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OF THE SCO COUNTRIES:  
SYNERGY AND INTEGRATION**

上合组织国家的科学研究：协同和一体化

International Conference



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参与者的英文报告

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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。

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## Foreword

*We thank all participants of our conference "Scientific research of the SCO countries: synergy and integration" for the interest shown, for your speeches and reports. Such a wide range of participants, representing all the countries that are members of the Shanghai Cooperation Organization, speaks about the necessity and importance of this event. The reports of the participants cover a wide range of topical scientific problems and our joint interaction will contribute to the further development of both theoretical and applied modern scientific research by scientists from different countries. The result of the conference was the participation of 56 authors from 7 countries (China, Russia, Uzbekistan, Kazakhstan, Azerbaijan, Tajikistan, Kyrgyzstan).*

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

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

**Fan Fukuan,**

*Chairman of the organizing committee of the conference*

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

*Full Professor, Doctor of Economic Sciences,  
member of the Chinese Academy of Sciences*

## 前言

我们感谢所有参加本次会议的“上海合作组织国家的科学研究：协同作用和整合”，感谢您的演讲和报告。代表所有上海合作组织成员国的广泛参与者都谈到此次活动的必要性和重要性。参与者的报告涵盖了广泛的主题性科学问题，我们的联合互动将有助于不同国家的科学家进一步发展理论和应用的现代科学研究。会议结果是来自7个国家（中国，俄罗斯，乌兹别克斯坦，哈萨克斯坦，阿塞拜疆，塔吉克斯坦，吉尔吉斯斯坦）的83位作者的参与。

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

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

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



楚瓦什共和国知识经济的系统观点：问题陈述  
**A SYSTEMATIC VIEW OF THE KNOWLEDGE ECONOMY  
IN THE CHUVASH REPUBLIC:  
FORMULATION OF THE PROBLEM**

**Efremov Oleg Yurevich**

*Candidate of Philosophical Sciences, Associate Professor*

**Mukin Vladimir Antonovich**

*Candidate of Physical and Mathematical Sciences, Associate Professor  
I.N. Ulianov Chuvash State University*

The study was carried out with the financial support of the Russian Foundation for Basic Research and the Cabinet of Ministers of the Chuvash Republic in the framework of the scientific project 18-410-210005p\_a "Comprehensive Study of the Knowledge Economy in the Socio-Cultural Space of the Chuvash Republic".

注解。 本文分析了俄罗斯联邦地区实现知识经济的现有模式，以便为楚瓦什共和国寻找最佳机会。 强调了实施现有知识经济模式的问题，这种模式与缺乏或缺乏与区域社会和经济要素的系统联系有关。

关键词：知识经济，区域经济，大学空间

**Annotation.** *This article analyzes the existing models of the realization of the knowledge economy in the regions of the Russian Federation in order to find the best possible opportunities for the Chuvash Republic. The problem of the implementation of existing models of the knowledge economy, which is associated with the absence or lack of systemic links with elements of a regional society and economy, is highlighted.*

**Keywords:** *knowledge economy, regional economy, university space*

### **Introduction**

A common place today is the attitude towards the modern education system in Russia as being in crisis. From a general philosophical point of view, the crisis is expressed in the search for actual solutions to the problem of learning objectives and ways of learning. What to learn? How to learn? The development of the Internet and computerization over the past 20 years have led to an awareness of the need for new ways to implement education as a system and as a process. One

of the ways to solve the crisis state is the construction of an education system that develops human capital and the production of knowledge and technology. The knowledge economy is understood as the most optimal way to solve the problem of the crisis of education through building a highly efficient society based on human development and knowledge production. That is, labor productivity is the highest. What should be the conditions for the implementation of this idea?

The article is devoted to the philosophical description of ways to solve the problems of building the knowledge economy in Russia and in the Chuvash Republic. The article analyzes the formation of the knowledge economy in the regions of the Russian Federation and discusses the basis for applying a systematic approach to the problem of the formation of the knowledge economy in the Chuvash Republic.

The hypothesis of the article is the assumption that the basic problem of the emerging knowledge economy in the region is the lack of interconnections with other elements of the region as a system. The solution to this problem is seen with the participation of the university complex.

The objectives of the article are to identify an understanding of the economics of knowledge and models of the realization of the knowledge economy in the regions of the Russian Federation, to analyze these models, to determine the basic problem in shaping the knowledge economy for the Chuvash Republic.

### **Results**

The World Bank reports ([www.worldbank.org/kam](http://www.worldbank.org/kam)) use the following characteristics of the knowledge economy:

1. Economic incentives and institutional regimes that ensure the efficient use of resources, the development of creativity, the production and dissemination of knowledge.
2. Education and qualified staff, the availability of opportunities to continuously learn and improve skills in accordance with the development of science and technology.
3. An effective innovation system of enterprises, research centers, universities, creating new knowledge and using global knowledge for regional use.
4. Information infrastructure for the transfer, distribution and processing of knowledge.

In general, it is possible to dwell on the indicators of the World Bank for studying in conditions for the realization of the knowledge economy.

In the scientific literature there are many different interpretations of the knowledge economy. The knowledge economy is understood as the creation of new knowledge and commodity-money relations about this knowledge. [10; Pp. 108] Or it emphasizes the role of universities in the development of an innovative economy, through participation in the creation of a new industry, new ways of economic relations, etc. [4] In the triple helix model G. Etzkowitz, the key partici-

pants in the knowledge economy here are the state, enterprises, and universities. And the leading role is played by universities. But here a special type of university is understood - entrepreneurial.

Kochergin D.G. gives a model of consideration of the economy (on the example of the Kemerovo region) knowledge on the basis of a systematic approach, which emphasizes the negative impact on the region of the presence of highly developed regions where intellectual and production resources go. [2; p. 114-115]

Tskhadya, N. D., Zykov V.A., Belyaeva O.I. consider the role of technology parks for the development of a regional knowledge economy (using the example of the Komi Republic) on the basis of the “education - science - production” model. [9; P. 109] Here, technology parks have the necessary status and are supported by the state, facilitate communication between developers and consumers, connect universities with the labor market. That is, technoparks act as integrators of participants in the regional knowledge economy. [9; p. 115]

Another widely discussed model of the development of the knowledge economy in the regions is based on Special Economic Zones. Here [1] economic stimulation in the development of the knowledge economy (for example, the city of Tomsk) is primarily implemented. It is noted that Special Economic Zones are primarily the state’s infrastructure investments. However, the implementation and implementation of high-tech products is difficult due to deficiencies in the management of infrastructure facilities. [1; p. 286]

Insufficient knowledge of the knowledge economy for the regions is noted by Popov E.V., Vlasov M.V., Kochetkov D.M. [ ] Authors based on 18 indicators [8; p.108] developed a model for assessing regions for the development of the knowledge economy. This model was originally developed to compare and evaluate regional economies, but not to develop conditions for the formation of a knowledge economy. The Chuvash Republic in the authors' model occupies the 12th place among all the subjects of the Russian Federation. It is noted that the republic is distinguished by a high level of knowledge production and at the same time a very low level of its implementation in the economy (in terms of gross regional product). [8; p. 113]

Thus, these models show:

- examples of economic activities (special economic zones), institutional forms of integration (technoparks) and university innovation activities in the formation and development of the knowledge economy in the constituent entities of the Russian Federation;

- working and established (understandable) practices of implementing the knowledge economy in Russia.

Therefore, we can assume that for the development of the knowledge economy in the regions, it is necessary to solve the problems that have formed as part of the implementation of these models.

However, with all the positive aspects of the models, their drawbacks are noticeable. Economic measures and infrastructure investments alone are not effective. Investments involve their management, focused on their return, that is, earning income, which complicates the economic activity of enterprises, especially at the initial stage. High rents, lack of housing, difficult access to infrastructure lead to a slowdown in innovation, does not contribute to the introduction of innovative products. Similar problems arise with technoparks. If we consider the leading role of universities, then the implemented models consider entrepreneurial universities with significant funding. There are no entrepreneurial universities in Russia. The main problem for all models is intellectual migration, the “brain drain”, which plays a negative role in Russia - any employee always has the opportunity to go where it is better, including abroad. There are no effective solutions to these problems.

Which of the above problems are most relevant for the Chuvash Republic? As already noted, the republic in various studies occupies rather high places in the ratings of innovation development. Popov E.V., Vlasov M.V., Kochetkov D.M. note the high level of knowledge production. In the study of the Higher School of Economics, the republic ranks 7th in the ranking of subjects of the Russian Federation in terms of the value of the Russian regional innovation index. The educational potential, the level of development of the information society, the innovative activity of organizations, the innovation policy are noted.

