing reputation and image risks is a comprehensive system aimed at ensuring the stability of export-oriented enterprises in the conditions of high dynamics of the digital environment [9]. Its

main purpose is to create conditions for early detection, classification and assessment of reputational threats, followed by the formation of a set of proactive management decisions. The mechanism is focused not only on responding to existing risks, but also on predicting potential threats using big data analysis tools and predictive analytics, which can significantly increase the level of manageability of reputation processes[10].

The mechanism's architecture is based on three fundamental principles-modularity, automation, and adaptability. The modularity principle involves splitting the mechanism into functionally complete subsystems, which ensures its flexibility and scalability, allowing you to adapt the solution to the specifics of a particular organization. The principle of automation ensures that information is processed in real time, minimizing human involvement in routine operations and speeding up the process of identifying and assessing risks. The principle of adaptability is implemented through the use of machine learning algorithms and regular updates of analysis parameters, which allows the system to function effectively in a changing external environment.



*Developed by the author

Figure 1. Mechanisms for structuring and managing reputational risks

Functionally, the architecture of the mechanism includes four interrelated sub-systems:

1. With data collection and analysis, risk assessment and structuring, management and response, and monitoring and feedback. The data collection and analysis subsystem provides monitoring of the external and internal information environment of the enterprise using big data processing technologies, web-scraping, streaming analytics, and API integration. Monitoring is implemented on a multi-level basis and covers a wide range of sources: social networks, media resources, feedback platforms, specialized forums, video hosting sites, as well as internal corporate channels, including CRM systems, customer support services, and feedback from employees and partners. The data received from these channels are automatically subject segmented and contextual filtered in order to highlight relevant information and exclude information noise [11, 13, 14].

2. The risk Assessment and structuring subsystem is responsible for classifying and ranking identified threats using natural language processing (NLP) tools, sentiment analysis, and predictive modeling algorithms. Each signal is assigned a reputation index, the probability of risk realization and its possible impact on the company's image are calculated. At the next stage, clustering and categorization of received signals is implemented, based on the classification of incidents according to the type of risk, the degree of negative connotation, the potential audience reach, and the level of reliability of the source. The natural language processing engine (NLP), which uses neural network architectures and machine learning algorithms, is used to evaluate the semantic structure of messages and analyze emotional coloring. This makes it possible not only to differentiate the tone of messages (positive, neutral, negative), but also to identify critical keywords and persistent phrases that indicate possible reputational threats.

An important component of the mechanism is dynamic risk profiling, in which each identified incident is assigned a unique profile. It includes time characteristics, distribution sources, thematic focus, a list of actors involved, and a projected development trajectory. Based on the combination of these parameters, an interactive risk map is formed that visualizes the level of threats and the dynamics of their escalation.

To quantify the criticality of incidents, an integral metric is used, calculated as the product of the probability of occurrence, potential damage, and the degree of involvement of the target audience. These parameters are determined using trainable algorithms based on accumulated empirical data and current analytics. The resulting assessments serve as a basis for prioritizing responses and forming proactive management scenarios.

The results of the analysis are promptly transmitted to the management module, where automated generation of recommendations for responding is carried

out, or notifications are sent to responsible structural divisions (PR service, legal department, information security service, etc.). Thus, the proposed risk monitoring and structuring mechanism provides a continuous assessment of the reputation field, allowing you to effectively manage emerging threats using the following tools: principles of proactivity and digital adaptability [8, 12].

3. The management and response subsystem forms strategies and scenarios for influencing risks, including proposals for adjusting communication campaigns, launching anti-crisis measures, and coordinating actions between departments. A special feature of this subsystem is its integration with notification and automated reporting systems, which contributes to the efficiency of decisions made [21, 23].

4. The control and feedback subsystem allows you to track the effectiveness of implemented measures and adjust the parameters of the mechanism based on KPI indicators, including the level of customer satisfaction, the dynamics of changes in the reputation index and the speed of incident response.

The proposed mechanism for structuring and managing reputation and image risks is an effective tool for organizations seeking not only to respond to emerging threats, but also to proactively prevent them. The introduction of artificial intelligence, predictive analytics, and big data processing technologies in the process of monitoring and evaluating risks can significantly improve the accuracy and speed of threat detection. The modular, automated and adaptive architecture of the system guarantees its flexibility and ability to adapt to changing environmental conditions. Ultimately, this approach helps strengthen the company's sustainability, improve its digital reputation, and increase trust among customers and partners. The most important component of success is continuous optimization of the system based on the obtained data and feedback, which allows you to achieve maximum efficiency in managing reputational risks in the digital age.

References

1. Abaimova K. V., Harutyunyan E. R. *Problems of economic security of the enterprise in modern conditions // Economics and business: theory and practice.* 2015, No. 4, pp. 4-8.
2. Aleshina, I. *Public relations for managers and marketers*, Moscow: INFRA-M, 2014, 266 p.
3. Arenkova I. A., Lezinoi T. A., Tsenzharik M. K., Chernovoi E. G. [Business management in the digital economy: challenges and solutions]. - St. Petersburg: Publishing House of St. Petersburg University, 2019. - 360 p.
4. Barinov V. A., Sinelnikov A.V. *Razvitie organizatsii v konkurentnoy srede [Development of an organization in a competitive environment] // Management in Russia and Abroad*, 2015, No. 6, p. 52.

5. Binetsky A. E. *Delovaya reputatsiya kompanii [Business reputation of the company]*. Moscow: Prosveshchenie. 2012, 217 p.
6. Blinov A. O., Zakharov V. Ya. *Imidzh organizatsii kak faktor ego konkurentosposobnosti [Image of an organization as a factor of its competitiveness] // Management in Russia and abroad. -2003. - No. 4. - pp. 35-44.*
7. Blum M. A., Molotkova N. V. *B71 PR-technologies in commercial activity: A textbook*. Tambov: Publishing House of Tambov State Technical University. univ., 2004, 104 p. (in Russian)
8. Gvozdeva E. A., Sorokin A. V. *Risk management: A textbook for students of all forms of training in the field of training "Economics". 2nd edition supplemented and corrected / Rubtsovsky Industrial Institute. - Rubtsovsk, 2021. - 84 p.*
9. *Gamble Marketing of relationships with consumers / Gamble et al. - Moscow: FAIR-Press, 2019. - 512 p.*
10. Goncharov D. S. *Integrated approach to risk management for Russian companies*. Moscow: Vershina. - 2008. - 221 p.
11. Gordyakova O. V., Lebedev A. N. *Lichnosti v sisteme kommunikatsii [Personalities in the communication system]*, Moscow: Institute of Psychology of the Russian Academy of Sciences, 2015, 214 p.
12. Интеллектуальный предиктивный мультимодальный Yarushkina N. G., Andreev I. A., Guskov G. Yu., et al., *Intelligent predictive multimodal analysis of weakly structured big data*, Ulyanovsk: UlSTUPubl., 2020, 220 p.
13. Kuchmaeva O. V. *Analysis of the socio-demographic structure of advertising consumers. Training manual*. Moscow, 2003, 166 p. (in Russian).
14. Lavrinenko V. N. *Methodological significance of the theory of social interests in the study of modern social phenomena. Znanie. Understanding. Ability. 2012, no. 1, pp. 38-43*
15. *Management (Modern Russian management)/ ed. by F. M'.Rusinova i ML. Razu. M.: FBK-PRESS, 1999. - 504 p.*
16. Pankratov F. G., Seregina T. K. *Commercial activity*, Moscow: Ekonomika Publ., 2009, 510 pp
17. Petrova E. E., Arapov S. V., Bikezina T. V. *Investment analysis: a textbook*
18. Samoylova E. A. *Management of competitiveness of enterprises in the hotel industry: abstract. dis. ... Candidate of Economic Sciences*, Moscow, 2015, pp. 15-17.
19. Tarasevich K. A. *Istoriya evolyutsii ponyatiya "delovaya reputatsiya" [History of the evolution of the concept of "business reputation"]*. — 2019. — № 1 (55). text: direct.
20. Tendit, K. N. *Osnovy reputatsionnogo menedzhmenta [Fundamentals of reputation management]. manual / K. N. Tendit. Комсомольск-на-Амуре: KnAGTUKhAITy, 2013, 85 p. (in Russian)*

21. Fahretdenova E. V. *Managing a company's brand and reputation in the context of digitalization* / E. V. Fahretdenova // *Marketing, Brand Management and Advertising Technologies: proceedings of the All-Russian Scientific and Practical Conference (Moscow, April 24, 2019)*. Moscow: State University of Management, 2019, pp. 133-137.

22. Chumikov A. N. *Reklama i svyazi s obshchestvom: Imidzh, reputatsiya, brand: Uchebnoe posobie dlya studentov vuzov [Advertising and Public Relations: Image, reputation, brand]*. Moscow: Aspect Press, 2014, 418 p. (in Russian).

23. Shkardun V. D., Akhtyamov T. M. *Otsenka i formirovanie korporativnogo imidzha, predpriyatiya [Шкардун, Т.М. Ахтямов Assessment and formation of corporate image, enterprise]*. *Marketing in Russia and Abroad*, 2001, no. 3, pp. 68-77.

24. Johnson, M., & Gustafsson, A. (2021). "Managing Reputational Risk in the Digital Environment: Best Practices for Export-Oriented Enterprises". *International Journal of Digital Management*, 28(3), 201-218.

25. Kolk, A., & Perego, P. (2010). *Determinants of the adoption of sustainability*

26. Roberts, P., & Dowling, G. (2002). *Corporate reputation and sustained superior financial performance*. *Strategic Management Journal*, 23(12), 1077-1093.

DOI 10.34660/INF.2025.97.35.033

非法开采水生生物资源犯罪案件侦查情况
**SITUATIONS OF CRIMINAL INVESTIGATION IN CASES OF
CRIMES RELATED TO ILLEGAL EXTRACTION OF AQUATIC
BIOLOGICAL RESOURCES**

Voronin Sergey Eduardovich

Doctor of Law, Professor

Siberian Institute of Business, Management and Psychology,

Krasnoyarsk, Russia

摘要。 本文揭示了与非法开采水生生物资源相关的刑事案件中出现的司法和侦查情况的法律性质。作者尝试对第一审法院和最高上诉法院中出现的疑难侦查情况进行科学分类。并尝试制定措施，以确保与远东有组织犯罪集团活动相关的案件中证人的安全。这些有组织犯罪集团专门从事非法开采水生生物资源的活动。他们是国际黑手党集团的一部分，对太平洋地区的任何国家都构成巨大威胁。

关键词： 侦查、情况、法院、生物资源、法医学、分类、重建、安全、证人、判决。

Abstract. *The article reveals the legal nature of judicial and investigative situations arising in criminal cases on crimes related to the illegal extraction of aquatic biological resources. The author attempted a scientifically based classification of problematic investigative situations arising in court 1 and cassation instances. An attempt was made to develop measures aimed at ensuring the safety of witnesses in cases related to the activities of organized criminal groups in the Far East. These organized criminal groups specialize in the illegal extraction of aquatic biological resources. They are part of international mafia groups and pose a great danger to any state in the Pacific region.*

Keywords: *Investigative, Situation, Court, Bioresources, Forensics, Classification, Reconstruction, Security, Witness, Verdict.*

1. The Concept of a Judicial Situation and Its Place in Modern Criminology

The diversity of judicial and investigative situations dictates the need for their systematization, streamlining for solving theoretical and practical problems. Unfortunately, on this issue in the theory of investigative situations, the research paths are only just outlined. The main problem, in our opinion, is to develop a

universal criterion for division that allows all the diversity of situations of judicial proceedings to be reduced to a single scientifically based classification. Attempts by individual authors to develop such a criterion are not always successful. Thus, D.V. Kim, depending on the stages of judicial proceedings, as well as the 3-stage structure of criminal activity and search and cognitive activity of the subjects of proof at the stage of preliminary investigation, suggests dividing them into situations of the initial stage of judicial consideration of criminal cases (cover the preparatory part of the trial); situations of a further stage of judicial consideration of criminal cases (cover the judicial investigation, judicial debate, the defendant's final word); situations of the final stage of judicial consideration of criminal cases (cover the ruling and pronouncement of the verdict. [1]

In our opinion, such division of judicial situations is rather arbitrary and schematic, since the boundaries of the stages of criminal procedural activity do not always coincide with the stages of forensic activity. For example, the stage of initiating a criminal case often does not coincide with the initial stage of the investigation, which, unlike the stage of criminal proceedings, may include, for example, operational-search activities carried out by police units in the home port of fishing trawlers long before the initiation of a criminal case. Therefore, based on the criterion proposed by the indicated author, it is very problematic to determine what is the initial investigative situation in the case. Such a basis for division does not allow us to clearly distinguish between the situation of judicial investigation and the situation arising during judicial debates, both in terms of the subject of knowledge and in terms of the direction of development. [2]

The conceptual position that situations arising during preliminary investigation and in court proceedings have the same epistemological nature allows for the successful application of classification grounds developed in the theory of investigative situations for the systematization and streamlining of situations of judicial investigation in cases of crimes under the jurisdiction of the investigative bodies of the border agencies of Russia. [10]

Thus, depending on the stages of the criminal process, it is possible to distinguish judicial problem-search situations arising in the courts of the first, appellate, cassation and supervisory instances. Depending on the level of knowledge, judicial investigative situations are divided into typical and real, where typical ones characterize the theoretical, and real ones - the empirical levels of knowledge. Real ones, in turn, are divided into typical and atypical judicial investigative situations according to the degree of repetition. Obviously, a typical judicial investigative situation is the result of theoretical understanding and generalization of judicial practice materials, including options for resolving typical and atypical situations. This is the essence of the complex dialectical connection of the typical, typical and atypical in the process of cognition in court, which corresponds to

the relationship of the philosophical categories of the general, the special and the individual in the studied class of phenomena. Judicial practice in cases of crimes under investigation by the investigative bodies of the border authorities of Russia shows that the specifics of the border activities themselves leave their mark on both the nature and dynamics of judicial and investigative situations that arise during the trial of crimes related to the illegal extraction of aquatic bioresources. As a rule, typical judicial and investigative situations for this category of criminal cases in the courts of first, appellate, cassation and supervisory instances differ in the nature of the problem posed and resolved by the judge. [5]

Thus, if a typical situation arising in first instance courts, in our opinion, is the collection by the court of evidence sufficient to make a decision on the merits of a criminal case, then a typical situation arising in appellate, cassation and supervisory courts is the verification of the correctness of decisions made by the first instance court. Hence the differences in the direction of development of typical judicial investigative situations and the nature of search and cognitive activity in the courts of the first, second and supervisory instances. [4]

Thus, a typical problem-search judicial situation in the first instance court (hereinafter we will call it PS) "collection by the court of evidence sufficient to make a decision on the merits of the case" is directly related to the purpose of proof in criminal proceedings - establishing the truth in the case and forms a block of typical judicial investigative situations:

1. PS related to the preservation in court of evidence obtained during the preliminary investigation.
2. PS related to filling gaps in the preliminary investigation materials. Let us consider each group of problematic search judicial situations separately.

2. Scientific Classification of Problematic Situations of Judicial Investigation

A typical judicial and investigative situation here, in our opinion, is a situation of tactical risk of losing witness testimony in court. In the context of the continuing deterioration of the crime situation in the country, including in the area of environmental safety, a witness in most criminal cases is exposed to a real danger of psychological and physical influence from members of criminal groups. Moreover, experts of the international community increasingly note cases of so-called edifying (intimidating) violence, when a witness or his relative can be killed only to show future potential witnesses what consequences they will have to face if they provide evidence.[3]

The consequence of this, as a rule, is a change in the court of witness testimony previously given during the preliminary investigation or inquiry, or the witness's refusal to appear in court.

Illegal extraction of aquatic bioresources has always been and is in the zone of increased attention from the criminal world, since this type of criminal activity is a

very solid source of replenishment of the thieves' cash box - the so-called criminal «common fund». Due to the specifics of the region, poaching activities in the Far Eastern Federal District are most often carried out as part of an organized criminal group, and all participants in such organized criminal groups «in good faith» pay a percentage of their illegal profits to the «thieves' common fund» as established by the criminal world. Therefore, a witness from among the members of these organized criminal groups who decided to assist the investigation bodies of the border agencies of the Russian Federation, in our opinion, needs special measures of criminal procedural protection. [6]

A study conducted by Khabarovsk scientists in 2021 shows that the impact on victims and witnesses occurs most often during the consideration of criminal cases in court - in 62% of the cases studied by her, during the investigation - in 28%; during the investigation and in court for the same criminal case - in 9%; after the trial - in 1%. That is why the problem of developing a tactical operation “ensuring the safety of a witness in court” is especially relevant at present, designed to resolve these very complex judicial and investigative situations. [11]

The problems of procedural and organizational support for the safety of participants in criminal proceedings have been repeatedly raised in scientific literature. At the same time, the authors offer various approaches to solving this problem. Thus, V.I. Andreev, analyzing the practice of law enforcement agencies in the Republic of Kazakhstan, notes that practitioners there have long been using the masking of witnesses' personal data in the investigation of crimes of various categories for more than 20 years. Noting the half-hearted nature of these attempts to ensure the safety of witnesses, V.I. Andreev at the same time rightly speaks of the need to carry out a set of measures aimed at creating a witness safety system, which involves legislative regulation of this issue, logistical support, the procedure and conditions for storing classified documentation, a mechanism for compensation for harm caused to a witness. [7]

Interrogation of a witness under a pseudonym as one of the measures for his/her safety in criminal proceedings is permitted today and in accordance with Article 166 of the Criminal Procedure Code of the Russian Federation. Analysis of judicial and investigative practice shows that most often in the studied category of criminal cases related to the illegal extraction of aquatic biological resources, criminal procedural situations arose that were in one way or another related to the safety of witnesses, as well as the pre-trial agreement on cooperation of suspects (accused) with the investigation. Practice shows that in the studied category of cases, these criminal procedural situations are, as a rule, closely related to each other. Moreover, most often, conflict criminal procedural situations and situations of tactical risk arise here.

The fact is that the current version of Part 9 of Article 166 of the Criminal Procedure Code can hardly be considered a sufficiently reliable guarantee of the

safety of witnesses and victims, as well as other participants involved in a criminal case related to the activities of well-organized, often international criminal groups of poachers. For example, in accordance with Part 2 of Article 317 of the Criminal Procedure Code of the Russian Federation, all measures of state protection of victims, witnesses and other participants in criminal proceedings provided for by federal law apply to a suspect or accused with whom a pre-trial agreement on cooperation has been concluded. But how the legislator plans to implement the said security measures with respect to convicted persons who have assisted the investigation and are serving their sentences in places of deprivation of liberty is completely unclear.

Undoubtedly, disguising personal data or interrogating a witness under a pseudonym gives rise to many problems in criminal procedure. First of all, such interrogation is, in essence, concealing the source of evidence, which even allowed some authors to talk about the existence of a “secret source of evidence”. This immediately raises the question of the suitability of such evidence from the standpoint of its admissibility before the investigator and the judge. Hence the logical conclusion about the need to amend Part 2 of Article 74 of the Criminal Procedure Code, providing for a disguised interrogation of a witness as a source of evidence for security purposes. The necessary adjustments will also have to be made to Articles 215-220 of the Criminal Procedure Code of the Russian Federation, regulating the procedure for completing the preliminary investigation. The appearance at this stage of the investigation of a covert source of evidence will inevitably create the problem of familiarising the accused with the factual data obtained from it. In order for the proposed witness protection system to work effectively, it is necessary to provide the trial with a mechanism for deciphering such a source of evidence. [3]

In this regard, we believe that for each criminal case, especially related to the activities of organized criminal groups involved in the illegal extraction of aquatic biological resources, the investigator and operative officer must draw up secret “letter” files on all witnesses who wish to remain anonymous. Such files, drawn up like intelligence files in operational investigative activities, must indicate the witness’s true personal data, his pseudonym, a statement from the witness with a request to conceal his participation in the criminal case, refusal to participate in both an open and closed court hearing, as well as the reasons for such refusal. The “letter” file must be a secret appendix to the indictment and be kept in the Criminal Investigation Department of the Russian Ministry of Internal Affairs for the region (oblast). The right to become familiar with the “letter” file must be granted only to the judge and the prosecutor with the appropriate forms of security clearance. This is entirely consistent with the requirements of Part 4 of Article 5 of the Federal Law of the Russian Federation “On Operational Investigative Activities”, which

limits the judge's access to information about persons assisting operational bodies on a confidential basis. In our opinion, interrogation of a covert witness in a court session (or in "online" mode) can only be carried out with his consent. Therefore, it is difficult to agree with the position of I.V. Smolkova, who compares the practice of announcing testimony in a court session in the absence of such witnesses with the instruction of A.Ya. Vyshinsky in 1937 not to summon informers to court, but to limit oneself to reading the testimony given to the investigator, without naming the names of the informants. [2]

We believe that such an analogy is inappropriate here, since the practice of announcing the testimony of one or another participant in a criminal trial in his absence or showing a video recording of such an interrogation is currently permitted by law. And, although in this case we are talking about interrogation under a pseudonym, we believe that the defendant's right to defense is in no way infringed, since we are talking only about concealing the source of evidence, and not the factual data that constitute the content of the evidence and are of greatest interest to the defendant from the point of view of the tactics of his defense. In our opinion, the guarantees of observing the defendant's right to defense when carrying out the said tactical operation in court are prosecutorial supervision and judicial control over the legality and quality of the compiled "letter cases of witnesses", carried out at all stages of the criminal process.

However, during a court hearing, a situation is possible when the defense attorney can fairly demand information from the court about the source of evidence. For example, a witness gives knowingly false testimony that the defense could refute by proving that the witness was in another place at the time of the crime and could not have seen what happened. We believe that in this case the defense attorney should be given the opportunity to familiarize himself with the witness's "letter" case file, warning the lawyer about criminal liability for disclosing preliminary investigation data. In this regard, Article 310 of the Criminal Code of the Russian Federation, in our opinion, should be supplemented with Part 2, approximately as follows: "The same actions that resulted in the death or serious harm to the health of a witness or other person assisting justice, shall be punished..."

A natural question arises: is it worth complicating the already cumbersome procedure of criminal proceedings because of such a participant in the process as a witness? We believe that it is. If the victim is an interested participant in the criminal process, and, according to some authors, its central figure, then the witness is currently the most unprotected, the most powerless participant in criminal proceedings. It remains completely unclear why a witness should suffer very serious deprivations only because "he became aware of some circumstances subject to establishment in this case"? The advantage of the proposed tactical operation in court is that by resolving such a complex PS as "ensuring the safety of a witness",

it, unlike the “marshal system” operating in the USA and Anglo-Saxon countries and the essence of which is the relocation of a witness, changing his appearance and biography, is obviously more economical and therefore quite realistic in the current socio-economic conditions in Russia.

In the context of the above, a few words should also be said about the problem of using videoconferencing during judicial interrogation. Part 8 of Art. 189.1 of the Criminal Procedure Code of the Russian Federation (Federal Law of 30.12.2021 No. 501-FZ) imperatively prohibits the use of videoconferencing if there is a threat of disclosure of state secrets or personal data of participants in criminal proceedings. It seems that the ban is far from the best way to resolve a problematic situation in court. In our opinion, Art. 189.1 of the Criminal Procedure Code of the Russian Federation should be supplemented with Part 9, allowing the use of videoconferencing and special programs that change the appearance and voice of a witness during interrogation. We believe that the use of such programs during judicial interrogation must be recorded in the witness’s “letter” file, which is also an integral part of the federal witness protection program in criminal proceedings. A problematic search-and-search judicial situation associated with the risk of losing evidence is also typical in cases related to the illegal extraction of aquatic biological resources. For example, in the case of involving a specialist in the trial.

Thus, in one of the criminal cases, an ichthyologist specialist participated in a pre-planned event by the Nakhodka Department of Internal Affairs to identify and prevent illegal extraction of aquatic biological resources. During its implementation, a motorboat was found in the waters of the Nakhodka lake, in which citizen P. was located, citizen K. was diving in the water next to the boat, periodically surfacing, the latter passed something to the boat. Subsequently, after the watercraft approached the shore and law enforcement officers performed verification actions, it was established that the said persons illegally extracted 128 sea cucumbers, 50 scallops and one octopus. This specialist participated in the inspection of the scene of the incident, and was later called in as an expert in the case of an administrative offence, initiated on the same fact. Subsequently, an explanation was taken from him, in which he outlined everything he saw while observing the actions of poachers from the shore, and then, having calculated the amount of damage caused, he determined its category - major.

In cases of crimes under investigation by the investigative bodies of the border agencies of Russia, problematic situations related to the participation of an expert or specialist in the case most often arise in court. Thus, an investigator of the Border Directorate of Russia for the Khabarovsk Territory and the Jewish Autonomous Region, investigating a criminal case in 2019 on the fact of illegal extraction and procurement of red caviar, demonstrated remarkable tactical ingenuity and the highest professionalism by ordering a genomic (genotyposcopic) examination in

a criminal case that was very difficult in terms of proof. The object of the examination was a spoon from which the suspect had eaten red caviar the day before, leaving traces of her DNA on this spoon. At the same time, during the investigation, the suspect categorically refused to admit her involvement in the counterfeit caviar. The genomic examination confirmed that the saliva left on the spoon belonged to citizen Nikiforova. However, during the trial, Nikiforova's defense attorney filed a motion to exclude evidence - the genomic examination report - as inadmissible. As forensic practice shows, this is a common tactic for defense attorneys in cases involving illegal extraction of aquatic biological resources, which boils down to establishing the fact of incompetence and unprofessionalism of the expert with the subsequent loss of this material evidence. This is what happened in the forensic situation described above. The court found that expert Anokhin did not have the appropriate expert clearance, properly executed, at the time of the genotiposcopic examination. As a result, this genomic examination report was recognized by the court as inadmissible evidence in accordance with Article 75 of the Criminal Procedure Code of the Russian Federation. [8]

Many situations of judicial proceedings in cases under investigation by the investigative bodies of the border authorities of Russia, in our opinion, can be successfully resolved during a competently conducted interrogation of a specialist already in court - with the help of the so-called tactical operation "selection, sequence and combination of various forms of judicial interrogation".

Specific conditions of judicial proceedings contributed to the emergence of unique forms of judicial interrogation - cross-examination and chessboard. In essence, these are modified forms of confrontation, applied adequately by the established judicial PS.

Cross-examination is the interrogation of one person by several participants in the judicial investigation regarding the same circumstance. The importance of this type of interrogation in the process of establishing the truth is difficult to overestimate. Thus, emphasizing the role of this tactical device, the English lawyer Hutchison notes: "The adversarial process is based on the principle that one cannot rely on unverified evidence. One of the guarantees of judicial fairness is that no one can be convicted on the basis of unverified evidence. Our system of proof depends mainly on oral testimony ("first-hand"). Without it, without checking the statement received from second hands, the case will come to any errors and abuses."

A chess interrogation can be called one in which the interrogator asks questions to other persons on the same facts and circumstances that are currently being investigated in the main interrogation. The purpose of such an interrogation is to confirm or refute the testimony of the person being interrogated with the testimony of other persons. Certain conditions must be observed when conducting a chess

interrogation: it can only be allowed in relation to persons who have already been interrogated in court; questions asked to other persons must pursue the specific goal of confirming or refuting the testimony of the person being interrogated and not lead away from the line of the main interrogation. A chess interrogation in court differs from a confrontation, since it is accompanied by a different problem-search investigative situation than in a confrontation. The need to conduct a confrontation arises as a result of significant contradictions in the testimony of two persons; there are significantly more participants in a court chess interrogation, and there may not be any contradictions in their testimony. The order of judicial interrogation, as a component of the above tactical operation, will also directly depend on the type of judicial investigative situation. [9]

Thus, if an adult participated in the commission of a crime related to the illegal extraction of aquatic biological resources together with a teenager, it is advisable to interrogate the minor first, otherwise he may adjust his testimony taking into account the position of the adult, whose influence on teenagers is sometimes great even after the crime has been committed. Of course, it also happens that an adult gives truthful testimony and imitation of him can have a positive effect on the results of the interrogation of a minor. But it is obvious that such an effect can also be expected when the teenager is asked questions after the interrogation of an adult.

Let us consider the Problem-search judicial situations related to filling gaps in the materials of the preliminary investigation.

Attempts to study the situations of judicial investigation related to filling gaps in the materials of the preliminary investigation have already been undertaken in the scientific literature, however, on this problem in forensic science, we believe, only the paths of research are being outlined.

Analysis of Chapter 37 of the Criminal Procedure Code of the Russian Federation shows that the arsenal of tactical means of the judge is significantly smaller than that at the investigator's disposal at the stage of the preliminary investigation. Obviously, the strictly formalized procedure of judicial proceedings does not allow for exhumation, verification of testimony on the spot, or a search. [10]

The performance of such investigative actions as an investigative experiment (Article 288 of the Criminal Procedure Code), inspection of the area and premises (Article 287 of the Criminal Procedure Code) are also extremely rare in judicial practice. The fact is that it is quite difficult for the court itself with the participants in the trial (due to the publicity of the process) to conduct an investigative experiment or, even more so, a search aimed at finding things and objects related to the criminal case under consideration, not only in organizational terms, but also in a purely moral aspect. The said actions are characterized by an increased degree of coercion, and the inspection and search involve various forms of search and in

various places (toilets, places where dirty linen, garbage are stored, etc.), which is hardly compatible with the administration of justice. Gaps in the preliminary investigation materials are also filled during interrogations (Articles 275, 277, 278, 282, Part 4 of Article 271 of the Criminal Procedure Code of the Russian Federation), during the forensic examination (Article 283 of the Criminal Procedure Code of the Russian Federation) and during the inspection of the area and premises (Article 287 of the Criminal Procedure Code of the Russian Federation). The latter, although it is used in judicial practice extremely rarely, is also, in our opinion, a very effective way of resolving rather complex judicial and investigative situations.

Summing up the above, we can make a reasonable conclusion that the problem of judicial and investigative situations arising during the consideration of cases of crimes related to the illegal extraction of aquatic bioresources, in our opinion, is very promising in scientific terms and needs further development.

References

1. Gavlo V.K. *Theory and practice of investigating crimes in the field of migration security: Monograph* / V.K. Gavlo, S.E. Voronin, I. V. Nikitenko, Krasnoyarsk: Publishing house of the Siberian Institute of Business, Management and Psychology. 2022.-P.236.
2. Voronin, S.E. *Psychotypological approach in the system of forensic knowledge: Monograph* / S.E. Voronin, R.L. Akhmedshin, T.A. Alekseeva. Krasnoyarsk: Publishing house of the Siberian Institute of Business, Management and Psychology. 2021.- P. 73
3. Voronin, S.E. *Moral and psychological foundations of operational-search activity and criminal proceedings: Monograph* / S.E. Voronin. - Krasnoyarsk: Publishing house of the Siberian Institute of Business, Management and Psychology, 2021.- P.114
4. Voronin, S.E. *Organization of a criminal community: criminal-legal and criminalistic aspects* / S.E. Voronin, E.S. Voronina, A.M. Zheleznyakov. - Krasnoyarsk: Publishing house of the Siberian Institute of Business, Management and Psychology, 2022.- P.108
5. Voronin, S.E. *Dialogues about criminal proceedings in Russia: Monograph* / S.E. Voronin. Khabarovsk: Publishing house of the Far Eastern Institute of the Ministry of Internal Affairs of the Russian Federation. 2021.- P.126
6. Voronin, S.E. *Situational modeling in forensic examination [Text]* / S.E. Voronin. - Krasnoyarsk: Publishing house of the Krasnoyarsk State Agrarian University, 2021.- P. 121.

7. Voronin, S.E. *Actual problems of modern forensic science [Text]* / C.E. Voronin, I. V. Nikitenko, D.A. Stepanenko. - Krasnoyarsk: Publishing house of ANO VO «Siberian Institute of Business, Management and Psychology», 2020.-P.102
8. Voronin, S.E. *Theory and Practice of Investigation of Crimes Associated with Illegal Extraction of Aquatic Biological Resources [Text]* / S.E. Voronin, M.N. Tokarev. - Krasnoyarsk: Publishing house of the Siberian Institute of Business, Management and Psychology, 2021.-P.136.
9. Voronin, S.E. *Forensic Science: Workshop / Study Guide* / S.E. Voronin. Krasnoyarsk: ANO VO «Siberian Institute of Business, Management and Psychology», 2022.-P.99
10. Akhmedshin R.L. *Legal and methodological support of border activities. Monograph* / R.L. Akhmedshin, S.E. Voronin. Krasnoyarsk: Publishing house of the Siberian Institute of Business, Management and Psychology. 2022- P.146
11. Lunev, V.V. *Crime of the XX century. World Criminological Analysis*. Moscow: Publishing house «Science». 2021.-P. 168

俄罗斯合伙融资制度的演变

ON THE EVOLUTION OF THE INSTITUTION OF PARTNERSHIP FINANCING IN RUSSIA

Vildanova Marina Mikhailovna

Candidate of Law, Leading Researcher

*Center for Private Law of the Institute of Legislation and Comparative
Law under the Government of the Russian Federation*

摘要. 本文探讨了俄罗斯正在试点实施的新的民法金融活动规制（合伙融资）的特点。自2023年9月起，合伙融资已在巴什基尔、达吉斯坦、鞑靼斯坦和车臣等融资体系与伊斯兰银行类似的地区实施。本文介绍了合伙融资的实践。目前，俄罗斯计划修订相关法律，以扩大试点范围，扩大合伙融资的交易（业务）范围，并制定此类活动的标准。

关键词： 合伙融资、伊斯兰银行、实验性法律制度、贷款、信贷、互助保险、伊斯兰教法规范、金融活动、实验性法律制度、合伙融资标准。

Abstract. *The article examines the features of the new civil-law regulation of financial activities (partnership financing), applied in the order of an experiment in Russia. Since September 2023, partner financing has been implemented in Bashkiria, Dagestan, Tatarstan and Chechnya, i.e., in those regions where the financing system is similar to Islamic banking. The paper presents the practice of using partnership financing. At present, it is planned to amend the legislation aimed at increasing the terms of the experiment, expanding the list of transactions (operations) of partnership financing and developing standards for the said activity.*

Keywords: *partnership financing, islamic banking, experimental legal regime, loan, credit, mutual insurance, sharia norms, financial activities, experimental legal regime, standards of partnership financing.*

If we look at the history of the institution of partnership financing in Russia, we cannot consider the idea of its creation to be entirely new. Previously, some banks attempted to carry out operations that would comply with the rules of Sharia. Thus, in 1991, the Badr-Forte Bank (ZAO) tried to introduce elements of partnership financing (i.e., Islamic banking), but the project was subsequently closed due to obvious contradictions to Russian legislation.

Currently, Islamic banking is represented in many countries around the world, including Malaysia, Saudi Arabia, UAE, Kuwait, Turkey, Indonesia, etc. The main financial instruments are: financing through trust management (*mudaraba*), interest-free financing (*qard al-hasan*), lending through trade activities (*murabaha*), venture financing (*musharaka*), leasing agreement (*ijara*), halal investment instruments (investments in securities of companies whose principles of financial and economic activities comply with Sharia standards, and whose assets have sufficient liquidity and growth potential) [1]. Investment of funds is possible only in tangible assets, and transactions with intangible assets or instruments are prohibited.

In this case, the structure of the legislation that provides opportunities for classical regulation and use of Islamic financial instruments is important. One of the most representative examples of such regulation is the legislation of Malaysia, which has the Financial Instruments Act 2013, which regulates the banking system, and the Islamic Financial Services Act 2013, which establishes an analogue of regulation applicable to the Islamic financial instruments sector. Thus, there is a certain dualism of the Malaysian financial system.

The experience of the United Arab Emirates, where the basis of legal regulation is the Federal Law of 1985 No. 5 “On Civil Transactions” (UAE Civil Code) and the Federal Law of 2018 No. 14 “On the Central Bank and the Organization of Financial Institutions and Financial Activities”, certainly deserves attention. According to the Constitution, the basis of legal regulation in the United Arab Emirates is Sharia.

In the financial sector regulated by Sharia law, the principle of separation between the creditor and the client in the transactions/deals carried out and the profit received has been introduced. and risks of causing losses “...This activity is also referred to by the term “partnership banking”, which is a financial activity for servicing entrepreneurial activity, associated with the sharing of income and risks between the creditor (investor) and the recipient of the loan” [2]. At the same time, their activities are limited by the established ban on financing the gambling business and weapons production. And ammunition; production and distribution of narcotic drugs; production and sale of tobacco products and alcohol, as well as production of products from the meat of animals that died a natural death, including pork.

Much attention is paid to ethical and religious aspects. According to the general concept of Sharia, it is forbidden to finance projects that could harm people and cause social injustice. Islamic law aims to implement the support of real sectors of the economy, stabilization of the financial and commodity market.

As the analysis of international experience shows, legal regulation on the same level as classical banking regulation is of particular importance for the successful functioning of partnership financing.

The basis for such regulation in the Russian Federation was the Federal Law of August 4, 2023 No. 417-FZ "On conducting an experiment to establish special regulation in order to create the necessary conditions for the implementation of activities on partnership financing in individual subjects of the Russian Federation and on amendments to individual legislative acts of the Russian Federation", hereinafter referred to as Law No. 417-FZ [3], according to which the experiment will be conducted from September 1, 2023 to September 1, 2025 in the territories of the Republic of Bashkortostan, the Republic of Dagestan, the Republic of Tatarstan and the Chechen Republic.

Law No. 417-FZ is largely aimed at identifying the population's interest in Islamic banking instruments. Participants in the experiment are legal entities included in the register maintained by the Bank of Russia. Legal entities participating in the experiment are not entitled to charge interest on loans. A general ban on speculation has been introduced, including with securities, which is explained by the high risk of losing clients' investments. A restriction has also been established on a number of transactions with derivative financial instruments. Futures are also prohibited. Financial institutions invest only in the production of real products and identification of the assets underlying the transactions/operations is mandatory.

In November 2023, the register of participants in the experiment included: Joint-Stock Commercial Bank AK BARS (public joint-stock company), Limited Liability Company Management Company AK BARS CAPITAL, Public Joint-Stock Company Sberbank of Russia, Limited Liability Company Domclick. Currently, the list of participants included in the Register of Participants in the experiment to establish special regulation in order to create the necessary conditions for carrying out activities on partner financing has increased to 31 participants [4]. The list of transactions made by the experiment participants has also increased significantly.

However, the above terminology of Islamic banking is not used in law No. 417-FZ, and provides structures known to the legislation of the Russian Federation, but essentially reproducing Islamic instruments. Thus, Article 2 of Law No. 417 provides for the following operations (transactions):

"1) attracting funds and (or) other property of individuals and legal entities in the form of a loan, by placing bonds, accepting property into trust management and (or) accepting a contribution (share) in the authorized (contributed, share) capital of a participant in the experiment;

2) provision of funds in the form of a loan to individuals and legal entities;

3) financing of individuals and legal entities through the purchase and sale of goods (including real estate) on terms of installment (deferral) payment for goods with the collection of a fee for the provision of installment (deferral) payment for goods;

4) financing of individuals and legal entities by providing property under a financial lease (leasing) agreement, making a contribution (share) to the authorized (contributed, share) capital of legal entities, carrying out joint activities under a simple partnership agreement, investment partnership;

5) issuing surety for third parties.”

Participants in the experiment implement the principles of partnership financing on a voluntary basis, and legal regulations do not limit the right of investors to use traditional financial instruments.

The minimum capital of the experiment participants that are not credit and non-bank credit organizations was 10 million rubles from September 1, 2023, and 15 million rubles from January 1, 2024. The management of a legal entity carrying out activities related to partnership financing must be separated from the normal management activities of a financial organization, and all financial instruments must not contradict the principles of Sharia.

The regulations of the Central Bank of the Russian Federation (hereinafter referred to as the Bank of Russia) establish the specifics of maintaining accounting records by organizations in connection with their activities in partnership financing [5]. Such accounting records must be maintained separately from the general accounting records of transactions not related to compliance with the principles of Sharia.

In addition, the Bank of Russia pays special attention the procedure for informing the clients of the experiment participant about the activities carried out by it on partner financing. The Bank of Russia’s instruction provides for a list of information subject to disclosure at customer service locations and on the official website of the experiment participant on the Internet, as well as the procedure and timeframes for disclosing such information”[6]. In particular, this concerns the following information: full name (full corporate name) and abbreviated name (abbreviated corporate name), primary state registration number, address specified in the unified state register of legal entities, address of separate subdivisions of the experiment participant (if any), email address, telephone number, website address, information about the registration number of the legal entity’s entry in the register of experiment participants maintained by the Bank of Russia.

The above innovations are successfully used by banks to develop products that comply with the principles of Islam. Thus, PJSC AK BARS BANK [7] developed a line of partner financing products, which include:

- a debit card that complies with Islamic principles (free issue and maintenance, accounting and storage of money according to Sharia standards);
- current account (opening an account online for 0 rubles, account maintenance, which is free every month when a salary of 75,000 rubles or more is credited per month; free transfers from this account to any client of a Russian bank in the amount of up to 2 million rubles);

- mortgage (fixed installment cost for the entire financing period; maximum installment period is 20 years; no interest, penalties, insurance, minimum down payment amount);

- lending through trade activities (fixed cost of installments; no collateral insurance required; funds are kept in a separate account and do not finance banking operations prohibited by Sharia;

- factoring (a set of services, including an open-ended factoring agreement, in which the bank does not charge interest, and the transactions are a trade transaction, where the bank enters into a partnership with the client, sharing some of the risks with the supplier, and at the same time the bank provides services to the client for managing accounts receivable);

- leasing (a financial service that allows you to rent equipment for a long term with the right to buy it back later; no interest, penalties or fines; the contract term is from 1 year to 5 years, the guarantee payment is from 10% of the cost of the leased item), etc.

Similar measures are being taken by JSC TBank [8] and its main products are: bank card, Islamic installment plan, launch of leasing (for legal entities).

PAO Moscow Exchange together with PAO Sberbank of Russia launched the Index about two years ago Moscow Exchange Islamic Investments (trading code - MXSHAR) and the Moscow Exchange Islamic Investments Total Return Index (trading code - MXSHARTR). Such indices were created to provide Muslim investors with the opportunity to invest funds in instruments created taking into account the principles of conducting activities approved by Sharia. The creation of indices is based on the selection of securities of issuers that have been checked for compliance with the specified principles by the Sharia Supervisory Board, created by Sberinvest Middle East Limited with headquarters in the United Arab Emirates [9]. The results of the introduction of indices are very indicative and are welcomed by business.