Which of these models is applicable to the Chuvash Republic?

Technoparks and Special Economic Zones are absent. That is, integration on the basis of creating special economic and administrative institutions is not carried out. Accordingly, there is an acute problem of integration, interaction between developers and consumers. At the moment they are implemented by individual enterprises.

Also, no investments are made in the development of the necessary infrastructure. Platforms and territories with simplified tax, legal and managerial regimes have not been established. Accordingly, there is a problem with the start of innovation, with the creation of innovative initiatives. Opportunities of creativity, intellectual mobility are not used. Currently, these initiatives are being implemented within individual enterprises.

In the republics of Chuvashia and Tatarstan, the high positions in the rating are primarily due to the maximum level of activity of organizations in the field of technological innovations (28 and 23.3%, respectively), 2.5–3 times higher than the national average. At the same time, the innovation economy of Chuvashia is still at the bottom of the ranking among the regions of the Volga Federal District. According to statistics, there are only 36 innovatively active enterprises in the republic, or 3.7 percent of their total number.

The brain drain remains serious for the republic. Individual companies are also engaged in solving this problem.

The model of the leading role of the university is the most attractive and feasible in the republic, as there are large universities, the number of students in universities about 35 thousand students. About 50% of them are Chuvash State University named after I.N. Ulyanova. The main task here is to clarify the possibility of implementing this model by a non-entrepreneurial university. There are practically no serious studies on the possibility of realizing and developing the economy of knowledge by a non-entrepreneurial university.

Also for the implementation of this model, the university is required to solve the above problems:

- integration and integration of developers and consumers of innovative products, communication with them (to solve a problem instead of technoparks);
- provision of infrastructure (to solve the problem instead of special zones and territories with a simplified tax and legal regime);
- innovative initiatives and scientific and technical creativity - innovative activity;
- use intellectual mobility to solve other problems.

Thus, in this article we examined how, based on the indicators for calculating the knowledge economy index of the World Bank, models of the realization of the knowledge economy in Russia were developed. First of all, in the regions. Within these models, key tasks are highlighted that need to be addressed for the development of a knowledge economy. That is, it is possible to consider in Russia the development of the knowledge economy is carried out around the solution of these problems. Hence, when considering the possibilities of the knowledge economy in the Chuvash Republic, these problems are solved within the framework of the university model.

### **Discussion**

The main problem of the models discussed above is the selection of criteria based on the parameters of World Bank research. These criteria are designed to identify manifestations of the knowledge economy for the purposes of the World Bank. In this case, they are given a managerial character - by manipulating these parameters it is supposed to obtain the necessary changes in society for the formation of a knowledge economy. Perhaps this approach is somewhat difficult in terms of the formation and creation of a knowledge economy in the regions and it is necessary to act on other grounds.

The intended goal - the possibility of forming the knowledge economy in the Chuvash Republic - in our opinion, should be considered within the framework of a system approach: system integrity, system openness, hierarchy of elements, structures, interaction and interrelation between system elements, etc. Thus, the region is also it is represented as a system, as an integrity, with established structures of elements, their hierarchy and interrelations. Accordingly, we are interested in what the elements and structures can be, what should be from the changes leading to the formation of the knowledge economy?



From the models discussed above, one can single out the main elements involved in shaping the knowledge economy:

- federal, regional and municipal authorities - financial and tax; events, legal support;
- investors - landlords, owners, etc .;
- production - interested enterprises;
- infrastructure;
- university complex - science and culture;
- external participants - science (foreign universities, scientific institutions), culture.

In all considered models, the formation of the knowledge economy occurred without taking into account the existing integral system, without taking into account invariants, when a free economic zone or a technopark was created out of communication with the regional economy and society. As a result, new elements existed practically in an alien environment, with which it is difficult to interact due to the absence of systemic connections.

That is, the basic problem of the emerging knowledge economy in the region is the difficulty of interconnections with other elements of the region as a system. In all models of the economy of knowledge in the regions there are difficulties with the involvement of scientific personnel, with the creation of a scientific result, using the results of scientific activity, etc.

In our opinion, the approach we are considering [5], based on the increasing role of the university complex, is able to solve this problem. The main provisions are as follows:

- the existence of correlations in the economy of the region;
- university opportunities in the formation of an innovative culture of the region;
- University as a key element in the self-regulating system of the region [6, p. 105] [7, p. 82]

### **Conclusion**

As a result of the analysis of the models of knowledge economy formation for the regions of the Russian Federation, the following features can be noted:

- Understanding and criteria for understanding the knowledge economy are formed on the basis of parameters for the World Bank study, as a result of which the system factors and relations of the region are ignored, respectively, neither the technopark model nor the special economic zone model is related to the culture, science and economy of the region and does not benefit the region itself;
- when forming and developing the knowledge economy in the region, it is necessary to take into account interrelations with the following elements: federal, regional and municipal authorities (financial and tax; measures, legal support), investors (landlords, owners, etc.), production (interested enterprises) , infrastruc-

ture, university complex (science and culture), external participants (foreign universities, scientific and cultural institutions);

- the most applicable model of the economy of knowledge for the Chuvash Republic is a model based on the activities of the university complex as a backbone in shaping the culture of the region and with the possibilities of increasing economic ties with regional enterprises.

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分析影响投资项目有效性的风险  
**ANALYSIS OF RISKS AFFECTING THE EFFECTIVENESS  
OF THE INVESTMENT PROJECT**

**Chechenova Liana Muhamedovna,**

*Candidate of Economic Sciences, Associate Professor*

**Egorov Yuriy Vladimirovich,**

*Candidate of Economic Sciences, Associate Professor*

**Volykhina Natalia Vladimirovna,**

*Senior Lecturer*

*Emperor Alexander I Petersburg State Transport University*

**摘要**

**目标:** 审议改进专家估计数的使用以分析影响复杂投资项目实施有效性的风险的问题。

**方法:** 作者考虑现有的专家估算方法和蒙特卡罗模拟, 用于识别和评估投资项目的风险。

**结果:** 提出了一种利用“减少”随机因子概念, 基于现有方法分析影响实施复杂投资项目有效性的风险的方法。该方法已用于分析项目创建多品牌经销商自动中心的风险, 并制定管理项目主要风险的建议。

**实际重要性:** 所提出的方法可以应用于为长期实施而设计的复杂投资项目的分析, 快速分析和风险管理。

**关键词:** 专家评估, 仿真建模, “减少”随机因素, 风险管理, 投资项目

**Summary**

**Objective:** Consideration of the issue of improving the use of expert estimates to analyze the risks affecting the effectiveness of the implementation of a complex investment project.

**Methods:** Authors consider the existing methods of expert estimates and Monte Carlo simulations which are used to identify and assess the risks of investment projects.

**Results:** An approach to the analysis of risks affecting the effectiveness of implementing complex investment projects based on existing methods using the concept of a "reduced" random factor is proposed. This approach has been used to analyze the risks of the project to create a multi-brand dealership auto-center with the development of recommendations for managing the main risks of the project.

**Practical importance:** The proposed approach can be applied to analysis, quick analysis and risk management of complex investment projects designed for a long period of implementation.

**Keywords:** expert estimates, simulation modeling, "reduced" random factor, risk management, investment project

### **Introduction**

In the field of investment projects' risk management for any organization, it is necessary to develop an integrated, comprehensive approach to risk management. Among Russian scientists, this direction has recently been reflected in the studies of P.L. Vilensky, V.N. Livshits, S.A. Smolyak. [1] , I.T. Balabanova [2], A. Damodaran [3], E.A. Kuzmina [5], A.A. Lobanova [6, 10], T.V. Nikitina [7] , V.V. Repin [8], E.B. Severnyuk [9]. Among foreign authors can be identified R. Braley, J. Bailey, G. Alexander, S. Hughes, K. Redhead, U. Sharp, A. NgM. Greenberg, [11], D. Hillson [12] and et al., which highlight issues of risk management, evaluation, the impact of risk on the cost of investment projects. Priority areas of risk analysis in the implementation of an investment project are: determining the likelihood of risk occurrence, qualitative identification of risks, determination of the amount of probable losses, consideration of risks, development of countering risks.

However, at present there is no complete and reasonable theoretical and practical base in terms of guidelines for assessing the value of investment projects at different stages of the life cycle under conditions of uncertainty and risk. At the same time, determining the likelihood of risks and possible losses continues to be a serious problem for complex investment projects with a long implementation period.

In this paper, we present one of the approaches to the analysis of risks affecting the efficiency of the implementation of a complex investment project. This approach is considered on the example of identifying and assessing risks affecting the effectiveness of an investment project in creating a multi-brand dealer auto center, implemented by JSC "Eurosib-AutoMC" in 2018-2024. The main feature of the proposed approach is the joint use of the method of expert assessments and the method of simulation modeling.