Currently, draft Federal Law No. 861621-8 “On Amending the Federal Law “On Conducting an Experiment to Establish Special Regulation in Order to Create Necessary Conditions for Carrying Out Activities on Partnership Financing in Certain Subjects of the Russian Federation and on Amending Certain Legislative Acts of the Russian Federation” and Article 28 of the Federal Law “On Advertising”” has been developed, hereinafter referred to as the draft law [10]. According to this draft law, it is proposed to extend the experiment until September 1, 2028, since, in the opinion of both regulatory authorities and business representatives, the 2-year period provided for in Law No. 417 is clearly insufficient to identify all the necessary needs for the development of a new financial instrument. It seems that such an approach is justified and necessary in the current circumstances.

In order to improve the mechanisms for conducting the experiment, the draft law provides for the expansion of the list of transactions/operations of partnership financing that the participants in the experiment have the right to carry out, with transactions of mutual insurance of the property interests of members of mutual insurance societies, opening and maintaining bank accounts of individuals and legal entities, and making transfers of funds on behalf of individuals and legal entities through their bank accounts.

The draft law establishes that the Bank of Russia may introduce additional requirements for the activities of the experiment participant, requirements for the procedure for determining the amount of equity (net assets), risk coefficients for individual types of assets, as well as the maximum amount of remuneration for the experiment participant. It also provides for an expansion of the grounds for refusing to include information about the applicant in the register of experiment participants and excluding information from the register, including in the presence of signs of lack of financial stability.

The draft law states the need to establish requirements for advertising the activities of the experiment participants, as well as the development of standards for partnership financing, as well as standards for the implementation of supervision over compliance with the standards for partnership financing by the Committee on Standards for Partnership Financing (hereinafter referred to as the Committee) and their coordination with the Bank of Russia. The Committee is created by an association of credit institutions, which must include at least two-thirds of the credit institutions participating in the experiment, determined in accordance with the register of participants in the experiment.

In addition, an important area of development of partner financing is digitalization, since both the Russian and international economies are seeing a trend towards abandoning the use of cash. The introduced electronic banking will facilitate the implementation of a set of measures aimed at improving banking products and services.

The draft law is aimed at ensuring uniform application of the institution of partnership financing, increasing the efficiency and transparency of its instruments. The consistent implementation of new institutions envisaged by the draft law is useful for the development of various sectors of the Russian economy. Thanks to the evolution of partnership financing, funds from individuals and legal entities from friendly countries of Asia, Africa, Latin America, and the Middle East will begin to flow into the Russian financial sector. As a result, the new level of trade and economic relations being created will help overcome the effects of the imposed foreign sanctions and their consequences.

References

1. *Simple instruments and complex transactions. How Islamic banking is developing in Russia* // <https://sber.pro/publication/prostye-instrument-i-slozhnye-sdelki-kak-razvivaetsia-islamskii-banking-v-rossii>
2. B.A. Shakhnazarov "Legal regulation of Islamic financial instruments in modern conditions", "Banking Law", 2021, No. 3.
3. *Federal Law of August 4, 2023 No. 417-FZ "On conducting an experiment to establish special regulation in order to create the necessary conditions for the implementation of activities on partnership financing in individual subjects of the Russian Federation and on amendments to individual legislative acts of the Russian Federation"* // ConsultantPlus System: Russian legislation (Prof Version).
4. [https://cbr.ru>vfs.files>supervision>list_PF\(XLS\)](https://cbr.ru>vfs.files>supervision>list_PF(XLS))
5. *Instruction of the Central Bank of the Russian Federation dated August 14, 2023 No. 6504-U "On the specifics of accounting for participants in the experiment that are non-credit financial institutions in connection with their implementation of partnership financing activities and the procedure for preparing accounting (financial) statements by experiment participants when implementing partnership financing activities for non-credit financial institutions"*; *Instruction of the Central Bank of the Russian Federation dated August 14, 2023 No. 6505-U "On the specifics of accounting for participants in the experiment that are credit institutions, in connection with their implementation of activities in partnership financing"* // ConsultantPlus System: Russian legislation (Prof Version).
6. *Bank of Russia Instruction No. 6517-U of September 5, 2023 "On the procedure for informing clients of an experiment participant about its activities on partner financing, on the list of information subject to disclosure at customer service locations and on the official website of the experiment participant on the Internet information and telecommunications network, as well as on the procedure and timeframes for disclosing such information"* // ConsultantPlus System: Russian legislation (Prof Version).
7. <https://akbars.ru>
8. <https://tbank.ru>
9. <https://bcs-express.ru/novosti-i-analitika/musul-manskii-portfel-na-mosbirzhe-v-chem-sekret-dokhodnosti>
10. <https://sozd.duma.gov.ru>

DOI 10.34660/INF.2025.66.27.035

教育与现代世界的新一代——全球和区域趋势：一位政治学家的观点
**EDUCATION AND THE NEW GENERATION IN THE MODERN
WORLD - GLOBAL AND REGIONAL TRENDS: A POLITICAL
SCIENTIST'S VIEW**

Proskurina Elena Aleksandrovna

Doctor of Political Science, Professor

Luhansk State University named after Vladimir Dahl

摘要. 本文探讨了高等教育体系在当今世界的重要意义。文中阐述了文明的年代非周期性及其与社会知识化水平成正比的关系。文中明确了高等教育的发展趋势和标准，以及其对新信息技术的依赖。文中揭示了高等教育国际化的因素，并提出了俄罗斯高等职业教育的战略目标。

关键词：文明的年代非周期性、教育投入、俄罗斯教育政策。

Abstract. *The article is devoted to the significance of the higher education system in the modern world. The chronological aperiodicity of civilizations and its determinacy by a directly proportional dependence on the level of intellectualization of society are presented. The trends and criteria of higher education and its dependence on new information technologies are determined. The factors of internationalization of higher education are revealed. The strategic goals of Russian higher professional education are designated.*

Keywords: *chronological aperiodicity of civilization, commitment to education, educational policy of Russia.*

The end of the 20th century – the first 20 years of the 21st century marked the beginning of a new path to the future. Time will show what future – better or worse. The call for peace and dialogue is always initiated by those who are closer to the pure essence and nature of the human desire for truth. The new path to coexistence and cooperation between freedom-loving and justice-seeking peoples and cultures, as a rule, lies in the plane of political dialogue between civilizations.

Dialogues on international political issues, economics, and various issues of cultures and civilizations help eliminate misunderstandings, bring positions closer together, and create the basis for greater provision of the rights of nations and states by establishing equality and peace in the international arena.

The entire modern world has become an arena for such a multiple cascade of socio-economic, geopolitical, ecological, transcultural innovations and diversifications, which in their totality have marked the beginning of a civilization of a different quality. A new generation has emerged with its own vision of “the most important trends and processes of global and regional significance, already having a direct impact on the development of the modern world and the formation of what is commonly called in broad expert circles a new global order” [1, p.3].

This circumstance in comparison with the categorical analysis of the accumulated experience of human development, the dynamics of historical epochs and changes of civilizations according to the concept of the phenomenon, the positive chronological aperiodicity (duration) of civilization is conditioned and explained by a directly proportional dependence on the level of intellectualization of society [2]. The accumulation of experience of human development, the dynamics of historical epochs and changes of cultural civilizations according to the kindling (aggressive) principles of scientific and technological revolutions became the basis for putting forward the concept of chronological, aperiodicity and asynchrony of these phenomena. We are talking about the further development of the doctrine concerning the theoretical and applied aspects of the phenomenon of waves, wave-like nature in the global process of birth, development, formation and dying out of cultural civilizations as great events and paradigms of the century [3].

The meaning of chronological aperiodicity is as follows. If the first wave, called agrarian civilization, continued in the form of a prolonged tide of 9-11 thousand years, then the second wave that came to replace it - industrial civilization - lasted 300-350 years. Moreover, it was believed that each of the civilizations basically destroyed earlier cultures and replaced them with a way of life that would be incomprehensible and anarchic for people who lived earlier. Today, history presents us with an even more accelerated transition to a modern cultural civilization, which is called informational.

The avalanche-like accumulation of new knowledge, the progressive cloning of information and technology. It seems that all this depends on the improvement of the education system as a whole and especially the higher education system.

The chronological asymmetry of civilizations, in particular the protracted anachronistic backwardness of the countries of the so-called third world from the advanced and middle countries over the course of decades and even centuries, is conditioned not only by the role of education in the country, but also by the selective global interests of the richest countries in the world and the deficit policy of global organizations and international communities.

Among the many factors that make the gap between countries and regions even more catastrophic is, for example, the phenomenon of the so-called “brain drain”, which does not prevent the community of prosperous countries.

The purpose of this study is to determine the synergetic patterns and role of the higher education system, its global and regional trends in the processes of formation of civilizations and dialogue between them.

In recent years, unprecedented doctrinal transformations have taken place in the higher education system both globally and in Russia in particular. This is an undoubted recognition of the positive role in the fate of any state, any society and an individual. The level of development of higher education is currently considered one of the reliable criteria in the structure of the integral assessment of the civilization of a separate country, region or continent. Numerous generally recognized and accepted axioms contained in the main documents of international regional forums postulate that society is increasingly based on knowledge, that higher education is a source of intellectual independence, advancement and progress of knowledge for the purpose of training and formation of responsible, enlightened qualified specialists, without whom neither economic, nor social, nor cultural, nor political progress of the nation, nor any economically sustainable development of people and communities is possible, the development of higher education is among the most important national priorities, higher education is a “strategic resource” in the 21st century. become an integral component of the educational project in Russia, designed to facilitate the solution of large-scale projects on a global, regional and local scale.

By now, the trends and criteria of higher education have been defined. Moreover, these criteria of education are defined both in international, globalized and regional processes. Radical educational reforms await Russia itself [4].

The main ones can be considered as follows:

A consensus has been reached that it is advisable to organize the higher education system as a dynamic system to perform its task of undergoing serious changes, acquiring organic flexibility by diversifying its institutions, structures, its organized basis, training courses, models and forms of knowledge organization, and mastering new information technologies for this purpose. The viability and sustainability of the system is in its constant development, renewal, adaptive reform in accordance with the changing realities of modern life, i.e. we are talking about higher education adapted to the world of work (compliance of the practical activities of universities with the expectations of society).

Attitude of higher education, which means the evolution of the needs of man and society. The system of higher education should be built in such a way as to be ready to meet the growing demands of society, which requires a discrete renewal of knowledge and skills and reorientation and retraining, as well as the development of a common culture. Evolution makes higher education a particularly favorable environment for contacts, knowledge exchange, as well as an ideal model,

which subtly reflects all socio-political, moral and ethical trends on a national, regional and international scale.

Higher education became widespread at the end of the 20th century. Accessibility of higher education should fit into the algorithm: not for the chosen few, but for all capable people. Back in October 1998, in Paris, under the auspices of UNESCO, 182 countries took part in the first World Conference “Higher Education in the 21st Century: Approaches and Practical Measures”. The idea of considering higher education and science from the position of a global factor of social development, formulated in the Declaration of the Conference, noted that higher education should be considered a common asset, and international cooperation and exchanges are the main ways of its global development. The factors of internationalization of higher education were identified:

1. Political, ideological, cultural (development of integration processes in the political and social spheres, democratization of the world community, growth of international openness and communication, developing dialogue of national cultures).
2. Economic (globalization of the economy and technology, requirements of global and regional labor market standards).
3. Academic (international nature of scientific knowledge, universal basis of education and research activities, formation of international educational quality standards).
4. Information (new information technologies, global networks).

The Bologna system, adopted in June 1999, was considered to be the most prominent example of continental internationalization of higher education. The so-called European Higher Education Area, as an example, became a common and mandatory reference point for states striving for the democratic values of the European Union.

The defining general guidelines, basic principles, and optimal models of development and functioning of the higher education macrosystem, which the Bologna system has become, took root with great difficulty both in Russia and in other republics of the post-Soviet space.

The reform of higher education in Russia according to European standards did not work out. Even those who supported this reform were disappointed. Full integration never happened. Attempts to mechanically transfer European models were often superficial, and the mentality, traditions of Russian education and technical and economic needs of Russian industry and agriculture as a result of the reforms in education did not provide the necessary quantity and quality of specialists.

Today, the state educational policy is focused on the practical aspect. A system of comprehensive university training has been developed within the framework of the reform of higher professional education in Russia in 2024-2025, strategi-

cally focused on the model of higher professional education in the context of the information civilization, in the interests of obtaining intensive higher training and updating knowledge in the context of the “new global order”.

In order to achieve the set strategic goals, in our opinion, it is necessary to develop tactical one’s events and their operational implementation. Therefore, in our opinion, the task of education managers, theoretical scientists, practical scientists, psychologists, sociologists, political scientists are to create a model of higher professional school that would meet the requirements of modern Russian society, but would be in the context of global trends, and in which not only the process of knowledge transfer would be carried out, but also the process of reproduction of cultural values and traditions of Russia.

References

1. «Valdai - New Generation». URL:<https://ru.valdaiclub.com/projects/newgeneration/>
2. Kryukov M.V., Sofronov M.V., Cheboksarov N.N. *Ancient Chinese. Problems of ethnogenesis*. M.: Nauka, 1978. 342 p.
3. Shchekin G.V. *Social Theory and Personnel Policy*. – K.: MAUP, 2000. – 475.
4. Decree “On Certain Issues of Improving the Higher Education System” dated May 12, 2023. — URL: <http://www.kremlin.ru/acts/news/71118>

语用语言教学法基础理论

FOUNDATIONAL TAMOILS OF PRAGMALINGUODIDACTICS

Sadirova Dinara Sadikovna

PhD, Researcher

Tashkent State Pedagogic University named after Nizami

Scientific Supervisor - Isyanov Ravil Gennadiyevich

Doctor of Science, Professor

Tashkent State Pedagogic University named after Nizami

摘要. 本文探讨了语言学专业学生在各种言语交际语域中运用主要言语实用化技巧的实验,提出了教材和教学材料的实用语言教学要求,并论证了基于新的语言教学技巧和教学技术(练习、作业、交际任务和培训课程)掌握现代语言工具的方法论可行性。

关键词: 实用语言教学法、语言学、原则、技巧、语域、言语行为、语用能力、语用化和交际。

Abstract. *The article discussed about, the experimental utilization of the main techniques for pragmatizing the speech of linguistics students across various registers of verbal communication, formulates pragmalinguodidactic requirements for textbooks and teaching materials, and justifies the methodological expediency of mastering modern language tools based on new linguodidactic techniques and teaching technologies (exercises, assignments, communicative tasks, and training sessions).*

Keywords: *pragmalinguodidactics, linguistic, principles, techniques, register, speech acts, pragmatic competence, pragmatization, and communication.*

Today's strategies for modernizing education predetermine the critical consideration and subsequent reorganization of the content of education at a linguistic university to improve the quality of teaching foreign languages and cultures to students. A linguistic university student - a future specialist in intercultural communication - must be prepared for interpersonal and intercultural cooperation both within their country and internationally. They should be able to avoid, and if necessary, overcome conflicts that may arise in interpersonal communication. In today's world, there is an increasing demand across numerous professional fields for specialists proficient in contemporary English, capable of engaging in professional

communication with both native and non-native English speakers across various functional and stylistic registers of verbal interaction.

From this, we can conclude that proficiency in a foreign language as a specialty is in demand only when it has a pragmatic nature. Thus, the pragmatization of students' foreign language activities is becoming one of the pressing issues in the linguistic training of language students, which raises the question of developing a new direction in methodological science. In our opinion, such a direction could be pragmalinguodidactics, which is based on the following fundamental principles.

I. Pragmatization of foreign language communicative activity

In their life activities, a person establishes contacts and interpersonal relationships, acquires and expands their knowledge with the aim of transforming natural and social reality through their native or foreign language. In foreign language communicative activity, a foreign language serves as a means of human development and ensures a way of existence, as it is used under certain conditions as a tool for achieving pragmatic aspirations, functioning in various spheres of communication. Consequently, identifying spheres of communication as components of the learning content plays an important role, as it allows for the construction of a general foreign language course that helps understand and master the rules of socially typical language use for communicative purposes.

In foreign language communicative activity, a foreign language implements a way of human development and ensures a way of their existence, as it is used as a means of achieving their pragmatic aspirations under certain conditions, functioning in various spheres of communication. Consequently, highlighting sphericity as a component of the learning content plays an important role, as it allows for the adaptation of the general course of foreign language to understand and master the rules of social-typical use of languages for communicative purposes.

Following I.I. Khaleeva, we believe that the four-part typology of communication macrospheres, based on existential relationships, will allow for a greater degree of "coverage" in determining the scope of a future specialist's activities and ensure their effective participation in intercultural communication through training [1: 92]. Each of the spheres of communication, namely: the sphere of production (material-practical) activity; the sphere of everyday life (domestic relations); the sphere of cultural communication; and the sphere of socio-political (social) activity, according to I.I. Khaleeva, is a sociocommunicative formation, which serves as a fundamental factor in determining the formation of language use domains (Ibid.: p. 90).

Since humans are egocentric, they create temporal and spatial parameters in the communication sphere themselves, striving to realize their practical goal, specifically to maintain or change the existing state of affairs in the process of communicative interaction. Because people, due to their pragmatic nature, care

more about the result than the process, they prefer the practical to the theoretical, and the concrete to the abstract. In other words, a person realizes their pragmatic competence, which involves using “language tools for certain functional purposes (realization of communicative functions, creation of speech acts) in accordance with interaction patterns” [2: 13]. Since social interaction and cultural environment have a particular influence on the formation of pragmatic competence, the pragmatization of foreign language communicative activities for linguistics students, future specialists in intercultural communication, can be ensured through the appropriate use of linguistic means belonging to the newest layer of the English language vocabulary, formed as a result of its evolution.

One possible approach to approximating the pragmatic aspect of modern foreign language is the creation of communicative-pragmatic sets of exercises and tasks aimed at improving students’ foreign language communicative competence, which implies an organic connection with language pedagogy.

II. Considering the developmental trends of the language being studied

Based on the results of pragma linguistic research, we note that language has undoubtedly changed, and at the beginning of the 21st century, the content of language education should represent the “language image” [3] that corresponds to the current period. However, in practice, we often observe a completely different situation: at the beginning of the 21st century, the language of the 19th century is being taught. There is a noticeable discrepancy between the living language used at the present stage of societal development and the linguistic material offered in university textbooks and teaching materials.

Often, on the material of textbooks of higher educational institutions, it is possible to teach the language system, but not to train specialists in intercultural communication, because in the process of communication, it is difficult for a linguist student to use the educational language. Today’s students need to be able to navigate the realities of life and culture in foreign-language societies, as well as represent the realities of their own society and culture when necessary. This disparity creates notable difficulties between modern teaching tools (multimedia resources, the Internet) and outdated textbooks with their corresponding obsolete teaching methods.

To draw a figurative comparison, we are teaching students a foreign language using a playback track, considering the content of the language material: outdated texts, dialogues, and excerpts from 19th-century literary works, whose language is only applicable when discussing the literary work itself. It should be noted here that we do not deny the importance of working with classical literature, assigning it a role in aesthetic, cognitive reading that enriches students’ sociocultural knowledge.

Today’s linguodidactics should not throw the linguist student, the future specialist in intercultural communication, into the depths of video, multicomputa-

tional linguistic material, but rather bring it closer. It is crucial to develop students' ability to pragmatically use modern language (with the aim of realizing the appropriate communicative intention for a given situation), and consequently, to understand the context of situations and thereby be an adequate communicator in the process of interaction.

III. Consideration of the functional-stylistic register of speech communication

In order to come as close as possible to understanding the semantic mechanisms of social interaction among people in the country of the studied language [1], it is necessary, in our opinion, to teach students to use the appropriate functional-stylistic register of speech communication. This will enable them to navigate the communicative-pragmatic space and cultural environment.

Participants in communication who belong to different cultures may fail to achieve mutual understanding or encounter intercultural misunderstandings in a specific cultural environment. This is primarily because different cultures may adopt different culturally specific discursive and speech norms for the same situation, as well as due to the use of a speech register that is inappropriate for the communicative situation.

For instance, in high-level formal situations where adherence to norms is prescribed for social relations with asymmetry, i.e., in the presence of hierarchy in relations, the use of speech economy tools or colloquial words is not permitted. Conversely, in personal communication situations with a high degree of familiarity between interactants, it is customary to use colloquial words and slang expressions in casual, informal conversations. Speaking of the pragmatization of speech, it is impossible not to mention the language of youth communication.

Many linguists, particularly E.M. Beregovskaya, argue that "student slang represents a fascinating linguistic phenomenon, the existence of which is limited not only by certain age boundaries, as is clear from its very name, but also by social, temporal and spatial frameworks. It exists among student youth - in separate, more or less closed reference groups" [4: 32].

It would be erroneous to assume that the study of this phenomenon does not deserve attention. The language of youth communication reveals the psychology of students, their views on life, and their vision of the world. It is one of the forms of speech behavior of young people that distinguishes this group from other social groups. Since youth slang has its own specific functioning in speech, we can therefore speak of the presence of a youth speech register as a distinct phenomenon.

The youth speech register of English-speaking students, for example, is characterized by the use of numerous abbreviations, often acronyms that convey irony, such as 'LOL - Laughing Out Loud' ("dying of laughter"). Words with foreign suffixes (itis, um) are productively used in students' speech, "adorning" it with

various emotional and evaluative overtones (humorous, ironic, sarcastic, familiar, contemptuous, dismissive), serving as stylistic markers that emphasize the informality of the communication situation. For instance, the use of words like “hatorium” (a cheap shop where hats are sold), “Hollywooditis” (a passionate desire to become a movie star), “Oxforditis” (a passionate desire to study at a prestigious university) and similar terms, reflecting the student’s attitude towards their student life and typically having an ironic-mocking character, represents a unique form of social protest.

Since ESP students in specialized higher education institutions are only exposed to formal and neutral communication registers when learning foreign languages, they find it difficult to adapt their speech behavior to informal registers, especially those used by young people. During a survey conducted at a linguistic university, students expressed a desire to work with more contemporary materials reflecting the social life of modern English-speaking societies. This is because their experiences working abroad during student holidays revealed difficulties in adapting to the surrounding English-speaking environment.

When communicating with their peers, students found it challenging to model their own verbal and non-verbal behavior to understand the shared meaning of interactions with their interlocutors. This difficulty arose because English-speaking youth communicate with each other using an informal speech register. Students cited examples of abbreviations used by English-speaking youth for brevity, which they were unfamiliar with and consequently did not use in their own speech, such as “brupper” for breakfast and supper, “cerf” for certificate (diploma), and “fess” for professor.

In light of this, we believe that authentic text materials used in the learning process should be rich in facts about contemporary foreign cultures, reflect the modern linguistic and cultural reality of the country where the target language is spoken or other foreign societies, and thus serve a pragmatic function.

For students to navigate more freely in the communicative-pragmatic space created around them during foreign language communication, we consider it important to account for three speech registers in the learning process - formal, neutral, and informal, including the student youth speech register.

By communicative-pragmatic space in this context, we mean the totality of factors directly surrounding an individual, operating in the communication situation at a given moment and influencing the process of thought formation and formulation. This can be called a conceptual model of a specific situation, characterized by the multifaceted nature and multiple aspects of external and internal influences.

Due to significant social, economic, and political changes occurring in society, accompanied by a considerable increase in the volume and density of information

and the rapid development of mass media, the environment in which language exists is also changing. The new paradigm of society and personality allows individuality to manifest more actively in all aspects, including linguistic ones, as it emphasizes the idea that not everything in a person is socially determined: chance, fate, spirituality, etc. are recognized as important [5: 49].

Since language is a means of expressing thought, to successfully solve a communicative task using the currently studied linguistic material that corresponds to modern language trends, the teacher must analyze the communicative-pragmatic space of the problematic situation. In other words, it is necessary to construct a problem situation in accordance with the conceptual model, taking into account all the multifaceted and multi-aspect nature of the social situation, while providing students with the opportunity to choose the appropriate speech register.

IV. Principle of Limiting Stylistic Reduction in Speech

When considering the relationship between language and linguistic culture, it is necessary to caution language users against excessive and sometimes inappropriate use of abbreviations for linguistic economy or emotional-evaluative overtones to produce an effect on their communication partner.

This also applies to borrowings, as there is currently a tendency, especially among young people, to “decorate” their speech with an excessive number of loanwords, which leads to a sharp stylistic decline and coarsening of speech. V.G. Kostomarov sees the reason for this phenomenon in the fact that the new paradigm of society and personality allows individuality to manifest itself more actively in all aspects, including linguistic ones[6]. At the same time, the author emphasizes that the norm of permissibility has changed in language, as in everything else. We find confirmation of this in the linguistic fashion of modern society, where terms such as “leasing,” “holding,” and “management” have entered our everyday use. The question arises whether it is worth changing the Uzbek word for “boshqaruv” to the Americanism “management” or the word “harid” to “shopping,” “tanlov” to “casting.”

Linguistic fashion is reflected in all languages. For example, in English, familiar expressions are replaced with new ones, such as: to telephone (to call) - to give smb. a buzz (Give me a buzz the next time you are going to town.); to be in a difficult situation - to be in a fix (I told her that someday she would be in a pretty fix.); in a moment/very quickly (quickly, soon, this second) - in a jiffy (I'll have it fixed in a jiffy.); there's no pleasure/it's hard (difficult, unpleasant) - it's no picnic (It's no picnic to work there. It's no picnic going there again.) and others.

With the development of a socially determined society, new words appear, for example, to mitigate property discrimination, the word ‘disadvantaged’ appeared; to mitigate racial discrimination, instead of the word ‘black,’ the words ‘coloured’ or ‘non-white’ are used; and underperforming students are called ‘underachiev-

ers.’ Or instead of the word ‘cancer,’ which refers to a person born under the constellation of Cancer but causes associations with the disease, it is now customary to use ‘moon-child.’

A linguistics student, a future specialist in intercultural communication, must know that when the associative-verbal network of modern language speakers is in a state of instability, their level of communicative competence decreases, which negatively affects the quality of the oral and written texts they produce [7]. A linguistics student, a future specialist in intercultural communication, must know that when the associative-verbal network of modern language speakers is in a state of instability, their level of communicative competence decreases, which negatively affects the quality of the oral and written texts they produce [7].

V. The principle of mediated intercultural communication in classroom settings

One of the significant features of intercultural communication in foreign language teaching, according to N.V. Baryshnikov, is that “preparation for real intercultural communication consists of practicing communication in a foreign language with peers belonging to the same culture” and is of an indirect nature, as “the process of teaching a foreign language is carried out outside the linguistic environment, far from the real functioning of the language and culture being studied” [8: 30]. Foreign language teachers must take this reality into account when selecting materials and developing teaching methods.

In the process of teaching foreign languages for intercultural communication, “the primacy of the native worldview and the secondary nature of the non-native one are characteristic” (Ibid.: 31). Consequently, in percentage terms, simulations of “socially constructed realities” should predominate among the teaching techniques used during communicative activities. At the same time, it is necessary to create a common pragmatic territory and a shared information zone in which learners jointly share meanings and emotions. A common pragmatic territory creates an informational basis and a shared socio-cultural background, allowing students to maintain a “natural style of verbal and non-verbal behavior,” which, according to N.V. Baryshnikov, does not hinder intercultural communication. Social understanding of reality and oneself within it, using a broad socio-cultural context, recognizes the importance of collective meaning-making activity, where various aspects of the “self” are constantly realized. Images of oneself and others identify expected/predictable and unexpected/unpredictable utterances, which necessitates the interaction of communicants in a “live” scenario.

Undoubtedly, teaching intercultural communication involves preparing learners for authentic interaction in a foreign language with native speakers. Therefore, it is crucial to facilitate communication between partners (student interactions within a group) who belong to the same culture, allowing them to discuss realities

of their native culture using a different language code. Unfortunately, most modern teaching materials do not provide such an opportunity.

Modern textbooks need to offer learners a wider range of sociocultural situations to develop their ability to master at least three speech registers (formal, neutral, informal) and switch between them depending on the given sociocultural context.

During social interaction, an individual must “perform” a fairly extensive repertoire of social roles while engaging in various role-based relationships. Therefore, it is necessary to create diverse social microcontexts in which communicants’ speech behavior, determined by their role relationships, would manifest. In our opinion, text materials should be selected with a focus on the parallel study of languages and cultures, which will contribute to expanding knowledge and understanding of similarities and differences between the cultures of the native country and other ethno cultural communities, which is particularly relevant today.

Moreover, based on the postulate that words have a cumulative function, meaning that a word is “the collective memory of native speakers,” “a monument of culture,” and “a mirror of the nation’s life” [9: 7], a significant portion of the learning process should be dedicated to exercises containing extra linguistic realities of English and American life and culture from recent decades, as well as realities reflecting the life and culture of society. This leads to the conclusion that the emphasis on developing linguistic competence, which textbooks traditionally present, is insufficient for full-fledged communication.

As for the use of foreign textbooks in the learning process, one cannot deny that they are a rich source of authentic materials, but they require linguodidactic adaptation to the learning conditions. It is necessary to analyze and critically evaluate authentic textbooks, as they pursue different goals, have specific content, and some materials evoke ambiguous attitudes from learners. The existing difference in the division of materials by age does not always correspond to our concepts and standards.

Conclusion. Considering the above, it appears to us that at the current stage of educational development, based on modern objectives of foreign language teaching, it would be important to take into account the principles of pragmalinguodidactics. Only in this case can students in the final stage of study at a linguistic university be brought to the C1 level of “Professional Proficiency” in accordance with the requirements of the Common European Framework of Reference for Languages.

Given that linguistic courses (lexicology, stylistics, and theoretical grammar) largely provide theoretical foundations and general information that are not realized in the process of language acquisition, it is necessary to create learning models that would result in a pragmatic application of the studied material, where

linguistics students would have the opportunity to experience and feel it in communication.

References

1. Khaleeva, I.I. *Fundamentals of the theory of teaching foreign language speech comprehension (translator training)* / I.I. Khaleeva. Moscow: Higher School, 1989. 238 p.
2. *Common European Framework of Reference for Languages: Learning, teaching, assessment*. Cambridge University Press; Moscow State Linguistic University, 2003. 256 p.
3. Karaulov, Yu.N. *On the state of the Russian language today: Report at the conference "Russian Language and Modernity"* / Yu.N. Karaulov // *Problems and prospects of Russian studies development and materials of postal discussion*. Moscow, 1991. 66 p.
4. Beregovskaya, E.M. *Youth slang: formation and functioning* / E.M. Beregovskaya // *Questions of Linguistics*. 1996. No. 3. P.32-37.
5. Kostomarov, V.G. *My Genius, My Language. A linguist's reflections on public discussions about language* / V.G. Kostomarov. Moscow, 1991. 64 p.
6. Kostomarov, V.G. *Linguistic taste of the era. Observations on speech practices* / V.G. Kostomarov. Moscow: Mass Media, 1994.
7. Apresyan, Yu.D. *Connotation as part of word pragmatics (lexicographic aspect)* / Yu.D. Apresyan // *Selected Works. Integral Description of Language and Systemic Lexicography: in 5 vols*. Moscow, 1995. Vol.2.
8. Baryshnikov, N.V. *Parameters of teaching intercultural communication in secondary school* / N.V. Baryshnikov // *Foreign Languages at School*. 2002. No.2. P.28-32.
9. Vereshchagin, E.M. *Language and Culture: Linguistic and Cultural Studies in Teaching Russian as a Foreign Language* / E.M. Vereshchagin, V.G. Kostomarov. 4th ed. Moscow: Russian Language, 1990. 246 p.

DOI 10.34660/INF.2025.14.42.037

美学和哲学传统中的美与真
**BEAUTY AND TRUTH IN THE AESTHETIC AND
PHILOSOPHICAL TRADITION**

Borsiakov Yuri Ivanovich

Doctor of Philosophy, Professor

Proskurina Lyudmila Konstantinovna

Candidate of Pedagogical Sciences, Associate Professor

Voronezh State Pedagogical University

注释。本文探讨了在现实的精神领域中，如何通过典故和主观阐释，将美与真解读为超文本。本文探讨了美与真作为绝对价值的现象，以及作为以作者意图为导向、充满受众意义的文本的现象。本文还探讨了陀思妥耶夫斯基、洛斯基和朗西埃关于美与真作为至善和救赎世界的哲学思想。

关键词：美、真、超文本、现实、典故、精神价值、善。

Annotation. The article examines the issues of interpreting beauty and truth as hypertext through allusions and subjective interpretations in the spiritual field of social reality. The phenomena of beauty and truth as absolute values and as a text oriented towards the author's intention and filled with the meanings of the addressee are studied. The philosophical ideas of F. M. Dostoevsky, N. O. Lossky, J. Rancière about beauty and truth as the highest good and salvation of the world are considered.

Keywords: beauty, truth, hypertext, reality, allusion, spiritual value, good.

The appeal to the study of the concepts of beauty and truth in the context of the diversity of reality is dictated by the need to understand the problems of the development of today's society, the existential changes of modernity, the deformations and transformations of the human personality and the concepts of beauty. Today, when the contours of a new post-industrial society are beginning to appear, we need to study the meaning of beauty more deeply and, as far as possible, to think again and analyze the meaning and significance of the concept of truth.

When discussing such global things as beauty and truth, we note that beauty is an absolute value, the quality of life phenomena and works of art (design): the ability to deliver aesthetic pleasure to human feelings. Beauty is a universal of the

subject-object series of culture, fixing the content and semantic-gestalt basis of sensory-perceived perfection [1].

Truth is defined by the coincidence of an object with the mental representation of it. But truth is such a coincidence not simply between the mental representation and the object - the mind thinks in its own categories - but between the multiform reality which we perceive only partially and evaluate imperfectly, and the expression which we can give to it, which is very relative and depends on our perception and on our ability to express what we have perceived. Truth can be compared to verisimilitude - a vision which enables a person to look at a certain moment of reality and see everything that the past has brought to this moment. Because every moment of our life is a summary, a generalization of our entire past, but we do not distinguish this. We consider as reality only what is visible on the surface, what catches the eye under the influence of certain circumstances and time.

Truth in the aesthetic-spiritual aspect of existence is the ability to look deep, both at the external form of objects, and at the same time beyond the external form. The surrounding reality is what exists and is within the boundaries and beyond the boundaries of external similarity and form.

Speaking about reality, we note that often what we see may not be real, not genuine, but may appear as an illusion and distortion. It may be a form that hides a deeper content, or it may be an incomplete expression of something real and genuine, or it may be a form that is a lie and a temptation. Speaking about visible reality as something illusory, we can turn to the Indian attitude to the material world (maya) as an illusion. This world is manifested, it exists, but, in essence, it is illusory, not real. The visible aspect of reality may also be a veil and a revelation. A veil - because the reality hidden behind it is deeper, greater, more significant, more valuable than those forms that we are able to comprehend.

Beauty and truth as an expression of form and meaning – static and dynamic – are partly just different ways of interpretation. Belonging to a certain tradition, cultural context, mental layer, we are able to understand the meaning only through allusions. These representatives awaken in our “database” our own experience, which we have already absorbed in the past, in them we can hear an echo of everything that has already been said or written and which fills every phenomenon and object in the reality of the present with meaning for us. All these allusions, like mirrors of being, often presuppose a multitude of interpretations and explanations, because by using them, a person shows only one subjective side of the phenomenon [truth/beauty], which he has perceived and expressed. But we always understand: the expressed thought is a false thought – that is, no matter what we say, these words will only limit our true experience, and the image will perhaps convey it better than verbal formulations.

The conclusion suggests itself that beauty is subjective in relation to truth. Relative truth is subjective in relation to absolute truth. This means that both truth and

beauty can be considered as hypertext, a kind of message, a metaphor embodied in form, in objective filling and in subjective content, woven from our conscious and unconscious borrowings, previous numerous quotations, reminiscences, clichés and references [2]. These allusions as reflections of reality and the multiplicity of interpretations of truth in its constant variability presuppose an infinite number of possible interpretations, explanations, understandings, etc., because a person is not capable of perceiving truth in all its absolute fullness, but only able to see a “fragment” of it, one of its countless sides, a particle that he has comprehended.

Beauty is perceived and transmitted subjectively, through the prism of internal illusions and distortions caused by various factors (experience, associations, etc.). In this case, how can we understand what kind of beauty and what kind of truth we are talking about, if all the reference points are confused and unstable, conditional and built on the “sand” of subjective deformations? Here we are faced with a dangerous problem: it turns out that both beauty and truth in one of the aesthetic-spiritual aspects of reality are a text interpreted by a person, redirected to other persons and to other texts, then these other texts to the next, and so on ad infinitum, constructing multidimensional series of curtains and illusions of the world. [3]. These masks and revelations in the structure of reality sound alongside the voice of the subject himself.

The problem is that, on the one hand, beauty is the highest absolute value, the source of aesthetic happiness, and on the other hand, it is a hypertext, read and oriented toward the author’s intention, a reference to his value and aesthetic preferences. The content of this text is multifaceted, the world behind it is seen and understood by the recipient differently, depending on what he needs to see, for what purpose and with what attitude he “looks” at the text.

Then any text is read many times and interpreted by readers/viewers/addressees, who in a certain sense become its co-authors, just as many times. By creating many allusions in this case, the meanings of the addressees expand and dissolve in the author’s ideological space, and this synthesis gives birth to a plurality of interpretations of reality. The only objectivity “runs away” from the author’s ideological content, representatives of different socio-historical eras and even the generation of one era read and interpret this hypertext in their own way, creating each time anew “in the eyes of the beholder” their own beauty and understanding of the truth.

Thus, Jacques Rancière is one of the influential thinkers of our time, whose numerous assessments of creativity have today formed a stable reputation as a philosopher and writer. He develops a concept of aesthetic politics. Since the artist trusts that the objects he creates have meaning, the artist acts as a creator of the world, and so the politician, trusting another, creates real politics. The comparison between aesthetics and politics is extremely important for Rancière. In his

work “Sharing the Sensuous,” Rancière writes: “Aesthetics is not a general theory of art, leading to its effect on the senses, but a specific mode of identifying and understanding the arts - a type of articulation of ways of making, from visible forms and ways of understanding their relationships, implying a certain idea of the duality of thought” [4, p. 12]. A line drawn on the surface of a sheet of paper divides and at the same time defines a common space. Similarly, words and forms define the boundaries between arts and at the same time the configurations of the visible and the thinkable. These configurations are simultaneously symbolic and material. They permeate the entire socio-political space, creating “forms of living in the sensory world.”

Thus, starting with the division of the surface of a sheet of paper by a line, Rancière ends with configurations of social experience. For him, aesthetics becomes a prerequisite for politics, and politics, aimed at reconfiguring the sensory, in turn turns into aesthetics. In Rancière’s reflections, the sensory is constantly constructed into a sensory experience in which everyone receives their own point of view. The concept of the division of the sensory is widely discussed in philosophy, aesthetics and literature. “Division of the sensory” is a concept formed at the border of aesthetics and politics. From it follows Rancière’s definition of both aesthetic and political activity. Politics and art become forms of division of the sensory for Rancière. A peculiar equalization of political and aesthetic activity is associated with Rancière’s general phenomenological attitude. His concept of the division of the sensory can be characterized as aesthetic phenomenology. The philosopher refers to the experience of modernist art. Classical painting in his views is appropriate only when industrial production did not yet exist. In his views, the philosopher divides modernist and postmodernist positions, but he does not draw a distinction between them. He argues that people have their own interests, and private interests can coincide with the interests of others. At the decisive moment of division of sensuality, there is a single interest. In his opinion, this is an event. He notes that for M. Heidegger, an event is an internal experience, where someone else’s problem can become yours. An act is a willingness to accept responsibility for someone else’s decisions. Plato and Aristotle spoke of politics as a citizen, they corresponded to the spirit of old art, art in which the boundary between an individual and the public cannot be erased, then in modern politics it is necessary to transfer the accents of an individual to the rules of division of the sensual. Rancière solves this issue in this way. Although experience is common, the ability to judge is the same, every judgment, in his opinion, is situational. Judgment is an opportunity to distinguish one from another. The philosopher tries to distinguish common interest from private interest in modern politics. He expands the very concept of interest. Referring to the experience of modernist art. Attempts to draw parallels between classical painting and the avant-garde. Classical painting

is classical representation, disinterested contemplation existed before industrial production. In the modern development of industry, it is impossible to maintain illusion. Rancière speaks of modernist art, the private connection of representations has been replaced by a common project of sensuality. In his opinion, old art requires amateurs, new art is the business of intellectuals. Old philosophers laid the route, old philosophy argued for the types of new philosophy, in which we move from private knowledge to general knowledge. This philosophy is able to speak about different modes of art. He says that the original regime was poetic. He insisted that each art has its place in the hierarchy of the arts. The aesthetic regime distinguishes our sensibility. Classics must be added to the aesthetic regime. The old approach, insisting on separate rules, the new approach, modernist and post-modernist, in which there are no separate genres and styles. Thus, in his work "The Surface of Design" Rancière smoothly moves from aesthetic experience to social experience. He is interested in how the design practices of the twentieth century determine other types of practices. Rancière writes that at the basis of politics lies "a certain aesthetics" that has nothing to do with the aestheticization of politics characteristic of the century, which Benjamin speaks of. This aesthetics should not be understood in the sense of a perverted capture of artistic will by politics, an attitude towards the people as a work of art. To use an analogy, it can be understood in the Kantian sense – in this case revised by Foucault – as a system of a priori forms that determine what appears to sensation, a certain division of times and spaces, visible and invisible, speech and noise, which simultaneously determines both the place and the goals of politics as a form of experience.

Thus, we note that, undoubtedly, interest in Rancière's work in the global aesthetic community is growing at the moment. There are many translations of his creative heritage, which intersects with outstanding classical and contemporary philosophers. Rancière emphasizes the fact that art and politics change the zone of visibility, the relationship between what can be said, seen and done. In this regard, genuine political and aesthetic activity are considered by Rancière as equal practices that create a new sensory experience. A specific feature of Rancière's phenomenology is, in our opinion, its aesthetic character. Art becomes a model for the study of social reality.

Perhaps the problem posed is unsolvable, and humanity will search for answers for a long time. But, due to the complexity of the task, we see no other way out of this labyrinth than to turn to a universal and sublime understanding and interpretation of the concepts of beauty and truth. Let us rely on the unshakable guidelines - the ideas of F.M. Dostoevsky, who saw the salvation of the world in beauty as the highest good and truth. N.O. Lossky wrote about beauty as "the concreteness of embodied positive spirituality in spatial and temporal forms" [5]. In medieval Christian thought, as in the ancient tradition, beauty and truth were

embodied in God, in His spirit, in His will. For Aristotle, beauty and truth are interpenetrating and, as the highest absolute, preserve the primacy and elusiveness of the divine. According to Aristotle, beauty is a form - as an innate divine principle, divine origin and at the same time the goal and result of any being. Truth and beauty are agreement with one's own essence, harmony of personal nature and divine will, i.e., good. The human ideal of the ancient Greeks is beauty-good, "the highest unity of all perfections." In Dostoevsky we also find a definition of beauty as truth and the highest good, an aesthetic ideal. This is the meaning of his phrase "Beauty will save the world" (beauty as truth and good). Truth and beauty are always turned to the light, manifesting themselves in the divine creative hypostasis. Dostoevsky focuses on spiritualized beauty - filled with divine meaning.

In conclusion, it should be noted that J. Rancière's ideas regarding the interpretation of beauty intersect with the ideas of I. Kant and partly F. M. Dostoevsky, who also defined beauty as a symbol of moral goodness, and perfect beauty represents being that contains truth.

References

1. *Aesthetics and Theory of Art in the 20th Century: A Textbook [Text]* / compiled by: N.A. Khrenov, A.S. Migunov. – M.: Progress-Tradition, 2005. – 520 p.
2. Borsyakov Y.I., Proskurina L.K. *Modern problems of humanitarian and social sciences [Text]* / Y.I. Borsyakov, L.K. Proskurina FGBOU VO "VSUET". - Issue. 3 (50). - Voronezh: Publishing and printing center "Scientific book", 2024. - 116 p.
3. Bakhtin M.M. *Questions of Literature and Esthetics. Research of Different Years* / M.M. Bakhtin – M.: Fiction, 1975. – 504 p.
4. Rancière J. *Dividing the Sensible* / J. Rancière. – St. Petersburg: Publishing House of the European University, 2007. – 264 p.
5. Lossky, N. O. *The World as the Realization of Beauty. Fundamentals of Esthetics [Text]* / N. O. Lossky. – M.: Progress-Tradition; Tradition, 1998. – 416 p.

DOI 10.34660/INF.2025.93.31.038

西安青龙寺樱花：文化符号的跨国演变

CHERRY BLOSSOMS AT QINGLONG TEMPLE IN XI'AN: CROSS BORDER EVOLUTION OF CULTURAL SYMBOLS

Xiang Yiyuan

*Candidate of Historical Sciences, Postgraduate student
Tomsk State University*

摘要. 本文以西安青龙寺樱花为例，通过探索从唐代至今中日两国交流的历史变迁和樱花的文化内涵，揭示文化符号在外交实践中的重塑逻辑作用。研究表明：中日两国通过外交重新加强互信，并在遗址重建、文化领域交流合作的措施，让曾经承载战争记忆的樱花转化为文明互鉴的载体。这一转型印证文化符号的价值取决于国家实力与文化策略的协同创新。

关键词： 青龙寺、樱花、文化互动、中日关系。

Abstract. *This article takes the cherry blossoms at Qinglong Temple in Xi'an as an example to explore the historical changes in exchanges between China and Japan from the Tang Dynasty to the present and the cultural connotations of cherry blossoms, revealing the reshaping logic of cultural symbols in diplomatic practice. Research has shown that China and Japan have strengthened mutual trust through diplomacy and implemented measures such as relic reconstruction and cultural exchange and cooperation, transforming the cherry blossoms that once carried memories of war into a carrier of cultural exchange and learning. This transformation confirms that the value of cultural symbols depends on the collaborative innovation of national strength and cultural strategy.*

Keywords: *Qinglong Temple, Cherry Blossoms, Cultural Interaction, China-Japanese Relations/*

I. The cultural bond of the millennium old temple

Chang 'an of the Tang Dynasty (now Xi 'an City) was the first city in the world with a population exceeding one million. As the economic and cultural center of East Asia, it attracted Japan to send envoys to systematically study China's systems, religions, literature, science and technology and many other knowledge.

In the year 804 AD, the Japanese Kukai studied under the guidance of the high monk Huiguo from the Tantric sect at Qinglong Temple and founded the Shingon Buddhism sect after returning to Japan. [1]

The descriptions and records of Qinglong Temple by Tang Dynasty poets such as Bai Juyi, together with the story of Kukai learned religious knowledge, constitute a shared historical memory between China and Japan, and have also become the origin of contemporary Chinese and Japanese co-production films at Qinglong Temple (*Legend Of The Demon Cat*). The essence of this early religious exchange was the cross regional transmission of cultural capital — Buddhist scriptures, classic poetry creation, and institutional knowledge formed a multidimensional interactive network, laying the foundation for cultural diplomacy in later generations.

II. Cherry Blossoms: From Aesthetic Symbols to War Totems

On the basis of absorbing the aesthetic creation techniques of flowers in ancient Chinese literature, especially after reading the Tang poetry and learning the way the Tang Dynasty designated the peony as the national flower, Japan gradually turned to the construction of local cherry blossom aesthetics.

By integrating the brief natural characteristics of the flowering period with the Buddhist concept that things are not eternal, a concrete image of “life and death interdependence” is formed. As cherry blossoms have been elevated to the status of Japan’s national flower, their symbolic meaning has also been alienated with historical images: especially during the World War II, cherry blossoms combined with Japan’s Bushido and became a spiritual symbol of the Japanese military, even directly including some suicide military activities named after cherry blossoms. [2]

The cherry blossom symbol in Japan has undergone a process of transformation from a basic biological concept to a political science examination that serves national and ethnic identity through three stages: selecting plant characteristics, grafting extral and local ideology, and forming institutionalized dissemination. [3]

III. Restoration of diplomatic relations and image reset

With the normalization of diplomatic relations between China and Japan in 1972, cooperation between the two countries in various fields also began to increase. Especially since the 1980s, China-Japanese cooperation has revitalized Qinglong Temple as a symbol of friendship:

Space reconstruction: Japan donated cherry blossoms and funded the construction of the Kukai Monument, while the Qinglong Temple Relic Park integrates Tang style architecture with cherry blossom landscapes;

Academic legitimacy: Scholars from both China and Japan have independently verified that cherry blossoms originated in the eastern Himalayas mountains and later spread from China to Japan. [4]

Functional innovation: The cherry blossoms at Qinglong Temple have been selected as one of China’s top ten cherry blossom tourist destination, forming a local cherry blossom tourism festival in Xi’an city, attracting hundreds of thousands of tourists annually, and forming a cultural and tourism brand of “Explore the

architectural style of the Tang Dynasty and enjoy the beauty of cherry blossoms in spring”.

Contemporary tourists in Qinglong Temple Relic Park tend to associate cherry blossoms more with the prosperous Tang Dynasty atmosphere and the current state of China’s prosperous development, rather than traditional Japanese aesthetics and memories of World War II. This perceptual shift reflects China’s emphasis on the memory of ancient friendly exchanges and its attention to the trend of contemporary peaceful development.

The case of cherry blossoms in Qinglong Temple represents a deeper reflection of the importance of cultural diplomacy in today’s era. Through the transformation of historical resources and religious building spatial narrative innovation, China integrates the value consensus of cooperation and inclusiveness into specific projects, guiding its own and foreign people to combine new meanings of China and its cultural space and imagery in the new era and trends from history and experience, and reshaping the Chinese interpretation of cherry blossoms’ cultural symbols.

China has always respected and tolerated the views of other countries, and has not simply denied the cherry blossom symbol from Japan or returned to the Tang Dynasty peony narrative. Instead, it has incorporated it into the framework of cultural mutual learning through the path of “dismantling militaristic memories from Japan, reconstructing friendship and diplomacy, and sharing the future of development”. This strategy not only breaks through cultural hegemony but also avoids confrontational discourse, providing a new paradigm for cross-cultural interaction.

Conclusion

The vitality of cultural symbols lies in continuous innovation. The contemporary transformation of cherry blossoms in Qinglong Temple showcases China’s efforts to soothe war pain through exchange and cooperation, reshape local cultural identity through tourism, and convey the concept of peace through spatial narrative. This flexible strategy provides creative solutions for handling historical heritage.

References

1. Wang Renbo. *The Envoys to Tang and China-Japanese Cultural Exchange [J]. Journal of Northwest University (Philosophy and Social Sciences)*(《西北大学学报(哲学社会科学版)》). 1975. – No. 4. – pp. 69–81.
2. Zhu Biyong. *Japan’s WWII “Cherry Blossom” Suicide Bomb Debut [J]. Aviation World*(《航空世界》). 2014. – No. 8. – pp. 62–67.

3. Hobsbawm Eric, Ranger Terence. *The Invention of Tradition* / translated by Gu Hang and Pang Guanqun. – Nanjing: Yilin Press, 2022. – 401 p.

4. Editorial Board of Culture Publication Bureau. *The Great Mirror of Cherry Blossoms*(《樱大鉴》). – Tokyo: Culture Publication Bureau, 1975. – pp. 180–181.

青少年对婚姻适应的性别认知
**GENDER PERCEPTIONS OF YOUTH
ABOUT ADAPTATION IN MARRIAGE**

Nabiev Timur Erikovich

Candidate of Pedagogical Sciences, Professor

Branch of A.I. Herzen Russian State Pedagogical University in Tashkent

Gafarova Irina Gennadievna

Candidate of Psychological Sciences, Associate Professor

Branch of A.I. Herzen Russian State Pedagogical University in Tashkent

Agzamova Malika Muratovna

PhD in Psychology, Associate Professor, Head of Department

Branch of A.I. Herzen Russian State Pedagogical University in Tashkent

摘要. 本文探讨了包括家庭在内的各种社会制度在塑造当代青年对婚姻和家庭生活观念方面所发挥的作用。研究指出，在快速变化的社会现实背景下，年轻人迫切需要更新的知识、价值观和人际沟通技巧，而这些对于建立健康稳定的婚姻和家庭关系至关重要。本文特别关注在家庭制度框架下，调整教育和养育方法以应对青年当前面临的挑战的必要性。

关键词：婚姻、家庭、婚姻关系、伴侣、配偶。

Abstract. This article presents the results of a study on the role of various institutions, including the social institution of the family, in shaping contemporary youth's perceptions of marriage and family life. It is noted that in the context of rapidly changing social realities, young people demonstrate a significant need for updated knowledge, values, and interpersonal communication skills essential for building healthy and stable marital and family relationships. Particular attention is given to the necessity of adapting educational and upbringing approaches in response to current challenges faced by youth within the framework of the family institution.

Keywords: marriage, family, marital relations, partner, spouse.

The study of gender differences in how young people perceive family values is gaining significant importance and urgency in contemporary society. At present, we are witnessing fundamental changes in family structures, established role

models, and commonly accepted values. In this context, it becomes critically important to determine which values are fundamental to the concept of family, how these values correlate with gender, and, most importantly, what differences exist between men and women in their attitudes toward these issues.

According to data presented in scholarly and methodological studies, gender-specific traits manifest in various aspects of life. For instance, women are more likely to emphasize the creation of a harmonious and cozy family environment and openly discuss issues related to sexuality. Men, on the other hand, tend to show a greater inclination toward romantic relationships and perceive the prospect of divorce less negatively [3].

In the context of weakening social control over the formation of traditional families, a transformation in young people's views on family values is being observed. The absence of clear frameworks and reference points in family formation increases the likelihood of choosing an incompatible partner, which, in turn, may lead to disharmonious relationships and eventually to divorce. In an attempt to avoid such outcomes, many potential partners postpone formalizing their relationships, opting instead for long-term cohabitation under the so-called civil marriage arrangement [1].

A growing number of experts and scholars across various fields have shown increased interest in analyzing family-related issues. This interest is driven by the key role that the family plays in the development and upbringing of the individual, as well as its broader impact on society. The family system, while stable, is also adaptive and demonstrates high sensitivity to socio-economic influences, which consistently lead to internal transformations.

A stable family structure can function effectively if it is based on the understanding that family well-being is determined by a combination of social and psychological comfort factors. These include marital harmony, satisfaction of essential needs, and social status. In light of this, future spouses require preparation for joint family life, which is recognized as one of the most complex and potentially vulnerable aspects for ensuring family stability [4].

The study of family and marriage has acquired paramount significance within the framework of the humanities. Through the comprehension and in-depth analysis of fundamental sociological and psychological concepts related to family, kinship, and marriage, we gain the ability to effectively address key issues of marital and family relationships. Despite the ongoing changes in their forms and content [2], these relationships continue to represent one of the core social values.

To explore gender-specific perceptions of the marital adaptation process among contemporary students, a psychological and pedagogical study was initiated and conducted during the 2023–2024 academic year.

The study, carried out under conditions of anonymity, involved 36 students — 18 male and 18 female — enrolled in the 2nd to 4th years of various departments at the regional branch of the A.I. Herzen Russian State Pedagogical University. The participants ranged in age from 18 to 25 years.

The primary objective of the study was to identify contemporary youth perspectives on marital relationships and key family values, with specific consideration of the gender factor.

Some researchers emphasize the importance of initial marital adaptation, which is typically manifested in two major dimensions: role-based and interpersonal. Within these dimensions, the views and motivations of newlyweds are revealed, including the following aspects:

- Household and domestic aspect: when the primary goal of the family is seen as the establishment of a comfortable home environment;
- Moral and psychological aspect: when the search for a partner who shares core life values is the main motivational factor;
- Parental and family aspect: when the awareness of the importance of child-bearing and childrearing as key family functions is central;
- Intimate and personal aspect: when the primary goal is to find a beloved person who is emotionally and spiritually close [5].

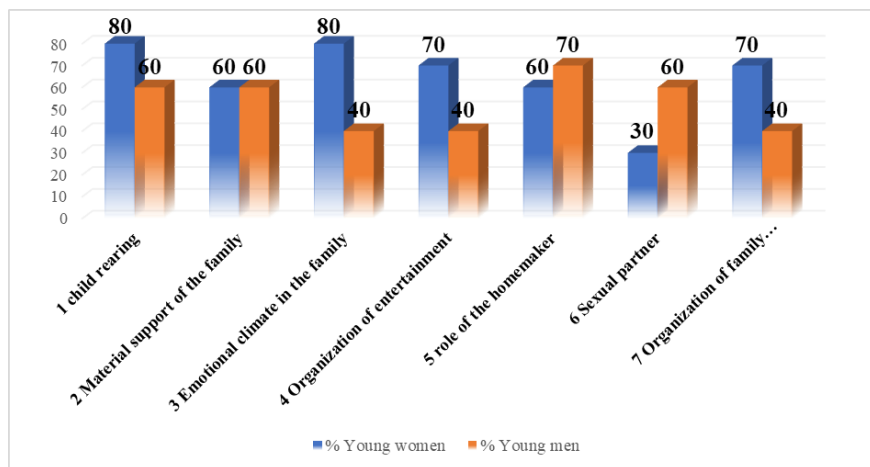


Figure 1. Results of the study based on the “Role Distribution in the Family”

It is important to emphasize the similarity in the structure of preferences regarding the ideal life partner among representatives of both genders, despite quantitative differences. This serves as confirmation of the thesis regarding the erosion

of gender boundaries in the structure of marital expectations. This situation may lead to the emergence of internal conflict and role clashes, manifested in the following ways:

1. Spouses expect to find the same character traits in each other (e.g., a desire for dominance);
2. Spouses expect mutually exclusive qualities from their partner (e.g., submissiveness);
3. There is a lack of role consistency in marital expectations.

In this study, the following methods were used: “Role Distribution in the Family” and the Personal Semantic Differential (PSD).

The results of the testing clearly revealed the stereotypical distribution of roles in the family, which requires no further explanation. The visualization shows only one point of agreement, namely, “material support of the family” (Figure 1). Here, there is unanimous agreement among both women and men. However, this situation may lead to conflict. In other words, both groups believe that both men and women should equally share responsibility for the financial well-being of the family.

Conclusion based on the results of this method:

The prospect of creating a classical family is clearly visible.

Figure 2 reflects the results of the survey based on three parameters (“provides material support,” “faithful spouse,” “loves children”). It is important to immediately note the unanimity in the evaluation of the third scale, “loves children” — both women and men, in their real self-perception as well as in their ideal, highlight this quality 100%. This, perhaps, is not so much a matter of mentality, but rather simply the norm for a reasonable person who has received proper upbringing.

However, the issue of the family budget and financial well-being (the first scale in the PSD method and the second scale in the “Role Distribution in the Family” method) demonstrates clear differences. It seems that traditional views on family finances conflict with modern perspectives on financial independence within marriage. When discussing traditional views, the question arises: who should provide material support for the family? The answer — the man. According to traditional views, even if the woman earns, it is likely that her income is somewhat less. In this case, the man would naturally feel self-sufficient.

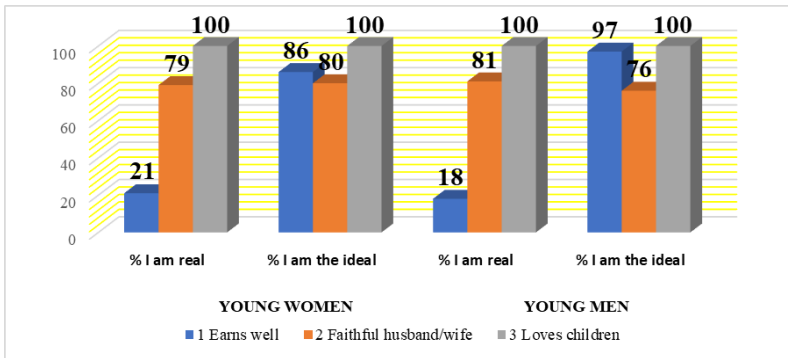


Figure 2. Results of the study indicators based on the PSD method (selected scales).

Based on the results of the “Role Distribution in the Family” test, it can be concluded that the study participants aspire to equality in financial matters, demonstrating a tendency towards gender equality. However, the results obtained through the PSD method point to the opposite: the preservation of traditional views on the financial aspect of marriage. Despite this, both groups of participants, according to the results of this scale, express dissatisfaction with their financial situation.

Thus, for a happy family, either a shared vision between the spouses or an agreement between them is necessary. The behavior of each spouse, considering their role in the family, should not contradict the views of the other. For example, if one spouse considers themselves the head of the family and the other sees themselves as subordinate, conflicts are inevitable, especially during critical moments when deep, often unconscious motives surface.

Based on the conducted study and the obtained data, the following conclusions were made:

- Women often perceive adaptation in marriage as an opportunity for self-assertion, a struggle for influence, which is characteristic of the nuclear family model.
- Men generally view adaptation in marriage as an equal partnership, a harmonious interaction, which aligns with the egalitarian family type.
- Without working on one’s own perceptions, developing empathy and tolerance, there is a risk of creating a traditional family that replicates the structure of the parental family.

In other words, communication based on gender agreement begins with transforming oneself, primarily resolving one’s own internal conflicts and disagreements. A positive mindset for interaction plays a crucial role in building relationships with the opposite sex.

Used literature

1. Gagarina E.Yu., Konopleva N.A., Karabanovas F. *Family vision: A textbook* // FLINT Publishing House, 2013
2. Zmanovskaya E. V. *Modern psychoanalysis. Theory and practice* // St. Petersburg: Peter, 2011 288 p.
3. Ivanova A. A. *Gender-specific features of youth marriage and family relations in the modern Russian region. Dissertation for the degree of Candidate of Sociological Sciences* // Astrakhan State University, Astrakhan – 2017. 246 p.
4. Raigorodskiy D. Ya. *Psychology of the family. (Series “Psychology of family relations”)*. Textbook for the faculties of psychology, sociology, economics and journalism // Samara: Publishing House “BAKHRAKH-M.”, 2002. 752 p.
5. Khalikova S. S., Snegireva D. A. *Social adaptation of spouses in the first year of marriage: a sociological analysis* // Electronic scientific publication “Scientific Notes of TOGU” 2016, Volume 7, No. 4, pp. 149-157

DOI 10.34660/INF.2025.73.24.040

最容易造成童年创伤的性格

THE MOST TRAUMATIC CHILDHOOD PERSONALITIES

Efanova Ksenia Yuryevna

Postgraduate student

Institute of Applied Psychoanalysis and Psychology,

University of Euro-Asian Economic Cooperation

摘要。本文探讨了家庭中造成精神创伤的主要原因，以及这些创伤的主要来源——来自周围环境的人群。研究证明，幼儿和青少年时期最容易造成创伤的是母亲和父亲，并指出需要更加认真地对待家庭心理学和亲子心理学。

关键词：精神创伤，童年创伤，家庭心理学。

Summary. *The article examines the main causes of mental injuries sustained in the family, as well as the main sources of these injuries from among those in the immediate environment. It is proven that the most traumatic figures of early childhood and adolescence are the mother and father, and the need for a more serious attitude to family psychology and the psychology of parenthood is noted.*

Keywords: *mental trauma, childhood trauma, family psychology.*

The problem of mental trauma has been the focus of scientific psychology for almost the entire period of its development (2 - 9). However, most studies focus on tragic extraordinary events that have led to the development of mental trauma and various post-traumatic reactions or PTSD: participation in military operations, earthquakes, floods, train, air and car accidents, etc. At the same time, in the practice of psychologists and psychotherapists, specialists most often encounter mental trauma of intra-family origin, inflicted by close relatives (1, 6, 10, 11).

In our study, students in years 1–5 of advanced training in psychology were offered an anonymous questionnaire with three groups of questions.

The first group is general information about previously received mental trauma: Do you have any memories of past traumas? How many traumas can you remember now? How many past traumas do you think are still active? How many years ago (approximately) did the most significant trauma occur?

The second group of questions (answer only “yes” or “no”) - what caused these injuries: a random combination of unfavorable circumstances, physical violence, humiliation or insult. Something else.

The third group of questions - who inflicted these injuries? Then the possible sources of the injuries suffered were listed, in particular: mother, father, brother, sister, husband/wife, other relatives, co-workers/friends, bosses, random people, robbers/hooligans/rapists.

A total of 65 students aged 22 to 60 took part in the study, including 16 men and 49 women. The choice of the object of the study was due to the fact that students of the psychology faculty are a rather specific contingent, for whom, firstly, the main motivational factors for mastering the profession are: "to understand myself" - 41%; "the desire to help people" - 33%; "interest in psychology" - 15%; "study of traumatic experience" - 5%; "for raising children" - 3%; "the desire to develop" - 2% (12). And secondly, they already had a certain level of psychological training, allowing them to more competently understand and evaluate their own mental trauma.

The results of the study and analysis of the data obtained are presented below. Memories of some mental traumas were preserved in 55 people (84.6% of the total sample). The average number of mental traumas received throughout the entire previous life was 3.6, while, according to the surveyed, an average of 2.5 traumas were still active to this day.

In the absolute majority of cases, the students surveyed indicated that individually significant mental traumas were received 22.87±10.70 years ago. Considering the average age of those surveyed (36.08±10.14 years), it can be concluded that the most significant mental traumas were received in childhood and adolescence (20-30 years ago).

An analysis of the relationship between the age of the subjects and the number of injuries received showed that the greatest number of anamnestic memories of injuries are demonstrated by students aged 37 (Fig. No. 1). These data are given simply as a fact, although there are many mythological ideas about this number. In particular, researchers of biblical texts note that the Bible contains exactly 37 psalms, and it is the 37th psalm that calls for faith in God. Mythological teachings note that this age is a harbinger of abrupt changes and turning points in life, etc. In Russian culture, the perception of the number 37 was significantly influenced by Vladimir Vysotsky's poetry "He who ended his life tragically is a true poet" (1972), where the following words are heard: "At the number 37, the intoxication flies off me in an instant. And now - as if a cold blew: Pushkin timed his duel to this number And Mayakovsky laid his temple on the barrel. Let's linger on the number 37! God is cunning - He put the question point-blank: either - or! At this point both Byron and Rimbaud lay down, And the current ones somehow slipped through..."

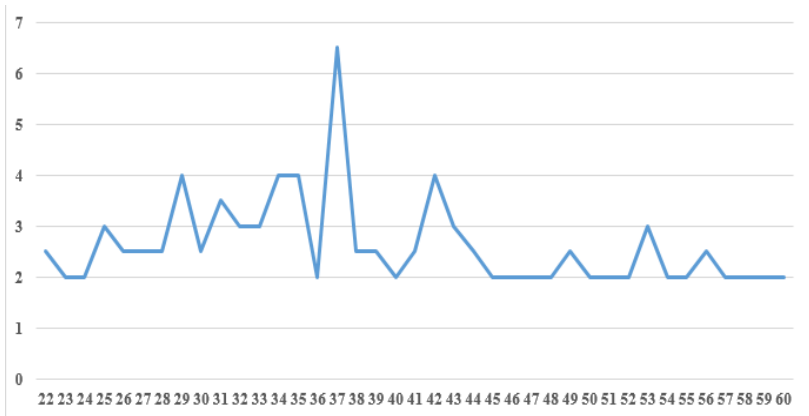


Figure 1. Dependence of anamnestic memories of traumas on the age of the subjects. In the figure: vertically the average number of traumas in the subjects of different ages, and horizontally the age of the subjects – from 22 to 60 years.

A study of the distribution of mental trauma by causes showed that the most common causes are humiliation and insult - 37.4% and physical violence (in the specified version: mainly in childhood) - 25.3%; together, these two factors account for 62.7% of cases. Random confluence of unfavorable circumstances (the most varied options) was indicated as the main causes of mental trauma in 37.3% of cases. Thus, the first place among the causes of mental trauma is occupied by negative psychological factors of childhood and adolescence.

A study of the data on who inflicted the most significant injuries showed that the most traumatogenic persons for the entire group of those examined were the mother - 26.1% and the father - 21.1%, which, taking into account the data on the age of those examined at which the most significant injuries were received, allows us to conclude that parental injury is the most severe.

And if we add to this other immediate family members, from whom the most significant mental traumas were received, in particular: spouses - 6.3%, brothers - 4.9% and sisters - 2.8%, then the total number of mental traumas associated with the immediate family environment will be 54.9%, and taking into account other relatives (“distant circle”) - 72.5%. Thus, it is the family environment that is the main source of mental trauma received in early childhood and adolescence, the effect of which extends over decades and has a significant impact on almost all adult life.

This suggests the need for a more serious attitude towards family psychology and the psychology of parenting, both in the area of professional education of

specialists – psychologists, teachers and sociologists, and the introduction of mandatory psychological education for future parents.

References

1. Winnicott D.V. *Family and personality development. Mother and child.* - M.: Litur, 2004. - P. 24 - 32.
2. Kalshed D. *The Inner World of Trauma* / trans. from English. – M.: Academic Project, 2001. – 368 p.
3. Conti P. *Trauma. Invisible Epidemic* / trans. from English by P.S. Odintsova. – M.: AST Publishing House, 2022. – P. 124-142.
4. Mrykhina V. V., Soldatkin V. A., Mrykhin V. V. et al. *Mothers of patients with schizophrenia: medical and psychological aspects of the problem. Literature review. Medical Bulletin of the South of Russia (July 23, 2019).* <https://www.medicalherald.ru/jour/article/view/921>
5. Cancerov D.V. *Working with clinical consequences of trauma* – M.: *Proceedings of the Russian-American Psychoanalytic Conference, 2005.* – P. 69-102.
6. Reshetnikov M.M. *Selected works in 10 volumes. - Volume 2. Mental trauma* // Reshetnikov M.M. - M.: Yurait Publishing House, 2020. - 178 p.
7. Smarisheva V.A. *Crisis psychological counseling.* - M.: 2022. - P. 58-60.
8. Tarabrina N.V. *Workshop on the psychology of post-traumatic stress.* – SPb.: Piter, 2001. – 272 p.
9. Freud Z. *A Study of Hysteria* / translated from German // Freud Z. *Collected Works in 26 volumes. – Vol. 1.* – St. Petersburg: East European Institute of Psychoanalysis, 2005. – 464 p.
10. Fuller Torrey E. *Schizophrenia. A book to help doctors, patients and their families.* - SPb.: Peter Press; 1996.
11. Spitz R. *Psychoanalysis of early childhood* / translated from English by Starovoytov V.V., Bokovikov A.V. – St. Petersburg: Canon+, 2023. – 256 p.
12. Reshetnikov M.M., Smarysheva V.A., Efanova K.Y. *On motivation for retraining in psychology of specialists with higher education. Proceedings of the International University Scientific Forum “Scientific Dialogues: Russia and the UAE in the 21st Century”. Part 1. (April 23, 2025. UAE).* – pp. 95 – 98.

DOI 10.34660/INF.2025.83.78.041

合唱表演的音乐象征意义《约翰受难曲》 J.S. 巴赫
**MUSICAL SYMBOLISM OF CHOIR PERFORMANCES “ST.JOHN
PASSION” J.S. BACH**

Makeeva Zhanna Robertovna

Associate Professor

Siberian State Institute of Arts named after Dmitry Hvorostovsky

注: J. S. 巴赫的声乐和器乐作品的音乐语言展现了作曲家个人风格的诸多特征, 这种风格源于他对当时潮流和探索的创造性理解。巴赫的一生 (1685–1750) 属于巴洛克时代。对于诗人、画家、建筑师和音乐家来说, 这是一个艺术和科学发生巨大变化的时期。巴洛克风格传入德国时, 德国正处于衰落的边缘。巴洛克风格的一个显著特征是古代修辞学的论点: docere (教导)、delectare (愉悦)、movere (震撼、激动)。为了表达精神上的感动 (情感), 人们使用了音乐修辞手法, 并为其稳定的含义赋予了一定的语调变化和声音规则。由于音乐与文字的紧密联系, 音乐修辞手法词汇的形成。动机语义的稳定性促成了音乐人物转化为符号、象征、特定情感或概念的象征。

关键词: 悲伤象征, 十字架母题, 宿命, 圆满, 宿命, 感叹, 死亡, 复活。

Annotation. *The musical language of the vocal and instrumental works of J. S. Bach reveals many features of the composer's individual style, which developed as a creative understanding of the trends and searches of his time. The years of Bach's life (1685-1750) belong to the Baroque era. For poets, painters, architects, musicians, this was a period in which great changes took place in art and science. Baroque came to Germany at a time when it was already on the verge of degeneration. A characteristic feature of the Baroque style were the theses of ancient rhetoric: docere (to teach), delectare (to delight), movere (to shake, to excite). To express spiritual movement (affect), musical rhetorical figures were used, for the stable meanings of which certain intonation turns and sound formulas were assigned. The musical lexicon of figures was formed due to the close connection of music with the word. The stability of the semantics of motives contributed to the transformation of musical figures into signs, emblems, symbols of certain feelings or concepts.*

Keywords: *symbolism of grief, the motif of the cross, predestination, fulfillment, predestination, exclamation, dying, resurrection.*

A. Schweitzer noted that studying the language of J. S. Bach is an urgent need for a practical musician: “Without knowing the meaning of a motif, it is often impossible to play a piece at the correct tempo, with the correct accents and phrasing” [6, p. 356]. The same can be said about works of the vocal genre. The semantic world of Bach’s music is revealed through musical symbolism; understanding it, mastering this language, as his contemporaries did, makes it possible to understand and reveal the “esoteric” (secret, hidden) language and discover the hidden meaning. Musical symbols contain certain motivic structures that correspond to verbal concepts; these can be choral melodies, stable sound combinations that have a constant meaning, and musical rhetorical figures.

The St. John Passion was composed in late 1723 – early 1724 and was first performed in Leipzig in 1724. The work is based on the Passion is a text about the sufferings of Christ taken from the Gospel of John. It has 82 verses, located in chapters 18 and 19. These lines formed the basis of the composition “Passion according to John”, consisting of 68 numbers, known as the “Russian version”.

In production the images of Christ, Peter, Pilate, a crowd of indignant Jews and Roman soldiers, with whom the dramatic gospel narrative is connected, are presented in the poem. Each of them is endowed by the composer with certain intonations-symbols, thanks to which the interpretation of images and content by J. S. Bach in the work of the Passion according to Matthew is revealed.

Choirs *turbæ* – collective images, presented different social groups of people: Christ’s disciples, guards, Roman soldiers, high priests. In the work they perform a great dramatic load. A motley, often blinded and cruel crowd of people, furious and mocking, is presented by Bach in various musical characteristics No. 3, 5, 17, 23, 25, 29, 34, 36, 38, 42, 44, 46, 48, 50, 54.

As a rule, *turbæ* choruses begin with a sudden loud sound, gradually increasing the tension in them. They end just as suddenly, their sound abruptly breaking off and giving way to the further story of the Evangelist. Thus, begins third and fifth choirs. The crowd of high priests, when Jesus asked: “Whom do you seek?”, answered: “Jesus of Nazareth.” In these constructions, typical symbols in the choir are the intonations of the ascending and descending sixth chord, which is a symbol of the inevitable fulfillment.

The imitative-contrapuntal texture of Choir No. 17 emphasizes the questions that rain down on the frightened Peter: “And you were with Him?” Their exclamations are marked by figures imitating the intonations of human speech: exclamation (Latin “exclamation”), interrogation (Latin “question”), based on intervals of ascending sixths, embodied in the motives of iambic structure. The mocking tone of these remarks is emphasized by a sharp stroke (*staccato*).

In #23, the words “if He had not been a villain, we would not have handed Him over to you” sound “with” *tradal* passage” (figure *passus durius culus*) - a

chromatic sequence with a range of fourth, symbolizing the deepest sorrow, mortal torment. The main theme is presented in the lower voices of the orchestra and the bass part. Its range is an octave, which is a symbol of unity, conciliarity. The well-known Christian thesis: “Christ died so that all might live” explains this interpretation of Bach.

The melodic pattern in other voices consists of the intonations of the cross: it seems to wrap around the mournful course of the bass, evoking an association with the beginning of the suffering of Jesus Christ, His trials. This pattern, like the previous one, also contains a chromatic line that steadily rises upwards (figureana-basis), symbolizing the move to Golgotha.

In No. 25 the thematic line of the previous choir, sounding in d-moll is repeated, but already in the key of a-moll. The basis of the melodic theme in the orchestra becomes the figure of circulatio - rotation, symbolizing the cup of suffering, redemption, which Jesus “drank” voluntarily. The figure of circulatio - rotation, permeates the theme in the string part, which also depicts the furious seething of the crowd, its hysteria, cruelty.

Choir No. 34 presents the image of Roman warriors, mocking Jesus. The words “Hail, King of the Jews!” have an ironic tone. The chorus’s successive polyphonic introductions (soprano, alto, tenor, bass) convey in an associative manner the exciting, noisy crowd, the cries of the soldiers mocking Christ. The theme is based on the ascending interval of the fifth, symbolizing emptiness and indifference. The rhetorical figure of catabasis, which concludes the theme, is read as a “devilish grin”. At the end of the musical construction there is a quarter-note pause in the choir and orchestra. The pause aposiopesis (Greek - concealment, concealment, silence) is symbolic. From our point of view, this is the composer’s “gesture, reaction” to what is happening.

The dramatic climax comes with the choruses “Crucify Him” (No. 36 and 44), the furious, mocking fugues “We Have a Law” (No. 38) and “Will You Be Free?” (No. 42). The theme of Choir No. 36 is based on the motif of the cross in a “closed” version, that is, in the direction of movement from top to bottom with active support on the tonic, reinforced by the interval of a fourth. In this presentation, the motif of the cross is a symbol of accomplishment (V. B. Nosina). Its rhythmic pattern (eighth, two sixteenths) symbolizes “pseudo-joy”. Sharp intervals, chromaticization and diminished seventh chords, formed in the harmonic vertical, as well as sigh motifs (in counterposition), are an expression of dramatic tension and suffering.

In Choir No. 38, “We Have a Law,” the thematic line runs through the bass part. On the one hand, it is built on the motif of “understanding the will of the Lord” (ascending tetrachord), on the other hand, its second half is within copied ending with a fourth at the end of the theme, which is a symbol of the requirement

of Christ's crucifixion. Let us try to explain this intonational and thematic contrast based on the biblical narrative. The high priests, referring to the law, did not accept Christ, and did not understand what God was telling them through the Holy Scriptures, namely: "all the law and the prophets speak of Christ." Waiting for the Messiah, they did not recognize Him, referring to the law - they did not fulfill it.

The musical structure of Choir No. 48 "Where to?" contains two themes. The first is an excited cry of people hurrying to the cross hill (Golgotha). The asymmetry of the introduction of choral lines after pauses gives the theme a nervous, restless character. The second theme, sounding in the bass aria, is the figure of *tirata* - "arrow, shot", which is characterized by movement in rapid octave durations, symbolizing flagellation, and the figure of *circulatio* - rotation, symbolizing the cup of suffering that was "drunk by the Savior on Golgotha" is also woven into it.

The content of Chorus No. 54 is about Roman soldiers casting lots to divide Jesus's clothes. In our opinion, the theme of "lots" presented by Bach here is very ambiguous. The soldiers cast lots for the tunic, their choice is focused on the acquisition of external material goods, which means their choice is superficial, fleeting. It contrasts with the lot of Jesus, who chose the lot of suffering in order to save humanity from sins.

The warrior theme consists of several "speaking" motives. The first is based on repeated notes (symbol of emptiness, facelessness); the second is a descending quartal leap with syncopated movement along the sounds of a triad (symbol of unbelief, frivolity). The third is the opposite, descending movement along a tetrachord (in contrast to the ascending motive, which is a post- (by the desire of the Lord's will), together with the figure of *catabasis* it symbolizes the refusal to accept the will of the Lord.

The madrigal choirs - the introductions and conclusions - are also filled with symbolism. The first choir "Our Lord, Our Master" is full of grandeur and drama and exhibits two themes. The first is based on the symbols of the cross, predestination and the figure *circulatio* (cup symbol), which permeate the entire work. The second is the theme of an angry crowd, it is characterized by two motives: the demands of the crucifixion of Christ and the symbol of unity.

The first theme in the first bar of the orchestral interlude is presented in a choral type of melody (in the upper voices and a larger rhythm). It sounds in an inverted form, which symbolizes redemption through the accomplished torment of the cross. The emerging chromatic moves in the descending movement are a sign of suffering, dying. From measure 21, the bass voice sounds a theme with a symbol of predestination.

The second theme (bar 33) is built, first, on a descending octave interval (which is a symbol of unity), then on an ascending syncopated motif with a diminished fourth, which V. B. Nosina called the demand for the crucifixion of Jesus Christ. The second theme ends with a downward movement along the seventh chord.

The second madrigal chorus, “Rest to you, holy body,” is entirely woven from intonations of lamentation, interspersed with mournful exclamations (figure exclamation - move up a sixth). The sign of sadness, dying is a widespread figure of catabasis. The musical construction begins with the symbol of inevitable fulfillment (descending sixth). The choir is written in the key of C minor, interpreted by Bach as the key of death.

Choral melodies, like musical symbols, have a clear semantic content. Their reading allows one to decipher the musical text, to fill it with a spiritual program. Every churchgoer knew church songs (chorales), their text and melody were an information sign for them, they became, in a way, a generalizing element in the system of symbols. In the work “St. John’s Passion” the composer used 11 chorales. In No. 7 “O Light of Love”, without directly following the text, he expresses one characteristic feeling (affect), which can be defined by one word - “love”. Bach highlights it with major harmony and ascending intonation. The composer uses the symbol of the suffering of the crucified Christ in the text “the path of suffering”, giving the bass part a chromatic intonation (volume min. 4).

In chorale No. 9, the key words are: “Let us endure the hour of troubles, carrying love and pain within us.” Therefore, the symbol of suffering predominates here, emphasized by descending chromatic intonations. The content of chorale No. 15 “Oh, who hit you?” is about the awareness of one’s misdeeds, sins before Christ “That I have done with sins, there are many of them in me without number.” In the melodic line, the fundamental becomes ascending scale of 5 sounds symbol of resurrection (presented in a compressed form). Why is there a resurrection motif and major joyful intonations in such a dramatic text? In the Christian worldview, awareness of one’s misdeeds is the beginning of rebirth, the resurrection of the soul.

The symbolic signs of chorale No. 20 are a prayer, an appeal to Jesus: “Turn to me, Jesus, if I do not repent” are: the figure of catabasis (descent, dying, mourning) and the symbol of sadness - falling on a third. In the text of chorale No. 27, the words “How can I fully show this faith to me?” are fundamental, the composer enriches the textual content with the intonations of the symbol of faith (with its characteristic leaps of fourths). The symbolism of No. 40 is the motive of “comprehension of the will of the Lord” (ascending tetrachord), associated with the content of the poetic original source. Chorale No. 52 “In me in the depths of the heart the Light of the Name and the Cross”, endowed with enlightened ascending intonations (anabasis figure). The final chorale No. 68 is endowed with intonations of address – descending sexta (symbol of invocation, exclamation), which can be traced in the text “Lord, in an angelic manner, allow... to be in the bosom of Abraham.” The solemn tone of the narrative is set by repeated intonations in the voices of the texture, doubling in sixths, tenths (in the soprano and tenor parts), signifying a calm feeling, joyful contemplation.

“Passions” according to John” have high merits and have important features. The connections with Bach’s pre-Leipzig music, namely with the spiritual cantatas, are more noticeable in them. Just as in the spiritual cantatas, the unity of a large composition is achieved, where a single plot unfolds and the whole is united by a complex system of musical connections.

Bach’s melodies are unique, varied, expressive. Especially the works connected with the word. The composer, generalizing the content, expresses one characteristic feeling, conveying it with a spiritual melodic theme, “speaking motives” that evoke visual and psychological associations. Due to the stability of semantics, musical figures have turned into signs, emblems of certain feelings or concepts. According to P. Florensky, “a symbol in itself is not yet music, but will become such only after its counterpoint development by our spirit, and moreover – certainly personal, certainly every time, even if reproduced – but creatively” [1, p. 53].