### **Identification of risks affecting the effectiveness of the implementation of the investment project**

The modern risk management process of an integrated investment project, which requires a long implementation period, is complex and multi-step. To achieve maximum economic efficiency of an investment project implementation, at the initial stage of the analysis it is necessary to apply qualitative methods to identify all types of risks that threaten an investment project, as well as to identify possible losses of resources accompanying the occurrence of risk events.

To identify the risks of an investment project to create a multi-brand dealer car center of JSC “Eurosib-AutoMC”, we used a qualitative method of expert assessments. When using the method of expert assessments, the specialists and managers of the automotive industry in St. Petersburg were asked to answer the questionnaire in order to identify and assess the risks affecting the effectiveness of the project of JSC “Eurosib-AutoMC”. During the survey, experts ranked the likelihood of possible risks, using ranks from 1<sup>st</sup> (least significant) to 10<sup>th</sup> (most significant). After processing the data, the total sum of ranks for each indicator is calculated (taking into account the opinions of all experts), using formula 1:

$$R_i = \sum_{j=1}^N r_{ij}, \quad (1)$$

Different formulas can be used to move from the ranking estimates of  $r_1, r_2 \dots r_n$  to the weighting factors; we used the Fishbourne formula. Table 1 shows the processed results of the expert survey and the calculated weighting factors.

*Table 1 – Results of expert risk assessments of an investment project*

Criterion	Ri	Place ( r <sub>i</sub> )	a <sub>i</sub>
The decline in sales of new cars	38	7,6	0,19
Increase the payback period of the project	14	2,8	0,07
Project cost increase	29	6,0	0,15
Exchange Rate Change	34	7,4	0,19
Under-funding of the investment project	16	3,2	0,08
Failure of the specified project criteria	19	3,8	0,10
Counterparties' defaults	17	3,4	0,09
Car supplies limitation	26	5,2	0,13

The consistency of expert opinions can be assessed using a concordance factor. For this investment project the rate of concordance is 0,71, which indicates a high degree of consistency of expert opinions.

Thus, using the method of expert assessments, it was determined that the probability of a risk situation of the investment project is average. It should also be taken into account that, based on the expert survey conducted and the mathematical processing of data results, it can be concluded that the risks that received the highest score (greatest significance) in the assessment are:

- the decline in sales of new cars;
- exchange rates change;
- change (increase) the payback period of the investment project.

**Evaluation of the impact of risk on the effectiveness of the investment project**

At the next stage of risk analysis of an investment project, it is proposed to use quantitative methods for analyzing an investment project, in particular, simulation methods. The Monte Carlo method is the most common simulation method. In the framework of this method, the analysis of the impact of the identified risks of investment projects is performed by applying models of possible results. [4].

In this paper, we applied a model of possible results using data from an investment project implemented by JSC “Eurosib-AutoMC”. The forecasted indicators used in the calculation include the most significant risks previously identified using the qualitative method of expert assessments:

- decline in sales of new cars;
- change in exchange rates;
- change (increase) the payback period of the investment project.

It should be noted that the Monte Carlo method, although it belongs to quantitative methods of analysis, can use elements of the qualitative method of expert assessments in building an optimistic, pessimistic and realistic scenario of changing random indicators.

If the sales volume of cars is predicted as random variables independent of the company's strategy, then their probabilistic change should be included in the simulation model, the exchange rate should also be included in the model, for this investment project – US dollar, because the exchange rate is not controlled by the company.

At the initial stage of the calculation, we formed a matrix that displays the forecast of car sales per year for 6 years ahead the Table 2.

*Table 2 – Forecast sales of new cars over the years, pieces.*

<b>Car model</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>
Opel	342	514	497	547	547	547	547
Ch	1113	1671	1617	1778	1778	1778	1778
Saab	17	30	33	36	36	36	36
Cad	10	15	17	18	18	18	18
Dw	300	489	490	517	620	744	744
Total	1782	2719	2654	2896	2999	3123	3123

For the investment project, a forecast indicator of sales volume for 6 years was calculated and the probability of an optimistic, pessimistic and realistic scenario of sales of new cars was estimated; Scenarios are presented in the Table 3. Expert estimation method was used to estimate the probabilities of scenario implementation. The formation of scenarios by experts was carried out for the forecast sales volume of cars, measured in conditional “reduced” cars independent of the manu-

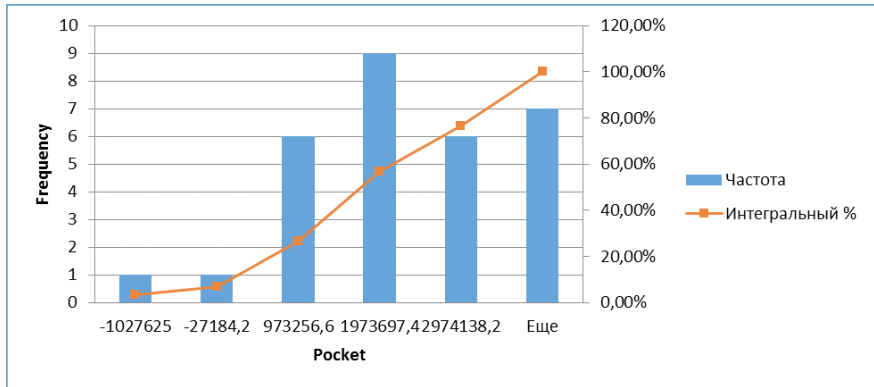
facturer, car brand and year of sale (within the considered period of 6 years). This made it possible to simplify the analysis by moving from a random matrix to a single random indicator – the sales volume of “reduced” cars for 6 years.

**Table 3** – Estimated sales for 6 years in three scenarios, pcs.

Scenario for new cars sales	New car sales, pcs.	Probability of implementation, %
Pessimistic	11578	20
Realistic	19296	70
Optimistic	15437	10

Using the data obtained, 30 iterations of simulation experiments were carried out (calculated) using the normal distribution, which allowed us to generate random numbers for further calculations of the net present value (NPV) of the project.

The result of processing the obtained values of the calculation of the model of simulation experiments is a distribution histogram, presented on the Figure 1:



**Figure 1** – The density of distribution of new cars sales

The results of the analysis indicate that in 10% of cases NPV takes on a negative value due to fluctuations in sales; 36.6% of cases give the NPV of the project less than the average.

Similar calculations were made for a quantitative analysis of the risk of change (increase) in the payback period of an investment project and the risk of currency volatility. It was found that in 40% of cases changes in sales volumes will lead to increasing of the project payback period relative to the average payback period (4,5 years). The change in the US dollar rate gives an NPV value less than the average of 56,67% of cases. However, only in 3% of cases, fluctuations in the dollar exchange rate will lead to a negative NPV value of the project.

Thus, having considered the possibility of the influence of the main risks on the project efficiency, it was concluded that the main threat is the risk of a decline in sales. The risk of reducing the effectiveness of the project from the exchange rate change is low.

### **Conclusion**

Our analysis of the investment project risks of the JSC “Eurosib-AutoMC” for the creation of a multi-brand dealer car sales center allowed us to identify and assess the main risks affecting the efficiency of the investment project being implemented. Based on our analysis, we formulated recommendations for managing the risks of the investment project.

The proposed risk analysis approach, which affects the efficiency of the implementation of a complex investment project based on a combination of expert assessment method and Monte Carlo method, includes a qualitative analysis of identifying the main project risks and quantifying the identified risks with subsequent development of recommendations on project risk management. The transition to the reduced units of measurement of random factors (in terms of the use of forecast sales volumes) made it possible to simplify the calculations in the proposed approach. This approach can be applied to analysis, express analysis and risk management of complex projects designed for a long period of implementation.



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在为住宅供电的创新技术的基础上提高住房和公共服务的质量

**IMPROVING THE QUALITY OF HOUSING AND COMMUNAL SERVICES ON THE BASIS OF AN INNOVATIVE TECHNOLOGY FOR SUPPLYING RESIDENTIAL HOUSES WITH ELECTRICITY**

**Larin Sergey Nikolaevich**

*Candidate of Technical Sciences, Leading Research Officer*

*Central Economics and Mathematics Institute*

*Russian Academy of Sciences*

*Moscow, Russia*

注解。本文提出了一种改善住房和公共服务质量的方法之一，即改善现有和发展新的创新机制和技术，促进住房和公用事业部门经济主体的相互作用，以证明基本上新的供电系统。公寓楼。该研究的目的是选择住房和公共服务领域的经济实体活动，为业主和租户提供适当质量的住房和公用设施。该研究的主题确定了能源供应和能源分配组织使用的创新机制和技术，以确保公寓建筑的不间断供电。在研究过程中，建立了引入创新机制和技术对改善住房和公共服务质量的影响（以提高电力供应质量为例）。

关键词：住房和公共服务，经济实体，住房和社区服务，质量改进，创新机制和技术，电力供应。

**Annotation.** *The article proposes one of the approaches to improving the quality of housing and communal services based on improving existing and developing new innovative mechanisms and technologies for the interaction of economic subjects of the housing and utilities sector on the example of substantiating fundamentally new power supply systems for apartment buildings. The object of the study was selected activity of economic entities in the sphere of housing and communal services for the provision of housing and utilities of proper quality to owners and tenants. The subject of the study identified innovative mechanisms and technologies used by energy supplying and energy distributing organizations to ensure uninterrupted power supply of apartment buildings. In the course of the study, the influence of the introduction of innovative mechanisms and technologies on improving the quality of housing and communal services (using the example of improving the quality of electricity supply) was established.*

**Keywords:** *housing and communal services, economic entities, housing and utility services, quality improvement, innovative mechanisms and technologies, electricity supply.*

## Introduction

The need for market reforms in the housing and communal services has been long overdue, and today no one doubts. The practical implementation of market reforms is based on modern legislative and regulatory frameworks, which include the Housing Code of the Russian Federation (approved at the legislative level) [4], the Housing and Utilities Development Strategy in the Russian Federation for the period up to 2020 [11], Comprehensive program of reforming and modernizing HCS for the period 2010-2020 [7] (approved at the level of the Government of the Russian Federation), as well as numerous programs for comprehensive modernization and effective development of the sphere HCS regions and municipalities (approved at the regional and municipal levels of government).

One of the specific features of the activities of economic entities in the sphere of HCS is its multidirectional nature [6]. The presence of this circumstance leads to the fact that effective for one group of economic subjects interaction mechanisms may not be so for economic subjects of other groups. This, in fact, implies the need to improve the existing and develop new innovative mechanisms and technologies used by economic actors in the HCS sector to ensure the improvement of the quality of housing and utility services (HUS).

### Main part

#### *1. The value of improving the quality of housing and communal services in the modernization of the HCS sector and the country's economy*

The housing fund, as the main object of management in the field of HCS, in itself cannot actually be used by its owners and employers, with the exception of the exercise of property rights or employment. In addition to the possession of these rights, for the owners and tenants of housing, its provision with the HUS complex becomes more important, the availability and uninterrupted provision of which makes the housing stock suitable for living. Equally important is the compliance of the HUS complex with the requirements of the sanitary rules and standards that are established for each specific service provided to owners and tenants of housing as measured result indicators of the activities of economic entities in the HCS sector. Compliance with sanitary rules and standards makes it necessary for economic entities in the HCS sphere to solve the problem of carrying out comprehensive modernization of communal, network and other infrastructure facilities in order to meet the modern requirements of SanPiNs and thereby maintain the established indicators of the quality characteristics provided to HUS owners and tenants. On this basis, we can conclude that maintaining the established indicators of the quality characteristics of the HUS complex and further improving its quality gain an important role and great importance in carrying out a comprehensive modernization of the infrastructure of the HCS sector and ensuring its effective development [9].

The availability of well-equipped housing and the provision of quality HUS can be the basis for supporting the high efficiency of the personnel of enterprises. The consequence of this should be the growth of labor productivity, and hence the successful modernization of the entire infrastructure of the Russian economy and its effective development as a whole..

## ***2. Innovative mechanisms and technologies applied by the economic actors of the HCS sphere to improve the quality of HUS***

The organization of an uninterrupted supply of electric energy to homes has become a promising area for improving the quality of HUS in recent years. Its implementation required the introduction of innovative mechanisms and technologies from the economic entities of the HCS sphere - energy supplying and energy distributing organizations - [8, 10]. For the supply of electrical energy to multi-family residential buildings (MFRB) in the neighborhoods of many cities in Russia, electrical networks are used for general purposes. The technical conditions of their operation and the equipment installed for these purposes do not meet modern requirements for electric energy quality indicators (EQI), since they allow for high-frequency noise, exceeding the permissible values of current frequency deviations, frequent voltage surges and significant losses of electric energy during transmission and distribution. The consequence of these and other shortcomings are periodic disconnections of the MFRB from the power supply. Power outages can lead to power outages in electrical networks, as well as natural anomalies and various kinds of man-made disasters. In many ways, the disconnection of power supply contributes to increased wear and imperfection of the equipment used, as well as the lack of effective power supply systems and reserve capacity.

In the situation associated with the disconnection of power supply, most likely, many residents of our country fell. Therefore, each of them is well aware of all the negative consequences associated with even a short-term power outage. This is not only the lack of lighting, water, broken elevators, but also the complete uselessness of all household appliances, electric cookers and other appliances. Naturally, such situations are unacceptable in the supply of electricity to modern MFRB, but, nevertheless, they occur quite often. This circumstance was another reason for the need to modernize general-purpose electrical networks and the infrastructure for the distribution of electricity.

Today, the real situation is that general-purpose electrical networks have low EQI values. Requirements for permissible EQI values are established by the Interstate Standard GOST 13109-97 [3]. At the same time in relation to modern high-tech equipment, they are not high enough. Therefore, it is not by chance that the State Center for Metrological Assurance in the Field of Electromagnetic Compatibility issued numerous conclusions, according to which the requirements of GOST 13109-97 to EQI by power supply and energy distribution organizations

in the field of HCS, as a rule, are not met [5]. Direct connection to the general-purpose electrical networks of home computers and other high-tech equipment sensitive to the deterioration of the quality of electrical energy may entail the risk of disrupting its normal operation or breakdown.

In general, the EQI characterize the cumulative properties of electrical energy, which determine its effect on electrical equipment. New requirements and standards for the control and measurement of EQI in the supply of electric energy to owners and tenants of housing set GOST 32144-2013 and 33073-2014 [1, 2]. Their implementation, as well as the implementation of the basic principles of the creation and operation of the MFRB power supply systems in urban neighborhoods, should in the near future ensure their uninterrupted power supply with a high degree of reliability. These principles include the following:

- the main power supply system should have an adequate supply of power for uninterrupted power supply of MFRB in the microdistricts of cities, subject to increased loads;
- the main power supply system must have backup power supply sources in case of unplanned outages and accidents;
- the main power supply system must take into account the requirements of environmental protection.

The power supply and energy distribution organizations that provide the direct supply and distribution of electrical energy should make their contribution to the provision of uninterrupted power supply to the MFRB in the urban neighborhoods and increase the EQI. To do this, they should expand the practice of using innovative interaction mechanisms, for example, in terms of improving and increasing the reliability of existing power supply systems. As is known, the electrical networks of urban neighborhoods are a combination of power transmission lines from electrical installations located on their territories - power centers (PC), distribution points (DP) and transformer substations (TP). It is they who carry out the power supply of the MFRB in the microdistricts of cities, which mainly belong to the consumers of the first category. For such consumers, the improvement of existing power supply systems may include parallel operation of power lines with automatic switching on backup power supply, as well as expanding the practice of applying ring power supply schemes. For this, the power transmission lines PC of each DP are connected to each other in a ring, the connection of the power lines DP of each TP, as well as the power lines between TP, is similar. This power supply system provides the highest reliability of power supply, because:

1) at least two independent sources and, accordingly, two parallel operating power lines are always used for supplying electrical energy to the MFRB in urban districts;

2) in case of failure of one of the sources or one power line, the power load will

be automatically transferred to another source or power line using an automatic switch-on device.

The transition of energy supplying and energy distributing organizations that provide electricity to the MFRB in the microdistricts of cities is all the more expedient because in addition to the living quarters of owners and tenants of housing in the MFRB there are general household electricity consumers. These include, first of all, freight-passenger elevators, fire alarm systems, evacuation and smoke removal, as well as lighting of common areas and house adjoining territories. Of course, these consumers are important for the normal residence of property owners and tenants, and for this reason they must be connected to the power supply sources most reliably.

Naturally, the implementation of such and other kind of interaction mechanisms between energy supplying and energy distributing organizations that provide MFRB power supply in the microdistricts of cities, and for this reason, related to the economic actors of the HCS sphere, should be based on the conclusion of relevant agreements between all entities, as well as between each entity and the housing department of the urban education or municipality.