References

1. Berchenko, R. E. *From the history of Russian Bach studies. B. L. Yavorsky on the Well-Tempered Clavier.* – Moscow: Klassika-XXI, 2005. – 167 p.
2. Druskin M. S. *Passions and Masses of Johann Sebastian Bach.* — Leningrad: Music. Leningrad Department, 1976. — 168 p...
3. Nosina, B. *Symbolism of Bach’s music / V. B. Nosina; International courses for higher artistic mastery of pianists in memory of S. V. Rachmaninov.* - Tambov: [b. i.], 1993. - 103 p.
4. Pisarevskaya, I. *High Mass in B minor by J. S. Bach: aesthetics, composition // Problems of Musical Science. Issue 7* – Moscow: Muzyka, 1989. - 311 p.
5. Saponov M. *Bach: St. John Passion.* - Moscow: Classics-XXI, 2008. - 40 p.
6. Schweitzer, Albert. *Johann Sebastian Bach.* Moscow: Classic-XXI, 2016. - 816 p.

DOI 10.34660/INF.2025.82.41.042

学生感知噪声听觉和视觉信息时脑血循环的生理特征

**PHYSIOLOGICAL FEATURES OF BRAIN BLOOD CIRCULATION
OF STUDENTS DURING PERCEPTION OF NOISY AUDITORY
AND VISUAL INFORMATION**

Klykov Anton Vladimirovich

Postgraduate student

Northern (Arctic) Federal University named after M.V. Lomonosov

摘要.现代后信息社会的特点是不断消费大量的视听信息，随之而来的是噪音问题，这对现代人的神经系统和健康产生了不利影响。学生尤其容易受到信息超载的影响，导致超负荷和疲劳。信息感知的最大负荷落在大脑及其血液供应系统上。研究目的：研究学生在感知嘈杂的听觉和视觉信息时脑血流动力学的特性。材料和方法：30名来自北方（北极）罗蒙诺索夫联邦大学的学生参加了这项研究。在感知嘈杂和无噪声的听觉和视觉刺激时，评估了脑血流参数，并同时记录了感知呈现信息的效率。

关键词：脑血流动力学、噪音、听觉信息、视觉信息、脑血流图。

Abstract. Modern post-information society is characterized by constant consumption of large amounts of audiovisual information, which is accompanied by the problem of noise, which adversely affects the nervous system and health of modern man. Students are particularly susceptible to the effects of information overload, leading to overload and fatigue. The greatest load in the perception of information falls on the brain and its blood supply system. **Purpose of work** - To study the peculiarities of cerebral hemodynamics of students during perception of noisy auditory and visual information. **Materials and methods.** 30 students of the Northern (Arctic) Federal University named after M.V. Lomonosov took part in the study. Cerebral blood flow parameters were evaluated during the perception of noisy and unnoisy auditory and visual stimuli, and the efficiency of perception of the presented information was simultaneously recorded.

Keywords: cerebral hemodynamics, noise, auditory information, visual information, rheoencephalography.

Introduction

The 21st century is characterized by the rapid development of information technology and expansion of the Internet, which has led to the formation of a

post-information society that consumes vast amounts of information, much of which is presented in audiovisual format [4].

At the same time, there emerged the problem of environmental noise pollution caused by various irritants such as acoustic and visual noise in the form of intrusive advertisements on billboards, public places, and online platforms, urban noise, crowd noise, etc. All these factors have a negative impact on the nervous system and overall well-being, impair memory and adaptive capabilities, and reduce mental concentration and attention [2; 5; 16; 19].

The presence of these problems has strongly influenced the human lifestyle, as new conditions of existence affect and disrupt evolutionarily fixed physiological reactions. Thus, the abuse of products of technological progress, constant consumption of information, and constant exposure of the human body to noise cannot but affect health in a negative way [10; 18].

Students are particularly vulnerable to the effects of information overload because they need to master large volumes of educational content, which in today's world is primarily obtained from internet sources containing not only necessary information but also advertising noise (static, animated, with or without sound). Additionally, the internet remains a constant companion for young people even during their free time. Consequently, students face an excess of information, leading to nervous system fatigue and psychological strain manifested through increased irritability, distraction, reduced cognitive abilities, and other adverse consequences. [1; 7; 8; 9].

It is known that the formation of the aforementioned consequences largely depends on brain function, which requires adequate circulatory-metabolic support provided by the cardiovascular system (CVS), specifically the cerebral circulation system. The state of CVS and cerebral hemodynamics can be assessed using rheoencephalography [11; 14; 15].

Taking into account the above, the aim of our study was to investigate the peculiarities of cerebral hemodynamics of students during the perception of noisy auditory and visual information.

Materials and methods of research. The study involved 30 students from Northern (Arctic) Federal University named after M.V. Lomonosov, with an average age of $22,03 \pm 1,08$ years. At the time of the study, all participants were somatically healthy, having no pathologies of the cardiovascular, visual, or auditory systems. The research was conducted following all principles of biomedical ethics, and the students were informed about the examination procedure, giving their written consent.

Cerebral hemodynamics at rest and during perception of auditory and visual information were studied using the reography method implemented with the Reo-spectr-2 reographic complex (Neurosoft LLC, Ivanovo, Russia). Registration

of rheoencephalograms was performed according to standard methodology using traditional electrode placement scheme providing information on blood flow in the basins of internal carotid arteries and vertebral arteries.

Rheoencephalogram registration was carried out in a state of calm wakefulness(baseline), while perceiving auditory and visual information both without and with noise. Parameters recorded included pulse blood filling, tone of main vessels, tone of large, medium, and small arteries, peripheral vascular resistance, and venous outflow.

The auditory stimuli without/with noise were an audio recording, an excerpt from popular science literature read by a speaker. The noise was crowd noise superimposed on one of the audio tracks using the program method. All audio stimuli were perceived with headphones and eyes closed in order to reduce the influence of the visual analyzer on the recording of hemodynamic parameters to obtain more reliable results [4].

The visual stimuli without/with noise were text presented on a monitor screen. In the case of the stimulus without noise, it was the usual static text, and as noise for this type of stimuli used digital noise in the form of the “broken TV” effect, which significantly complicated the perception of the information presented. The perception of visual stimuli was performed with noise-canceling earplugs to reduce the influence of the auditory analyzer on the results obtained [4].

To determine the effectiveness of perception, participants were asked to complete tests based on the content of each stimulus immediately after its presentation.

Statistical data analysis was performed using IBM SPSS Statistics version 27.0. Wilcoxon criterion was used to analyze the collected data. All identified relationships were considered statistically significant at the value of the probability of erroneous acceptance of the null hypothesis $p < 0,05$.

Research results and discussion. The statistical analysis of cerebrovascular hemodynamics indicators in students revealed statistically significant differences between the state of calm wakefulness(baseline) and the perception of information of different modalities (Table 1).

Table 1.

Significant changes in cerebral hemodynamics parameters during perception of noisy and non-noisy information of different modalities compared to baseline

Index	Derivation	Baseline	Visual stimulus without noise	Statistical significance level
Vmd	Omd	0,84 (0,69; 1,44)	1,01 (0,65; 1,59)	0,02
DIA	Omd	73,25 (61,75; 89,75)	66,50 (57,75; 77,00)	0,03
VOI	Oms	19,75 (5,75; 35,25)	31,00 (18,00; 41,25)	0,001
	Omd	19,5 (8; 33,38)	31,00 (15,75; 37,75)	0,02

Index	Derivation	Baseline	Auditory stimulus without noise	Statistical significance level
Q-x	Fms	0,17 (0,16; 0,19)	0,16 (0,15; 0,18)	0,01
	Oms	0,16 (0,15; 0,17)	0,16 (0,15; 0,16)	0,04
	Fmd	0,17 (0,15; 0,19)	0,16 (0,15; 0,18)	0,03
	Omd	0,16 (0,15; 0,17)	0,15 (0,14; 0,17)	0,02
Vmax	Fms	2,72 (1,8; 3,67)	2,97 (2,19; 3,77)	0,03
DIA	Fmd	60,5 (53,75; 70,25)	56,00 (52,59; 59,00)	0,001
VOI	Oms	14 (5,75; 31,75)	30,50 (17,13; 40,25)	0,01
Index	Derivation	Baseline	Auditory stimulus with noise	Statistical significance level
DIA	Fmd	60,5 (53,75; 70,25)	58,00 (47,02; 64,50)	0,05
	Omd	68,25 (59,5; 79,25)	64,00 (58,00; 72,25)	0,05
VOI	Oms	14 (5,75; 31,75)	28,50 (10,75; 40,25)	0,001

Примечание: Q-x – assessment of the tone of the main vessels; Vmax- tone of large arteries; Vmd - tone of medium and small arteries; DIA - diastolic index; VOI – venous outflow index; Fms – left frontomastoideal derivation; Oms – left occipitomastoideal derivation; Fmd – right frontomastoideal derivation; Omd – right occipitomastoideal derivation; Statistically significant changes are highlighted in bold. Red color - increase of the indicator relative to the baseline; Blue color - decrease of the indicator relative to the baseline.

Students' perception of a visual stimulus without noise is accompanied by a vasodilatory response in the right vertebral artery basin, where there was an increase in the index of the tone of medium and small arteries by 20,24% ($p=0,02$) (Figure 1). It is known that the index of vascular tone of medium and small arteries characterizes the average blood flow velocity, and the increase of this index indicates a decrease in the tone itself.

On this basis, we can conclude that the perception of an unnoised visual stimulus, due to the relaxation of arteries and expansion of their lumen, caused an increase in the volume of blood flow to the occipito-mastoidal region on the right side, where brain structures responsible for the integrity of perception are located. Increased cerebral blood flow in this case may be associated with the activation of brain structures located here [7].

Also in this area there is a significant decrease in peripheral vascular resistance in the basin of the right vertebral artery by 10,15% ($p=0,03$), which indicates a decrease in the resistance of the vascular system to increased blood flow in order to meet the metabolic needs of the brain regions involved in perceptual activity.

A significant increase in the venous outflow index in the vertebral artery basins was recorded: on the left - by 59,96% ($p=0,001$), on the right - by 58,97% ($p=0,02$). The increase of this index indicates the difficulty of venous outflow in the vertebrobasilar system relative to the baseline.

It is noteworthy that reliable changes in the perception of an unnoised visual stimulus are observed exactly in the vertebral arteries that provide cerebral blood flow to the occipital region of the brain, which is more associated with the perception of visual information [15].

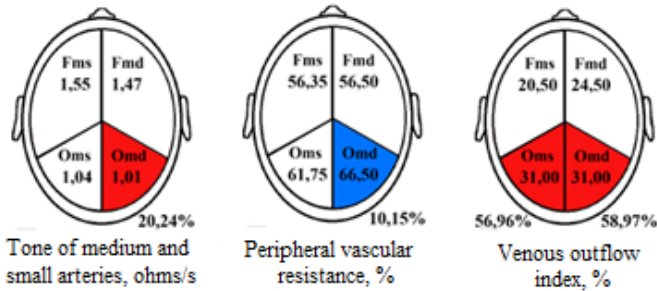


Figure 1. Significant changes in cerebral hemodynamic parameters of students during perception of a visual unnoised stimulus compared to the baseline

The perception of a visual stimulus with noise was not accompanied by statistically significant changes in hemodynamic parameters compared to the state of quiet wakefulness.

The perception of an unnoised auditory stimulus by the study participants resulted in a vasoconstrictor response of the main vessels in all derivations (Figure 2). A decrease in the index of the tone of the main vessels in the left internal carotid artery basin by 5,03% ($p=0,01$), in the left vertebral artery basin by 4,17% ($p=0,04$), in the right internal carotid artery basin by 3,46% ($p=0,03$) and in the right vertebral artery basin by 3,25% ($p=0,02$) was recorded, indicating an increase in the tone of the main vessels in the corresponding areas.

At the same time, an increase in the tone of large arteries in the basin of the left internal carotid artery by 9,19% ($p=0,03$) was revealed, which indicates a decrease in the tone of arteries of this caliber in the fronto-mastoidal region on the left.

Peripheral vascular resistance during perception of an unnoised auditory stimulus in the right internal carotid artery basin decreased by 3,46% ($p=0,001$), and the venous outflow index in the left vertebral artery basin increased significantly by 117,86% ($p=0,01$) relative to baseline.

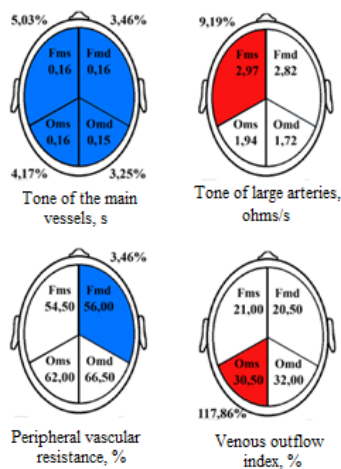


Figure 2. Significant changes in cerebral hemodynamic parameters of students during perception of auditory unnoised stimulus compared to the baseline

During perception of an auditory noisy stimulus compared to baseline, a decrease in peripheral vascular resistance in the basins of the right internal carotid artery and right vertebral artery by 4,31% ($p=0,05$) and 6,64% ($p=0,05$) was observed, respectively (Figure 3). The index of venous outflow in the left vertebral artery basin increased by 103,57% ($p=0,001$).

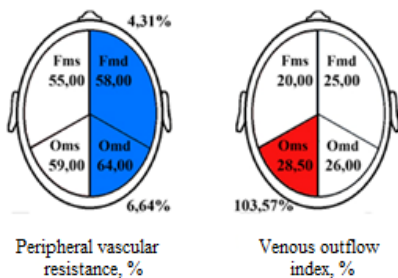


Figure 3. Changes in cerebral hemodynamic parameters of students during perception of an auditory noisy stimulus compared to the baseline

Therefore, during the perception of information of different modality with/without noise, specific changes in the students' cerebral blood flow are observed: during the perception of visual stimuli, changes are recorded in vessels of different caliber in the occipital region, during the perception of auditory information,

multidirectional changes in the parameters of students' cerebral hemodynamics, localized in both frontal and occipital regions, are observed. The greatest number of changes in students' cerebral hemodynamics was recorded during the perception of non-noisy stimuli.

In addition to studying the peculiarities of cerebral blood flow, the efficiency of perception of the presented information was evaluated during the study (Figure 4). The evaluation was performed by means of tests consisting of 5 open-ended questions for each stimulus (visual and auditory, with and without noise).

The results showed that the subjects were able to memorize the information from the visual unnoised stimulus most easily compared to all others. This may be due to the fact that students receive most of their information through the visual analyzer, so this type of information is perceived by them much easier than information presented in audio format.

Regarding the effect of noise on perceptual efficiency, it should be noted that in the case of visual stimuli, adding noise significantly impaired the ability of students to perceive and memorize the information. However, when noise was added to auditory stimuli, the testing outcomes remained nearly unchanged.

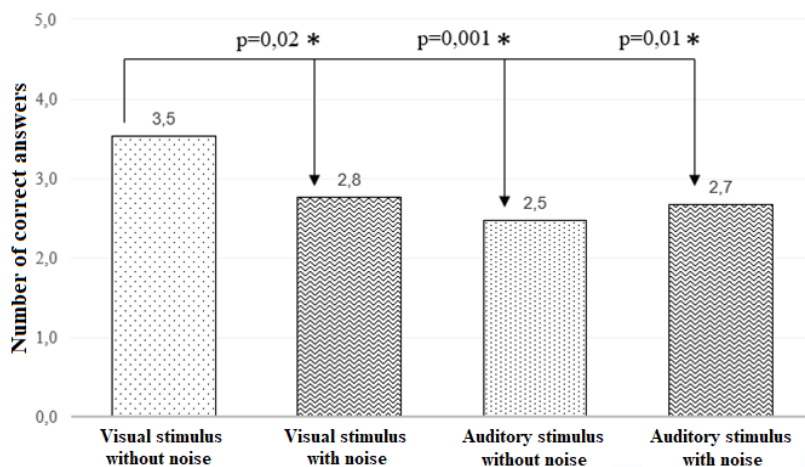


Figure 4. Efficiency of students' perception of information of different modality with/without noise (* - statistically significant differences at $p<0.05$)

Conclusion

Based on the results of our study it was found out that the perception of information of different modality by students entails specific changes in cerebral blood flow caused by activation of specific brain structures. Thus, when perceiv-

ing visual stimuli, changes in vessels of different caliber are observed in the occipito-mastoidal area involved in the processes of visual perception, and when perceiving auditory information, changes are manifested in the frontal-mastoidal and occipital-mastoidal areas. It is known that temporal regions of the brain are involved in the process of auditory perception. The greatest number of changes in students' cerebral hemodynamics is observed during the perception of non-noisy stimuli [12; 13; 17].

This study allowed us to better understand how students' bodies react to the perception of different types of information and noise, and how cerebral hemodynamics changes. However, further research is needed to more accurately assess the impact of different types of stimuli and noise on students.

Our results can be used for more in-depth study of this area, can be useful for creating more effective teaching methods, as well as for the development of ways to protect against the harmful effects of noise and the influence of information overload.

References

1. Aghajanyan, N. A. *Study of lifestyle, health status and academic performance of students during the intensification of the educational process* // *Hygiene and Sanitation*. - 2005. - № 3. - PP. 48-52
2. Amineva, E. S. *Analysis of the impact of noise on students and schoolchildren* // *Science, education, production in solving environmental problems (Ecology-2017)* - Ufa, 2017. - PP. 24-29
3. Jackson, T. *Hacking Biology* // *AST Publishing House - Moscow*, 2019 - 224 p.
4. Elyakov, A. D. *Deficit and excess of information in modern society* // *SOCIS: Sociological Studies*. - 2010. - N.12. - PP. 107-114
5. Zotova, O. M., Zotov, V. V. *Information overload as a factor of stress of university students* // *Man and his health*. - 2015. - № 4
6. Ignatova, Y. P. *Modern aspects of the study of functional interhemispheric brain asymmetry (literature review)* // *Human Ecology*. - 2016. - № 9
7. Kolychev, D. I. *Brain and central hemodynamics in students in the process of mental workload (review)* // *Proceedings of the IX International Student Scientific Conference "Student Scientific Forum"* - 2017. - 7 p.
8. Marinina, M. G. *Study of adaptation of students' organism to the educational process in higher education* // *Medical and biological and psychological and pedagogical aspects of human adaptation and socialization*. - T. 1. - Volgograd: *Volgograd Scientific Publishing House*, 2008. - PP. 206-209.

9. Melnik, S. N. *Features of cerebral hemodynamics of young people under mental load with different types of motor asymmetry* // III Republican scientific-practical internet conference with international participation - Gomel. - 2019. - PP. 65-67

10. Popova, T. V. *Factors shaping the health of students of higher educational institution in the conditions of a large city* // *Medicine. Sociology. Philosophy. Applied research.* - 2020. - № 3

11. Pospelov, N. I. *Influence of physical activity on the indicators of rheoencephalogram in students* // *Medicine and Ecology.* - 2020. - № 3

12. Potapova, R. K. *Cognitive mechanism of semantic segmentation of oral speech (in difficult to perceive noise conditions)* // *Proceedings of the All-Russian Acoustic Conference* - 2014. - 6 p.

13. Prischepa, I. *Neurophysiology.* // Litres. - 2021. - 285 p.

14. Spitsin, A. P. *Features of cerebral and systemic hemodynamics in students with optimal and high normal blood pressure* // *Vyatka Medical Bulletin.* - 2021. - № 3

15. Khalyavkina, I. O. *Individual-typological features of hemodynamics in adolescence* // *Journal of Fundamental Medicine and Biology.* - 2017. - № 1

16. Croy, I. *Effects of train noise and vibration on human heart rate during sleep: an experimental study* // *BMJ Open.* - 2013. - Vol. 3. - N. 5.

17. Davis, M H. *Hearing speech sounds: top-down influences on the interface between audition and speech perception* // *Hear Res.* - 2007. - 229(1-2). - P. 132-147.

18. Fox, S., & Duggan, M. (2013). *Health online 2013* // Pew Research Center's Internet & American Life Project. - 2013. - 55 P.

19. Goyal, S. *Effect of noise stress on autonomic function tests* // *Noise Health.* - 2010. - Vol. 48. - N 12. - P. 182-186.

人工通气对3.1~7岁急性脑衰竭患儿心肌需氧量昼夜节律的影响

**THE EFFECT OF ARTIFICIAL VENTILATION ON THE
CIRCADIAN RHYTHM OF MYOCARDIAL OXYGEN DEMAND IN
ACUTE CEREBRAL FAILURE IN CHILDREN AGED 3.1-7 YEARS**

Muhitdinova Hura Nuritdinovna

*Doctor of Medical Sciences, Full Professor
Center for the Development of Professional Qualifications
of Medical Workers*

Mirzayeva Adiba Damirovna

*Head of Department
Republican Scientific Center for Emergency Medical Care*

Manapova Nodira Halilovna

*Assistant
Center for the Development of Professional Qualifications
of Medical Workers*

摘要。通过研究人工通气对入住RRCEM重症监护病房的3.1-7岁急性脑衰竭患儿心肌需氧量昼夜节律的影响, 结果发现: 第2组患儿(52天)的心肌需氧量(MOD)指标在峰值期与日均水平存在可靠的偏差, 偏差幅度达20%, 而深潮期则下降了19%, 这证实了MOD在昼夜节律中的波动性。强化治疗使昼夜节律的中值恢复正常, 所有患儿在第3天的MOD在1天内增加了30%。昼夜节律和MOD节律相位结构的偏差与肺炎的严重程度(ACF)相对应。第2组患儿的血流动力学高动力学趋势导致MOD自然增加。

关键词: 人工肺通气、昼夜节律、心肌需氧量、急性脑衰竭、肺炎、儿童。

Abstract. Based on the study of the effect of artificial ventilation on the circadian rhythm of myocardial oxygen demand in acute cerebral failure in children admitted to the ICU of the RRCEM in severe condition at the age of 3.1-7 years, the following was revealed. A reliable deviation from the average daily level of the MOD indicator in the acrophase was noted in children of group 2 (52 days) by 20%, as well as a decrease in the bathyphase by 19%, which confirmed the fluctuation of MOD in the circadian rhythm. The intensive therapy led to the normalization of the meso of the circadian rhythm MOD increased in 1 day by 30% in all children on the third day. Deviations in the phase structure of the circadian and MOD rhythm corresponded to the severity of pneumonia, ACF. The

tendency to hemodynamic hyperdynamics in group 2 caused a natural increase in MOD.

Keywords: *artificial lung ventilation, circadian rhythm, myocardial oxygen demand, acute cerebral failure, pneumonia, children.*

Relevance. The authors have experimentally proven that severe ACF is accompanied by depression of cardiac contractility and increased myocardial dependence on oxygen and glucose supply, which may be associated with pathogenic factors such as hypoxia, impaired bioenergetics, oxidative stress and Ca²⁺ imbalance. However, there is insufficient information on changes in myocardial oxygen demand, the degree of circadian rhythm disturbance of cardiac function in children with ACF caused by pneumonia, the pathogenetic and etiological significance of cardiac dysfunction in the occurrence and development of MODS have not been sufficiently studied, which significantly complicates the development of complex intensive therapy (CIT) for this contingent of victims [1-6].

The purpose of the work. To study the effect of artificial lung ventilation on the circadian rhythm of myocardial oxygen demand in acute cerebral failure in children aged 3.1-7 years.

Material and methods of the study. The results of continuous prolonged monitoring with hourly recording of hemodynamic parameters, myocardial oxygen demand (MOD), body temperature, and respiration were studied in children admitted to the ICU of the RRCM in a serious condition caused by pneumonia complicated by acute respiratory and cerebral failure at the age of 3.1 to 7 years. Intensive care was carried out in accordance with the recommendations in thematic clinical protocols. Group 1 included 7 children who, upon admission to the clinic and throughout intensive care, had no indications for mechanical respiratory support, which did not exclude oxygen therapy. Almost all patients of Group 2 (9 children) were transferred to mechanical ventilation from the moment of admission to the clinic according to indications. The research data were processed by the variation statistics method using the Excel program by calculating the arithmetic mean values (M) and errors of means (m). To assess the reliability of differences in two values, the parametric Student's criterion (t) was used. The relationship between the dynamics of the studied parameters was determined by the paired correlation method. The critical significance level was taken to be 0.05.

Results and their discussion. A tendency towards an increase in the average mesor value, the indicator in the acrophase, the amplitude and daily fluctuation of the MOD in the circadian rhythm depending on the severity of the condition was noted. A reliable deviation from the mesor level of the MOD in the acrophase in children of group 2 (52 days) by 20%, as well as a decrease in the bathyphase by 19% confirmed the fluctuation of the MOD in the circadian rhythm (Table 1).

Table 1.

Average values of the phase structure indicators of the circadian rhythms of the MOD

Groups	Mesor	In acrophase	In the bathyphase	Amplitude	Daily fluctuation range
1	105±9	119±12	89±10	15±6	30±10
2 (7 days)	113±7	125±6	101±6	12±3	24±4
2 (52 days)	116±9	140±12*	93±9*	24±8	47±13

Table 2.

Dynamics of the mesomorphic circadian rhythm of the MOD in %.

Days	1 group	2 group
1	130±14	129±8
2	109±9	120±4
3	102±5*	107±3*
4	106±4*	106±5*
5	105±5*	108±6*
6	97±6*	111±4*
7	82±9*	109±6*

Table 3.

Average circadian rhythm of the MOD in %.

Hours	1 group	2 group 7 days	2 group 52 days
8	109±13	116±8	126±12
9	111±13	116±7	128±13
10	110±12	118±4	125±13
11	110±12	117±3	125±12
12	108±15	122±6	121±11
13	112±12	117±6	122±12
14	112±15	117±9	121±12
15	112±14	113±8	120±11
16	110±11	115±9	120±13
17	110±9	110±10	119±12
18	106±11	115±9	118±12
19	108±10	116±9	122±14
20	105±7	111±7	118±12
21	102±8	115±10	116±11
22	99±9	115±7	113±13
23	99±13	110±6	110±12

24	97±13	116±8	109±13
1	93±9	112±8	108±14
2	93±11	109±8	106±13
3	95±9	107±7	103±12
4	96±9	103±7	106±10
5	99±9	106±7	105±11
6	108±6	107±6	113±12
7	105±11	107±5	115±11

*- the difference is reliable relative to the indicator in 1 day

On the first day, the mesor of the circadian rhythm of the MOD was increased by 30% in all children. The complex intensive therapy caused a decrease in the mesor of the MOD on the third day in group 1 by 28%, in group 2 by 22%. A significantly significant decrease in the mesor of the circadian rhythm of the MOD to the physiological level in both groups remained in the following days (Table 2). The level of fluctuations in the average circadian rhythm of the MOD in group 2 both in the first 7 days and in the following days of observation retained a relatively greater tendency to increase than in children in group 1 (Table 3), which was due not only to more severe pneumonia, but also to pronounced cerebral insufficiency, despite more active stress-limiting intensive therapy. Fluctuations in the mesocircadian rhythm in the 2nd group occurred in a circadian rhythm in the first 7 days, subsequently deforming with a decrease in the oscillation period to 4-5 days (Fig. 1).

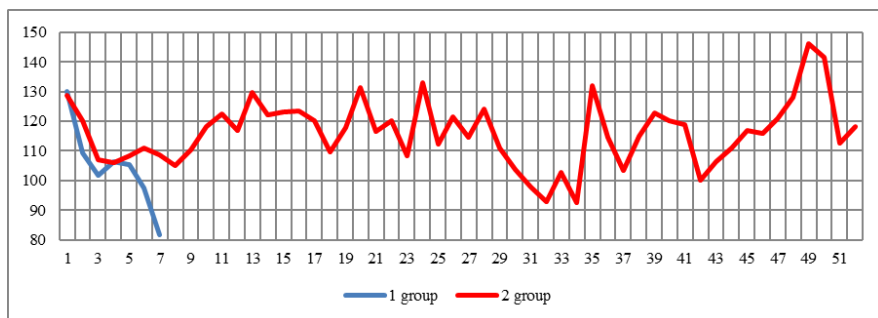


Figure 1. Dynamics of the mesomorphic circadian rhythm of the MOD in %.

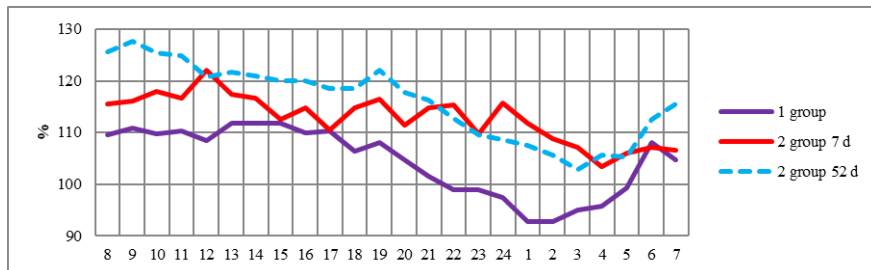


Figure 2. Average circadian rhythm of the MOD in %.

The average circadian rhythm in group 1 with the projection of acrophase at 13:00, bathyphase at 1:00 a.m. was closest to the physiological norm (Fig. 2). More pronounced deviations were noted in children of group 2 in the average circadian rhythm of the MOD over 52 days of observation, which were characterized by a higher level of the meso of the circadian rhythm of the MOD. Thus, the average daily level of the MOD in group 1 was $105 \pm 5\%$, in group 2 in the first 7 days $113 \pm 4\%$, in group 2 over 52 days of intensive therapy $116 \pm 6\%$. Thus, the complex intensive therapy, including respiratory prosthetics, made it possible to prevent myocardial ischemia, when not only adequate oxygenation was important, but also drug preventive protection through the effect on intracellular metabolism and the prevention of mitochondrial failure.

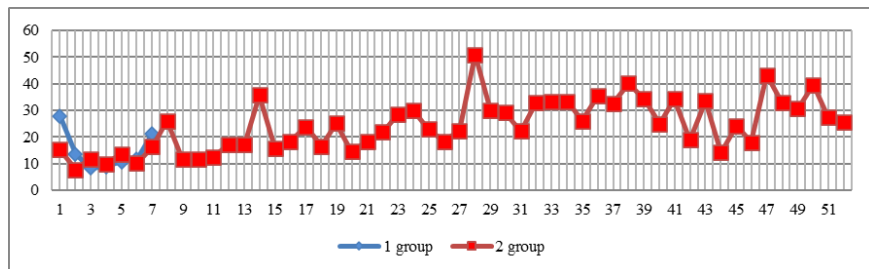


Figure 3. Amplitude of the circadian rhythm of the MOD in %.

The dynamics of the amplitude of the circadian rhythm of the MOD in Group 1 corresponded to a circadian oscillation. In Group 2, the circadian period of change in the amplitude of the circadian rhythm of the MOD in the following days of observation was an alternation of 6-, 4- and 5-day waves of change in the indicator (Fig. 3). Changes in the daily oscillation of the MOD also represented 4-6-day waves, in some places the wavelength increased to 11 days (20-31 days), 13 days (31-44 days) (Fig. 4).

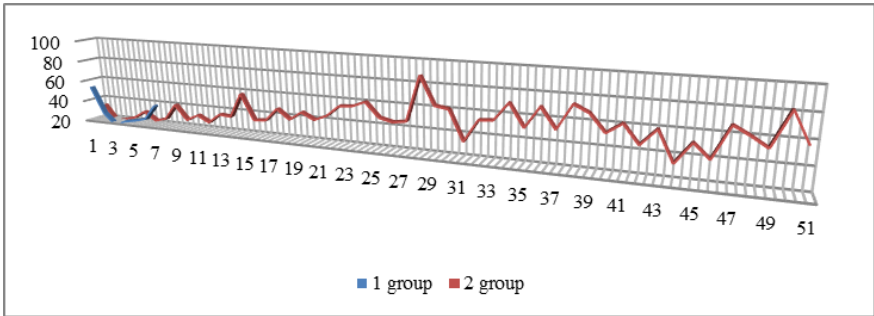


Figure 4. Daily range of oscillations of the circadian rhythm of the MOD in %.

The longest inversion of the circadian rhythm of the MOD in % relative to the duration of stay in the intensive care unit was noted in group 1 - 58% (4 days), in group 2 52 days 38% - (19 days) (Fig. 5).

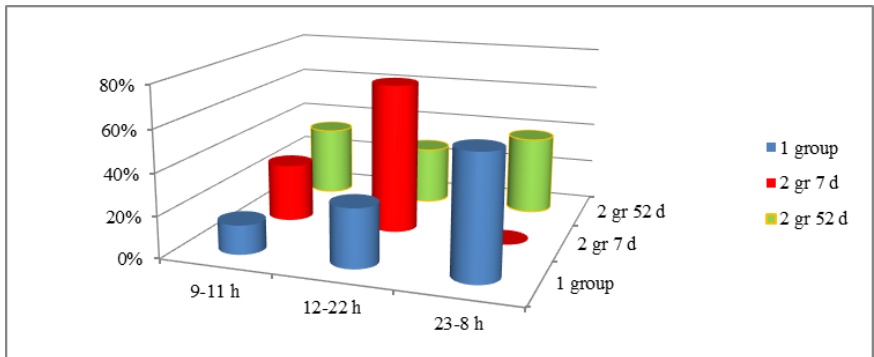


Figure 5. Duration of the inversion of the circadian rhythm of the MOD.

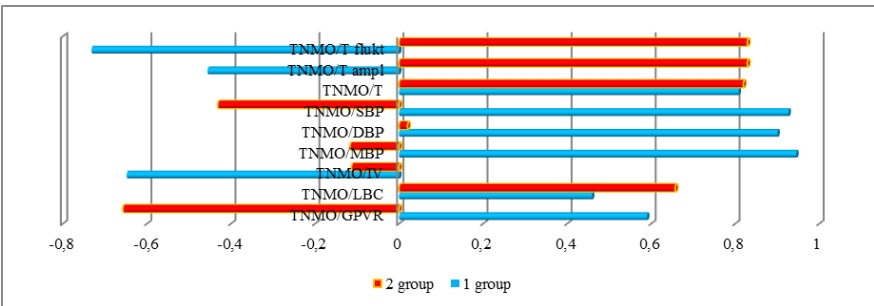


Figure 6. Correlation links of the mesor of the circadian rhythm of the MOD.

A direct strong correlation link between the dynamics of the MOD and the mean arterial pressure (0.94) was revealed in Group 1, which completely disappeared in children of Group 2 (Fig. 6). That is, an increase in the mean arterial pressure was accompanied by an increase in the MOD, which was one of a number of pathogenetic factors causing the development of acute cardiac decompensation during spontaneous breathing of a child with pneumonia. Also, in Group 2, the revealed direct relationship between the MOD and the diastolic arterial pressure (0.9), and between the MOD and the systolic arterial pressure (0.9) disappeared. In both groups, a direct strong relationship between the MOD and body temperature was found in both groups (0.8, respectively). At the same time, an increase in the change in the amplitude of the circadian rhythm of body temperature was accompanied by an increase in the level of the mesor of the circadian rhythm of the MOD in Group 2. Increase in daily temperature fluctuations caused an increase in the average daily level of MOD (0.82) against the background of artificial ventilation. However, in Group 1, an inverse correlation was noted between the range of daily temperature fluctuations and the mesoscale circadian rhythm of MOD (-0.73). The latter is probably due to other compensatory mechanisms operating during spontaneous breathing of the patient, participating in the process of adaptation of cardiac function at the height of the inflammatory response of the body in pneumonia, occurring under the control of the central nervous system.

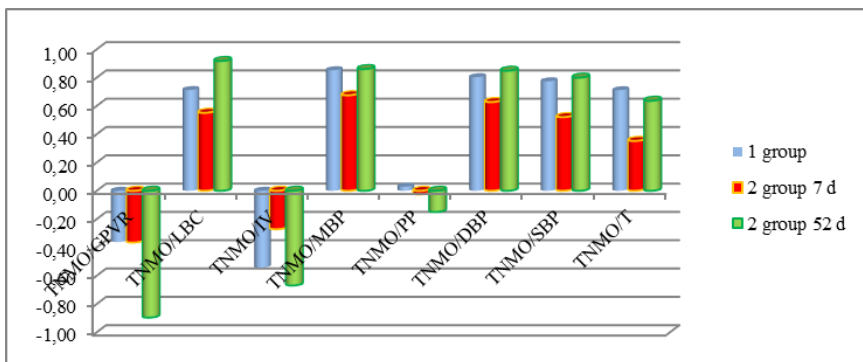


Figure 7. Correlation relationships of the average circadian rhythm of the MOD.

An increase in the level of the average circadian rhythm of the cardiac output was accompanied by an increase in the MOD in group 1 (0.71) and in group 2 for 52 days (0.92) (Fig. 7). Only in children of group 2 did a decrease in the level of the average circadian rhythm of the total peripheral vascular resistance cause an increase in the same indicator of the MOD in group 2 (-0.9). That is, the tendency

to hemodynamic hyperdynamics in group 2 caused a natural increase in the MOD, increasing the risk of developing acute heart failure due to an energy-deficient state. In group 1 and group 2 for 52 days, a direct dependence of the MOD on the mean BP (0.85; 0.86, respectively), the MOD on the diastolic BP (0.8; 0.85, respectively), the MOD and systolic BP (0.77; 0.8, respectively), the MOD and body temperature (0.71; 0.64, respectively) was revealed. Thus, the tendency to hemodynamic hyperdynamics, more pronounced in children of group 2, caused natural hypoxia, myocardial ischemia, aggravating the energy-deficient state and the risk of developing acute heart failure with a more severe infection and ACF, even with more extensive drug-induced stress-limiting protection and blood oxygenation prosthetics with maintaining blood oxygenation above 95%. It was noteworthy that in the first 7 days of intensive care with MCI, it was not possible to achieve the level of activity of functional compensatory connections that occurred in group 1, due to the severity of pneumonia complicated by ACF. Perhaps, even under conditions of reversible disorders causing severe ACF, mechanisms arise leading to the failure of myocardial contractility due to the energy-deficient state, primarily caused by myocardial oxygen starvation, with subsequent mitochondrial insufficiency. Conclusion. A reliable deviation from the average daily level of the MOD indicator in the acrophase in children of group 2 (52 days) by 20%, as well as a decrease in the bathyphase by 19% confirmed the fluctuation of MOD in the circadian rhythm. The intensive therapy led to the normalization of the increased mesomorph of the circadian rhythm MOD indicator on the 1st day by 30% in all children on the third day. Deviations in the phase structure of the circadian and MOD rhythm corresponded to the severity of pneumonia, ACF. The tendency to hemodynamic hyperdynamics in group 2 caused a natural increase in MOD.

References

1. Belkin A.A., Zislin B.D., Leiderman I.N., Domansky D.S.; *Clinical Institute of the Brain, SSC RAMS; Journal "Intensive Care" No. 3, 2006.*
2. Likhterman L.B., Kravchuk A.D., Okhlopov V.A., Mogila V.V., Likhterman B.L.; *Federal State Autonomous Institution "National Medical Research Center of Academician N.N.Burdenko"; S.I. Georgievsky Medical Academy of the Federal State Autonomous Educational Institution of Higher Education "V.I.Vernadsky Kazan Federal University"; Federal State Autonomous Educational Institution of Higher Education "I.M.Sechenov First Moscow State Medical University" of the Ministry of Health of the Russian Federation (ConsiliumMedicum portal, journal "Neurology and Rheumatology" No. 1, 2018.*
3. <https://intensive-care.ru/index.php/acc/article/view/31/2071>

4. https://mknc.ru/spravochnik-zabolevaniy/10107/ostrye-narusheniya-mozgovogo-krovoobrashcheniya/2/?kt_lang=ru

5. <https://cyberleninka.ru/article/n/osobennosti-tserebralnoy-i-ekstratserebralnoy-nedostatochnosti-u-bolnyh-s-neblagopriyatnym-prognozom-hirurgicheskogo-lecheniya>

6. <https://laesus-de-liro.livejournal.com/399570.html>

DOI 10.34660/INF.2025.25.45.044

人工通气对3.1~7岁儿童急性脑供血不足自主神经调节昼夜节律的影响
**THE INFLUENCE OF ARTIFICIAL VENTILATION ON THE
CIRCADIAN RHYTHM OF AUTONOMIC REGULATION IN
ACUTE CEREBRAL INSUFFICIENCY IN CHILDREN AGED 3.1-7
YEARS**

Muhitdinova Hura Nuritdinovna

Doctor of Medical Sciences, Full Professor

*Center for the Development of Professional Qualifications
of Medical Workers*

Babajanova Zumrat Omarovna

Head of Department

Republican Scientific Center for Emergency Medical Care

Alauatdinova Gulhan Inyatdinovna

Assistant

*Center for the Development of Professional Qualifications
of Medical Workers*

摘要。研究了16名儿童每小时记录一次AVT的监测结果。第二组患者（9名儿童）自入院起根据指征转入人工呼吸机。急性肺炎的ANS反应表现为第一组第一天交感神经系统（SNS）张力增加90%，第二组增加80%。在综合强化治疗过程中，第一组患者第五天交感神经张力降低50%，第二组降低30%。交感神经张力反应的严重程度与患者病情严重程度相对应。显然，重症肺炎时最佳的交感神经紧张反应水平是动静脉血流速度（AVT）增加30–40%，而更严重的轻度认知功能障碍（MCI）时，交感神经紧张调节水平应增加40–50%。此时，应在强化治疗的同时，预防性地纠正能量缺乏状态和急性线粒体衰竭。

关键词：人工肺通气，昼夜节律，植物性调节，急性脑衰竭，儿童。

Abstract. The results of monitoring with hourly registration of the AVT in 16 children were studied. Patients of the 2nd group (9 children) were transferred to artificial ventilation from the moment of admission to the clinic according to indications. The reaction of the ANS to acute pneumonia was expressed in an increase in the tone of the sympathetic nervous system (SNS) on the first day in the 1st group by 90%, in the 2nd by 80%. In the process of complex intensive therapy, a decrease in sympathotonia in the 1st group was revealed on the 5th day by 50%, in the 2nd - by 30%. The severity of the sympathotonic reaction corresponded

to the severity of the patients' condition. Apparently, the most optimal level of sympathotonic reaction in severe pneumonia is an increase in the AVT by 30-40%, and in a more severe form with MCI, an increase in the level of sympathotonic regulation by 40-50%, when intensive therapy should be supplemented with preventive correction of the energy deficiency state, acute mitochondrial failure.