### **Conclusion**

In the course of the research, it was substantiated that the energy supplying and energy distribution organizations that provide MFRB with electricity can be referred to the economic entities of the HCS sphere. As an innovative mechanisms and technologies for improving the quality of HUS, the transition to a fundamentally new power supply system MFRB, ensuring its high reliability and continuity, is proposed. The implementation of this approach in practice will require additional costs for energy supplying and energy distributing organizations to improve the power supply system and introduce innovative technologies to improve the quality of HUS. However, these costs can quickly pay for themselves by improving the reliability of electricity supply and the quality of electricity supply to owners and tenants of housing, as one of the most important HUS.

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使用两用空间技术制定和实施环境政策：国际经验  
**THE USE OF DUAL-USE SPACE TECHNOLOGIES  
FOR THE DEVELOPMENT AND IMPLEMENTATION  
OF ENVIRONMENTAL POLICY: INTERNATIONAL EXPERIENCE**

**Larin Sergey Nikolaevich**

*Candidate of Technical Sciences, Leading Research Officer*

**Sokolov Nikolai Aleksandrovich**

*Candidate of Physical and Mathematical Sciences, Leading Research Officer*

*Central Economics and Mathematics Institute, Russian Academy of Sciences  
Moscow, Russia*

注解。保持现代经济中先前技术结构的生产对整个地球的生态安全构成重大威胁。在政府间一级的国外，许多研究机构已经参与解决这个问题超过三十年。但是，无法获得实际结果，进一步采用若干基本文件。在许多欧洲国家和美国，主要工作重点是组织环境监测和利用两用空间技术研究气候变化的可能后果。本文介绍了利用这些技术在国际和国家层面制定环境政策的可能性。

关键词：气候变化，环境威胁，两用空间技术，监测，环境政策。

**Annotation.** *Preserving the production of the previous technological structures in the modern economy poses significant threats to the ecological safety of the entire planet. Abroad at the intergovernmental level, many research institutions have been involved in solving this problem for more than thirty years. However, real results, further adoption of a number of basic documents, could not be obtained. In many European countries and the United States, the main efforts are focused on the organization of environmental monitoring and the study of possible consequences of climate change using dual-purpose space technologies. This article describes the possibilities of using these technologies for the development of environmental policy at the international and national levels.*

**Keywords:** *climate change, environmental threats, dual-use space technologies, monitoring, environmental policy.*

### **Introduction**

The development of the world economy until the last years was accompanied by the simultaneous influence of two opposite factors on the vital activity of the world community. On the one hand, informatization and digitalization of the



economy contributed to the rapid expansion of the range of services provided to the population, and the formation of other economic benefits for producers and consumers of products. But, on the other hand, the preservation in the economy of production of the previous technological structures posed more and more significant threats to ensure the environmental safety of the entire planet. In this case, the greatest damage to the environment brought greenhouse gas emissions. Without their significant reduction (two or more times) in the next 10 years, climate change processes may become irreversible. In this situation, the population of our planet will face a critical rise in sea level, sharp fluctuations in weather conditions and an increase in their impact on the environment, an increase in the frequency of endemic and infectious diseases, as well as other significant negative consequences. As long as the economy remains highly dependent on the use of hydrocarbons and a number of other external factors, the level of environmental pollution will increase.

In light of the solution to the problem of reducing the use of hydrocarbons and greenhouse gas emissions, international agreements such as the Kyoto Protocol are called upon to play a key role [9]. This document provides for a set of measures to abate greenhouse gas emissions, develop energy efficient technologies and transfer them to third countries, justify the benefits and costs of using renewable energy sources, transfer production to new environmental regimes that protect the environment.

In addition to the Kyoto Protocol, the OECD countries adopted the Environmental Strategy in May 2001 [6]. Based on the results of the implementation of the strategy, annual reviews are conducted in which progress has been made at the level of individual participating countries. However, already at the initial stage, the pace of implementation of the strategy turned out to be insufficient to protect biodiversity, address the problems of climate change, reduce the environmental burden on economic growth in key sectors of the global economy [7, 8].

Many leading scientists and economists believe that dual-purpose space technologies, such as Earth remote sensing (ERS), satellite navigation systems, satellite transmission of solar energy, etc., can make a significant contribution to solving these problems. They can provide higher quality monitoring the state of the environment, managing the flow of traffic related information, and in the near future obtaining renewable energy from space.

### **Main part**

#### ***1. Application of dual-use space technology to formulate environmental policy***

Dual-use space technologies have real potential to contain or eliminate the negative effects of climate change. First of all, their use will help to more correctly understand the upcoming difficulties in combating climate change and reducing

greenhouse gas emissions, and organizing real monitoring of environmental processes. Thus, they will provide an important contribution to the development and effective implementation of environmental policies at the national and international levels.

The main difficulty in the development of environmental policy is the lack of understanding of the impact of climate change processes on the life of society. It is difficult to determine effective measures to reduce the harmful effects of climate change. In this case, the most serious is the problem of determining the costs and timing of their implementation, since they can be significant for business and society as a whole.

So far, scientists have only fixed the rapid changes in the environment, the rates of which are growing exponentially. For example, they convincingly proved that since the industrial revolution the level of carbon dioxide on the planet has increased by more than 25%, and about 40% of the entire land has been transformed by human activity to a state close to the onset of irreversible consequences. At the same time, there are active discussions about causal relationships between lands, oceans and the atmosphere, there are various justifications for the extent of their impact on the speed of change of the consequences of the formation of future climatic conditions. In addition, scientists need to take many measurements over a long period of time and gather information to build reasonably accurate models for predicting the causes and effects of climate change. An effective way to collect this information can be the use of space "Remote Sensors". These instruments can measure many parameters at a distance and be used in coordination with ground-based measuring instruments.

In Europe, such initiatives to develop the use of satellite-based Earth observation data were taken at the end of the past and the beginning of this century. Thus, in 1984, the Committee on Earth Observation Satellites (CEOS) was established. He coordinates civilian space observation missions to provide the necessary information to environmental policy makers. CEOS includes a number of ad hoc working groups, for example, disaster management or a support group (DMSG) for the application of satellite data in potentially dangerous areas and others.

The Earth Observation Group (GEO) was established in 2003. It is intended to strengthen cooperation and coordination between global observations of space and non-space systems. The main goal of GEO is to broadly coordinate global civilian observation strategies through the development of 10-year plans. 29 organizations participate in the work of this group, including CEOS, which represent various scientific organizations and space agencies of several countries [5].

In 2001, the European Space Agency and the Council of the European Union adopted the European Global Monitoring of Environment and Security (GMES) initiative [3]. Its result was the creation in 2008 for Europe of the possibility of

observing the Earth with the provision of constant access to reliable and timely satellite information on the state and evolution of the environment throughout this continent. Under this initiative, there are space and ground systems that are able to quickly provide information to enhance the protection of society from natural disasters, as well as to meet the specific needs of European environmental policy makers.

Finally, a collaborative partnership on the Integrated Global Observing Strategy (IGOS) was organized, the main goal of which is to reduce observations by eliminating unnecessary repetitions and agreeing to conduct the study taking into account common interests. IGOS focuses on a limited number of topics, including oceans, carbon and water cycles, land erosion processes, coastal zones (including coral reefs) and potential geological hazards. The partnership includes 14 international organizations involved in monitoring the components of global environmental problems, in terms of their research, both in long-term and operational programs.

In the United States, the National Aeronautics and Space Administration (NASA), back in the 1990s, developed the Earth Observation System (EOS) to systematically study the ecological state of our planet using satellites. This system provides the maximum amount of data to understand the causes of climate change at the global level. It has three main components:

- 1) a network of satellites specifically designed to study complex global changes;
- 2) a network of modern computers for processing, storing and distributing data (EOSDIS);
- 3) a network of scientists who receive data from space satellites and study them around the world.

The EOS network includes three main satellites:

- Terra, which provides for the collection and collection of global data on the state and interactions of the atmosphere, land and oceans, as well as the influence of solar radiation on them;
- Aqua, which is designed to conduct research on interrelated processes in the atmosphere, oceans and on the surface of the earth, as well as to establish their connection with changes in the ecological system of the Earth;
- Aura, which conducts measurements of the composition and transformations of atmospheric gases to study the chemical dynamics from the earth's atmosphere to the mesosphere of our planet [1].

The main EOS satellites complement a number of target satellites developed in collaboration with international partners. These include: the TRMM satellite created by the Japan Aerospace Exploration Agency (JAXA), which measures the intensity of tropical precipitation over time; satellite Jason-1, created jointly by the

French space agency and the Center for National Space Research Ispagtt d'Études Spatiales (CNES); The satellite of the German Aerospace Research Center (DLR, Deutsche Forschungsanstalt für Luft- und Raumfahrt), which carries out a series of experiments on gravity and climate (GRACE).