Keywords: *artificial ventilation of the lungs, circadian rhythm, vegetative regulation, acute cerebral failure, children.*

Relevance. The autonomic nervous system receives impulses from various parts of the central nervous system (CNS) involved in the processing and integration of information about the state of the internal environment of the body and the impact of stimuli from the environment. These structures include the hypothalamus, the nucleus of the solitary tract, the reticular formation, the amygdala, the hippocampus and the olfactory cortex. The autonomic nervous system (ANS) in the acute period of cerebrovascular accident is the leading link modulating cardiac functions. Violation of the dynamic organization of the ANS, which implies the interaction and mutual modulation of the sympathetic and parasympathetic neuroeffector mechanisms of cardiac activity control, contributes to maladaptive reactions, which increases the sensitivity of the myocardium to damaging agents. Patients with different courses of the pathological process have different variants of changes in the vegetative regulation and different degrees of their severity, which allows using the assessment of changes in both parts of the ANS to predict the severity and outcome of the disease. In diseases or disorders of brain function, damage to the structures that carry out central regulation of the cardiovascular system leads to various deviations from the norm, including hypertension, pronounced changes in the frequency and rhythm of heart contractions. It has been proven that intracranial hypertension leads to disruption of neurohumoral regulatory processes and autonomic functions, as well as to failure of compensatory mechanisms. The regulatory role responsible for the integration of vascular reactions during changes in intracranial pressure is played by suprasegmental structures of the ANS.

Research by many authors has convincingly demonstrated the presence of correlations between the localization of brain damage and cardiac disorders. The development of transient cardiac disorders is directly related to acute cerebral damage and is designated by the term "cerebrocardial syndrome" (CCS). The development of CCS in cerebral ischemia is based on structural myocardial disorders that are not associated with coronary blood flow disorders. In the pathogenesis of CCS, the leading role is played by disorders of the autonomic regulation of the cardiovascular system and changes in the function of the hypothalamic-pituitary-adrenal system, leading to the development of morphofunctional changes in cardiomyocytes. According to A.M. According to Dolgova (1995), cardiac arrhythmias —

supraventricular and ventricular extrasystoles, paroxysms of atrial fibrillation, and atrioventricular conduction disturbances — are the most common symptoms of CCS. Cardiac arrhythmias can negatively affect reparative processes in the cerebral ischemia zone. It has been proven that frequent supraventricular extrasystole causes a reduction in cerebral blood flow by 7%, ventricular extrasystole by 12%, and ventricular paroxysmal tachycardia by 40-75%. Cardiac arrhythmias, such as sick sinus syndrome, developing during acute cerebrovascular accident, cause additional neurological deterioration. Due to the lack of information on the specifics of managing children aged 3.1–7 years with severe acute pneumonia, an attempt was made to assess the state of autonomic regulation of mechanical respiratory support in systemic inflammatory response complicated by acute cerebral insufficiency based on a study of data from monitoring circadian rhythms of autonomic tone (AT) [1–4].

Objective. To study and evaluate the effect of artificial ventilation on the state of the circadian rhythm of autonomic tone in acute cerebral failure caused by pneumonia at the age of 3.1-7 years.

Material and methods of the study. The results of continuous prolonged monitoring with hourly registration of AVT were studied in children admitted to the ICU of the RRCEM in a serious condition caused by an infection complicated by acute respiratory, cerebral failure at the age of 3.1 to 7 years. Group 1 included 7 children who, upon admission to the clinic and throughout intensive care, had no indications for mechanical respiratory support, which did not exclude oxygen therapy without mechanical ventilation. Almost all patients of group 2 (9 children) were transferred to mechanical ventilation from the moment of admission to the clinic according to indications.

Results and their discussion. As shown in Table 1, the mesoral circadian rhythm index of the AVT in both groups did not differ from the physiological indices in this age group. A reliable difference in the AVT index in the acrophase was revealed in the first 7 days of observation in Group 2 by 18%, which confirmed the fluctuation of the AVT in the circadian rhythm (Table 1). The reaction of the ANS to acute pneumonia was expressed in an increase in the tone of the sympathetic nervous system (SNS) on the first day in Group 1 by 90%, in Group 2 by 80%. During complex intensive therapy, a decrease in sympathotonia in Group 1 was revealed on the 5th day by 50%, in Group 2 - by 30%. Stabilization of the sympathotonic reaction that persisted in the following days of the SVR was of a physiological nature and was aimed at mobilizing adaptive resources to ensure compensatory reactions due to severe infection. Despite more significant drug-based complex stress-protective therapy in Group 2, a tendency for more pronounced mobilization of the protective mechanisms of the autonomic nervous system was noted throughout the observation period. This was confirmed by changes in the average circadian rhythm of the AVT (Table 3).

Table 1.

Average values of the parameters of the phase structure of the circadian rhythm of the AVT, units.

Groups	Mesor	In acrophase	In the bathyphase	Amplitude	Scope
1	1,5±0,1	1,8±0,2	1,2±0,19	0,3±0,1	0,6±0,2
2 (7 days)	1,6±0,1	1,9±0,1*	1,4±0,1	0,3±0,1	0,5±0,1
2 (52 days)	1,7±0,2	2,2±0,3	1,3±0,2	0,5±0,2	0,9±0,3

*- the difference is reliable relative to the mesor index

Table 2.

Circadian rhythm mesor AVT, units.

Days	1 group	2 group
1	1,9±0,3	1,8±0,1
2	1,6±0,1	1,7±0,1
3	1,5±0,1	1,6±0,1
4	1,5±0,1	1,6±0,1
5	1,4±0,1*	1,5±0,1*
6	1,4±0,1*	1,5±0,1*
7	1,4±0,2	1,6±0,1

Table 3.

Average circadian rhythm of AVT, units

Hours	1 group	2 group 7 days	2 group 52 days
8	1,5±0,2	1,6±0,1	1,7±0,2
9	1,6±0,2	1,6±0,1	1,8±0,3
10	1,6±0,2	1,6±0,1	1,8±0,2
11	1,7±0,3	1,7±0,1	1,8±0,2
12	1,6±0,2	1,8±0,1	1,8±0,3
13	1,6±0,2	1,6±0,1	1,7±0,2
14	1,6±0,2	1,7±0,1	1,7±0,2
15	1,6±0,2	1,6±0,1	1,7±0,2
16	1,6±0,1	1,6±0,1	1,8±0,3
17	1,6±0,1	1,6±0,2	1,7±0,3
18	1,5±0,1	1,7±0,1	1,7±0,2
19	1,5±0,1	1,7±0,1	1,8±0,3
20	1,5±0,1	1,6±0,2	1,7±0,2
21	1,5±0,1	1,7±0,1	1,7±0,2
22	1,5±0,1	1,7±0,1	1,6±0,2
23	1,4±0,2	1,5±0,1	1,6±0,2

24	1,4±0,2	1,6±0,1	1,6±0,2
1	1,4±0,1	1,6±0,1	1,6±0,2
2	1,4±0,1	1,6±0,1	1,5±0,3
3	1,4±0,1	1,5±0,1	1,5±0,3
4	1,4±0,1	1,5±0,1	1,5±0,2
5	1,5±0,1	1,6±0,1	1,6±0,2
6	1,7±0,1	1,6±0,1	1,7±0,2
7	1,6±0,1	1,5±0,1	1,7±0,2

*- the deviation is reliable relative to the indicator in 1 day

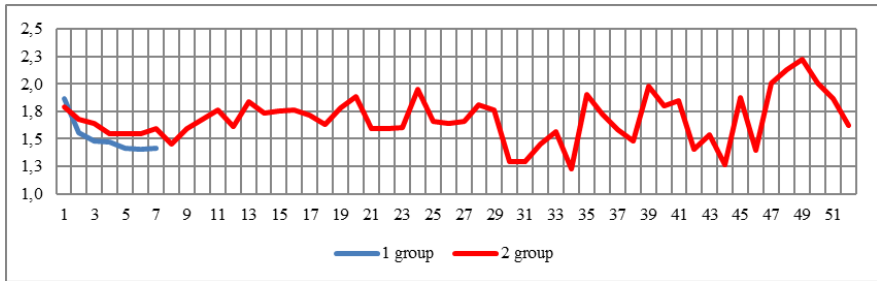


Figure 1. Mesor of the circadian rhythm of the AVT, units.

Fluctuations in the mesor of the circadian rhythm of the AVT already in the first days in both groups represented a deformed circadian rhythm of the AVT (Fig. 1). In the following days of intensive therapy with mechanical respiratory support (MRS), changes in circadian biorhythms were expressed in a decrease in the wavelength to 4 - 5 days.

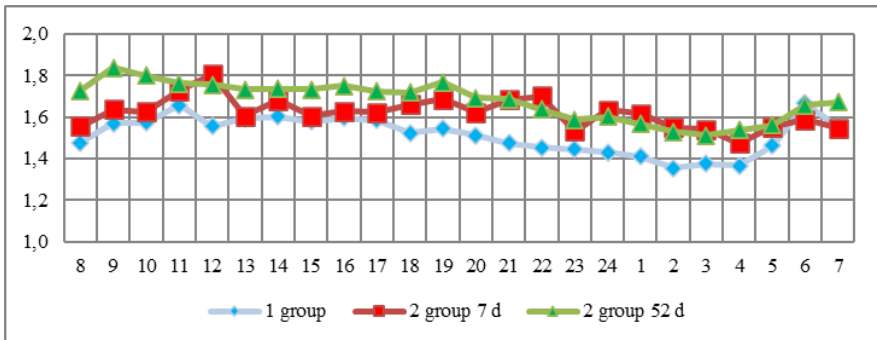


Figure 2. Average circadian rhythm of the AVT, units.

The correspondence of the expression of the sympathotonic reaction to the severity of the patients' condition was noteworthy. Thus, a less significant average daily level of sympathotonia in group 1 was expressed by the normal projection of acrophase at 11 am, bathyphase at 2 am (Fig. 2). In the first 7 days of treatment of children in group 2, there was no significant shift in the projection of acrophase and bathyphase. However, a longer MCI due to the severity of the ACF and ARF, despite the preservation of the physiological projection of acrophase and bathyphase (at 9 and 3 am, respectively), vegetative regulation occurred at a higher level of functional activity of the sympathetic nervous system, which suggests the advisability of adequate replenishment of energy resources due to a more pronounced hypermetabolism syndrome with prolonged ventilation of the lungs.

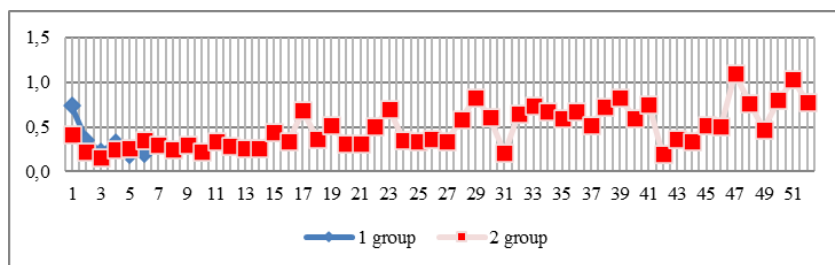


Figure 3. Amplitude of the circadian rhythm of the AVT, units.

Significant changes in the amplitude of oscillations of the circadian rhythm of the AVT after 14 days of management in 4 patients, and from 19 to 27 days in the two remaining children after transfer to the specialized department in the intensive care unit indicated the continuing stressful mode of vegetative regulation of homeostasis systems, including respiratory, cardiovascular, thermoregulatory and others (Fig. 3). Confirmation of the stressful state of vegetative regulation in conditions of prolonged MCI over 52 days is the dynamics of daily oscillations of the circadian rhythm of the AVT in children of group 2 (Fig. 4).

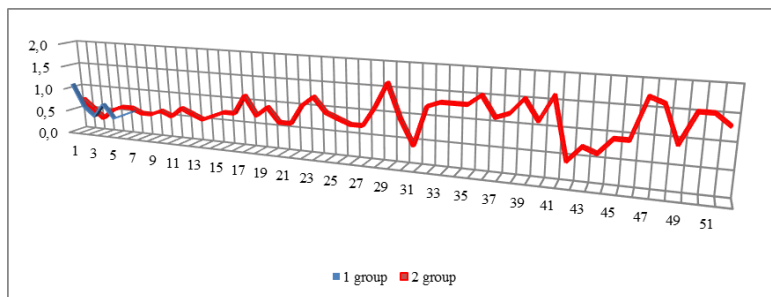


Figure 4. Daily range of oscillations of the circadian rhythm of the AVT, units.

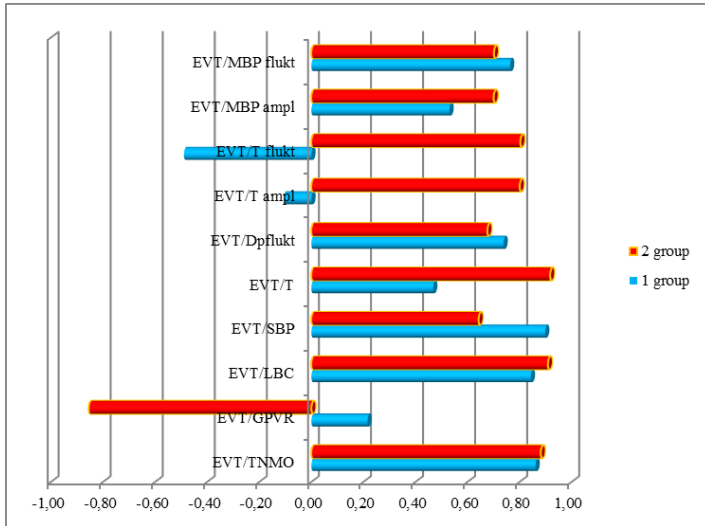


Figure 5. Correlation links of the mesomorph of the circadian rhythm of the AVT.

A direct statistically reliable correlation was found between the expression of the functional activity of the SNS and the MVC in Groups 1 (0.86) and 2 (0.88) (Fig. 5). A reliable direct correlation was also noted between the AVT and the MBV in both groups. That is, the sympathotonic reaction in all examined patients was accompanied by an increase in the MBV, SBP, and an increase in the MVC. In a more severe condition of patients in Group 2, a negative relationship appeared between the AVT and the TPR, the direct relationship between the sympathotonic reaction and the tendency to hyperthermia increased, the amplitude and daily range of fluctuations in the circadian rhythm of temperature and MAP increased.

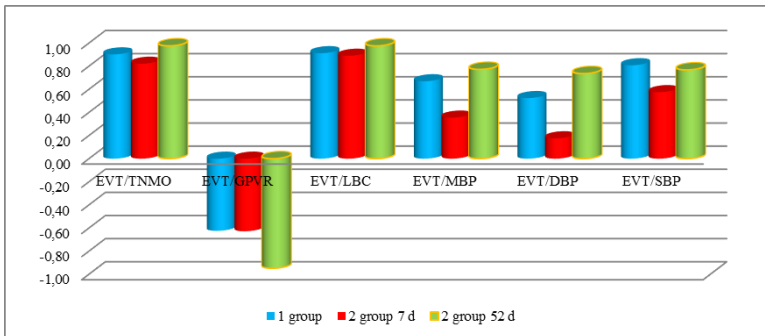


Figure 6. Correlation links of the average circadian rhythm of the AVT.

All subjects showed a direct dependence of the average circadian rhythm of the MOD on the average circadian rhythm of the AVT, MBV, SBP and MAP (Fig. 6).

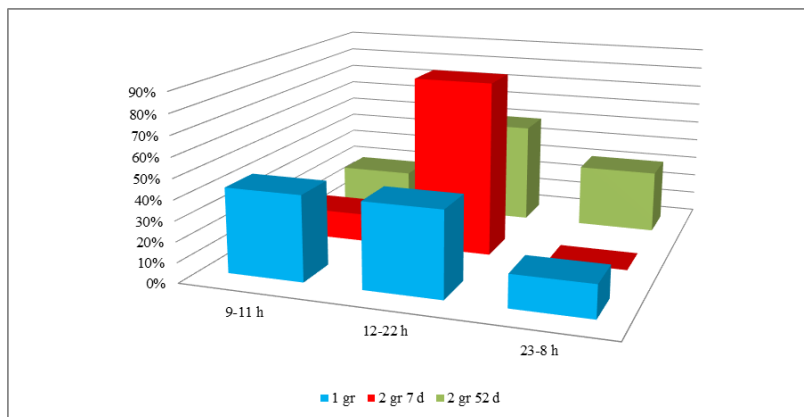


Figure 7. *Inversion of the circadian rhythm of the AVT.*

A moderate shift in the acrophase of the circadian rhythm of the AVT in group 2 was predominant in the first 7 days (86%) (Fig. 7). Apparently, the most optimal level of sympathotonic reaction in severe pneumonia is an increase of 30-40%, and in a more severe form with MCI, an increase in the level of sympathotonic regulation by 40-50% is advisable to supplement intensive therapy with preventive correction of the energy deficiency state, acute mitochondrial failure.

Conclusion. The reaction of the ANS to acute pneumonia was expressed in an increase in the tone of the sympathetic nervous system (SNS) on the first day in group 1 by 90%, in group 2 by 80%. In the process of complex intensive therapy, a decrease in sympathotonia in group 1 was detected on day 5 by 50%, in group 2 - by 30%. The severity of the sympathotonic reaction corresponded to the severity of the patients' condition. Apparently, the most optimal level of sympathotonic reaction in severe pneumonia is an increase in the AVT by 30-40%, and in a more severe form with MCI, an increase in the level of sympathotonic regulation by 40-50%; it is advisable to supplement intensive therapy with preventive correction of the energy-deficient state and acute mitochondrial insufficiency.

References

1. Bein B.K., Tatarenko S.A. *Dysregulation of the heart rate and respiration in patients with circulatory failure in the vertebrobasilar basin // Practical neurology and neurorehabilitation.* — 2008. — No. 2. — P. 28-31.

2. Dolgov A.M. *Cerebrocardial syndrome in ischemic stroke // Bulletin of intensive care.* — 1995. — № 2. — Part 2. Data and diagnostic methods. — P. 15-18.

3. Fakhurtdinov R.Kh., Yakubov E.Z., Khasanova D.R. et al. *The state of cerebrovascular reactivity and visual evoked potentials in patients with vegetative crises at different rates of passive transmembrane ion transport // Nevrol. vestn.* — 2005. — Vol. XXXVII, Iss. 1-2. — P. 41-44.

4. Shevchenko K.V. *Mechanisms of dysfunction of the hypothalamic-pituitary-adrenal and immune systems in men with different outcomes of acute severe traumatic brain injury: author's abstract. Thes. of Doctor of Medical Sciences.* — Perm, 2010. — 45 p.

咖啡因对学生体能表现的影响

EFFECT OF CAFFEINE ON PHYSICAL PERFORMANCE OF STUDENTS

Ananiev Vladimir Nikolaevich

*Doctor of Medical Sciences, Full Professor, Leading Research Worker
Institute of Biomedical Problems of the Russian Academy of Sciences,
Moscow, Russia*

ORCID ID: 0000-0002-4679-6441

Prokopyev Nikolai Yakovlevich

*Doctor of Medical Sciences, Full Professor
Tyumen State University, Tyumen, Russia*

ORCID ID: 0000-0002-9525-0576

Ananiev Georgy Vladimirovich

*Doctor, Medical Representative
JSC "PHARMSTANDART", Moscow, Russia*

ORCID ID: 0009-0005-4287-8430

Ananieva Olga Vasilievna

*Doctor of Medical Sciences, Full Professor
Tyumen State Medical University, Tyumen, Russia*

ORCID ID: 0000-0002-0672-9164

Pashkina Irina Valerievna

*Candidate of Medical Sciences, Associate Professor
Tyumen State Medical University, Tyumen, Russia*

Gurtovoy Elisey Sergeevich

Student

Tyumen State Medical University, Tyumen, Russia

摘要. PWC-170 测试证实,运动前饮用咖啡可提高学生的体能表现。这种效果源于活跃运动肌肉的血流量增加。去甲肾上腺素和肾上腺素浓度的升高有助于血流重新分配,有利于运动肌肉。已证实,饮用咖啡后体能表现提升的生理机制之一是运动肌肉充血效率的提高。

关键词: 学生, 体能表现, 咖啡因, 运动肌肉充血, 去甲肾上腺素, 肾上腺素, 肌肉血流量。

Abstract. Drinking coffee before physical activity increases students' physical performance, as confirmed by the PWC-170 test. This effect is due to an increase in muscle blood flow in actively functioning muscles. An increase in the concentration of norepinephrine and adrenaline contributes to the redistribution of blood flow in favor of working muscles. It has been established that one of the physiological mechanisms that ensure an increase in physical performance after drinking coffee is an increase in the effectiveness of working muscle hyperemia.

Keywords: students, physical performance, caffeine, muscle working hyperemia, norepinephrine, adrenaline, muscle blood flow.

Introduction. The psychostimulating effect of caffeine is based on its ability to suppress the activity of central adenosine receptors (A1 and A2) in the cerebral cortex and subcortical formations of the central nervous system [7, 13]. It has now been shown that adenosine (an intermediate product of ATP metabolism) acts as a neurotransmitter in the central nervous system, agonistically affecting adenosine receptors located on the cytoplasmic membranes of neurons [13]. Excitation of adenosine receptors of the type (A1) by adenosine causes a decrease in the formation of cAMP in brain cells, which ultimately leads to the suppression of their functional activity. Blockade of A1-adenosine receptors helps to stop the inhibitory effect of adenosine, which is clinically manifested by an increase in mental and physical performance [14, 15].



Figure 1. Adrenergic synapse

Adenosine receptors are found in large numbers in various parts of the central nervous system and are also present in peripheral tissues, regulating the activity of the cardiovascular and respiratory systems. This may explain the development of a number of other ergogenic effects associated with its intake, such as improved blood supply and oxygenation, including working muscles [13-15].

Coffee components [11], including but not limited to caffeine, have neuromuscular, antioxidant, endocrine, cognitive, and metabolic effects (e.g., glucose removal and vasodilation) that affect the effectiveness of physical exercise and recovery. In most, but not all studies, coffee or its components improve performance across the entire time range of actions, from reaction time, short-term strength exercises, and ending with aerobic exercise. Stimulates mental activity, increases mental and physical performance, shortens reaction time.



Figure 2. Effect of caffeine on the body

Analysis of the studies included in the study showed [9-14] that both caffeinated sports drinks and energy drinks are effective in improving some sports performance if the drink contains at least 3 mg of caffeine per 1 kg of body weight.

The question of how to increase human physical performance (PP) and prevent fatigue using medications has been relevant for a long time [3]. In European coun-

tries, tea and coffee containing caffeine are traditionally used for these purposes [4]. In Eastern countries, such as China and India, tea has been used for over a thousand years.

The behavioral effects of caffeine [7] are apparently largely due to the antagonism of the action of endogenous adenosine on A1- and A2a-receptors in the central nervous system. Other biochemical mechanisms of caffeine action, such as the release of intracellular calcium, inhibition of phosphodiesterases and blockade of the regulatory sites of GABA receptors. The mechanism of action of coffee and tea on the human body (Fig. 2) is well studied. Caffeine blocks adenosine receptors of brain neurons, which leads to an increase in the release of norepinephrine (Fig. 1) and dopamine [1]. In addition, caffeine blocks the enzyme phosphodiesterase, which destroys cAMP. This leads to the accumulation of this secondary mediator in cells. cAMP, through which the effects of various physiologically active substances are carried out, increases the amount (Fig. 1) of norepinephrine and adrenaline [2]. As a result, there is an accumulation of these substances in the synapses of the sympathetic nervous system and blood, which leads to excitation of the sympathetic system [1, 2].

In this regard, the aim of the study was to study the effect of caffeine (in tea and coffee) on muscle work in the PWC-170 test.

Material and methods of the study. The study involved 56 young students (18 ± 1 years) of the first courses of the Tyumen State University, who had approximately the same daily routine, rest, level of physical activity and weight (weight 71 ± 4 kg). To determine the FR, the PWC170 load test was used as modified by V.L. Karpman [5].

The study results were processed on a personal computer using modern electronic programs (STATISTIKA). The analysis of the material was carried out on the basis of mathematical calculations with the calculation of the arithmetic mean, the error of the arithmetic mean, and the standard deviation. The reliability of differences was assessed using Student's t-test.

Study results. The studies showed (Table 1) that with dosed consumption of Jardin coffee, the FR PWC 170 of young men increased by 42 kgm/min ($P < 0.05$).

Table 1
Physical performance of 18-year-old male students from Tyumen before and after coffee ($M \pm m$)

Time	Before coffee PWC 170 kgm/min ($M \pm m$)	n	After coffee PWC 170 kgm/min ($M \pm m$)	How much did PWC170 increase before and after coffee kgm/min	Reliability of differences PWC170 before and after coffee
morning 10 o'clock	825 ± 7	56	867 ± 9	42	$t = 3,59$ $P < 0,01$

Discussion of the obtained data. In the study [10] the use of caffeine (9 mg kg) was studied in well-trained runners, physical endurance was increased by more than 30% after taking caffeine during running. The concentration of plasma adrenaline was increased. In the review [6] the authors indicate that caffeine is the most widely used drug in the world.

In the publication [8] it is shown that the use of 6 mg kg caffeine allows to maximally increase physical performance in athletes, especially endurance. In our studies the dose of caffeine was 60 mg, which is completely safe, the authors of the publications conducted studies on athletes, our studies on students who are not athletes.

The following work [12] showed that caffeine increases the production of plasma catecholamines, which allow the body to adapt to the stress created by physical exercise. Caffeine is able to increase the contractility of muscles, can increase the time of work before exhaustion. Caffeine can also improve physical performance and endurance during prolonged submaximal intensity activity.

In our work [1], we revealed the mechanism of muscle hyperemia, which consists of a decrease in the sensitivity of alpha-adrenergic receptors in the arteries of working muscles. Based on these mechanisms, we were the first to suggest that when coffee increases the concentration of adrenaline and noradrenaline, then the blood flow in the working muscle increases. We were the first to propose a hypothesis that one of the mechanisms of coffee's action is to increase the effect of working muscle hyperemia. There are no such hypotheses or data in the world literature.

Conclusions. The use of caffeine in a dose of 60 mg before physical activity helps to increase the physical performance of Tyumen students, which is confirmed by the results of the PWC-170 test. This is achieved by increasing muscle blood flow in actively working muscles and the effect of increased concentrations of noradrenaline and adrenaline, which leads to a redistribution of blood flow in favor of the involved muscle groups. One of the physiological mechanisms explaining the increase in physical performance after consuming caffeine is the increased effectiveness of working muscle hyperemia. The study found that a single dose of caffeine at a dose of 60 mg leads to an increase in physical performance by 42 kgm/min, from an initial level of 825 ± 7 kgm/min to a level of 867 ± 9 kgm/min after consuming caffeine. The results also demonstrated that regular coffee consumption contributes to a further increase in physical performance by tens of kgm/min.

References

1. Ananyev V.N. *Physiological adrenergic mechanisms of the influence of working muscle hyperemia on the regulation of systemic arterial pressure* / V.N. Ananyev, N.Ya. Prokopyev, G.V. Ananyev, E.S. Gurtovoy, O.V. Ananyeva. // *Natural and technical sciences*. 2019, N6 (132). P. 66-70.
2. Bertram G.K. *Basic and Clinical Pharmacology* /. - Moscow, 1998, Vol. 1, 612 p.
3. Bobkova S.N. *Study of the effect of the adaptogen trecrezan on physical performance in young men* / S.N. Bobkova, M.V., Zvereva Zh.T. Isakova // VII All-Russian. Conference. Ural State Pedagogical University. Ekaterinburg, November 21-22, 2018. - P. 13-15.
4. Ershova N.V. *Coffee is the drink we choose. The effect of caffeine on the human body* / N.V. Ershova, V.S. Marina // *Science and Education*. 2019. No. 2. P. 388.
5. Karpman V.L. *PWC-170-test for determining physical performance* / V. L. Karpman, Z. B. Belotserkovsky, B. G. Lyubina // *Theory and practice of physical education*. 1969. – No. 10. – P. 37-39.
6. Astorino TA, Roberson DW. *Efficacy of acute caffeine ingestion for short-term high-intensity exercise performance: a systematic review.* // *J Strength Cond Res*. 2010 Jan; 24(1):257-65.
7. Daly JW, Shi D, Nikodijevic O, Jacobson KA. *The role of adenosine receptors in the central action of caffeine.* *Pharmacopsychologia*. 1994; 7(2): 201-213.
8. Daniel Castillo *Effects of Caffeine Supplementation on Power Performance in a Flywheel Device: A Randomised, Double-Blind Cross-Over Study* // *Nutrients*. 2019 Feb; 11(2): 255.
9. Jiménez SL, Díaz-Lara J, Pareja-Galeano H, Del Coso J. *Caffeinated Drinks and Physical Performance in Sport: A Systematic Review.* // *Nutrients*. 2021 Aug 25; 13(9):2944. doi: 10.3390/nu13092944.
10. Graham TE, Spriet LL. *Performance and metabolic responses to a high caffeine dose during prolonged exercise.* // *J Appl Physiol* 1991, Dec; 71(6): 2292-2298.
11. Lowery LM, Anderson DE, Scanlon KF, Stack A, Escalante G., Campbell S.C, Kerkick C.M, Nelson M.T., Ziegenfuss T.N., Van Dusseldorp T.A., Kalman D.S., Campbell B.I., Kreider R.B., Antonio J. *International society of sports nutrition position stand: coffee and sports performance.* // *J Int Soc Sports Nutr*. 2023 Dec; 20(1):2237952. doi: 10.1080/15502783.2023.2237952.
12. Nehlig A., Debry G. *Caffeine and sports activity: a review.* // *Int J Sports Med*. 1994 Jul; 15(5): 215-223.

13. Ribeiro J.A., Sebastião A.M. Caffeine and adenosine. //J Alzheimers Dis. 2010;20 Suppl 1:S3-15. doi: 10.3233/JAD-2010-1379.

14. Shabir A., Hooton A., Tallis J., F Higgins M. The Influence of Caffeine Expectancies on Sport, Exercise, and Cognitive Performance. //Nutrients. 2018 Oct 17;10(10):1528.

15. Takada S, Fumoto Y, Kinugawa S. Ergogenic effects of caffeine are mediated by myokines. //Front Sports Act Living. 2022 Dec 8;4:969623.

DOI 10.34660/INF.2025.30.65.046

胶原海绵与同种异体成纤维细胞对缺血性皮肤缺损修复形态结构的影响
**MORPHOLOGICAL STRUCTURAL COMPONENTS OF
REGENERATING ISCHEMIC SKIN DEFECT UNDER THE
INFLUENCE OF COLLAGEN SPONGE WITH ALLOFIBROBLASTS**

Baranovskiy Yuriy Gennadievich

PhD, Associate Professor

*Order of the Red Banner of Labor Medical Institute named after
S.I. Georgievsky of V.I. Vernadsky Crimean Federal University,
Simferopol, Russian Federation*

Shapovalova Yelena Yurievna

PhD, Professor, Head of Department

*Order of the Red Banner of Labor Medical Institute named after
S.I. Georgievsky of V.I. Vernadsky Crimean Federal University,
Simferopol, Russian Federation*

Kutuzova Liliana Alexeevna

PhD, Associate Professor

*Order of the Red Banner of Labor Medical Institute named after
S.I. Georgievsky of V.I. Vernadsky Crimean Federal University,
Simferopol, Russian Federation*

Baranovskiy Alexey Gennadievich

Assistant Professor

*Order of the Red Banner of Labor Medical Institute named after
S.I. Georgievsky of V.I. Vernadsky Crimean Federal University,
Simferopol, Russian Federation*

摘要。 静脉功能不全并发的长期皮肤缺损愈合问题依然存在。目的是对移植胶原海绵和真皮同种异体成纤维细胞后缺血性皮肤伤口愈合第 10 天的组织再生进行形态学分析。材料和方法。使用 16 只性成熟的 C57/B1 小鼠，将其平均分为对照组和实验组。将浸润有真皮同种异体成纤维细胞的 DMEM/F12 生长培养基 (Lonza) 的胶原海绵 “Belkozin” 移植到对照组小鼠的模型伤口中。术后第 10 天，切除愈合伤口的活检组织，制备石蜡切片，用苏木精和伊红染色。使用 ImageJ 程序测量表皮厚度、胶原纤维和微血管所占面积。使用 STATISTICA Enterprise 应用程序 (StatSoft Inc., 美国) 的分析软件包对数字数据进行统计处理。使用显

著性水平为 $p=0.05$ 的 Mann-Whitney 标准。结果。在模拟长期不愈合的缺血性皮肤伤口并用同种异体真皮成纤维细胞的胶原海绵闭合后第 10 天, 伤口愈合过程处于增生阶段, 伴随肉芽组织形成。与对照组相比, 实验组活检标本的肉芽组织胶原纤维含量高出 $36.63 \pm 0.12\%$, 血管含量低出 $45.83 \pm 0.01\%$, 显示出对照组未见的纤维化迹象, 并表明瘢痕形成的开始。表皮比对照组厚 $20.31 \pm 0.01\%$ 。结论。使用含有同种异体真皮成纤维细胞的胶原海绵闭合模型缺血性皮肤伤口, 在伤口愈合第10天时可显著改善伤口愈合过程第二阶段的形态学特征。

关键词: 缺血性皮肤伤口, 胶原海绵, 同种异体成纤维细胞, 活检。

Abstract. *The problem of long-term skin defects healing complicated by venous insufficiency remains relevant. The aim was to conduct a morphological analysis of tissue regenerate on the 10th day of ischemic skin wound healing after transplantation of a collagen sponge with dermal allogenic fibroblasts. Material and methods.* Sixteen sexually mature C57/B1 mice were used, which were divided equally into control and experimental groups. A collagen sponge “Belkozin” impregnated with dermal allofibroblasts in DMEM/F12 growth medium (Lonza) was transplanted into the model wound of mice in the control group. On the 10th day after surgery, biopsies of the healing wound were excised, paraffin sections were prepared, which were stained with hematoxylin and eosin. The thickness of the epidermis, the area occupied by collagen fibers and microvessels were measured using the ImageJ program. Statistical processing of digital data was performed using the analytical package of the STATISTICA Enterprise application (StatSoft Inc., USA). The Mann-Whitney criterion with a significance level of $p=0.05$ was used. **Results.** *On the 10th day after the operation to model a long-term non-healing ischemic skin wound and close it with a collagen sponge with allogenic dermal fibroblasts, the wound healing process is at the proliferation stage with the formation of granulation tissue. Granulation tissue of the biopsy specimens of the experimental group is $36.63 \pm 0.12\%$ richer in collagen fibers and $45.83 \pm 0.01\%$ poorer in blood vessels compared to the control group, showing signs of fibrosis that are absent in the control group and indicating the onset of scarring. The epidermis is $20.31 \pm 0.01\%$ thicker than in the control. Conclusion.* Closure of a model ischemic skin wound with a collagen sponge with allogenic dermal fibroblasts by the 10th day of healing significantly improves the morphological characteristics of the second stage of the wound healing process.

Keywords: ischemic skin wound, collagen sponge, allofibroblasts, biopsies.

Introduction

The problem of healing long-standing skin defects complicated by venous insufficiency remains relevant [1]. Fibroblasts with their ability to actively synthesize intercellular substance, the main component of which is collagen fibers, are recognized as the main cells capable of forming granulation tissue and sub-

sequent ulcer scarring [2]. Fibroblasts are able to move along the collagen fibers they synthesize, which makes collagen fibers an excellent scaffold for tissue engineering structures [3]. Artificial collagen production has been developed based on its extraction from connective tissue of mammals (rats or cattle), birds (duck feet) [4] and fish [5]. Hemastatic collagen sponges produced by the pharmaceutical industry serve as an excellent basis for their association with dermal fibroblasts [6] and subsequent transplantation into a long-term non-healing ulcer, especially complicated by exudation. However, information on the structural features of the regenerate at the second stage of the wound process, including neoangiogenesis, is few and rare.

Aim of the study. To conduct a morphological analysis of tissue regenerate on the 10th day of healing of an ischemic skin wound after transplantation of a collagen sponge with dermal allogenic fibroblasts.

Research methods and materials

The study involved 4–6 month old white laboratory mice of the C57/B1 line. Two groups of 8 mice were allocated: control and experimental. The experiment was conducted in accordance with the principles of humanism set out in Directive 2010/63/EU and ICMR on animal research (2006). An ischemic skin wound was modeled surgically in the interscapular region on the back of mice of both groups [7]. For animals of the experimental group, dermal fibroblasts were obtained enzymatically and cultured in DMEM/F12 growth medium (Lonza) with the addition of 10% fetal calf serum (HyClone). [7].

The biodegradable collagen sponge “BELKOZIN” was produced by LUZHSK Enterprises from a collagen solution. It contains boric acid and furacilin. The sponge is a dry, porous, yellow plate that adheres well to the wound surface. Left in the wound, it gradually degrades [6]. A sponge soaked in dermal fibroblasts in a growth medium was transplanted into a model wound in mice from the experimental group. The wound was covered with a sterile “Voskopran” dressing and sutured to a silicone ring that held the wound from joining its edges [8].

Biopsy specimens of the healing wound were excised on the 10th day after surgery. For morphometric studies, paraffin sections were prepared from the biopsy specimens, which were stained sequentially with hematoxylin and eosin as standard. Histological sections were studied using an OLIMPUS CX-31 light-optical microscope with an OLIMPUS 35050Z digital camera. The thickness of the epidermis, the area occupied by collagen fibers and microvessels were measured using the ImageJ program at a total magnification of 400 times, 50 measurements per section.

Statistical processing of digital data was performed using the analytical package of the STATISTICA Enterprise application (StatSoft Inc., USA). The normality of the data distribution was checked using the Shapiro-Wilk criterion [10].

Pairwise comparisons of the control and experimental groups of mice were performed. Since the data distribution differs from normal, the Mann-Whitney criterion was used for pairwise comparisons, and group data were described using the median, first and third quartiles (interquartile range) [9]. All calculations were performed in the statistical environment R version 4.2.3 [10]. The reliability of differences was accepted at a significance level of $P = 0.05$.

Results

On the 10th day after the operation to model a long-term non-healing ischemic skin wound and close it with a collagen sponge with allogenic dermal fibroblasts, the wound regeneration is in the second stage of the wound process (proliferation stage), when the dermis of the biopsy specimens is formed by vascularized granulation tissue. In the control group, the wound surface is covered with a thick scab consisting of fibrin and dead cells (Figure 1A). Under it, a thin layer of regenerating epidermis is visible, which consist of 3-4 rows of cells. They can be conventionally divided into stratum basale and stratum spinosum. The median value of the epidermis thickness is $39.73 (36.24 - 41.36) \mu\text{m}$ (Table 1). In the most central areas of the wound, limited by the sutured silicone ring, the epithelium is absent. Granulation tissue under the superficial epithelium is well developed. Collagen fibers are thin, short, and lie chaotically, intertwining with each other. The median value of the collagen fiber area is $21.68 (16.21 - 26.42)\%$ of the biopsy dermis area. Between them there are fibroblastic differon cells, mainly active specialized fibroblasts with a round or oval nucleus. Minor leukocyte infiltration is present only in the deep layers of the biopsy. Blood capillaries are numerous, wide, some of them are filled with blood. The median value of their area is $0.52 (0.48 - 0.56)\%$ of the biopsy dermis area. In the biopsy samples of the experimental group, the presence of a collagen sponge was not detected (Figure 1B). It was completely absorbed. The thickness of the scab on the wound noticeably decreased. The epidermis is thicker compared to the control by $20.31 \pm 0.01\%$. The number of cell rows increased to 5-6 and signs of the beginning of the formation of the granular layer appeared. Cells with basophilic granularity are traced on the surface of the epidermis. The entire surface of the wound is covered with epithelium. In the granulation tissue, the median value of the area occupied by collagen fibers is $36.63 \pm 0.01\%$ greater than in the control group. The thickened oxyphilic fibers acquired a relatively ordered location: parallel to each other and to the epidermis, which can be regarded as signs of the beginning stage of granulation tissue

Table 1.
Quantitative characteristics of biopsy components of the control and experimental groups

The day after the operation	Experimental group median (1-3 quartiles), interquartile range	Control group median (1-3 quartiles), interquartile range	P – significance	Studied indicators
10	49,85 (42,51 – 53,18) *	39,73 (36,24– 41,36)	P < 0,05	Epidermis thickness in μm
10	0,96 (0,91-0,99) *	0,52 (0,48-0,56)	P < 0,05	Vessel area in %
10	34,21 (31,14-40,02) *	21,68 (16,21-26,42)	P < 0,05	Collagen fiber area in %

Note: *Significance of difference from control, P < 0.05.

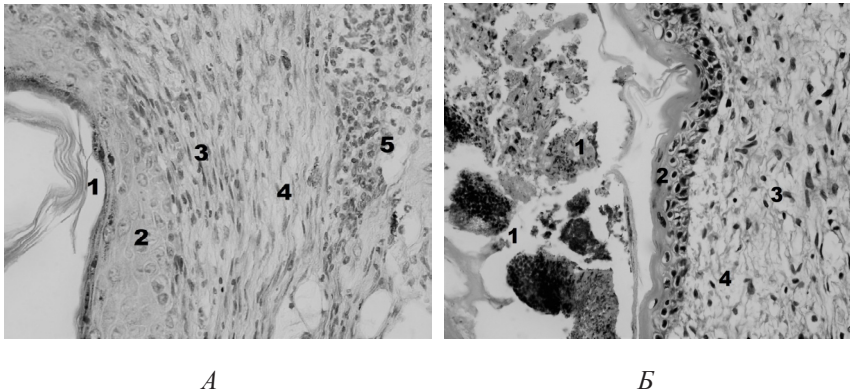


Figure 1. Mouse skin biopsy on the 10th day of regeneration. A – control group. B – experimental group. 1 – scab; 2 – epidermis; 3 – blood capillary; 4 – collagen fibers; 5 – leukocyte infiltration. Hematoxylin and eosin staining. Magnification: approx. 10 x 40.

remodeling, characteristic of the third stage of the wound process. Functionally active fibroblasts lie between collagen fibers and have an elongated shape with an elongated nucleus. The median value of the area of blood vessels decreased by $45.83 \pm 0.01\%$ compared to the control group. However, in the deep layers of the biopsy, individual venules are dilated and filled with blood.

Conclusion

1. Hemostatic collagen sponge is an effective scaffold for dermal fibroblasts.
2. Closure of a model ischemic skin wound with a collagen sponge with allogenic dermal fibroblasts by the 10th day of healing significantly improves the morphological characteristics of the second stage of the wound process.

3. Granulation tissue of biopsies is $36.63 \pm 0.01\%$ richer in collagen fibers and $45.83 \pm 0.01\%$ poorer in blood vessels compared to the control group, showing signs of fibrosis that are absent in the control group and indicate the onset of scarring.

4. Epidermis is $20.31 \pm 0.01\%$ thicker than in the control group. The collagen sponge is completely resorbed by this time.

Literature

1. Guest J. F., Fuller G.W., Vowden P. "Venous leg ulcer management in clinical practice in the UK: costs and outcomes." *Int Wound J.* vol. 15, № 1, pp. 29-37, 2018. DOI: 10.1111/iwj.12814.

2. Nair R. P. "Contribution of fibroblasts to the mechanical stability of in vitro engineered dermal-like tissue through extracellular matrix deposition." *Biores Open Access.* vol. 5, pp. 217-225, 2014.

3. Ramanathan G., Singaravelu S., Muthukumar T., Thyagarajan S., Perumal P. T., Sivagnanam U. T. "Design and characterization of 3D hybrid collagen matrixes as a dermal substitute in skin tissue engineering" *Mater Sci Eng C Mater Biol Appl.* vol. 7, pp. 359-370, 2017. DOI: 10.1016/j.msec.2016.11.095.

4. Sultan M.T., Jeong J.Y., Seo Y. B., Lee O. J., Ju H.W., Park H. J. "Fabrication and characterization of the porous duck's feet collagen sponge for wound healing applications." *J Biomater Sci Polym Ed.* vol. 29, N 7-9, pp. 960-971, 2018. DOI: 10.1080/09205063.2017.1367636.

5. Chen J., Gao K., Liu S., Wang S., Elango J., Bao B. "Fish collagen surgical compress repairing characteristics on wound healing process in vivo." *Mar Drugs.* vol.17, N 1, pp. E33, 2019. DOI: 10.3390/md17010033.

6. Shekhter, A. B., Guller, A. E., Istranov, L. P., Istranova, E. V., & Butnaru, D. V. (2015). Morphology of collagen matrices for tissue engineering (biocompatibility, biodegradation, tissue response). *Archives of Pathology*, 77(6), 29–38. <https://doi.org/10.17116/patol201577629-38>

7. Baranovskiy Yu.G., Il'chenko F.N., Shapovalova Ye.Yu. "Method for modeling trophic ulcers in laboratory mice in the experimental model." *Bulletin of Emergency and Reconstructive Surgery.* vol. 1, № 2, pp. 259-261, 2016.

8. Shapovalova Ye.Yu., Boyko T.A., Baranovskiy Yu. G., Harchenko S.V., Yunsi G. A. "Morphological characteristics of the healing of an ischemic experimental wound on day 12 after the application of auto- and heterofibroblasts and dermal equivalent." *International Research Journal.* vol. 8, № 3, pp. 51-55, 2017. DOI:10.23670/IRJ.2017.62.051.

9. Lakin G.F. *Biometrics: A Textbook for Biological Specialties of Universities.* 4th ed., revised and enlarged. Moscow: Higher School. 1990. 294 p.

10. R Core Team 2024. *R: A Language and environment for statistical computing.* R Foundation for statistical computing. Vienna, Austria. 2024.

DOI 10.34660/INF.2025.94.40.047

UDC 616-036.22

传染病流行病学的某些领域

CERTAIN AREAS OF EPIDEMIOLOGY OF INFECTIOUS DISEASES

Smetanin Viktor Nikolaevich

Candidate of Medical Sciences, Associate Professor

*Ryazan State Medical University named after academician I.P. Pavlov,
Ryazan, Russia*

Smetanina Galina Petrovna

Lecturer

Ryazan Medical College, Ryazan, Russia

摘要. 本文致力于研究传染病流行病学的主要概念。作者论证了该研究课题的相关性和重要性，并简要介绍了传染病流行病学的基本原理。作者指出，传染病流行病学研究的是感染和疾病在人群中发生的环境，以及影响其发生频率和传播的因素。需要指出的是，该概念区分了感染和疾病，因为决定它们发生的因素可能不同，而且许多病毒的特征是感染但不发病。感染是指病原体在宿主生物体内的繁殖，其主要取决于决定病原体作用和宿主生物易感性的因素。疾病是宿主生物对感染的反应，当感染严重到足以引起一系列可识别的临床症状时。影响这种反应发生和严重程度的因素因所涉及的具体病毒及其进入途径而异，但许多常见感染最重要的决定因素在于疫情本身。其中，感染年龄是最重要的因素。本文还以COVID-19 疫情为例进行了案例研究。

关键词: 流行病学、传染病流行病学、传染病、“同一个健康”、“SARS-CoV-2”、“COVID-19”、“干预”、“初级卫生保健”、“世界卫生组织”。

Abstract. The article is devoted to the study of the main concepts of infectious disease epidemiology. The author substantiates the relevance and significance of the research topic. A brief rationale for the epidemiology of infectious diseases is given. The author notes that the epidemiology of infectious diseases studies the circumstances under which both infection and disease occur in a population, and the factors that influence their frequency and spread. It is noted that the concept distinguishes between infection and disease, since the factors that determine their occurrence may be different, and also because infection without disease is characteristic of many viruses. Infection indicates the reproduction of the pathogen inside the host organism and is determined largely by factors that determine the effect of the pathogen and the susceptibility of the host organism.

Disease is the host organism's response to infection when it is severe enough to cause a recognizable set of clinical symptoms. The factors that influence the occurrence and severity of this response vary depending on the specific viruses involved and their route of entry, but the most important determinants for many common infections lie within the outbreak itself. Of these, age at infection is the most important. The COVID-19 pandemic is also examined as a case study.

Keywords: *epidemiology, infectious disease epidemiology, infectious disease, one health, SARS-CoV-2, COVID-19, intervention, PHC, WHO.*

Introduction

As is well known, the epidemiology of infectious diseases is concerned with the circumstances under which both infection and disease occur in a population and the factors that influence their incidence, spread, and dissemination. This concept distinguishes between infection and disease because the factors that determine their occurrence may be different and because infection without disease is common to many viruses. Infection refers to the multiplication of a pathogen within the host and is determined largely by factors that determine exposure to the pathogen and host susceptibility. Disease is the body's response to infection when it is severe enough to cause a recognizable set of clinical symptoms. The factors that influence the occurrence and severity of this response vary depending on the specific viruses involved and the route of entry, but the most important factors determining many common infections are within the host itself. Of these, age at infection is the most important. This article will briefly review the concepts, methods, and techniques of infectious disease control. Epidemiology is the study of the distribution and determinants of health conditions or events in defined populations and the application of the results of this study to the control of health problems. It is the quantitative science of infectious diseases that studies the circumstances under which disease processes occur, the factors that influence their prevalence, and the host response to the infectious agent, and the use of this knowledge for control and prevention. It includes the pathogenesis of disease in both the community and the individual. In infectious diseases, it is necessary to study the circumstances under which both infection and disease occur, since they may be different. Infection results from the encounter of a potentially pathogenic microorganism with a susceptible human host through an appropriate portal of entry, and usually involves an observable host response to the pathogen.[1] Exposure is a key factor, and sources of infection are generally outside the individual host, in the environment or in other infected hosts. Disease is one of the possible consequences of infection, and the factors important in its development are largely intrinsic to the host, although the dosage and virulence of the infecting microbe play a role. These intrinsic factors include age at infection, portal of entry, presence or absence of

immunity, strength of primary defense, effectiveness and nature of humoral and cell-mediated immune responses, host genetic makeup, nutritional status, presence of other diseases, and psychosocial influences. These factors that lead to clinical disease among those infected have been termed “clinical disease promoting factors,” and many of them remain unknown. Host responses may include death, classic clinical features of disease, mild or atypical forms, subclinical and undetectable infections, and the carrier state, which may exist in the absence of a detectable host response. Whereas the clinician is primarily concerned with disease, the epidemiologist is concerned with both infection and disease itself. Infection without disease is common, so that a study limited to clinical disease alone would provide an incomplete epidemiologic picture and would be a poor basis for control and prevention. A complete understanding includes the pathogenesis of the process leading to clinical disease, both in the community and in the individual.

Research Methods

Epidemiology can be divided into descriptive, analytical, experimental, and serologic epidemiology. The main analytical methods used are cohort (prospective) and case-control (retrospective).

Before conducting epidemiologic studies, it is advisable to read a textbook on epidemiologic methods that includes discussion and examples on infectious diseases. It should be noted that the World Health Organization (WHO) has published a concise book on all aspects of epidemiologic research.

Epidemiologic studies can be descriptive or analytical. Descriptive studies are based on available data sources and describe the pattern of disease in populations over time, place, and individual factors. Epidemiological investigations begin with a descriptive study. These data often provide clues to the etiology of the disease or its associated risk factors. Analytical studies are then designed to test the causal hypotheses developed from the descriptive studies, and this usually requires new data. Three common analytic methods are used in epidemiological studies.

Results and Discussion

The concepts of bacterial infection epidemiology are very similar to those of viral infection epidemiology. Some differences between viral and bacterial infection include the intracellular location of all viruses, their smaller size, the requirement for living tissue for viral replication, the ease with which many viruses are spread by the respiratory tract or insect vectors, the relatively high level of immunity following viral infection, the usefulness of serologic tests for the diagnosis of most viral infections, and the failure of viral infections to respond to antimicrobial therapy [2]. Highly sensitive and specific molecular techniques are increasingly being used to identify the causative agent and the host response to it.

Many of the concepts and methods of epidemiology are applicable to both infectious and non-infectious diseases, and there should be no essential dichotomy between the two.

In general, epidemiology can be thought of as the development, pathogenesis, and expression of infection and disease in a community, much as clinical medicine is concerned with the development, pathogenesis, and expression in an individual. The emergence of new diseases such as Lyme disease, toxic shock syndrome, and the development of antibiotic-resistant pneumococci and tubercle bacilli, the emergence of erythrogenic streptococci (flesh-eating streptococci) and a new strain of cholera called 0139, outbreaks of foodborne *E. coli*, and the waterborne outbreak of cryptosporidiosis are among the emerging infections that continue to pose challenges to epidemiologists and for which prevention strategies are being developed. It is becoming clear that in many countries the continuing, and in some cases increasing, importance of infectious diseases is of public health concern.

In developing countries, infectious diseases remain a major cause of morbidity and mortality, and efforts are underway to develop curricula in epidemiology and surveillance in such areas.

Public health authorities often monitor the severity and status of an epidemic by estimating the transmission activity and/or intensity (i.e., transmissibility) of the entire epidemic. For example, public health measures such as contact tracing, case isolation, hand hygiene, face mask wearing, and social distancing can influence human behavior and change the transmission activity or transmissibility of the underlying virus circulating in the community. Estimates of epidemiological parameters, including the generation interval, effective reproduction number (R_t), and superspreading potential (k), can reflect the transmission activity or transmissibility of an epidemic and are used to determine the impact of these factors (Figure 1).

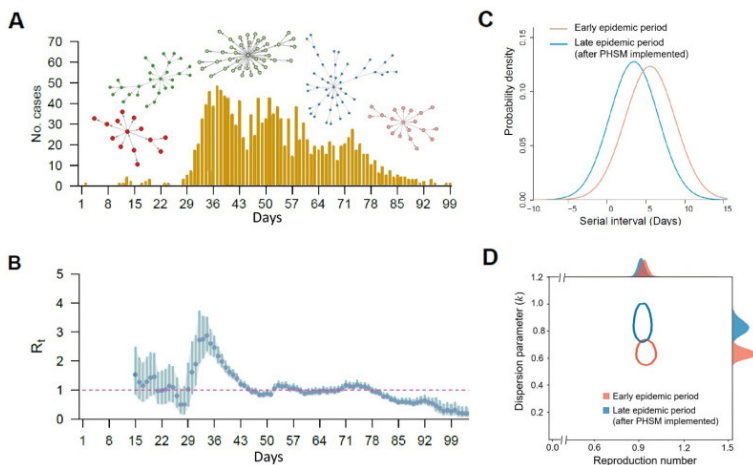


Figure 1. Definition of epidemiological parameters

Note: The results of COVID-19 in South Korea are modified from the materials. (A) Epidemiological curve with the chain of transmission of infectious diseases (transmission activity index). (B) Daily effective reproduction number (R_t) of infectious diseases (transmissibility index). (C) Distribution of infectious diseases by successive intervals in two different epidemic periods. (D) Risk of super-spreading cases of infectious diseases during two different epidemic periods.

For example, after COVID, many countries are relaxing primary health care (PHC) services. However, there remains a significant knowledge gap regarding the relationship between the relaxation of PHC and changes in these epidemiological parameters. Some studies have reported that these parameters could potentially be changed for COVID-19 variants and sub-variants and would affect the dynamics of other infectious diseases. [3] This may increase the infectious burden of future infectious diseases across countries and settings.

During the COVID-19 pandemic, the potential for transmission of SARS-CoV-2 before symptom onset has hampered effective PHC. It is difficult to determine the onset time of transmission because it is difficult to accurately determine who is infected and when. However, detailed contact tracing exercises allow reconstruction of transmission chains based on information about onset time, possibly using timing of infection with known dates of potential exposure. Combining this data with known information about symptom onset in the infector and the exposed, the incubation period and distribution of successive intervals can be inferred.

Transmission of infectious diseases depends on the number of infectious and susceptible individuals in a population and their effective contacts. For example, the stochastic compartmental model of susceptible-infectious-recovered assumes population homogeneity and indicates a high probability of effective contact between similar age groups. Not all individuals in a population are equally susceptible to infection. Thus, information on the age-specific infection rate, infection probability, and contact matrix could be used to develop an age-structured compartment model. For example, at the onset of the COVID-19 pandemic in 2020, few cases were reported among children, and an age-varying transmission matrix of infector-infected pairs was observed (i.e., children had a higher probability of transmission from adults). Since public health authorities in many countries report age-stratified COVID-19 case numbers daily, the age-specific infection prevalence (i.e., age-specific susceptibility to infection) can be estimated using Bayesian inference using Markov Chain Monte Carlo [4].

Thus, age-specific COVID-19 vaccination coverage and vaccination effectiveness can be applied to the susceptible population within an age-structured compartment model for COVID-19. In addition, many countries have changed their

COVID-19 surveillance scheme from active to passive, and many COVID-19 cases have gone unreported due to changes in health care-seeking behavior and lack of contact tracing (Figure 1). Consequently, seroprevalence studies have been conducted in many communities during the omicron wave of SARS-CoV-2 to identify age-related susceptibility to SARS-CoV-2 infection. In addition, longitudinal community seroprevalence studies can improve epidemic modeling and pharmaceutical intervention strategies by elucidating the immune dynamics of SARS-CoV-2 at the individual and population levels [5].

Results

The co-circulation of multiple viruses in the community following COVID-19 may address several critical questions regarding cross-protection from natural infections caused by similar viruses, the seasonality of multiple pathogens, and their complex burden and impact on healthcare facilities. This creates opportunities to develop a holistic quantitative approach.

Nowadays, developing optimal intervention strategies is crucial to respond to epidemics or pandemics in real time. Optimization theory in optimal control problems is well established. However, optimization theory for individual models (or network models) has a relatively short history and is currently under development. Game theory can provide good methods for optimizing individual models, while dynamic or geometric programming can optimize network models. Optimization problems (optimal control or dynamic programming) often require pre-defined information (priors), and optimization systems using artificial intelligence (AI) provide an alternative approach to answering epidemiological questions. For example, it can be used to determine when to screen or treat infected individuals in resource-limited settings and across a variety of infectious diseases.

AI-based research is a growing field and has been applied to many sequential decision-making problems. An AI-based reinforcement system consists of two main entities: a policy maker (or actor) and a dynamic model of disease transmission (or environment). The actor makes a decision based on the structure of the contact network and information about the dynamically changing epidemiological characteristics of the population (susceptible-exposed-infectious-recovered). Reinforcement learning exploits past-present-future states and identifies inherited or embedded information. These features can provide an innovative and alternative framework for understanding the dynamics of infectious disease transmission.

It is worth mentioning that in the last decade, two coronavirus diseases, Middle East respiratory syndrome coronavirus and SARS-CoV-2, have affected the world's population. These zoonotic infectious diseases have been documented to be transmitted from animal populations (e.g., wildlife and livestock) to susceptible humans or vice versa through direct or indirect contact. This contact is becoming more frequent due to the violent encroachment of humans into natural spaces due

to population growth and travel. Moreover, changes in climate and landscape have altered the interactions between animals and humans, causing either competition for or distribution of natural resources. Such changes in the interactions occur constantly between wild and farmed animals, as livestock rely heavily on humans for breeding and feeding. For example, in South Korea, many domestic ducks were infected with avian influenza from wild birds. Animal health authorities have been conducting proactive surveillance for avian influenza in both wild and farmed birds. In addition, early detection and reduction of infected poultry flocks and serosurveillance of farm workers were implemented to prevent possible spread of viruses from animals to humans (i.e. secondary spread). Thus, an integrated and holistic approach such as One Health can improve public health policy decision-making regarding community-based mitigation and intervention strategies against these infectious diseases.

Conclusions

It is fair to conclude from the above that knowledge of infectious disease epidemiology is increasing. The basic epidemiological methods and principles are still in use today, however, improved laboratory diagnostic techniques help confirm cases more quickly, see how they are related to each other, and can therefore help prevent the spread of a particular disease. Better computers can improve data analysis, and the Internet provides access to detailed information on specific diseases. Computer connectivity improves disease reporting for surveillance purposes, and the epidemiologist can take preventive measures more quickly when needed, as well as identify disease clusters and outbreaks in a timely manner.

With all these changes, infectious disease epidemiology has received increased attention, making it a challenging area to work in. Thus, to mitigate or control future infectious disease epidemics and pandemics, a critical strategic breakthrough in PHC from a whole health perspective is needed. Continued improvements in community-based epidemiological modeling and computational methods are needed to generate scientific evidence for improved public health policy decision-making.

References

1. Ryu S., Cowling B.J. *Human Influenza Epidemiology*. Cold Spring Harb. Perspect. Med. 2021;11: a038356.
2. Mesfin Y., Chen D., Bond H., Lam V., Cheung J., Wong J., Ali S.T., Lau E., Wu P., Leung G., et al. *Epidemiology of Infections with SARS-CoV-2 Omicron BA.2 Variant, Hong Kong, January-March 2022*. Emerg. Infect. Dis. 2022; 28:1856–1858.

3. *Abrams S., Wambua J., Santermans E. The SIMID COVID-19 team, P. Beutels, N. Hens Modeling the early phase of the Belgian COVID-19 epidemic using a stochastic compartmental model and studying its implied future trajectories. 2020*
4. *Achangwa C., Park H., Ryu S., Lee M.S. Collateral Impact of Public Health and Social Measures on Respiratory Virus Activity during the COVID-19 Pandemic 2020–2021. Viruses. 2022; 14:1071.*
5. *Zaitsev A.A., Akimkin V.G., Tutelyan A.V., Maryin G.G. Current issues of epidemiology, pharmacotherapy and prevention of acute respiratory viral infections. // RMJ. Medical Review. 2018. Vol. 2. No. 11. P. 53-57.*

DOI 10.34660/INF.2025.95.78.048

心源性休克后慢性心力衰竭患者成功撤离儿茶酚胺的预测因素
**PREDICTORS OF SUCCESSFUL WEANING FROM
CATECHOLAMINES IN PATIENTS WITH CHRONIC HEART
FAILURE AFTER CARDIOGENIC SHOCK**

Zhimspaev Damir Mukhambetovich

Resident doctor

Surgut State University, Medical Institute, Russia

Murzabaev Ramzil Yunirovich

Resident doctor

Surgut State University, Medical Institute, Russia

Minochkin Pavel Ivanovich

Doctor of Medical Sciences, Professor

Surgut State University, Medical Institute, Russia

注释：目的：评估临床、实验室及仪器参数对慢性心力衰竭合并心源性休克患者成功撤离儿茶酚胺的预测价值。

方法：计划开展一项前瞻性队列研究，纳入心源性休克后病情稳定的患者。

预期结果：确定对成功降低升压药剂量具有较高预测价值的监测参数。

结论：一些临床实验室及临床旁路参数可预测儿茶酚胺撤离成功率，并可据此制定成功的儿茶酚胺撤离方案，从而改善治疗效果。

关键词：慢性心力衰竭（CHF）、心源性休克（CS）、儿茶酚胺撤离机、VIS、NT-proBNP。

Annotation. *Objective: to assess the predictive value of clinical, laboratory and instrumental parameters of successful weaning from catecholamines in patients with chronic heart failure who have suffered cardiogenic shock.*

Methods: it is planned to conduct a prospective cohort study, including patients stabilized after the development of cardiogenic shock.

Planned results: identification of monitoring parameters that have a high predictive value of successful de-escalation of inopressor therapy.

Conclusions: some clinical-laboratory and paraclinical parameters can predict successful weaning from catecholamines, on the basis of which, it is possible to develop a successful weaning from catecholamines program, which can improve treatment results.

Keywords: *chronic heart failure (CHF), cardiogenic shock (CS), weaning from catecholamines, VIS, NT-proBNP.*

Introduction

Chronic heart failure (CHF) remains one of the leading causes of hospitalization and mortality in the world. Cardiogenic shock (CS) is an extremely severe complication of CHF that requires intensive therapy with inopressor drugs. However, long-term use of catecholamines is accompanied by severe toxicity, impaired microcirculation and increased mortality. Decatecholamination — the process of de-escalation and withdrawal of inopressor support - is a key step in patient recovery. The hypothesis of our study is that some clinical, laboratory and instrumental indicators of ICU monitoring, in particular ECG, echocardiography, X-ray examination, as well as the level of cardiomarkers, blood gas and acid-base balance, marker of intracellular metabolism, blood electrolyte composition, markers of inflammation, hypoperfusion, and microcirculatory disorders, rather than relying solely on hemodynamic parameters, could serve as reliable predictors of successful weaning from catecholamines in patients with CHF after CS.

Research design

A prospective cohort study is planned. Inclusion of patients in the study will be carried out only after receiving approval from the ethics committee and on the basis of formalized consent of the patient to participate in the study, in accordance with the provisions of the Helsinki Declaration of the World Medical Association (WMA) last revised on October 2024 [1].

Inclusion criteria: patients aged 18 years and older, with CHF complicated by CS according to the SCAI classification B, C, D, E [2], who are in the stage of stabilization of intensive care and receive inopressor support in the intensive care unit.

Exclusion criteria are: age less than 18 years, the presence of bacterial, viral or other infection that causes decompensation of CHF, patients with temporary mechanical circulatory support devices (Impella, Protek Dou, IABCP, ECMO) [3], patients after massive cardiac surgery, patients with COPD, with severe bronchial asthma, with irreversible multiorgan failure, acute cerebrovascular accident, pronounced hemophagocytic syndrome. It is planned to divide all patients included in the study into 2 groups according to the effectiveness of weaning from catecholamines (Figure 1). Early criteria for effectiveness include the withdrawal of inopressor support within 168 hours of the start of de-escalation and the absence of its resumption or death within the next 168 hours. Late performance criteria are considered to be survival within 1 month after complete withdrawal of inopressor support.

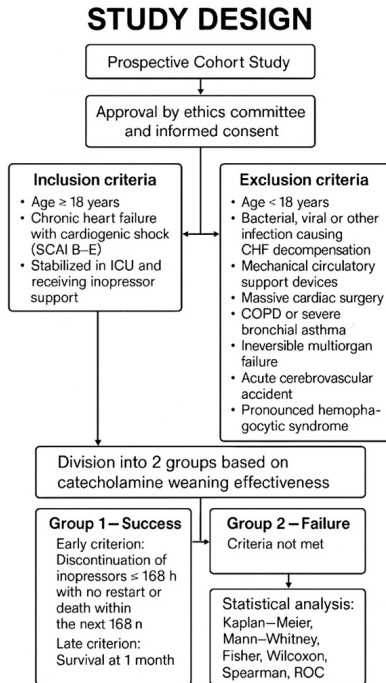


Figure 1

Materials and methods of research

In order to determine the number of patients in the groups, a power analysis was performed. Given that one of the criteria for the effectiveness of weaning from catecholamines is the survival of patients within 1 month after the complete withdrawal of inopressor support, the Kaplan-Meier survival method is the study method. Given that the current risk of mortality in CS is 30% - 50% within 30 days [2], due to multiple organ failure, respectively, the survival rate will theoretically be 70% and 50%. With an Alpha error value of 0.05 and a Power Goal of 0.8, when choosing a two-sided hypothesis type ($P_{i2}=P_{i1}$), the sample size in each group should be 96 patients. The total number of patients included will exceed 200 people and, taking into account the exclusion criteria, will probably be about 300 patients.

All patients after admission are evaluated according to the following scales: SOFA, Charlson Comorbidity Index, SAPS 3, RASS, or GCH. As data accumulate, patients are evaluated on the hemophagocytosis scale HScore [4]. CBC (complete blood count) is performed once a day or according to indications, ferritin

on admission and then according to indications, triglycerides 1 time and then according to indications, a coagulogram including INR, APTT, D-dimers, fibrinogen on admission and then according to indications. PCT, CRP is performed when a bacterial infection is suspected and during ABT to determine its effectiveness. Troponin- I in dynamics is studied in order to exclude the ischemic nature of CGS. NT-PROBNP is studied at admission and further according to indications. Blood gases and COR with electrolyte composition, glucose, lactate, hemoglobin and hematocrit are examined at admission and then monitored every 6 hours or more often, depending on the indications. An ECG is performed upon admission, then continuous monitoring of the ECG is performed using a bedside monitor, as well as continuous monitoring of SBP, DBP, average BP, respiratory rate, pulse oximetry, SpO₂, patients on mechanical ventilation are given continuous capnography. Echocardiography and ultrasound of the pleural cavities, X-ray of the chest cavity, is performed at admission and then according to indications. If necessary, a CT scan of the chest cavity or brain is performed. The CVD is also monitored once a day. Ultrasound-FAST (POCUS) protocol is performed in all patients. Hourly diuresis is continuously monitored. All monitoring parameters are recorded in the patient's electronic chart every hour. Also, all medical measures and the time of their implementation are entered in the patient's electronic card with the recording of the VIS index. After the end of the case (the occurrence of a fatal outcome or survival up to 30 days inclusive after the complete withdrawal of inopressor support), data from the patient's electronic card is imported into a summary spreadsheet in the STATISTICA system, where statistical analysis is performed after the accumulation of the necessary information. for an adequate statistical study of the number of cases.

Statistical processing of the material will be carried out using the licensed application software package "STATISTICA-13.0" (Stat Soft, USA). The threshold level of statistical significance is assumed to be 0.05. Quantitative data are presented in Methe median (Me) and interquartile range (IQR: UQ–LQ) format-median, upper and lower quartiles (25-75 percentiles). Analysis of the equality of medians and comparison of the frequency of occurrence of qualitative binary features in groups of participants was carried out using the Mann-Whitney test and the two-way Fisher test. Power analysis is used to determine the sample size. To compare quantitative data in comparison groups in dynamics, the Wilcoxon method will be used. The study of interrelations is planned by calculating Spearman's correlation coefficients (rss). ROCIt is planned to use the MedCalc application (MedCalc Software, Belgium) to perform ROC analysis and calculate relative risk MedCalc Software. To study the survival rate in the studied groups of patients, we will use the Kaplan – Meier multiple estimator method. To compare the significance of differences in survival studies, the nonparametric Koch-Mantel method is used.

Discussion

The planned study includes a large number of monitoring parameters that, if carefully analyzed, can be useful in deciding whether to start de-escalation therapy aimed at successful weaning from catecholamines, as well as in choosing the de-escalation step based on the VIS index. Within the predictor model, it is possible to determine threshold criteria for the studied parameters, which to some extent correlate with hemodynamic parameters, but can significantly clarify the need and timeliness of taking de-escalation steps aimed at preventing the resumption of CS and worsening the patient's condition. This may be due to the lower severity of hemodynamic disorders and better functional reserve capacity of the myocardium in such patients. The results highlight the importance of a comprehensive assessment of the patient's condition when deciding whether to reduce the dose of inopressors.

Conclusion

The planned study is promising in terms of identifying predictors of successful weaning from catecholamines by de-escalating inopressor support up to its cancellation. The data obtained can improve the treatment outcomes of patients with CHF who have suffered cardiogenic shock, increasing the survival rate of this group of patients. The planned study is safe for patients, as it does not involve any aggressive interventions, but is diagnostic. A promising area is the development of scales for assessing the probability of successful weaning from catecholamines and a comprehensive weaning from catecholamines program.

List of literature

1. <https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/>
2. Mehta A, Vavilin I, Nguyen AH, Batchelor WB, Blumer V, Cilia L, Dewanjee A, Desai M, Desai SS, Flanagan MC, Isseh IN, Kennedy JLW, Klein KM, Moukhachen H, Psotka MA, Raja A, Rosner CM, Shah P, Tang DG, Truesdell AG, Tehrani BN and Sinha SS (2024) Contemporary approach to cardiogenic shock care: a state-of-the-art review. *Front. Cardiovasc. Med.* 11:1354158. doi: 10.3389/fcvm.2024.1354158.
3. Nakata, J., Yamamoto, T., Saku, K. et al. Mechanical circulatory support in cardiogenic shock. *j intensive care* 11, 64 (2023). <https://doi.org/10.1186/s40560-023-00710-2>
4. Kriulin I.A., Alekseeva E.I., Dvoryakovskaya T.M., Tepaev R.F. Hemophagocytic syndrome: mechanisms of development, clinical manifestations, therapeutic technologies. *Issues of practical pediatrics*. 2021; 16(6): 94–102. DOI: 10.20953/1817-7646-2021-6-94-102

面部按摩对皮肤干燥脱皮患者皮肤屏障功能恢复的影响研究
**STUDY OF THE IMPACT OF FACIAL MASSAGE ON THE
RESTORATION OF SKIN BARRIER FUNCTION IN PATIENTS
WITH DRYNESS AND FLAKING**

Katshani Nina Vladimirovna

Medical doctor, esthetician, facial massage specialist,

Author of the original Flow-Balance facial massage method,

Private practice

摘要. 本文介绍了一项临床研究的结果, 该研究评估了一系列手动面部按摩对出现皮肤干燥和脱皮症状的患者恢复皮肤屏障功能的影响。本文阐述了按摩对皮肤影响的生理机制。一项涉及40名志愿者的临床试验评估了客观皮肤参数和患者的主观感受。结果显示, 实验组的皮肤状况显著改善。该研究强调了面部按摩作为一种便捷有效的修复受损皮肤屏障功能的方法的作用。

关键词: 面部按摩、皮肤屏障功能、皮肤干燥、脱皮、美容、微循环、表皮修复。

Abstract. *This article presents the results of a clinical study evaluating the impact of a course of manual facial massage on the restoration of skin barrier function in patients with clinical signs of dryness and flaking. The physiological mechanisms of massage effects on the skin are described. A clinical trial involving 40 volunteers was conducted, assessing both objective skin parameters and patients' subjective perceptions. The results demonstrate a statistically significant improvement in skin condition in the experimental group. The study highlights the role of facial massage as an accessible and effective method for correcting impaired skin barrier function.*

Keywords: *facial massage, skin barrier function, dry skin, flaking, cosmetology, microcirculation, epidermal recovery.*

Introduction. The skin barrier plays a key role in protecting the body from external aggressive factors. Disruption of this function leads to increased transepidermal water loss (TEWL), reduced resistance to physical, chemical, and microbial agents, and manifests clinically as dryness, flaking, tightness, and increased sensitivity [1, 2].

In recent decades, the number of patients with signs of impaired skin barrier has increased, associated with both adverse environmental factors and modern lifestyle features. The development of effective, safe, and physiologically appropriate methods for restoring skin barrier function is therefore especially relevant [3].

One promising direction is the use of manual facial massage. Mechanical stimulation of the skin promotes microcirculation, enhances metabolic processes, stimulates sebaceous gland activity, and improves the condition of the stratum corneum [4, 5]. Despite the widespread use of massage in aesthetic cosmetology, its role in restoring the skin's barrier properties remains insufficiently studied.

Modern Approaches to Skin Barrier Restoration. Contemporary approaches include the use of emollients, moisturizers with ceramides and hyaluronic acid, and physiotherapeutic methods such as microcurrent therapy, ultrasonic phonophoresis, and fractional mesotherapy. While effective, many of these techniques require specialized equipment, medical supervision, and carry the risk of side effects. In contrast, manual methods like facial massage offer a safe, accessible, and physiologically compatible alternative that preserves the skin's protective barrier.

Study Objective. The aim of this study was to evaluate the effect of a facial massage course on restoring skin barrier function in patients presenting with dryness and flaking.

Physiology of Skin Barrier Function. The barrier function is ensured by the structure of the stratum corneum, consisting of corneocytes embedded in a lamellar lipid matrix. Disruption in epidermal lipid synthesis, keratinocyte dysfunction, chronic inflammation, or exogenous damage can compromise the lipid barrier and increase TEWL [1, 2]. Aging is also associated with decreased fibroblast activity and impaired lipid metabolism, exacerbating skin dryness [3].

Causes of Dryness and Flaking. Facial skin dryness can result from decreased sebum production, disruption of the hydrolipid mantle, changes in epidermal lipid composition, chronic stress, and hormonal imbalances [3, 5].

Effects of Facial Massage on Skin Condition. Mechanical stimulation through massage enhances microcirculation, lymphatic drainage, and tissue regeneration [4, 6]. Some studies indicate that massage accelerates epidermal cell turnover, boosts extracellular matrix synthesis, and normalizes skin's hydro-lipid balance [6, 7]. However, data on its specific impact on skin barrier restoration remain fragmented, justifying the need for targeted studies.

Materials and Methods. Study Design. A prospective clinical study was conducted over 8 weeks. Participants were randomly assigned to experimental and control groups.

Participants. 40 volunteers aged 30–55 with signs of facial skin dryness were included. Inclusion criteria: presence of dryness and flaking, consent to partici-

pate. Exclusion criteria: active dermatological conditions, systemic retinoid therapy, allergy to massage components.

Massage Protocol. The experimental group received classical facial massage with lymphatic drainage elements (20 minutes, twice weekly, for 8 weeks). The control group used only a basic moisturizing cream.

Assessment Methods:

- Visual dryness scale (0–5 points) [6]
- Flaking severity assessment
- Subjective symptoms (tightness, itching) on Visual Analog Scale (VAS)

Statistical Analysis. Descriptive statistics and Wilcoxon signed-rank test were used. Significance level was set at $p<0.05$.

Results. Clinical Changes. After 8 weeks, dryness scores in the experimental group dropped from 4.1 ± 0.6 to 1.8 ± 0.5 ($p<0.001$). In the control group, changes were minimal and statistically insignificant ($p>0.05$). Flaking decreased by 65% in the massage group vs. 10% in controls.

Subjective Sensations. 90% of the experimental group reported relief from tightness and itching, compared to 30% in the control group.

Table 1.
Dynamics of Clinical Skin Condition Indicators

Indicator	Before the course Experimental group	After 8 weeks Massage group	Before the course Control group	After 8 weeks Control group
Skin dryness (points)	4.1	1.8	4.0	3.9
Flaking (%)	100	35	100	90
Tightness & Itching (VAS)	7.8	2.1	7.5	6.8

Note: VAS — Visual Analog Scale for subjective symptoms (0 = no symptom, 10 = maximum intensity).

Commentary: The data show statistically significant improvement in the experimental group across all parameters. Especially notable was the reduction in subjective discomfort, confirming both physiological and sensory benefits of massage. Minimal changes in the control group underscore the effectiveness of massage as an intervention.

Adverse Effects. No adverse effects were reported. Temporary post-procedure erythema occurred in 20% of cases and resolved within 30 minutes.

Discussion. The findings align with existing knowledge about the impact of massage on skin microcirculation and regeneration [4, 5, 7]. Mechanical stimula-

tion increases blood flow, enhances metabolism, and promotes repair of the stratum corneum. Significant improvements in both clinical and subjective indicators suggest that regular facial massage is a valuable tool in correcting impaired skin barrier function associated with dryness and flaking.

A limitation of this study was the absence of instrumental TEWL or hydration measurements, which are planned in future research.

Conclusion. Regular facial massage has a statistically significant positive impact on restoring skin barrier function in patients with dryness and flaking. The method can be recommended as part of comprehensive therapy and prevention of hydro-lipid imbalance.

References

1. Proksch E., Brandner J. M., Jensen J. M. *The skin: an indispensable barrier. Experimental Dermatology.* 2008;17(12):1063–1072. doi:10.1111/j.1600-0625.2008.00786.x
2. Elias P. M. *Skin barrier function. Current Allergy and Asthma Reports.* 2008;8(4):299–305. doi:10.1007/s11882-008-0041-5
3. Rawlings A. V., Matts P. J. *Stratum corneum moisturization at the molecular level: an update in relation to the dry skin cycle. J Invest Dermatol.* 2005;124(6):1099–1110. doi:10.1111/j.0022-202X.2005.23720.x
4. Tsuji N., Mayuzumi J., Ikeda S. *Improvement of facial skin condition by a facial massage treatment: a randomized controlled study. J Cosmet Dermatol.* 2005;4(2):111–116. doi:10.1111/j.1473-2130.2005.00158.x
5. Denda M., Tsuchiya T., Elias P. M., Feingold K. R. *Stress alters cutaneous permeability barrier homeostasis. Am J Physiol Regul Integr Comp Physiol.* 2000;278(2):R367–R372. doi:10.1152/ajpregu.2000.278.2.R367
6. Zöller N., Hempen M., Schmidt J., et al. *Influence of facial massage on skin barrier function and skin microcirculation. Skin Res Technol.* 2018;24(1):45–51. doi:10.1111/srt.12397
7. Bonté F., Girard D., Archambault J. C., Desmoulière A. *Skin changes during ageing. Subcell Biochem.* 2019;91:249–280. doi:10.1007/978-3-030-24286-9_9

金属合金电极电解熔盐过程中的质量传递
**MASS TRANSFER DURING ELECTROLYSIS OF MOLTEN SALTS
WITH ELECTRODES MADE OF METAL ALLOYS**

Mikhalev Yuri Glebovich

*Doctor of Chemical Sciences, Full Professor
Siberian Federal University, Krasnoyarsk, Russia*

摘要: 本文介绍了在恒电位条件下, 使用液态和凝固金属合金制成的电极电解熔融盐时, 对稳态极化依赖性的研究结果, 以及极化电极上的传质强度, 以传质系数 K_s 为特征。

在液态金属合金与电解质电极相界面 (IPB) 处进行阴极极化时, 电解质和金属相中会出现结构, 这是由相界面对流引起的, 以相互连接的涡旋形式存在——循环单元, 以及自然对流, 以电解质射流在阿基米德升力的作用下从IB上升, 金属射流从IB下降。IB具有特征性的最大电流密度。在这种情况下, 传质强度相对较高, K_s 约为 10^{-4} 米/秒。在合金电极凝固过程中, 相间对流不发生, 在金属盐熔体中仅发生自然对流, K_s 值下降一到两个数量级, 为 10^{-6} 至 10^{-5} 米/秒。

在液态合金的阳极极化过程中, 由相间和电解质中的自然对流引起的结构沿相间边界形成薄膜层流。此时 K_s 约为 10^{-5} 米/秒。

关键词: 电流密度、扩散过电压、极化依赖性、传质系数、盐熔体、金属合金。

Abstract. The article presents the results of studies of stationary polarization dependences under potentiostatic conditions during electrolysis of molten salts using electrodes made of liquid and solidified metal alloys and the intensity of mass transfer at polarized electrodes, characterized by the mass transfer coefficient K_s .

During cathodic polarization of liquid metal alloys at the interphase boundary (IPB) of electrodes with electrolytes, structures arise in the electrolyte and in the metal phase, caused by interphase convection in the form of vortices linked to each other - circulation cells and natural convection in the form of electrolyte jets rising from the IB under the action of the Archimedes lifting force and metal jets descending from the IB. IBs have a characteristic maximum current density. The intensity of mass transfer in this case is relatively high, and K_s is of the order of 10^{-4} m/s. During solidification of the alloy electrode, interphase convection does not develop, only natural convection occurs in the MG, and the value of K_s decreases by one or two orders of magnitude and is $10^{-6} - 10^{-5}$ m/s.

During anodic polarization of liquid alloys, structures caused by interphase and natural convection in the electrolyte are formed in the form of film laminar flows along the interphase boundary. K_s in this case is of the order of 10^{-5} m/s.

Keywords: Current density, diffusion overvoltage, polarization dependences, mass transfer coefficient, salt melts, metal alloys.

Introduction

During the process of electrolysis, electrochemical systems deviate significantly from the state of equilibrium, therefore, conditions are created for self-organization and the formation of non-linear dissipative structures in them [1].

During the polarization of solid electrodes made of individual metals in electrolytes diluted with electrochemically active particles, in general, structures arise in the form of a concentration gradient of electrochemically active particles in the electrolyte, causing a diffusion flow of ions to the electrode or from the electrode and currents caused by natural convection (NC), arising under the action of the Archimedes lifting force. Regardless of the type of structures, NC “ensures” a relatively low mass transfer rate, which is of the order of $10^{-6} - 10^{-5}$ m/s [2], and is characterized by the mass transfer coefficient K_s , which is calculated by the formula

$$K_s = \frac{i}{n \cdot F \cdot c_0 \left[1 - \exp\left(\frac{\eta \cdot n \cdot F}{R \cdot T}\right) \right]}, \quad (1)$$

where η – diffusion overvoltage (for the cathode process – a negative value), V; R – universal gas constant, J/mol·K; T – temperature, K; n – the number of electrons participating in the electrode process, equal to the oxidation state of ions of higher valence; F – Faraday constant, C/mol equivalent; c_0 – initial concentration of electrochemically active particles or concentration in the volume of electrolyte outside the diffusion layer, mol/m³; i – polarizing current density, A/m².

The type of structures (hydrodynamic situation) is determined by the orientation of the “working” surface of the electrode in space and the design of the electrochemical cell.