Related initiatives include the monitoring of tropical forest ecosystems (the observation project from TREES satellites) and the surface of the oceans, as well as the formation of weekly maps of global vegetation indices, using the toolkit of dual-purpose space technologies located on SPOT-4 and SPOT-5 satellites [3].

These results were supplemented by work carried out by the Space Institute of Italy (SAI), in which EOS results were used for crop prediction and agriculture monitoring based on satellite optical imaging.

Thus, dual-purpose space technologies have powerful ERS tools, which allow us to represent the Earth as a dynamic, integrated and interactive system of land, water, atmosphere and biological processes. ERS space technologies and their tools can be used to map and predict processes related to climate change, such as measuring tropical precipitation, assessing the state of vegetation, monitoring the loss of Arctic ice cover in real time, the occurrence of hurricanes and dust storms, and impact on the climate of agricultural and industrial wastes, etc. In addition, sea-surface temperature can be measured and “hot spots” can be identified at which unusually high s temperature threaten the biological diversity of coral reefs, which determine the conditions of life more than 30 million. man in the world.

In addition to global climate issues, dual-purpose space technologies allow you to monitor the change over time of certain situations in the regions and thus can help predict possible environmental degradation (for example, degradation of water parameters or soil contamination) and plan for countering this situation.

***2. Application of dual-use space technologies to implement some of the provisions of the environmental policy (for example, reducing greenhouse gas emissions)***

Dual-use space technologies can be used to control the implementation of environmental policies to reduce greenhouse gas emissions when national governments accept international agreements, market quotas and agree to pay taxes that shape the market and allow financial payments to be linked depending on quantitative emission limits. This approach can be implemented with the support of dual-use space technology ERS.

In his work, C. Barrett [2] convincingly proves that the main obstacle to the organization of effective environmental control in the framework of international treaties is the lack of law enforcement practice and credible monitoring tools. The presence of the significant potential of the dual-purpose space technology ERS as a tool for monitoring and ensuring, given its ever more complete spectral and spatial resolution, as well as the ability to clearly separate activities across geographic

boundaries, emphasize in their writings M.K. Macaulay and T.J. Brennan [4].

ERS space technologies and the tools they use can be useful for monitoring either the sources of hydrocarbon production themselves, or many sources of actual greenhouse gas emissions. For example, these technologies can be successfully used to control methane emissions, which is a potent greenhouse gas that has a detrimental effect on climate. It is almost 20 times more than carbon dioxide, although the latter factor is much more often discussed. Therefore, the ERS space technology toolkit can be a cost-effective option for managing the reduction of greenhouse gas emissions.

Using the ERS space technology toolkit can provide more accurate measurement data on the biological storage of carbon in tree foliage, plant roots, soils, etc., through monitoring, in coordination with land-based land-use change control systems, such as extinction and / or recovery. forests. In this regard, the use of ERS space technology tools in forestry practice can have a significant impact on the balance between accumulated carbon and carbon dioxide content in the atmosphere.

The Kyoto Protocol sets binding targets for controlling greenhouse gas emissions for the world's leading countries that have adopted it. Benchmarks range from a reduction of 8% to an increase of 10% from individual 1990 emission levels in countries, with the goal of reducing their total emissions of such gases by at least 5% below the current 1990 levels during the Protocol's commitment period from 2012 until 2018.

The methodology for reducing greenhouse gas emissions relies on the removal of carbon dioxide from the atmosphere, either on its own territory or on the territory of other countries. To this end, several innovative mechanisms have been created, such as "emissions trading" (Article 17 of the Kyoto Protocol) and others. As a result, countries that cannot reach the indicator established for them have been able to pay for foreign projects (quotas of other countries) that lead to cuts in greenhouse gas emissions [8].

Protocol obligations vary by country. The overall 5% target for developed countries should be achieved by reducing from 8% to the 1990 level in the countries of the European Union, Switzerland, and most of the central and east European countries; 6% in Canada; 7% in the United States (although the United States today refused to support the Protocol); and 6% in Hungary, Japan and Poland. New Zealand, Russia and Ukraine should stabilize their emissions, while Norway could increase emissions to 1%, Australia to 8% (after the United States, Australia also refused to support the Protocol) and Iceland to 10%. In the EU, an internal agreement was reached to achieve an 8% indicator, in which all its members were distributed their rates.

### **Conclusion**

Based on the results obtained, the following conclusions can be drawn:

1. The development of the world economy must be reoriented towards an accelerated transition to new environmentally friendly technological structures. Preserving the production of the previous technological structures today represents a significant threat to the ecological safety of the entire planet. In this case, the greatest damage comes from greenhouse gas emissions.

2. The solution of the problems of environmental safety at the interstate level has been going on for more than 30 years. However, apart from the adoption of a number of basic documents (Kyoto Protocol), the implementation of other really significant projects was not carried out for financial reasons. Moreover, at present, countries such as the United States and Australia have withdrawn from the number of countries that recognize the Kyoto Protocol.

3. It has been established that dual-purpose space technologies, such as remote sensing of the Earth (ERS), space navigation systems, transmission of solar energy by satellites, etc., can make a significant contribution to solving environmental safety problems.

4. The use of dual-use space technologies and the data obtained with their help contribute to the development of environmental policies at the national and international levels, as well as the study of climate change and the organization of real monitoring of environmental processes.

### **Thanks**

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教育营销的认知研究

COGNITIVE RESEARCH FOR EDUCATIONAL MARKETING

**Ababkova Marianna Yurievna**

*Candidate of Economic Sciences, Associate Professor*

*Department of Advertising and Public Relations, Humanitarian Institute,*

*Peter the Great St. Petersburg Polytechnic University*

注解。 本文讨论了多学科的教育营销研究方法问题。 在大学认知营销的框架内, 考虑应用生物反馈方法的可能性, 该方法允许研究课堂上学生的心理生理状态, 研究学生的参与以及评估教育材料的有效性。 Zaltman的变形模型(ZMET), 作为认知营销研究的另一种方法, 可以评估对大学品牌的情感态度。

关键词: 消费者行为, 教育中的认知营销, 生物反馈方法, Zaltman变形模型(ZMET)

**Annotation.** *The article deals with the issues of a multidisciplinary approach to marketing research in education. Within the framework of cognitive marketing at the university, the possibilities of applying the biofeedback method, which allows studying the psychophysiological state of students in the classroom, studying student involvement, and evaluating the effectiveness of educational materials, are considered. Zaltman's metamorphic model (ZMET), used as an alternative method of cognitive marketing research, allows to evaluate the emotional attitude to the university brand.*

**Keywords:** *consumer behavior, cognitive marketing in education, biofeedback method, Zaltman metamorphic model (ZMET)*

**Introduction.**

Models of consumer behavior inherent in traditional marketing activities in the field of higher education include certain stages of the sales process, a hierarchy of effects from advertising and branding, and are linear models [1]. The main models describing consumer behavior include a model of marketing incentives and customer response of F. Kotler, a model of consumer behavior by D. Hawkins, R. Best, K. Koni, a dynamic model by J. Howard and J. Sheta, a model by J. Sheta, B. Newmont and B. Gross. The traditional approach to describing the process of making a purchase decision is described in the following steps: awareness of the need to purchase goods; search for ways to meet it; evaluation of informa-



tion in accordance with the standards of the consumer; formation of the desire to purchase the most preferred product; purchase response; evaluation of choice; exemption from the goods [2]. However, in reality, consumer behavior is nonlinear, emotionally, it is often influenced by cognitive processes that a person does not realize or cannot formulate [3]. Thus, linear models of consumer behavior describe the process of choosing goods or services, ignoring the role of emotions and subconscious processes.

The cognitive approach to marketing is a tool for studying consumer behavior and focuses on the study of cognitive processes and human thinking, which determine the characteristics of decision-making by market actors [4]. In conditions of high competition and technological progress, all elements of marketing of a modern university, from the product (curriculum and design of specialties) to the educational environment (equipment, classrooms, etc.) as an important part of educational marketing, require constant updating in the light of modern practice. The use of alternative qualitative and quantitative methods of marketing research within the framework of cognitive marketing of education is due to the fact that the educational process, the image of the university, the quality of classroom work provide comparative advantages in the education market and need careful study. Nonlinear and non-verbal methods and research techniques, such as biofeedback methods, which allow to evaluate and train cognitive abilities, attract the attention of both scientists and practitioners in the field of education. Projective and psychosemantic research methods are aimed at receiving information about ideas and attitudes of a person, including attitudes towards an educational product or service, consumers' emotional attachment and their attitude to the university brand, and are also of interest to modern educators. Teachers of the Advertising and Public Relations Department of the Humanitarian Institute of Peter the Great St. Petersburg Polytechnic University tested two non-linear marketing research methods - the biofeedback method and the Zaltman metamorphic model for solving marketing problems.