In the case of flat horizontal electrodes, the following main types of hydrodynamic situations can be distinguished [2]:

1. Horizontal electrodes with the working surface facing upwards and the electrolyte density at the electrode surface ρ_s less than the electrolyte density in the melt volume ρ_0 outside the diffusion layer or downwards at $\rho_s > \rho_0$. Natural convection is realized in the form of electrolyte jets moving turbulently upwards or downwards in planes perpendicular to the electrode plane. A flow in the form of alternating ascending and descending flows is formed at the electrode surface.

2. Horizontal electrodes with the working surface facing upwards at $\rho_s > \rho_0$ or downwards at $\rho_s < \rho_0$. In the general case, natural convection is realized in the

form of an electrolyte layer moving laminarly along the electrode surface from the center to the periphery. A creeping flow is formed.

During polarization of liquid metal electrodes made of individual metals in dilute melts, interphase convection (IC) generally develops along with NC, caused by the non-uniformity of the interphase tension (σ) at the electrode-electrolyte interface (Marangoni effect [3]). The stationary gradient (σ) arises due to:

1) uneven distribution of the current density (i), surface concentration of electrochemically active particles (c_s), potential (E) at the interphase boundary due to the geometric features of the system - and in this case the Marangoni macro effect takes place,

2) amplification of fluctuations of the same quantities when the system loses stability with respect to disturbances of i , c_s , E and σ - and in this case the Marangoni micro effect or instability takes place [4]. In this case, IC manifests itself on the MG in the form of vortices or circulation cells (CC) linked to each other.

In electrolysis of molten salt mixtures diluted with electrochemically active particles with liquid metal electrodes, the behavior of the systems and the course of polarization dependences (PD) are determined by the interaction of MC and NC and depend on the type of structures arising in the system. In most cases, interphase convection dominates over natural convection, and then the behavior of the system is determined by the structures generated by interphase convection, and the mass transfer rate constants are an order of magnitude or more higher than those for the conditions of "pure" NC [5].

In cathodic polarization of liquid electrodes from individual heavy metals in dilute chloride melts, the following main types of dissipative structures and the corresponding mass transfer modes are classified [4]:

1. Development and attenuation of circulation cells. At the interphase boundary of the electrode with the electrolyte, structures in the form of vortices - circulation cells (CC), caused by the Marangoni micro effect, dominate. The PZ have a characteristic density maximum at overvoltage corresponding to developed CY. When CY occurs, the scale of movement is of the order of 0.5 mm, and K_s is $10^{-4} - 10^{-3}$ m/s.

2. During anodic polarization, a laminar flow regime occurs. The structure exists in the form of an electrolyte layer moving laminarly along the MG, the stability of which is determined by the interaction of the Marangoni macro effect and natural convection. At the PZ, the current density changes with overvoltage without extremes. In this case, the scale of movement is commensurate with the scale of the electrode, and K_s is of the order of 10^{-5} m/s.

Along with electrodes made of individual metals, metal alloys are widely used as electrodes in the electrolysis of molten salts in the processes of refining, joint extraction of metals, etc. [6],[7]. In this regard, it was of interest to find out wheth-

er there are mass transfer modes characteristic of the polarization of liquid metal electrodes made of individual metals during the polarization of liquid metal alloys.

Experimental part

Experiments were carried out in an argon atmosphere in the cells shown in Fig. 1. Stationary polarization curves were studied under potentiostatic conditions using a lower auxiliary electrode and with symmetrical current distribution along the interphase boundary of the working electrode made of the alloy with the electrolyte.

Results and discussion

The studies were conducted in the following electrochemical systems:

1. Sb – Bi (21 wt.%) – (CsCl – NaCl) eut. – SbCl_3 (0.42 wt.%), temperatures of 883 K and 786 K. In this case, the electrode potential of antimony is more negative than that of bismuth [8], so its ions are potential-determining and participate in electrode processes.

2. Bi – Pb (2.5 wt.%) – NaCl – KCl (1: 1) – PbCl_2 (1 wt.%), temperature of 973 K. Since the electrode potential of bismuth is more positive than that of lead [8], lead ions are potential-determining and participate in electrode processes.

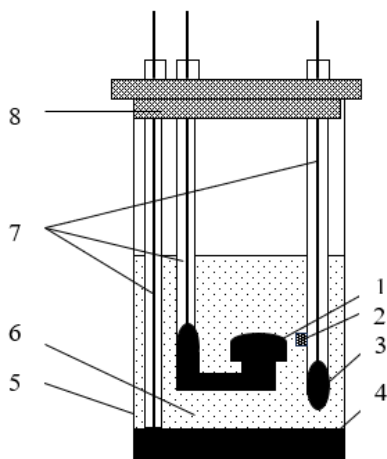


Figure 1. Schematic diagram of the electro-chemical cell.

1 - working electrode (lead or antimony); 2 - diaphragm; 3 - reference electrode - Pb + 10 wt.% PbCl_2 in the corresponding back-ground electrolyte;

4 - auxiliary electrode (lead or antimony); 5 - quartz vessel;

6 - electrolyte; 7 - tungsten current leads; 8 - rubber stopper, protected from below by a fluoroplastic plate.

According to the melting diagram [9], at a temperature of 883 K, the Sb – Bi alloy was in a liquid state, and at a temperature of 786 K, most of the alloy had solidified. The density of the solid phase enriched in antimony (the density of which is less than the density of bismuth [10]) was less than the density of the liquid phase and, therefore, at a temperature of 786 K, the solid phase was in contact with the melt. Experiments at two temperatures made it possible to compare

the conditions of mass transfer during polarization of a solid and liquid electrode under approximately the same conditions.

Just as with the polarization of individual heavy metals, the cathode branches of the polarization dependences of the alloys (Fig. 2) have a maximum current density, while the anodic ones are monotonous. Based on the type of polarization dependences, it can be concluded that during cathode polarization of the studied alloys, a circulation cell regime can take place, and during anodic polarization, a laminar flow regime can take place. During partial solidification of the Sb – Bi alloy, interphase convection does not occur and mass transfer occurs only under conditions of natural convection in the electrolyte. The conclusion made is also confirmed by the values of the mass transfer coefficients (Table 1), calculated using formula (1) for system 1 under the assumption of electrode reversibility and neglecting polarization on the side of the metallic phase. Due to the relatively high concentration of antimony, it is sufficient to take into account polarization only on the side of the electrolyte. For system 2, the mass transfer coefficient cannot be calculated based on polarization measurements, since it is impossible to separate the total polarization into polarization on the side of the melt and the metallic phase.

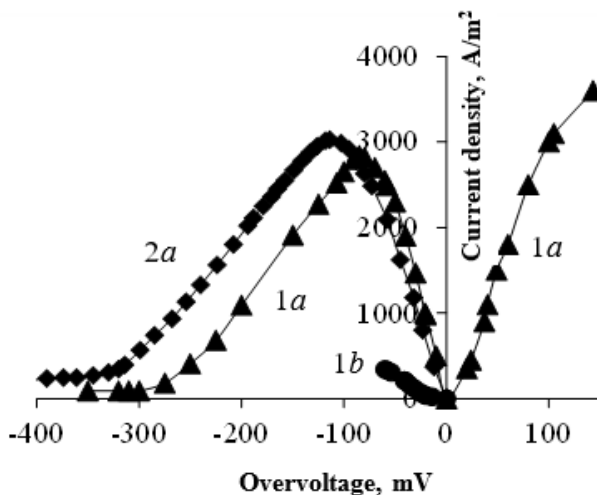


Figure 2. Polarization dependences for alloys in the systems:

1 – Sb – Bi (21 wt.%) – (CsCl – NaCl) eut. – SbCl_3 (0.42 wt.%); 2 – Bi – Pb (2.5 wt.%) – NaCl – KCl (1: 1) – PbCl_2 (1 wt.%); a – liquid alloy; b – solid alloy.

Table 1*Mass transfer coefficients during polarization of the Bi (21 wt.%) – Sb alloy.*

Absolute value of overvoltage, mV	Circulation cell mode	Laminar flow regime	Hard alloy. Cathodic polarization.
	$K_s \cdot 10^5, \text{ m/s}$	$K_s \cdot 10^5, \text{ m/s}$	$K_s \cdot 10^5, \text{ m/s}$
20	13	2	0,4
40	17	2	1,8
60	20	1,2	2,7
80	21	0,7	-
100	20	0,4	-
150	14	-	-
200	8	-	-

The behavior of the studied systems during polarization depends on changes in such parameters as the interfacial tension and density near the MG on the side of the metallic phases and the electrolyte. In work [11], a theoretical analysis using the normal mode method of the MG stability with respect to small perturbations of i , c_s , E and (σ) during polarization of liquid metal electrodes made of individual metals showed that the occurrence of CC should be expected: a) during cathodic polarization, if the electrode potential without current corresponds to the ascending branch of the electrocapillary curve (ECC) and b) during anodic polarization, if the electrode potential without current corresponds to the descending branch of the ECC. In both cases, during polarization, the interfacial tension increases, and the electrochemical system self-organizes in such a way (CCs arise) as to increase mass transfer and reduce surface energy. Such behavior of the systems has been repeatedly confirmed by experimental studies using liquid electrodes made of individual metals [4]. During polarization of liquid metal alloys, as follows from Fig. 2 and Table 1, the same mechanism is apparently in effect. In system 1, the electrode potentials without current for bismuth and antimony separately correspond to the ascending branches of the EKC [12], [13], so it can be assumed that the same is true for the alloy, therefore, during cathodic polarization, the interfacial tension should increase, which promotes the formation of circulation cells during cathodic polarization. No data on the surface tension in the Bi – Sb system have been found, however, based on the surface tension values of individual metals [10] (at 883 K 0.37 N/m for Sb and 0.34 N/m for Bi), it can be concluded that antimony in the alloy with bismuth is a surface-inactive component, since, according to [12], the interfacial tension at the boundary with salt melts is higher for those metals whose surface tension is higher. Natural convection during cathodic polarization in an electrolyte develops according to the type of hydrodynamic situation 2. Indeed, according to [14], the density of SbCl_3 near the boiling point at 492 K is 2.35 g/cm³, which is less than the density of the eutectic mixture $\text{CsCl} - \text{NaCl}$ (2.55 g/cm³

at 833 K and 2.64 g/cm^3 at 786 K). Obviously, at the experimental temperatures, the density of SbCl_3 should be less than 2.35 g/cm^3 and, therefore, significantly less than the density of the eutectic mixture. Since the concentration of SbCl_3 at the MG decreases during cathodic polarization, the density of the electrolyte at the MG obviously increases, i.e. $\rho_s > \rho_o$. In the alloy, since the density of antimony is less than the density of bismuth [10] (at 883 K 6.5 g/cm^3 for Sb and 9.6 g/cm^3 for Bi), and its concentration at the MG increases, NC should develop according to the type of hydrodynamic situation 2, but due to the limited space, such flows in the metallic phase apparently do not develop. In general, the conditions of mass transfer during cathodic polarization are determined by circulation cells. During cathodic polarization of partially solidified Bi–Sb alloy, NC obviously develops according to the type of hydrodynamic situation 2. During anodic polarization, circulation cells do not arise, but a laminar flow regime develops and natural convection arises – according to the type of hydrodynamic situation 1 both in the electrolyte and in the alloy.

In system 2, the electrode potentials without current for bismuth and lead separately correspond to the ascending branches of the EKC [12], therefore it can be assumed that the same is true for the alloy, consequently, during cathodic polarization, the interfacial tension should increase. In addition, during cathodic polarization, the lead concentration in the alloy for MG increases, which also leads to an increase in the interfacial tension, since the surface tension of lead is greater than that of bismuth [10] (at 973 K 0.42 N/m for Pb and 0.36 N/m for Bi). At the same time, the density of lead is clearly greater than that of bismuth [10] (at 973 K 10.2 g/cm^3 for Pb and 9.5 g/cm^3 for Bi), and lead chloride is heavier than an equimolar mixture of sodium and potassium chlorides [14], [15] (at 973 K the density of PbCl_2 is 4.6 g/cm^3 , and that of an equimolar mixture is 1.58 g/cm^3), therefore, in the alloy, during cathodic polarization, the density of the metallic phase in MG increases, while the density of the electrolyte in MG decreases. Consequently, natural convection in the alloy and in the melt develops according to the type of hydrodynamic situation 1. Thus, the processes in the electrolyte and metal simultaneously enhance mass transfer. During anodic polarization, the system is stable to disturbances and circulation cells do not arise, and only processes in the electrolyte lead to the development of the laminar flow regime, since convection does not develop in the metallic phase (due to the ratio between the densities of lead and bismuth, convection should develop according to the type of hydrodynamic situation 2, but due to the limited space, such flows in the metallic phase apparently do not arise).

Conclusion

1. During the electrolysis of molten salts with liquid electrodes made of metal alloys, the same mass transfer regimes take place as during the polarization of

individual metals. This makes it possible to increase the intensity of mass transfer during the production or separation of alloys if the process is carried out in the circulation cell mode. For example, the possibility of increasing the intensity of mass transfer during the formation of circulation cells formed the basis for methods for producing aluminum-lithium alloys [6] using an intermediate lead electrode, when the dissolution of lithium from lead results in the formation of a circulation cell regime.

2. The relatively high mass transfer rate (K_s) for polarized liquid metal electrodes during cathodic processes is due precisely to the development of interphase convection in the form of CY, since during solidification of the electrodes, when MC is impossible, K_s is approximately an order of magnitude smaller.

3. Polarized electrodes made of liquid metal alloys are characterized by a wider range of flow interactions at the interphase boundary compared to individual metals, which can leave an imprint on the manifestation of one or another regime or even lead to the emergence of other structures and, consequently, other mass transfer regimes. During polarization of individual metals, there are interactions of micro- and macro-Marangoni effects and natural convection in the electrolyte, and during polarization of alloys, the same interactions generally take place in the metallic phase, and in addition, the flows caused by such interactions in both phases can, in turn, act on each other through the interphase boundary, generating new types of structures.

In total, 16 variants of parameter combinations determining the intensity of mass transfer can be distinguished for alloys, if they are conditionally considered separately in the metallic phase and in the electrolyte. Each combination will correspond to certain structures at the interphase boundary and a certain mass transfer rate.

References

1. Baranowski B. *Dissipative structures // Chemia Stosowana*. –1983. – V. 26. – P. 288–315.
2. Isaeva L.A. *Mass transfer during free convection in electrochemistry of molten salts and diffusion layer: Abstract of Cand. of Chemical Sciences Dissertation*. – Sverdlovsk, 1975. – 17P.
3. Scriven L.E, Sternling C.V. *The Marangoni effect // Nature*. – 1960. – V.187. – No. 16. – P.18 – 20.
4. Mikhalev Yu.G., Polyakov P.V., Isaeva L.A. *Dissipative structures in the liquid metal electrode – molten salt system*. – In: *Thermodynamics of irreversible processes*. – Moscow: Nauka, 1987. – Pp.138–145.

5. Isaeva L.A., Polyakov P.V., Mikhalev Yu.G., Rogozin Yu.N. *New modes of interphase convection during electrolysis of molten salts with a liquid cathode* // *Electrochemistry*. – 1984. – Vol. XX. – No.7. – Pp. 957–962.

6. Belyaev A.I. *Physicochemical foundations of cleaning metals and semiconductor materials*. – M.: Metallurgy, 1973. – 224 P.

7. Burnakin V.V., Pankov E.A., Blinov V.A. and others. *Method for producing aluminum-lithium alloys* // *A.S. USSR*. – No. 1800852. – 1992.

8. Delimarsky Yu.K. *Electrochemistry of ionic melts*. – M.: Metallurgy, 1978. – 248 P.

9. https://www.crct.polymtl.ca/fact/phase_diagram.php?file=Bi-Sb.jpg&dir=BINARY

10. Smithles K. J. *Metals. Directory*. – M.: Metallurgy, 1980. – 447 P.

11. Aogaki R., Kitazawa K., Fueki K., Mukaibo T. *Theory of polarographic maximum current – I*.

Conditions for the onset of hydrodynamic instability in a liquid metal electrode system // *Electrochimica Acta*. – 1978. V. 23. – P. 867 – 874.

12. Stepanov V. S. *Interphase phenomena in ionic salt melts*. – Ekaterinburg: Nauka, 1993. – 316 p.

13. Prisekina T. N., Kuznetsov V. A. *Zero-charge potentials of some metals and alloys* // *Physical chemistry and electrochemistry of molten salts and slags. Collection of materials of the 3rd All-Union conference*. – Khimiya Publishing House, 1968. Pp. 230 – 237.

14. Jans G. J. et al. *Molten salts. Chlorides and mixtures* // *J. Phys. Chem. Re. Data*. – 1975. – V.4. – No.4.- P. 893, 1011.

15. *Handbook of molten salts. T1*. Ed. Morachevskii A. G. – Publishing house “Khimiya”, 1971. – 168 p.

DOI 10.34660/INF.2025.81.96.051

UDC 2.44

圆顶抗震结构设计方法

**METHODOLOGY FOR DESIGNING DOME-SHAPED,
EARTHQUAKE-RESISTANT STRUCTURES**

Ivanova Anastasia Petrovna

*Doctor of Technical Sciences, Full Professor
Orenburg State University*

Vasilyeva Marina Anatolyevna

*Candidate of Technical Sciences, Associate Professor
Orenburg State University*

Mezhueva Larisa Vladimirovna

*Doctor of Technical Sciences, Head of Laboratory
Orenburg Federal Research Center of the Ural Branch of the Russian
Academy of Sciences*

Piskareva Tatiana Ivanovna

*Candidate of Technical Sciences, Associate Professor
Orenburg State University*

注释：本文探讨了基于节段桁架、实体覆盖层“充气”表面以及球壳形状等多种方案的穹顶抗震结构设计方法。并给出了计算示例。

关键词：实验技术、几何穹顶表面、混凝土覆盖层、抗震性能、聚苯乙烯泡沫塑料。

Annotation. *The paper considers the design methodology of dome-shaped, earthquake-resistant structures using various approaches: based on segmental trusses, “inflating” surfaces of a solid covering, a spherical shell shape. Examples of calculations are presented.*

Keywords: *experimental technologies, geometric dome surfaces, concrete covering, earthquake resistance, polystyrene foam.*

The creation of a dome structure begins with defining the territory on which it will be erected, respectively, the topographic surface of the area is studied, with the possibility of construction and use of accompanying infrastructure.

The design methodology, mathematical calculations, should be considered in conjunction with technological capabilities and technical support. Conducting

preliminary survey work is a prerequisite for justifying investments in the construction of any structure. Therefore, the object is analyzed by its purpose, geometric shape, design features, dimensions (volumetric or linear). In accordance with building codes and regulations, design documentation is developed, technological components are selected and architectural and construction solutions are made. The design stages of non-standard, seismically resistant dome structures can be significantly reduced due to the specific features of these objects.

The feasibility of dome construction arises from [1,2]: lower consumption of building materials than in the classical construction of a structure; the absence of load-bearing walls in small structures or their arbitrary location in large-form structures; potential possibilities of construction and operation of the finished facility in various climatic zones; tight construction deadlines; the possibility of giving the dome structure any non-standard shape that fits into the proposed territorial conditions; durability of the dome, which can withstand a large external load (for example, snow, rain mass), since the strength is due to the uniform distribution of loads throughout the dome, with the absence of hazardous areas and conditions of self-construction of bulk and liquid external environments that exert load effects; seismic resistance (in Russia there are quite a lot of territories with high seismic activity, i.e. Baikal and Transbaikalia, Altai, Sayan, North Caucasus, Kuril-Kamchatka region and Sakhalin Island); streamlined shapes of surfaces that reflect external sound impacts and noise effects, creating a comfortable environment inside the structure; the absence of seams, joints, making the structure reliable; aerodynamics of the dome, making the structure resistant to wind loads, in which moving air masses do not exert a powerful rectilinear impact, but move along the envelope smooth forms of surface transitions; economic costs, reduced due to the lack of need to use lifting equipment during the construction of the object, as well as a reduction in the number of workers. The geometric shapes of the dome structure are always original, unusual, individual, unique. In the 60s, the architect Dante Bini created a technology for “inflating” a building from concrete. The use of experimental technologies in the construction of industrial, agricultural, cultural and household and other buildings in the shortest possible time, with high quality construction, is an urgent problem of our time. In light of innovative approaches, it is necessary to note the undeniable superiority of the dome structure, especially, for example, in the agro-industrial complex, where more than 50% of livestock farms have been destroyed. The possibilities of using the internal space of such structures are expanding due to the versatility of application for various purposes: production, sports, design centers, cultural facilities, entertainment and shopping centers, warehouses and utility rooms, agricultural, poultry hangars, etc. [3]. The estimated cost of each designed structure includes the cost of building materials. The surface area of a dome structure is 15-20% less than the area of a similar rec-

tangular parallelepiped, accordingly, the consumption of building material for a dome structure will be less. At the initial stage, the geometric shape is determined, which can be considered as a frame structure or as having a continuous coating.

Due to the fact that there are different approaches to modeling a dome structure, it should be noted that the structural components, while maintaining the general shape, may have certain differences, for example, ribbed, panel, frame or solid surface coating. When forming the frame, the most suitable geometric elements in terms of functionality (components of the dome) are selected. Depending on the purpose, concrete, reinforced concrete and combined materials are most widely used as a coating material. It is advisable to use reinforcement material taking into account the climatic characteristics of the construction areas. The simplest and least expensive dome structure is considered to be “Binishell”, so its construction is almost always justified. The method of “inflating” a building from concrete includes several stages. Preliminary work is carried out related to determining the topographic surface for the construction of a dome structure. If the structure will not have a decorative function, then the potential possibilities of supplying the future facility with electricity, water supply and drainage, ventilation, and heat are considered. The optimal result will be if the structure fits into the existing infrastructure. It is advisable to conduct research in terms of the close location of groundwater in order to prevent subsidence moments. It is necessary to prepare a site or foundation (like a foundation ring) for the dome structure. After that, a membrane is laid out in a certain way on the selected (round) site, and a frame of reinforcement is laid on it, after which everything is poured with an even layer of concrete. Another layer of membrane is laid on top. And for an hour and a half, until the concrete sets, a powerful compressor supplies air under the lower membrane - the structure is inflated and a dome is formed using the “binishell” technology [2]. The surface layer of the finished structure is treated with vibrating platforms, eliminating the cracks that have formed. The pressure inside the dome is maintained for 24 hours. After the concrete has set, the top membrane is removed and holes are cut (for windows, gates, doors, ventilation, etc.) in the places specified in the project. In this case, the diameter of the designed dome should be taken into account to calculate the dimensions of the membrane on which the reinforcement is laid. The material consumption will depend on the diameter of the dome, which can vary in a wide range from 4 m to 30 m (more than 30 m if necessary) and the height of its rise. A typical height is considered to be one that is half the diameter of the dome (spherical), but if the height is greater than the diameter, the dome is modified and acquires a toroidal shape. Or, if the dome structure remains unchanged, a ring-shaped foundation is built up under it. There is another component when calculating the material consumption for the structure, this is the thickness of the dome coating layer, which can vary depending on the type of coating and

the number of layers used. In an average calculation, the ratio between the coating thickness and the dome diameter of 1:100 can be taken as a basis. When calculating a domed structure of spherical (shell) shape, it is advisable to break it down into basic structural components.

The construction of a dome structure in seismically dangerous regions such as Baikal, Transbaikalia, Altai, the North Caucasus, Sakhalin, with a diameter of 16 meters, at a height of 11 m, will have a dome surface area of 553 m². It is necessary to take into account the area of the base - 170 m². When performing calculations, the main indicator is the volume of concrete mix required to cover the dome, which depends on the thickness of the coating layer, single or multiple. When applying one layer of 5 cm, the volume of concrete required is about 27.65 m³, when covering with a second layer of the same 55.3 m³. The price of the dome structure (about 330-350 thousand rubles) will correlate with the selected concrete grade (M300 - M400). Reinforcement mesh, insulation, waterproofing, finishing work, labor costs - these are the necessary components of the cost of the structure (which cannot be abandoned and which cannot be reduced). It is allowed to apply additional roofing to the surface of the dome structure, mastics (hot or cold). The final cost of a structure with an area of 170 m²-200 m² can be 1 million 500 thousand - 2 million rubles. The construction of such a structure is very expedient.

Geodetic, stratodesic, which can be used in less seismically active areas of the Amur region, Primorye, Koryakia and Chukotka.

The dome structure, despite its apparent solidity, can be divided into several structural components, by analogy with a segmental geometric truss. It can be considered as a surface of revolution (around the projecting axis coinciding with the ridge node post), formed by elements of a segmental geometric truss. Accordingly, it will have a lower chord (platform), an upper chord (the function of which is performed by diagonals or struts) and a covering (which is a shell).

When considering the geometric parameters that characterize dome structures, the following should be noted: the diameter of the base and the slope of the ribs (if the structure is ribbed) that create the dome. The slope of the dome is the tangent of the angle of inclination of the rib (upper chord) of the truss to the base of the dome surface mount. It should be noted that when calculating the structure, the dominant indicators will be the radius and height. Their ratio regulates the slope, i.e. the greater the height of the rise, the steeper the slope of the dome structure (excluding the bending radius of the upper chord). Depending on the conditioned load on the dome, the frequency (density) of the ribs is regulated. Inflatable, binishell structures have the most accurate spherical surface. All other types of domes have certain deviations from the spherical shape, since, on the one hand, errors arise during the construction of the structure, and on the other hand, most geometric shapes have a ribbed base, which, like a multifaceted body, fits into a hemisphere.

In the case of developing structures using modern materials [2], for example, polystyrene that has undergone a foaming procedure, then, according to Japanese researchers, 10-15 centimeters of polystyrene foam, in terms of thermal insulation qualities, is equal to brickwork with a thickness of one meter. When constructing a dome structure from polystyrene foam, a layer-by-layer technology of applying ultraviolet and fire protection, plaster and facade paint or tiles is used. As a result, the possibility of fire and moisture absorption is reduced. Since moisture can penetrate into polystyrene foam by 2-3 mm, then in the absence of an additional layer of waterproofing in the coating of the dome structure, an additional layer of polystyrene foam is used as compensation. In the absence of cataclysms, such a dome structure can be used for about 200 years, with systematic maintenance.

When considering the elements of dome structures with a continuous coating, it should be noted that depending on its purpose, thin-walled and thick-walled shells can be used. This division is formalized, that is, the ratio of the shell thickness (S) and the radius of curvature (R). $S / R = 1/20$ is the interface between thin-walled and thick-walled dome shells. When using thick-walled shells, it may be necessary to install columns inside the structure. To determine the deviation of columns from the vertical, an alternative method of “indirect measurements of the angle” of the column deviation, as well as the distance from the theodolite (tachometer) to the reference plane is proposed. In this case, geometric schemes are used to determine the linear angle of column deviation from the vertical and the installation of the theodolite (tachometer) to shoot the deviations of columns perpendicular to the sides of the structure. Earlier, we described the methodology for conducting experimental studies and provided the obtained graphical dependencies. The surveys and calculations performed allow us to determine the deviations of columns from the vertical by angular measurements from the ground [4].

When using thin-walled shells, it should be noted that the momentless theory is valid for them throughout the dome structure. The only exception is the place where the dome contacts the lower base (support), since bending moments occur there.

Due to the lack of classical approaches to determining the strength characteristics of shell dome structures, it can be imagined as a surface of revolution, based on the shape of a segmental truss (Fig. 1).

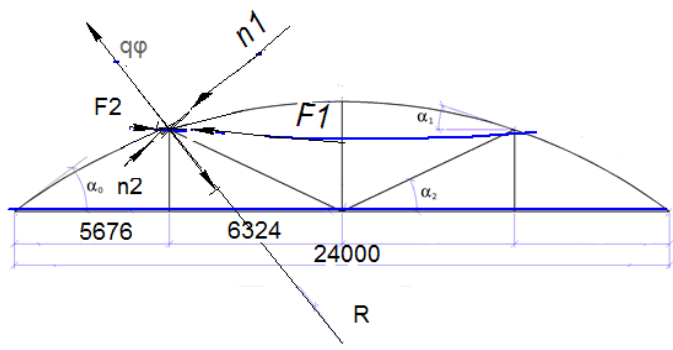


Figure 1. Scheme of a formalized dome based on a segmental truss

It should be noted that wind, snow, and rain loads on the dome surface can be both symmetrical and asymmetrical.

If a dome of radius R is divided into microsegments (limited on two sides by the corresponding radii of curvature of the surface, and on other sides by parallels), it should be noted that the thin-walled shell is under the influence of normal forces (n_1 , n_2) directed along the meridian, as well as tangential forces (F_1 , F_2) along the parallel (Fig. 1). Their values will depend on the weight of the structure itself and the additional weight created by external influences - rain, snow, wind, etc. With symmetric loading, $F = 0$, and n_1 , n_2 will be functions of the angular coordinate by latitude. Conventionally, there are no racks and diagonals. In this case, the stress state of the dome can be characterized by a system of equations (Table 1).

Table 1.
Characteristics of the stress state of the dome

No.	Stress state of the dome	Equation
1	Axisymmetric load	$n_1/R + n_2/R = q\varphi$ $q\varphi$ - normal to the dome surface
2	Balancing (along the parallel)	$Q_\varphi - n_1 \sin \varphi 2\pi R = 0$
3	Normal force (along the meridional direction)	$n_1 = \frac{Q_\varphi}{2\pi R} \sin^2 \varphi$ Q_φ - compressive force

At the level of the center of gravity of the upper chord of the segmental truss, there will be a parallel along which the forces F will be equal to zero, it can be called the zero parallel. Its position can shift, since it depends on the shape of the dome surface and the possibility of additional forces. The streamlined solid, shell

shape allows water and snow masses to slide along the surface, and can be used in regions associated with large year-round precipitation. Dome objects that work well under wind loads are quite safe structures in areas with a specific wind rose.

The research results allow us to give certain recommendations for the construction of a dome structure. To create a strong, monolithic structure of a dome structure, preliminary work is carried out, quite complex, while a powerful compressor is used, capable of creating high working pressure when lifting the mass of concrete to the height of the dome shape. The process is fast and quite specific. It provides for additional preparation associated with checking the impermeability of the membranes and the fact that the reinforcement must bend along with the increase in the volume of the structure. When using the technology of laying reinforcement with a gap from the surface of the inflatable dome, the consumption of concrete is reduced. This is a method of spraying concrete onto the formwork. In this case, the vibration compaction technology can be replaced by concrete shotcreting. To do this, the surface of the dome is filled with concrete mixture using concrete pumps and compacted at high speed, without sliding under its own weight. To bring the structure to a finished state, it is necessary to level the surface and wrap it with a layer of waterproofing. If necessary, you can add a layer of insulation (polyurethane foam) or a layer of concrete.

For seismically hazardous regions, it is advisable to carry out concreting of a reinforced concrete dome structure by shotcreting, while both the “dry” and “wet” principles can be used. With the “wet” principle, a layer-by-layer, reusable concreting scheme can be used, the number of layers depends on the purpose of the object. It is necessary to strictly adhere to the technology of applying the coating layers, i.e. the thickness should not be more than 15-25 mm, otherwise the concrete mixture may slide off the surface of the dome. When using the “wet” principle, Portland cement is selected in the range of grades 300-400 with the introduction of additives for forced setting. Depending on the climate zone and season, the composition of the cement mixture can vary in the ratio of water and cement from 0.45 to 0.55 (Fig. 2), while fine-grained and coarse aggregate is used, and such an indicator of the concrete mixture as adhesion to reinforcement and concrete is also important. It is necessary to control the beginning and end of setting, which should be from 3 to 12 minutes, with the strength of the set concrete of 40% - 45%. When preparing the concrete mixture, the density regulation is established by the ratio of the components included in its composition. In particular, the water consumption per 1 m³ of concrete, which can vary depending on the concrete grade. The ratio of cement content in the concrete mix and its density varies depending on the concrete grade and the number of layers when covering the dome structure.

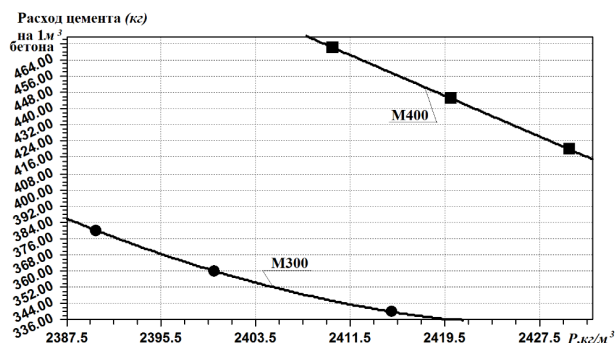


Figure 2. Concrete mix density versus cement consumption per 1m3 of concrete

It is recommended to use 0...5 mm sand as a fine-grained filler. Sand consumption per 1 m3, when using different grades of concrete, can differ by up to 80 kg and be replaced by large aggregate made of crushed stone and gravel.

For high-quality concreting, it is necessary to maintain the temperature regime and not to carry out work at temperatures below 50 C. Accordingly, as with any concreting work, hydration of the concrete surface with its periodic wetting should be carried out, this will solve the problem of cracks during concrete hardening. The operation of concrete hydration will be impossible if the ambient temperature drops to 00 C and the water freezes.

References

1. Esipova A.A. Use of geodesic domes in construction: advantages and disadvantages // *Science and modernity*. - 2015. - No. 38. - P. 8-11.
2. Magomedov, R. A. "Technologies for forming dome structures". Magazine "Young Scientist", 2021, No. 18 (360), P. 131-133.
3. Ivanova A. P. Prerequisites for exposure to and methods of protection against vibration of building structures / A. P. Ivanova, L. V. Mezhueva, A. V. Bykov, M. A. Vasilyeva // In the collection: Educational environment today and tomorrow. Proceedings of the XI International scientific and practical conference. NEI HE Moscow Technological Institute. 2016. P. 209-212.
4. Kuznetsov O. F. Alternative method for experimental measurement of the angle of deviation from the verticality of the frame during design and construction // O. F. Kuznetsov, A. P. Ivanova, M. A. Vasilyeva, V.V. Deligova, T.I. Piskareva, L.V. Mezhueva. Construction materials and products. 2022. Vol. 5. No. 2. P. 13-21.

DOI 10.34660/INF.2025.59.23.052

UDC 628.921/.928

建筑工程系统中智能窗的信息处理

PROCESSING INFORMATION ON SMART WINDOWS IN ENGINEERING SYSTEMS OF BUILDINGS

Gunko Nikita Maksimovich

Lecturer

Orenburg State University

Ivanova Anastasia Petrovna

Doctor of Technical Sciences, Full Professor

Orenburg State University

Deligirova Victoria Viktorovna

Candidate of Technical Sciences, Senior Lecturer

Orenburg State University

Rakhimova Natalia Nikolaevna

Candidate of Technical Sciences, Associate Professor

Orenburg State University,

Corresponding Member of MANEB

注释。本文探讨了“智能窗”的制造材料、其工作原理及其对人体舒适生活条件的影响。分析了光照对一天中的时间、一年中的时间以及所用设备方向的影响，并记录了眩光发生的阈值。

关键词：“智能窗”，日照，优化，光泽度，光照。

Annotation. *The materials for the manufacture of “smart windows”, the principle of their operation and their influence on the comfortable living conditions of a person are considered. The dependences of illumination on the time of day, time of year, and the orientation of the devices used were analyzed and the thresholds for the occurrence of glare were recorded.*

Keywords: *“smart window”, insolation, optimization, gloss, illumination.*

Smart windows are an innovative element in construction technologies. Civil and industrial premises are usually equipped with window and door openings that perform the following functions: light transmission, protection from the external environment, thermal insulation, etc.

The use of natural lighting in premises is preferable and is supplemented by artificial lighting during the daytime, if necessary, and if SNiP requirements are not met.

Comfortable working conditions are created by standard illumination, which should provide the necessary insolation, reduce glare and blindness during certain daytime hours.

To improve the conditions of comfortable stay of people in buildings, it is necessary to develop a method for modeling the probability of glare from natural light in rooms with smart windows, with a built-in lattice optical filter.

The impact of external physical conditions (temperature, humidity, electric current, light on smart windows allows changing their characteristics, properties and intended functions.

An important factor is the material used in their manufacture.

The main functions of smart windows (reducing, increasing, maintaining the temperature in the room) and protection of space from sun glare (reflection, shine and blindness), related to the object of research.

It should be noted that each type of smart windows has unique properties that affect the feasibility of their use [1,2].

It is known that thermochromic perovskite smart windows are produced on the basis of perovskite - calcium titanate (CaTiO_3) - named after the Russian mineralogist L. A. Perovsky. When exposed to temperature on this material, the color gamut of the ink changes from yellow to black in the temperature range from 25 °C to 120 °C. The color for the LED is blue.

A distinctive feature of smart windows made of vanadium dioxide is that it is used as a thermochromic element that can change color when exposed to a certain temperature regime. Some properties of this material are reflected in Table 1.

Smart windows made of hydrogel are a promising material, since the hydrogel actively regulates the supply of solar energy. The polymer used in this case, as a result of heating, loses the bonds between molecules, which leads to certain difficulties in transmitting sunlight. Reducing the temperature allows the reverse reaction to occur, creating the prerequisites for increasing the throughput of solar energy. In warm periods, the efficiency of light transmission decreases.

Table 1
Some properties of vanadium dioxide

Smart windows	Material	Operating principle	Disadvantages	Colour at low temperatures, transparent	Color at high temperatures, metallic does not allow solar	Elimination of deficiencies

					energy to penetrate into the room, and the temperature does not rise in it	
Thermo-chromic	Vanadium dioxide	Based on the change in color of the material depending on temperature	low light transmittance in semiconductor and metallic states	increases the flow of energy into the room and optimizes the heating system	Color at high temperatures, metallic does not allow solar energy to penetrate into the room, and the temperature does not rise in it	adding new impurities to the material (W, Mo, Nb)

Electrochromic glass. The operation of smart glass is based on the presence of special crystals inside the smart film that change their position under the influence of electric current. When switched off, these crystals are located inside the glass chaotically and create a matte surface (opalescence), and when electric current is applied, the liquid crystals instantly line up parallel to each other, thereby allowing light to penetrate through the glass.

Photochromic smart glass. Windows with adjustable transparency were obtained due to a polymer liquid crystal film located between the glass sheets.

Experimental research conditions. To study the lighting performance of smart windows, a room was used: length 6.2 m, width 4.0 m, height 2.6 m, in which 12 measurement points were installed, located every 1.5 m. The azimuth of the room is 2090 (latitude N 51.8430, longitude E 54.9830, GMT +05:00). Measurements were taken during daylight hours, at one-hour intervals, on the 15th of each month. The angle of incidence of solar rays is less than 67° . The optimal angle of inclination of the gratings $\gamma = 28^\circ$ was calculated, which was obtained by approximating the solar trajectory relative to the window. Calculations were carried out taking into account the conversion factor (equivalent) of $1 \text{ W/m}^2 - 120 \text{ lx}$. with reflectivity of the ceiling, walls and floor - 0.7 (white), 0.48 (beige) and 0.48 (beige). Average reflectivity of surfaces $R = 0.54$. Average reflectivity of surfaces above and below the horizontal, through the center of the window R_c , R_t , are 0.62 and 0.48.

Empirical studies included the development of a set of lighting indicators regulated by lattice smart windows, Table 2 [3,4,5]. The experiments were conducted using a window with a height of 145 mm, a width of 211 mm, a thickness of 24 mm, modification 4-16-4, a single-chamber glass unit with gratings on the inner surfaces of the chamber, the same width of the stripes of 10 mm. A photochromic device with deposited layers of tungsten oxide, platinum and titanium oxide was

used, with a transmittance coefficient in the discolored state of 0.7, and in the colored state of 0.3. The color appears, as a rule, in a sunnier time of the year, approximately from May to early October. Due to the fact that the window is oriented in the western direction, then in the above-mentioned months, in the first half of the day there is no direct sunlight.

The studies were conducted for a chromogenic window with a coating and a window without a coating. Glass parameters such as absorption of 0.02 mm⁻¹ and glass refraction of 1.5 were established and the angles of the grating tilt of the characteristic angle and the widths of all filter bands were calculated.

Table 2
Complex of lighting parameters regulated by lattice smart windows

Quantitative indicators			
Luminous flux, lumens, lm	Radiation from a light source in different directions		F
Luminous intensity, cd	Intensity of light emitted in a certain direction	dF - elementary luminous flux dw - elementary solid angle to the value of this angle	$I = dF / dw$
Illumination, lux, lx	Surface area on which the luminous flux falls	dF - incident luminous flux ds - illuminated area	$E = dF / ds$ $E = F / S \cos \alpha$
Brightness, cd/m ²	Photometric value characterizing the emissivity of extended bodies in a given direction	dI - luminous intensity of the reflected surface in the direction α S - surface area	$L = I / S \cos \alpha$
Luminosity, lm/m ²	Reflected or transmitted luminous flux	dF - luminous flux reflected or transmitted by the surface, ds - surface area	$M = F / S$
Quality indicators			
Reflectivity		F_{omp} - reflected luminous flux F_{nao} - incident luminous flux	$p = F_{отр} / F_{пад}$
Glare Index	Criteria for assessing glare	S - glare coefficient, $S = V_1 / V_2$	$p = (S - 1) 1000$
Reflected Glare	Reduced visibility due to excessive brightness	Reflection of light flux from a surface	

Discomfort Glare	$UGR = 8 \lg \left[\frac{0,25}{L_a} \sum_{i=1}^N \frac{L_i^2 \omega_i}{p_i^2} \right]$	L_c – luminance of the glare source, cd/m ² ; ω – angular size of the shining source, ster; φ_0 – index of the position of the glare source relative to the line of sight; L_{ad} – adaptation brightness, cd/m ² .	$M = \frac{L_c \omega^{0,5}}{\varphi_0 L_{ad}^{0,5}}$
---------------------	---	---	---

Based on the results of the experimental studies, graphical dependencies of KEO% on the distance to the measurement point were constructed, Figure 1.

Research tools. Measurements were carried out using the TESTO 480 0 - 100,000 Lux device. The integrated memory capacity is up to 10,000 measurements. Operating temperature range is 0 - +40 °C. Overall dimensions are 81 x 235 x 39 mm.

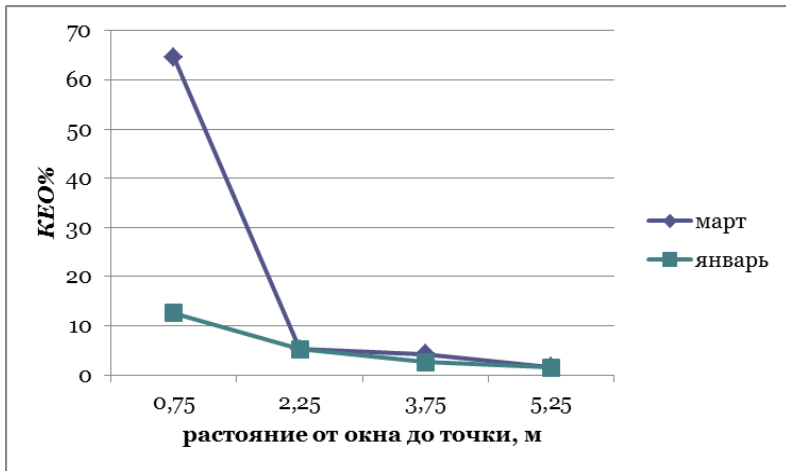


Figure 1. Graphic dependence of KEO% on the distance to the measurement point

The orientation of the device, when taking readings, was carried out in two directions: towards the window and towards the wall located perpendicular to the window. Figure 2 shows the dependence of illumination on the time of day, readings were taken on the 15th in the range of months December - May, with the orientation of the device towards the window. Readings were taken every hour from 10:00 to 20:00, local time (Orenburg Oblast).

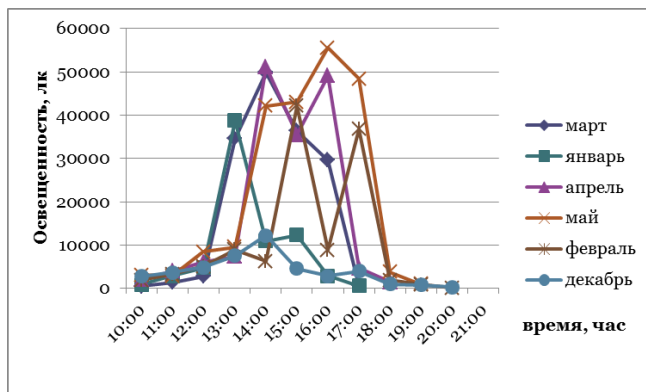


Figure 2. Orientation of the device when measuring towards the window

The graphic dependencies demonstrate the illumination level, which, taking into account the discomfort indicators and established standards, shows the possibility of glare, above 20,000 lux.

Figure 3 shows similar graphic dependencies when the device is positioned towards the wall, located perpendicular to the direction of the window. The peak value is observed in the indicators taken in May, from which glare begins to occur, above 20,000 lux.

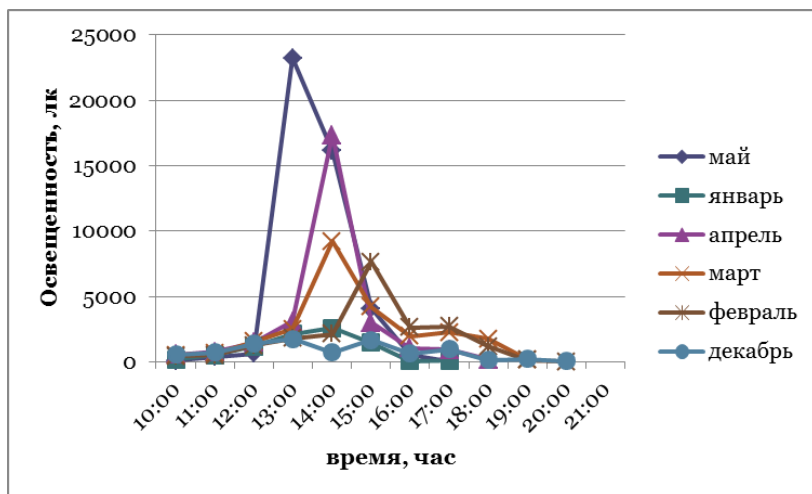


Figure 3. Orientation of the device when measuring towards the wall (west)

In accordance with the International Building Codes and Standards, discomfort indicators for natural lighting have been established. The glare probability indicator DGP was used, the calculations of which are based on formula (1) developed by Vinold and Christopheren and modified by Rustam Sabirovich Zakirullin (professor of the Department of TGVIGM, Orenburg State University).

$$DGP = 5,87 \cdot 10^{-5} \cdot E^v + 9,18 \times \log_{10} \left(1 + \sum_i \frac{L_{s,i}^2 \omega_{s,i}}{E_v^{1,87} P_i^2} \right) + 0,16 \quad (1)$$

Having carried out a step-by-step calculation of the parameters included in the formula for determining DGP, the condition for the appearance of glare is determined if:

$DGP < 0,35$ – glare is unnoticeable and insignificant;

$DGP = 0,35-0,4$ – glare is noticeable but does not cause discomfort;

$DGP = 0,4-0,45$ – glare is noticeable and causes discomfort;

$DGP > 0,45$ – unbearable (intolerable) glare.

References

1. Gunko N.M. Smart glass, a method for calculating the probability of daylight glare / N.M. Gunko, A.G. Bikeeva, A.P. Ivanova // In the collection: Science, education, transport: topical issues, priorities, interaction vectors. Proceedings of the II International Scientific and Methodological Conference. Orenburg, 2023. Pp. 44-47.
2. Gunko N.M. Functionality of organic glass as an alternative to silicate / N.M. Gunko, A.I. Kaluzhina, A.P. Ivanova / In the collection: Science, education, transport: topical issues, priorities, interaction vectors. Proceedings of the II International Scientific and Methodological Conference. Orenburg, 2023. Pp. 47-51.
3. Zakirullin R.S. Modeling of heat gain from solar radiation through lattice smart windows // R.S. Zakirullin, I.A. Odenbach, N.M. Gunko, N.A. Gorkov, V.A. Girin, E.A. Pikalova. Academia. Architecture and Construction. 2023. No. 3. Pp. 132-139.
4. Odenbach I.A. Optimization of natural lighting and insolation of buildings with curved facades / I.A. Odenbach, R.S. Zakirullin. In the journal: Academia. Architecture and Construction, 2021. No. 2. Pp. 111-116.
5. Zakirullin R.S. Double-grating optical filter for smart windows// R.S. Zakirullin, I.A. Odenbach, N.M. Gunko, V.A. Girin. Third International Conference on Optics, Computer Applications, and Materials Science (CMSD-III 2023). Washington, 2024.

通过方法创建和生产复合材料“溶胶-凝胶”
**CREATION AND PRODUCTION OF A COMPOSITE SUBSTANCE
“SOL-GEL” BY THE METHOD**

Atambekova Aigerim Kenjebekovna

Applicant

I. Arabaev Kyrgyz State University

摘要。本文研究了在酸性介质中由氧化钡 (BaO)、三氧化二锑 (Sb₂O₃)、PVA (聚醋酸乙烯酯) 和H₂O的复合材料制备“溶胶-凝胶”糊剂的方法。为了有效形成复合物,使用电动搅拌器结合机械搅拌1.0小时,得到符合公式Ba_{0.5xx}Sb_{1.0xx} PVA_{6x} H_{200.5x} (其中x = 0.5: 1.0: 6.0: 0.5)的多组分物质。这些复合物形成反应的研究基于有机络合物与金属离子的相互作用。因此,“溶胶-凝胶”过程包括在特定温度范围(30–35° C)下的水解,后者的机械作用导致进一步聚合,形成粘稠的树脂(凝胶)。确定了“溶胶-凝胶”化合物在50–55° C温度下的结晶。所得复合物类型化合物称为聚醋酸乙酯锑钡。

关键词: 溶胶、凝胶、干凝胶、气凝胶、胶体、结晶、介质、凝固、聚合、水解、形成核、复合物形成、干燥、糊状物、氧化钡、三氧化锑、加热器、聚乙烯醇、水乳胶漆。

Abstract. The article studies the mode of obtaining a “sol-gel” paste from a composite substance of barium oxide (BaO), antimony trioxide (Sb₂O₃), PVA (polyvinyl acetate) and H₂O in an acidic medium. For effective complex formation, an electric stirrer was used with mechanical stirring for 1.0 hours, resulting in a ratio of a multicomponent substance in accordance with the formula Ba_{0.5xx}Sb_{1.0xx} PVA_{6x} H_{200.5x} (where x = 0.5: 1.0: 6.0: 0.5). Studies of these reactions of complex formation are based on the interaction of organic complexones with metal ions. Thus, the “sol-gel” process includes hydrolysis at a certain temperature range, 30–35 ° C, and the mechanical actions of the latter lead to further polymerization with the formation of a viscous resin (gel). Crystallization of the “sol-gel” compound at a temperature of 50–55 ° C is determined. The resulting compounds of the complex substance type are called barium polyvinyl acetate antimony

Keywords: sol, gel, xerogel, aerogel, colloid, crystallization, medium, coagulation, polymerization, hydrolysis, formation nucleus, complex formation, drying, paste, barium oxide, antimony trioxide, heater, PVA, water-emulsion paint.

Introduction.

The development of labor-intensive technologies has led to the need to develop methods for the synthesis of new organic compounds and the creation of materials with various properties based on them. Among the compounds for which there is a possibility of targeted change in properties are, first of all, materials (compounds) structural transformations of the substance of which can be accompanied by significant changes in its mechanical, electrical, thermal or magnetic characteristics, as well as the emergence of qualitatively new properties. In this regard, the definition of the stability regions of the physical properties of a substance is of great interest. Regarding external conditions and the nature of their changes accompanying structural transformations. Theoretical study of structural phase transitions in crystals allows us to significantly expand our understanding of the mechanisms of formation of instabilities of their structures, the formation of ordered states and the nature of changes in their physical properties. Sol-gel technology is widely used in the synthesis of nanodispersed materials: ceramic films of coatings and powders, fibers, bulk dense and porous materials. The classical sol-gel method is a physicochemical process based on the hydrolysis reaction with subsequent stages of the appearance of a new phase and the formation of a gel or separation of the precipitate. In its most complete form, this process is implemented in sol-gel technologies of nano-dispersed silica. There are many methods for synthesizing the initial compounds for the manufacture of ceramic materials. Very often, when developing the “sol-gel” method, nitrates of the required metals are used, and colloidal particles of sols are obtained in the form of metal nitrates [1]. The invention relates to methods for obtaining compounds of complex composition, in particular barium magnoniobate and magnetantalate, and can be used for the production of materials for electronic equipment, for example, when obtaining a batch of capacitor ceramics. A method is known for obtaining compounds of the composition $A(B^{I}_{1/3}B^{II}_{2/3})O_3$, where A is a divalent metal, B^I is a divalent or trivalent metal, B^{II} is a pentavalent or hexavalent metal, which includes preparing alkoxides of the corresponding metals, dissolving them in an organic solvent in a ratio corresponding to the formula indicated above, hydrolyzing the metal alkoxides by introducing water or steam into the solution at 0-200°C, obtaining a precipitate in the form of a mixture of metal alkoxide hydrolysis products, and high-temperature heat treatment to convert the mixture into the corresponding compound. The method is complicated by the need to prepare alkoxides of all elements participating in the reaction and high-temperature heat treatment to obtain a compound from the mixture obtained during hydrolysis. The closest to the proposed method in terms of technical essence and the achieved result is a method for obtaining perovskite-type compounds of the composition $Ba(Mg_{1/3}\Theta_{2/3})O_3$, where Θ is Ta, Nb, which includes the preparation of alkoxides (isopropylates or

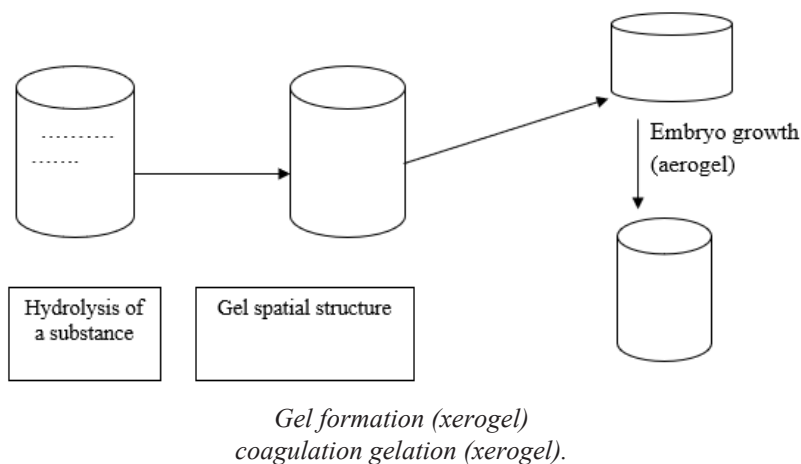
ethylates) of aryl, magnesium and tantalum (or niobium), mixing them in an organic solvent, which is a mixture of one of the non-polar organic solvents (benzene, toluene, xylene, ethylbenzene, hexane, heptanol, hexanol), and one of the polar organic solvents (methanol, ethanol, propanol, butanol, introducing water for the hydrolysis of the metal alkoxides Ba, Mg and Ta or Nb) at a mixture temperature of 85 °C and higher until a ratio of water to the alkoxy group $[H_2O][OR]$ of 1:1-50:1 is ensured, separating the precipitate obtained during hydrolysis from the mother liquor by centrifugation or filtration and drying obtained as a precipitate of the compound (mixture) in air at 120 °C. The method involves separate production of alkoxides of all elements participating in the reaction, their isolation and dosing, a stage of drying the solvent and does not allow obtaining powdered compounds with a high content of the crystalline perovskite phase without additional high-temperature heat treatment, which negatively affects the possibility of obtaining powders of uniform particle size. In accordance with the proposed invention, a method for producing perovskite-type compounds of the composition $Ba((Mg_{1/3}\Delta_{2/3}))O_3$, where Δ is Ta, Nb, involves preparing an alkoxide (butylate or methyl cellosolve) of tantalum or niobium, mixing it with an organic solvent (methyl cellosolve), introducing barium and magnesium elements in the form of metals into the resulting solution, heating the resulting mixture to 80-90°C until magnesium is completely dissolved, slowly introducing water into the resulting solution with vigorous stirring and boiling at a ratio of $[H_2O] [OR]$ of 20: 1 (not less) followed by boiling the reaction mixture for 2-4 hours, separating the precipitate from the mother liquor by centrifugation and drying the compound obtained as a precipitate in a vacuum at 100-120°C. Example 1. Prepared tantalum butoxide $Ta(OBu)_5$ is dissolved in methyl cellosolve $CH_3OC_2H_4OH$. The concentration of tantalum (Ta) in the solution is determined by the gravimetric method. A reaction flask equipped with a reflux condenser, dropping funnel and stirrer is charged with 100 g of a solution containing 4.68 wt. % Ta (0.025 g-at). 0.3 g (0.0125 g-at) of metallic magnesium (Mg) in the form of shavings and 5.3 g (0.038 g-at) of metallic barium (Ba) suspended under a layer of kerosene are introduced into the resulting solution. Intensive dissolution of barium is accompanied by heating of the reaction mixture and formation of a precipitate, which subsequently dissolves. Heating to 80-90 °C is required for complete dissolution of magnesium. The resulting yellowish-transparent solution is stable during storage. The solution is then hydrolyzed with excess water ($[H_2O] [OR]$ 20:1) under intensive stirring. After hydrolysis, the reaction mixture is boiled in a flask equipped with a reflux condenser for 2 hours, then the precipitate is separated from the mother liquor by centrifugation and dried in a vacuum at 100 °C. The X-ray diffraction pattern of the dried product (powder) corresponds to the cubic phase of perovskite of the $Ba(Mg_{1/3}Ta_{2/3})O_3$ compound. [2]. In the article [3], the modes of obtaining a sol-gel

paste from multicomponent substances barium chloride (BaCl_2), strontium chloride (SrCl_2), triantimony oxide (Sb_2O_3) and citric acid in a liquid medium by the complexometric (chelate) method are studied. During the formation of the compounds, the pH of the medium was 5.5 units, and the temperature range was 40-42 °C. An electric stirrer was used for effective complex formation. The ratio of multicomponent substances according to the formula $\text{Ba}_{1x} \text{Cr}_{x1} \text{Sb}_{1x} \text{JK}_{1x}$ (where $X=1:1:1:1$). The study of these reactions of complex formation is based on the interaction of organic complexones with metal ions. Thus, the “sol-gel” process includes hydrolysis in a certain temperature range and the mechanical actions of the latter lead to further polymerization with the formation of a viscous resin (gel), resulting in a homogeneous white liquid substance, which is a nano substance. Methods for obtaining a perovskite compound of similar composition have been studied [4]: $\text{Ba}_{0.5x} \text{La}_{0.5x} \text{O}_{1x}$ (where $X=0.5:0.5:1$). The multicomponent composition was obtained in the process of gelation coagulation (xerogel) pH = 5.5 in an acidic medium, at a temperature of 45-50 °C, with mechanical stirring for 10 hours. Crystallization of the “sol-gel” compound at a temperature of 400-500 °C was determined and the preliminarily obtained substance was called barium *lanthonyloxalate*. In the article [5] the technology of obtaining barite concentrate (barium sulfate) from the Tuya-Moyunskoye deposit using specific organic precipitating reagents by sequential application was investigated and studied. Organic precipitating reagents form a precipitate of the intra-complex compound of metals. Metal impurities are precipitated on the basis of extraction and in the work inorganic precipitating reagents were experimentally studied, with the sequential use of reagents, precipitation of impurities of metal compounds, in the final stage using H_2SO_4 , $(\text{NH}_4)_4\text{SO}_4$ precipitate barium sulfate. Barium sulfate is then washed with distilled water to a neutral medium, and when heated to a temperature of 300 °C, adsorbed compounds are released. Based on gravimetric analysis, it was determined that the barite ore of the Tuya-Moyunskoye deposit contains about 58.39% and 41.61% barium sulfate. [6]

Experimental part

Good complex formers of three antimony oxides are (aliphatic and PVA (polyvinyl acetate)). To obtain a “sol-gel” solution from the paste, a colloidal solution with the following chemical composition was used: barium oxide (BaO) + antimony trioxide (Sb_2O_3) + PVA (polyvinyl acetate) + water (H_2O) in an acidic medium pH = 3.2 units. The essence of the experiment is to prepare a solution of calcium oxide, antimony trioxide PVA (polyvinyl acetate), and water in an acidic medium. For effective complex formation of the substance, an installation with an electric stirrer of 1200 revolutions, continuously operating for 0.5 hours, at a temperature of 30-35 °C was used. Thus, the “sol-gel” process turns off hydrolysis, for polymerization, an organic solvent PVA (polyvinyl acetate) is involved in the

reaction. Contents multicomponent colloidal solution is expressed by the formula $Zn_{0.5xx} Sb_{1.0xx} PVA_{6x} H_2O_{0.5x}$ (where $x=0.5:1.0:6.0:05$). Thus, the “sol-gel” process includes the following stages:



After coagulation of the solution, the resulting substance was loaded into a special container at a temperature of 50-55 °C, held for 20 minutes. The resulting substance can be preliminarily called zinc polyvinyl acetate antimony

Conclusions:

1. The study showed that in the studied system in an acidic medium (pH = 3.2) at a temperature of 30-35 °C, with an electric stirrer, a “sol-gel” compound, zinc polyvinyl acetate antimony, was synthesized
2. Coagulation of the substance was carried out at a temperature of 50-55 °C, for 20 minutes.
3. Coagulation gelation (xerogel) obtained from three antimony oxides can be used as a water-emulsion paint for construction.

References

1. Nazarov, V.V. Medvedkova, N.G. Grishchenko, L.I. Tyumenev, A.F. Frolov, Yu.G. *Synthesis of colloidal-chemical properties of titanium dioxide hydrosol. Sol-gel processes for obtaining inorganic materials. Ekaterinburg. 1996.P. 43-50.*
2. Russian Federation Patent No. 2051105 Method for obtaining perovskite-type compounds 12/27/1995
3. A.K. Atambekova, Y. Tashpolotov, E.M. Ysmanov *Obtaining a “sol-gel” paste in BaCl₂-ScCl₂-Sb₂O₃ complex systems based on citric acid and H₂O at a*

temperature range of 40-42 °C // Bulletin of Science and Practice Vol. 5. No. 11. 2019. P. 50-53.

4. Y. Tashpolotov, E.M. Ysmanov, A.K. Atambekova *Creation and production of a composite substance of barium lanthonyl oxalate based on sol-gel technology // Bulletin of Science and Practice 2020. Vol. 6. No. 8. P. 45-49.*

5. A.K. Atambekova, Y. Tashpolotov *Creation and production of barite concentrate from the Tuyu-Moyun deposit // scientific and information journal Materials Science, Bishkek, No. 2/2020 (34). P.*

6. V.V. Nazarov, N.G. Medvedkova, L.I. Grishchenko, A.F. Tyumenov, Yu.G. Frolov *Synthesis and colloidal-chemical properties of titanium dioxide hydrosol // Sol-gel processes for obtaining inorganic materials. Ekaterinburg, 1996. P. 43-45.*

春软小麦新育种材料Milturum和Ferrugineum的产量与品质
**PRODUCTIVITY AND GRAIN QUALITY OF NEW BREEDING
MATERIAL OF SPRING SOFT WHEAT VARIETIES MILTURUM
AND FERRUGINEUM**

Stepanova Natalia Alexandrovna

Senior Research Officer

Sidorenko Vladimir Sergeevich

Candidate of Agricultural Sciences

Yandubaykin Evgeniy Evgenievich

Applicant for a degree

Federal Scientific Center of Legumes and Groat Crops,

Orel, Russian Federation

摘要: 本文对春小麦品种米尔图鲁姆 (Milturum) 和费鲁吉姆 (Ferrugineum) 的育种材料进行了产量和籽粒品质研究, 获得了两年多的试验数据。结果表明, 米尔图鲁姆和费鲁吉姆两个品种的育种系在产量上与标准品种达利亚 (Daria, Lutescens) 无显著差异。所有品种样品的籽粒品质均符合面粉和谷物生产的要求。米尔图鲁姆A11和费鲁吉姆B5育种系的产量高于标准品种达利亚。穗部红色对蛋白质、淀粉和面筋含量有积极的影响。基于结构分析和其他分析结果, 首次鉴定出高蛋白质和高面筋含量的育种系: 米尔图鲁姆-L57、米尔图鲁姆970和米尔图鲁姆B5, 并获得了具有一系列优良性状的、可用于高产育种的新原始材料, 可作为源材料。

关键词: 春软小麦, 彩色穗, 产量, 籽粒品质指标。

Abstract. *In this article, experimental data on the study of the breeding material of spring wheat varieties Milturum and Ferrugineum in terms of yield and grain quality were obtained. Over two years of research, the data obtained showed that the breeding lines of the Milturum and Ferrugineum varieties were not significantly inferior in yield to the standard variety Daria (Lutescens). In terms of grain quality, all variety samples meet the requirements for the production of flour and cereals. The breeding lines Milturum A 11 and Ferrugineum B5 had a higher yield than the standard Daria. The red color of the ear had a positive effect on the content of protein, starch and gluten. Based on the results of structural and other analyses, new breeding lines with a high content of protein and gluten were identified for the first time: Milturum -L57, Milturum 970, Milturum B5 and new*

original material with a set of positive traits for breeding for high productivity as a source material was obtained.

Keywords: *spring soft wheat, colored ear, yield, grain quality indicators.*

Introduction. Spring soft wheat is one of the leading food crops in Russia. Increasing yield and improving grain quality are the most important tasks facing breeders. However, in recent years, the country has seen a trend towards a decrease in the commercial quality of grain.

Currently, one of the key factors in solving the problem of effective functioning of crop production is the creation of adapted varieties that include resistance to biotic and abiotic stressors. According to various estimates, the variety accounts for up to 40% of the total increase in the yield of the most important agricultural crops. And spring soft wheat is no exception.[1]

Successful creation of varieties that combine high yield with resistance to adverse environmental conditions requires a detailed study of the morphophysiological and economically valuable traits of plants and their interaction in specific environmental conditions. [2, 5] The varieties of spring soft wheat grown in our country are predominantly white-eared, belong to the varieties *Erythrospermum* (white, awned) and *Lutescens* (white, awnless), which often complicates their identification during varietal control. Therefore, for production conditions, red-eared wheat varieties *Milturum* (red, awnless) and *Ferrugineum* (red, awned) are of undoubted interest. The lower prevalence of red-eared wheat in production is often explained by scientists by their insufficient drought resistance and, as a result, low production capabilities. It is also known that the frequency of alleles that determine the red color of the ear increases significantly in regions with insufficient heat supply during the growing season.[3,4]

The purpose of the research is to conduct a comparative analysis of the yield and grain quality of spring soft wheat of the *Milturum* and *Ferrugineum* varieties.

Methodology. Experimental crops of spring soft wheat were placed on the crop rotation fields of the selection center of the Federal Scientific Center of the ZBK. The predecessor was bare fallow. Soils were dark gray forest, medium loamy, moderately cultivated. The microrelief of the site was leveled. According to the main physicochemical indicators, these soils are typical for this natural and economic zone.

In the competitive variety testing, the total area of each plot was 8.25 m² (width 1.65 m x length 5.0 m). The accounting area of the plot was 7.5 m². The number of rows per plot is 10, the row spacing is 15 cm, and the repetition is 3-5 times. Sowing was carried out using the SKS-6-10 selection seeder (portion and cassette versions). The seeding rate is 5 million viable grains per hectare. The objects of the research were new selection lines created at the Federal State Budg-

etary Scientific Institution FSC LGC, the standard is the Daria variety (Lutescens). The biochemical composition of the grain was determined using the Infratec 1241 Grain Fnalizer (Foss, Denmark). Program WH990226. Results and discussion. According to our research, the yield of soft spring wheat lines of the Milturum and Ferrugineum varieties in competitive variety testing averaged 7.25 t/ha in 2023 and 3.75 t/ha in 2024. In terms of yield, the soft spring wheat lines were not much inferior to the Daria standard, less than 0.6%. Some lines significantly exceeded the yield of the Daria standard. Thus, the highest yield over two years of research in comparison with the standard was noted in the selection lines Ferrugineum B (6.313 t/ha) and Milturum A 11 (6.076 t/ha) (Table 1).

Table 1
Productivity of selection samples of spring soft wheat

Variety, line	Yield, t/ha		
	2023 r.	2024 r.	Average
Daria	8,167	3,941	6,054
Milturum A 11	8,774	3,378	6,076
Milturum B 5	8,400	3,338	5,869
Milturum D10	-	4,025	-
Milturum 970	-	3,944	-
Milturum D13	6,542	3,108	4,825
Milturum L-57	6,762	4,101	5,431
Milturum F14	-	3,991	
V.Lis (Sumer)	6,929	4,096	5,512
(GR x L 57) x Bombona	6,119	3,394	4,756
Ferrugineum B5	8,400	4,227	6,313
(GR x L57) x Cornetto	6,119	2,557	4,338
V.Lis ferreginum	-	3,734	-
HCP ₀₅	0,426	0,313	0,369

The grain quality of spring wheat varieties, among other factors, is determined by their adaptive capacity to specific agroecological conditions. For wheat, the most important priority, along with increasing potential productivity and environmental sustainability, is the technological quality of grain, increased protein content in grain. In the Oryol Oblast, the yield properties and grain quality of spring wheat varieties have been poorly studied, and the grain of soft wheat varieties often does not meet the requirements of the processing industry. [4,5] In terms of grain quality, all variety samples meet the requirements for the production of flour and cereals. New breeding lines with high protein content (more than 15%) and gluten (more than 28%) have been identified: Milturum L57, Milturum 970, Milturum B5. The conclusion has been confirmed that breeding lines of wheat

with colored ears with equal yield form higher grain quality. In terms of starch content, over two years of research, the breeding lines of spring soft wheat were not significantly inferior to the standard variety Daria. In 2024, the Milturum 970 breeding line provided a high protein yield per hectare of 0.65 t/ha. (Table 2).

Table 2
Quality indicators of breeding samples of spring soft wheat

Variety	Protein, %		Starch, %		Gluten, %	
	2023 r.	2024 r.	2023 r.	2024 r.	2023 r.	2024 r.
Daria	13,9	14,3	66,5	64,8	25,4	25,4
Milturum A 11	14,4	16,0	64,9	61,2	25,8	29,1
Milturum B 5	-	15,5	-	61,3	-	26,4
Milturum D10	-	14,8	-	62,4	-	25,7
Milturum 970	-	16,4	-	58,8	-	26,5
Milturum D13	13,7	14,9	63,9	59,7	22,7	23,8
Milturum L-57	16,1	15,2	63,3	63,4	31,3	27,8
Milturum F14	-	14,2	-	61,4	-	23,3
V.Lis (Sumer)	14,1	14,9	63,4	62,6	25,5	25,7
(GR x L 57) x Bombona	13,7	15,0	64,2	59,8	23,2	24,4
Ferrugineum B5	13,5	14,1	65,5	64,6	21,0	24,2
(GR x L57) x Cornetto	13,7	15,4	65,4	60,6	23,5	26,5
V.Lis ferreginum	-	14,6	-	63,1	-	25,4
HCP ₀₅	0,8	1,02	1,9	2,48	2,8	2,31

Consequently, new selection lines of spring soft wheat varieties *Milturum* and *Ferrugineum*, grown in the conditions of the Oryol region, differ in biochemical indicators of grain quality, and they are not inferior in yield and surpass the standard variety in grain quality.

Conclusion. According to the data obtained over two years of research, it was shown that the selection lines of the Milturum and Ferrugineum varieties were not significantly inferior in yield to the standard. The selection lines Milturum A 11 and Ferrugineum B5 had a higher yield than the standard Daria. The red color of the ear had a positive effect on the content of protein, starch and gluten. In terms of grain quality, the standard was inferior to the selection lines with a colored ear. New selection lines with a high protein content (more than 15%) and gluten (more than 28%) were identified: Milturum -L57, Milturum 970, Milturum B5. The study of breeding lines of spring soft wheat with colored ears allows us to determine with sufficient accuracy the role of this trait in the formation of yield and grain quality. The results obtained can be used to create variety models and directly in the breeding process.

References

1. Stepanova N.A., Sidorenko V.S., Yandubaykin E.E. *Comparative assessment of spring soft wheat in terms of yield and grain quality / Collection of scientific articles based on the results of the International Scientific Forum SCIENCE AND INNOVATIONS – MODERN CONCEPTS - 2024 - Moscow: Infinity Publishing House - 125 p. ISBN 978-5-905695-78-0*
2. Sidorov A.V., *Influence of ear color on the yield and grain quality of spring wheat. / Bulletin of Krasnoyarsk SAU. – 2014. – No. 1 (88). – P. 69-72. – EDN RXKRUH.*
3. Khlestkina E. K. *Genes determining the color of various organs of wheat / Vavilov Journal of Genetics and Breeding. – 2012. – Vol. 16. – No. 1. – P. 202-216.*
4. Nikitina V. I. *Influence of morphological traits of the ear and grain on the yield of spring soft wheat in the conditions of the Krasnoyarsk forest-steppe / V. I. Nikitina, E. M. Gromova // Bulletin of the Buryat State Agricultural Academy named after V. R. Filippov. – 2009. – No. 3 (16). – P. 99-102. – EDN KYUFOL.*
5. Stepanova N. A. *Cluster analysis of varieties and breeding lines of spring soft wheat based on structural analysis and grain quality indicators // Grain legumes and cereal crops. – 2023. – No. 2 (46). – P. 107-116. – DOI 10.24412/2309-348X-2023-2-107-116. – EDN WYBVMP.*

DOI 10.34660/INF.2025.44.94.055

中部黑土地区集约化有机农业大豆植株有效植被管理技术
**EFFECTIVE TECHNIQUES FOR MANAGING THE VEGETATION
OF SOYBEAN PLANTS FOR INTENSIVE AND ORGANIC
FARMING IN THE CENTRAL BLACK EARTH REGION**

Semenov Alexey Sergeevich

Applicant for a degree

Stepanova Natalia Alexandrovna

Senior Research Officer

Starikova Zhanna Viktorovna

Research Officer

Federal Scientific Center of Legumes and Groat Crops,

Orel, Russian Federation

摘要。本文探讨了在限制使用化学药剂的情况下提高豆科作物可持续性生产的新技术潜力，这将成为发挥新品种生物潜力和应用新技术管理大豆作物的基础，同时兼顾当地生物气候潜力的特点。叶面喷施Ultramag combi以及Ultramag combi与Biostim油籽油的组合对两个品种的产量形成均产生了积极的影响。可以推测，由于形态生理特性，大豆品种Lider 1在生殖发育期间对缺水等胁迫因素的作用具有更强的抵抗力。结果表明，在大豆新品种Mezenka和Lider 1上联合使用两种制剂两年后，最有效的方案是使用两种叶面肥Ultramag combi和Biostim oilseed，用量为0.5升/公顷，与对照相比，产量增幅最高，为9.40%。

关键词：大豆，技术，有机农业，产量，植被管理，叶面施肥。

Abstract. This article identifies the potential of new technologies for increasing the sustainability of leguminous crop production with limited use of chemicals, which will serve as a basis for realizing the biological potential of new varieties and applying new technologies for managing soybean vegetation, taking into account the characteristics of the bioclimatic potential of the territory. Foliar feeding with Ultramag combi and Ultramag combi in combination with Biostim oilseed had a positive effect on yield formation in both varieties. It can be assumed that the soybean variety Lider 1, due to its morphophysiological characteristics, turned out to be more resistant to the action of such a stress factor as lack of moisture during the period of reproductive development. It was found that as a result of the combined use of preparations on new soybean varieties Mezenka and Lider 1 for two years, the most effective option is the one with the use of two foliar

top dressings Ultramag combi and Biostim oilseed at a dose of 0.5 l / ha, which ensured the highest yield increase in relation to the control - 9.40%.

Keywords: soybean, technology, organic farming, yield, vegetation management, foliar feeding.

Introduction. Soybean is the most valuable crop in world agriculture, the production of which has been steadily growing in recent decades. This is due to the exceptionally high content of almost all nutrients in the seeds. In the Central Black Earth Region, due to climatic conditions, it is possible to cultivate only early maturing varieties, which, as a rule, are inferior in yield to varieties with a longer growing season, cultivated in more southern regions. Therefore, one of the main tasks in soybean cultivation is to increase yields by improving cultivation technologies, observing the basic technical requirements /1/ and using advanced technological methods, including the use of complex agrochemicals for seed treatment and foliar feeding during critical periods of plant development /2, 3/. An important method is the use of inoculants based on active strains of rhizobia, which increase the level of symbiotic nitrogen fixation of legumes /4/.

Objective of the work. To develop elements of plant vegetation management technology by using microfertilizers for foliar feeding and amino acid biostimulants of crops to determine the impact on the level of homeostasis of new soybean varieties.

Methodology. The objects of the study were widely new soybean varieties recommended for the Central Black Earth Region and breeding lines. The chemical composition of the preparations studied in the experiment is as follows: Ultramag Combi for legumes, % - N-15; MgO - 2.0; SO₃ - 1.0; B - 0.5; Cu - 0.2; Fe - 0.3; Mn - 0.4; Mo - 0.036; Zn - 0.3; Ti - 0.02; Co - 0.002. Biostim Maslichny is a fertilizer - biostimulant with microfertilizers for oilseeds and legumes: free amino acids of plant origin % - 6.0; N-1.2; MgO - 3.0; SO₃ - 8.0; B - 0.7; Cu - 0.1; Fe - 0.2; Mn - 1.0; Mo - 0.02; Zn - 0.2; Ti - 0.02; Co - 0.02.

Field experiments were carried out with two soybean varieties (Lider 1 and Mezenka). The experiments were repeated four times. The area of the experimental plots was 10 m². Sowing - wide-row, row spacing - 45 cm. Seeding rate - 600 thousand viable seeds per 1 ha. Sowing - with SKS-6-10 seeder. Seed yield accounting - in plots by continuous threshing with the Sampo-130 combine. The experimental design included 5 options:

1. Control (no treatment);
2. Seed treatment (Scarlet ME) - in advance;
3. Basic treatment (Scarlet ME + Rizoform);
4. Basic treatment + Ultramag combi (0.5 l / ha) in the phase of 1-3 true leaves;
5. Basic treatment + Ultramag combi in the phase of 1-3 true leaves + (Ultramag combi (0.5 l / ha) + Biostim oil (0.5 l / ha)) in the budding phase.

The soil of the experimental plot was dark gray forest heavy loamy with an arable layer of 28×30 cm. The fertility level was characterized by the following indicators: pH of salt extract - 4.9-5.0, humus content - 5.0-5.4%, content of mobile forms of nutrients per 100 g of soil: P_2O_5 according to Kirsanov - 11.4-14.5 mg, K_2O according to Kirsanov - 5.7-12.3 mg. The predecessor was winter wheat. Autumn plowing was carried out in September to a depth of 23 ... 25 cm. Pre-sowing soil cultivation in both years included early spring harrowing, primary and pre-sowing cultivation. Sowing was carried out in the middle of the second ten-day period of May.

Results and discussion. The use of Riziform in the basic treatment is intended for the effective formation of the symbiotic apparatus and an increase in the level of biological nitrogen fixation. By the time of the experiments, a large local population of nodule bacteria had formed in the soil of the experimental plot as a result of long-term soybean cultivation, which is confirmed by the formation of nodules on the roots of the control plants (Table 1) in the same quantity as in the inoculated variants. Despite this, inoculation with Riziform increased the level of nodule formation by 6-100%. The use of more active strains compared to local nodule bacteria can be especially noticeable in the effect on the protein content in soybean seeds. Table 1 - Effect of inoculation with Riziform on the symbiotic activity of soybean varieties (number of nodules/weight of nodules); 2023-2024.

Option	LIDER 1			MEZENKA		
	pieces/plant/mg/plant					
	2023	2024	Average	2023	2024	Average
Control	59/708	13/550	36/629	33/421	18/650	25/535
Scarlet ME	50/570	26/920	38/745	28/312	17/490	22/401
Scarlet + rhizoform (basic treatment)	67/889	20/760	43/824	39/481	23/850	31/666
Basic + 1 foliar feeding	73/960	24/1070	49/1015	45/561	30/860	38/710
Basic + 2 foliar feeding	68/780	26/1220	47/1000	38/466	19/680	28/573

Harvesting was carried out at full maturity in plots using the direct method with a Sampo 130 combine (September 7 in 2023 and September 9 in 2024). Foliar feeding with Ultramag combi and Ultramag combi in combination with Biostim oilseed had a positive effect on yield formation in both varieties. The responsiveness to foliar feeding was twice as high in the Mezenka variety in both years as in the Lider-1 variety. The yield increase in the variant with two feedings was 13.0 and 6.2%, respectively, in 2023 and 12.6 and 5.4% in 2024. In quantitative terms, the increase in the variant with two foliar applications was 0.18 and 0.32 t/ha in 2023 and 0.13 and 0.31 t/ha in 2024 for Lider-1 and Mezenka, respectively. Comparing the yield of the studied varieties, it should be noted that in 2023, the

Lider 1 variety exceeded the Mezenka variety by an average of 0.36 t/ha in the experiment: 2.99 and 2.63 t/ha, respectively (Table 2).

Table 2
Yield of soybean varieties (t/ha).

Option	LIDER 1		MEZENKA		Average by option
	2023	2024	2023	2024	
Control	2,90	2,41	2,47	2,46	2,56
Scarlet ME	2,97	2,45	2,53	2,60	2,64
Scarlet + rhizoform (basic treatment)	2,97	2,48	2,60	2,55	2,65
Basic + 1 foliar feeding	3,04	2,50	2,75	2,66	2,74
Basic + 2 foliar feeding	3,08	2,54	2,79	2,77	2,80
Average by variety	2,99	2,47	2,63	2,61	
Average for 2 years	2,73		2,62		
HCP ₀₅	for the variety - 0.05 t/ha, for the variant - 0.08 t/ha				

A two-year trial of the combined use of preparations showed that the most effective, in terms of increasing the soybean grain yield, was the option using two foliar top dressings Ultramag combi and Biostim oilseed at a dose of 0.5 liters / ha, which ensured the highest yield increase in relation to the control - 9.4%.

Conclusion. The obtained new experimental data on the impact of environmental factors on the level of homeostasis of soybean varieties in the Central Black Earth Region reflect the range of changes characteristic of the development of vegetation management technologies for agricultural plants and an integrated system for increasing the productivity of agrophytocenoses. The possibilities of new technologies for increasing the sustainability of leguminous crop production with limited use of chemicals have been identified, which will serve as a basis for realizing the biological potential of new varieties and applying new technologies for managing soybean vegetation, taking into account the features of the bioclimatic potential of the territory. New experimental data on the impact of various factors, including the use of micronutrient fertilizers for foliar feeding and amino acid biostimulants of crops, on the level of homeostasis of new soybean varieties have been obtained. It has also been established that as a result of the combined use of preparations on new soybean varieties Mezenka and Lider 1 for two years, the most effective option is the one with the use of two foliar feedings Ultramag combi and Biostim oilseed at a dose of 0.5 liters / ha, which ensured the highest yield increase in relation to the control - 9.40%.

References

1. Zotikov V.I. *The role of legumes and cereal crops in the adaptability and diversification of crop production* // *Legumes and cereal crops*. No. 3 (11) 2014. P. 3-11.
2. *Special fertilizers* / Shchyolkovo, JSC "Shchyolkovo Agrokhim", 2018. - 132 P.
3. Piskov V.B., Chernyshev V.p., Karakotov S.D. *M-dinitroaromatic moiety as a fragment of biologically active compounds* / Karakotov S.D.// *Pharmaceutical Chemistry journal*, 2016.- V.49.-№11.-P.724-734.
4. Vasilchikov A.G., Akulov A.S. *Vegetation management of promising soybean varieties by using highly effective inoculants*// *Agriculture*. No. 4, 2018. P.19-21.

科学出版物

上合组织国家的科学研究：协同和一体化

国际科学大会的材料

2025年5月7日，中国北京

编辑A. A. Siliverstova

校正A. I. 尼古拉耶夫

2025年5月7日，中国北京

USL。沸点：98.7。 订单253. 流通500份。

在编辑和出版中心印制

无限出版社