### **1. The study of the emotional state of students on the basis of biologic feedback.**

The purpose of the study based on the biofeedback (BFB) method was to study the influence of the perception features of various forms of presentation of educational material on the current mental state of students using the biofeedback method. As part of the study, the psychophysiological state of the students was studied before and after the lesson, and the data obtained from the control and experimental groups were also compared. It was suggested that students better perceive and memorize educational material in an illustrative, graphical form, have a better current mental state than when studying the same material in the form of simple text.

The pilot study began with the formation of identical experimental and control focus groups of students based on the PEN method, which measures neuropsychiatric lability, extraversion and psychoticism.

Before the training session, for each focus group, preliminary data were obtained on the assessment of the psycho-physiological state by the method of biological feedback. The experimental group was tasked to study theoretical material in the form of a presentation containing animated charts, tables, video and sound. Another group (control) studied the same theoretical material presented in the form of text. Further, after the classes, students of both groups were re-examined.

As a result of the study, the authors obtained quantitative parameters of the current states of the subjects (adaptive resources, mobility of mental processes, neuroticity, mental productivity, etc.). The obtained data were compared with the reference values of the optimal state (Table 1).

As a result of the experiment, it was found that the study of various forms of educational materials significantly affects the improvement or deterioration of different groups of indicators of the current mental state of students. Indicators of the reserve of management of mental activity and the reserve of syndromological adaptability when students independently study texts are improved than when studying illustrated presentations. Indicators of the emotional sphere (Af, affectivity, level of emotional tranquility; MN, state agitation, property of mania) are different in the experimental and control groups and are expressed in increased emotionality, the appearance of signs of concern with an overall high level of positive attitude. At the end of the lesson, regardless of the form of presentation of educational material, the indicators of mania in both groups decrease and the balance of "I-Rest" balances. Textual material less affected the manifestation of fear, increased anxiety in the studied groups.

Indicators of perceptual-mental sphere (N, neurotic, hypersensitivity to stimuli) in both groups deteriorated. The study of textual material improved the indicators of concreteness and realism of thinking (S, level of earthiness, practicality of thinking), as well as accuracy, infallibility of judgments (PD, full conviction in the correctness of judgments).

When studying the illustrated material, the indicators of repetitive obsessive experiences have been improved (OF, the property of the obsession).

Thus, it is necessary to alternate the forms of educational materials: educational videos and interactive presentations cannot fully replace the reading of educational texts [5]. Further studies of the psychophysiological state of students will help clarify issues related to such educational marketing tools as process, setting, product, and develop specific recommendations for their improvement.

## **2. The study of the attitude of students to the university, department and specialty based on the metamorphic model of Zaltman.**

Understanding the emotional-figurative component of the attitude of applicants to the university and its educational services is an important aspect for building an advertising campaign and a brand.

**Table 1**  
*Summary of the experiment*

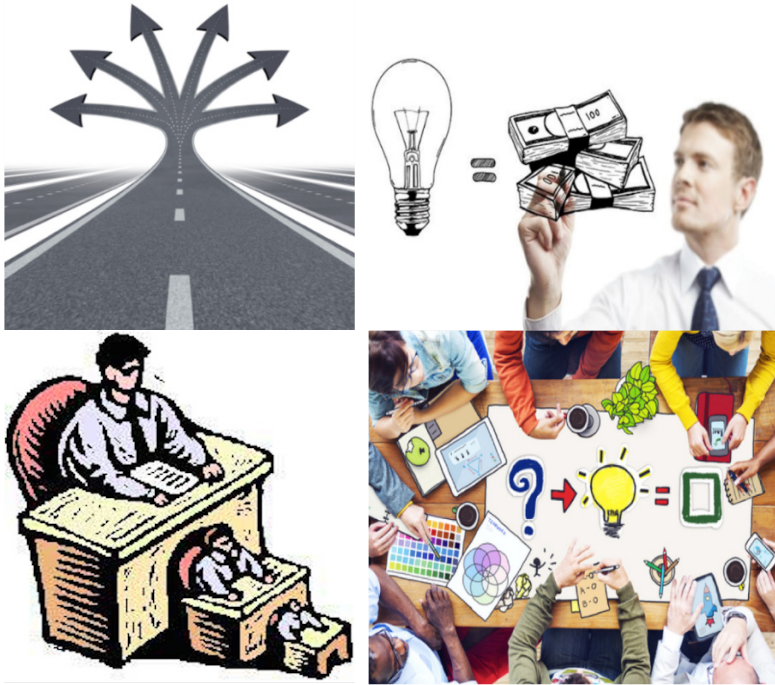
Experiment Number	Nosological scales					Syndromological scales				
	Af, affectivity, level of emotional calm)	E, epileptoid, (level of mobility — rigidity of mental processes)	S, level of concreteness, earthiness, practicality of thinking	Ad, reserve of mental adaptability	N, neurotic (hyper-sensitivity to stimuli)	IS, scale of hysteria (balance of mental reactions "I-others")	MN, state of mania property	PD, full conviction in the correctness of judgments	OF, obsession property	Z, syndromological adaptability scale
1.1	14,83	13,55	16,11	15,22	7,16	5,38	12,44	7,86	5,7	15,10
1.2	16,94	7,72	10,66	23,33	7,94	2,58	5,52	5,41	3,74	28,63
2.1	20,69	21,53	28,38	21	8,30	6,62	22,67	10,41	4,41	20,81
2.2	23,61	19,15	9,46	35,77	11,69	3,34	14,45	5,93	4,84	35,84
Reference value	4,8	7,6	6,3	73,3	8,1	1	1,1	1,3	1,1	88,4

The study was conducted among 2-year students of the department, including foreign students, using the ZMET method (Zaltman's Metamorphic Model). The study involved a sample of students in the amount of 91 people.

The purpose of the study was to determine the associations, images associated with the attitude of students to the university, the department and the chosen specialty. It was assumed that the identification of the emotional attitude of students to the department, specialty, university will clarify (improve) the positioning of the department, specialty, university in the market of educational services.

The subjects selected three images (visual images) associated with the concepts of “My University”, “My Department”, “My Specialty”. Examples of options for images selected by students are shown in Fig. 1.

A modified and adapted ZMET questionnaire was chosen as the research method [6]. Further, the authors of the study interviewed students in order to obtain comments on the name of the picture and descriptions of associative emotions. During the study, the presented lexical material was analyzed, the starting point for which was the picture chosen by the respondent. It was found that the respondents' description of their emotional relationship can be put into three factors of the semantic differential of C. Osgood: assessment, strength and activity. The comments received were grouped into general categories (“Life Force”, “Power”, “Control, etc.).



*Fig. 1. An example of images selected by students, reflecting the categories “Vital Force”, “Power”, “Control”, and “Pleasure” of the semantic differential C. Osguda*

As a result of the analysis, 16 categories were obtained, representing 8 bipolar scales presented in Table 2

**Table 2**

*Bipolar scales and their meaning*

Positive scale	Negative scale	Category Treatment
Life force	Fading away	Realization of potential, energy, purposefulness
Pleasure	Discontent	Extracurricular activities, entertainment, fulfillment of desires
Unity	Separately	Involvement, harmony, union
Power	Impotence	Success, leadership, achievement
Affiliation	Lack of tradition	Tradition, history, communication
Individuality	Mass character	Self-determination, feeling special
Control	Lack of control	Stability, cold mind
Security	Insecurity	Stability, transparency, lack of conflict with the outside world

A study based on the modified ZMET method showed that the emotional attitude of students (Table 3):

1. The department is less structured than the attitude of students to the university. In relation to the university, 88% of respondents' answers fall on the positive poles of the 4 scales, and no other scale has scored more than 5% of the answers. At the same time, the students' answers in relation to the department were distributed to the positive poles of all eight scales (from 3% to 23% per scale), and another part of the answers fell on two negative poles (8% out of control, 4% separation).

**Table 3**

*Comparative distribution of respondents' answers by emotional attitude to the university, department and specialty*

Scales	Emotional attitude to the university	Emotional attitude to the department	Emotional attitude to the specialty
Affiliation	36%	12%	3%
Unity	19%	23%	9%
Life force	19%	11%	14%
Power	14%	3%	24%
Individuality	2%	3%	39%

2. The specialty is as structured as the attitude towards the university. As in the case of the university, 86% of the respondents' answers fall on the positive poles of four scales, and no other scale has scored more than 4% of the answers. The dominant scales that determine the emotional attitude towards the department and specialty do not fully coincide with those for the university [6].

The results of this study can serve as a starting point for further improvement and updating of the marketing communication strategy of the university. The novelty of this study gives the use of psychosemantic marketing methods: a modified method of ZMET and semantic scaling. Prospects for the study due to the possibility of expanding the sample to study the perception of the university faculty and graduates.

### **Conclusion**

The above studies in the framework of cognitive marketing pursued the following goals: first, to study the possibilities of applying the biofeedback method in the educational process, and, second, to adapt the Zamtman metamorphic model and evaluate students' emotional attitude to the university, department and chosen specialty to improve marketing strategy and branding of the university. It is necessary to expand the scope of traditional marketing activities in a modern university to find new solutions to current issues of education, to involve cognitive methods and technologies in marketing research of an educational organization.

The practical significance of pilot studies is to expand the scope of marketing research for educational purposes, as well as to provide a deeper understanding by practitioners and marketers of educational and marketing activities of the university, expanding research methodology based on an interdisciplinary approach in the framework of cognitive marketing in education.

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作为区域经济增长因素的集群形态税收过程建模  
**MODELING OF TAX PROCESSES IN CLUSTER FORMATIONS  
AS A FACTOR IN THE GROWTH OF THE REGIONAL ECONOMY**

**Snegireva Tatiana Konstantinovna**

*Candidate of Economic Sciences, Associate Professor,*

*Vladimir Grigorievich and Nikolai Grigorievich Stoletovs Vladimir  
State University*

注解。 本文讨论了在区域经济发展框架内组织和控制集群活动时开发财政方面模型的可能性。 制定了基于对拟议方法后果的加权估计的基本原则，强调了税收模型的基本周期成分，建立了它们的相互依赖性和主要参数。 该研究确定了估计的指标，包括预计到2020年的预算效应，净收入的增加和该地区的总体区域产品。

关键词：税收模型，集群形成，税收模型原则，均衡增长，预算效应。

**Annotation.** *The article discusses the possibilities of developing modeling of fiscal aspects in organizing and controlling the activities of clusters in the framework of the development of the regional economy. The basic principles based on weighted estimates of the consequences of the proposed approach are formulated, the basic cyclical components of tax modeling are highlighted, their interdependence and main parameters are established. The study determined the estimated indicators, including the budget effect expected by 2020, the increase in net income and the gross regional product of the region.*

**Keywords:** *tax modeling, cluster formations, principles of tax modeling, balanced growth, budget effect.*

The development of tax modeling mechanisms is of particular relevance and importance in a clustering of regional economies. On the one hand, this direction allows to provide an objective-scientific approach to the formation of plans and forecasts for the development of constituent entities of the Russian Federation, on the other, it substantiates and forms those economic groups that can become points of real economic development of territories and their balanced development. One cannot but agree that the idea of forming clusters or “clustering the economy of a territorial level in modern conditions acts as one of the promising areas for the development of regions” [1]. The problems related to the improvement of fiscal approaches, which can remove the existing barriers to the development of the

regional economy and create additional incentives for its development, become even more important [2, 3].

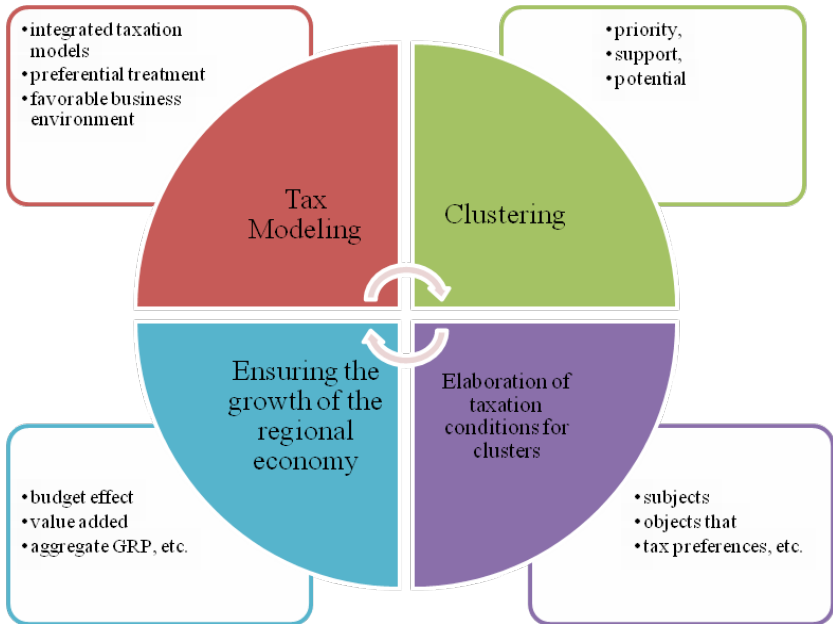
This paper examines the possibilities of applying tax modeling as applied to the activities of individual cluster entities of the Vladimir region. The modeling of taxation is given a lot of attention both in domestic and in foreign sources. Many of them are reduced to the process of notification and are mainly descriptive in nature [4, 5]. Among foreign authors, common approaches are the use of panel regression and endogenous growth models [6, 7]. Providing an effective regional policy can be based, in our opinion, on taking advantage of such tax modeling tools that will allow combining all the proposed approaches.

The main principle of modeling tax processes for clusters should be their preliminary testing and a balanced assessment of the consequences. It is also important to optimally assess the practical results of the operation of individual groups of enterprises whose activities are consolidated technologically and territorially, with the possibilities of modeling tax processes. Indeed, not every segment or industrial production association is ready to conduct such innovations, especially since they are associated with such a key aspect of the activity as paying taxes. Creating and using models helps to work out a variety of tax policy options and is a leveling tool for potential negative consequences.

As part of the implementation of the general investment strategy for the development of the Vladimir region, it is intended to "create priority clusters - precision engineering, pharmaceutical, bioenergy, textile, tourism and food industry clusters" (*including interregional, development of cooperation and functional interdependence within which will reduce costs of the Vladimir region*) [9]. In the studies previously carried out by the author [10, 11], additional approaches were proposed both for identifying support clusters and modeling tax processes in the region. Figure 1 shows the structurally logical matrix of interdependent tax modeling processes in the implementation of the cluster approach to the management of territories.

In the process of implementing these proposals, the main element is the creation, approbation and practical use of the model of integrated taxation of individual industrial or socially oriented groups of enterprises and organizations. At the same time, it is necessary to take into account the peculiarities of the activity of a particular cluster entity, its tax possibilities. This will allow us to simultaneously create favorable business conditions with positive consequences for the region as a whole.

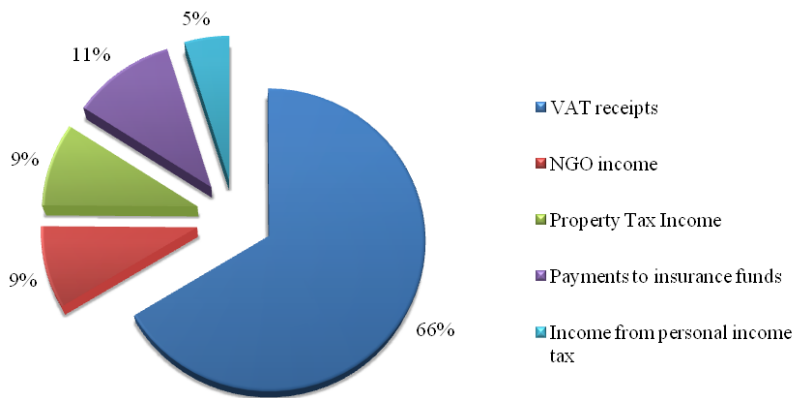
The division of clusters into priority and potential [9] in this work has been supplemented by supporting ones, to which it is expedient to include those types of production that are not the main ones in terms of speed, but have a stable dynamics of development. These types of enterprises include light industry enterprises, whose share of turnover is from 22 to 25% in their total volume in the Vladimir region [11].



*Fig.1 Cyclic matrix of tax process modeling in cluster formations of the region*

An important element of modeling tax processes in relation to cluster formations is the development of the conditions for their taxation. The main principle that should be implemented at the same time is taking into account the peculiarities of their activities, starting from the location of the availability of the necessary infrastructure, ending with the provision of competent specialists and performing staff. This is a fairly extensive range of factors, the competent accounting of which determines the efficiency of modeling tax processes. In more detail, the parameters of the model of complex taxation are developed and proposed by the author on the example of the light industry in the region [10].

The objective basis of these proposals is to ensure a balanced and sustainable growth of the regional economy. As criterion assessments of the results of modeling tax processes in cluster formations, the author selected the following indicators: the budgetary effect, the increase in net output and the gross regional product. It should be noted that this list of indicators is not exhaustive. It can be supplemented with other data in accordance with the needs of modeling the activities of clusters and their taxation. With regard to the issues under consideration, we consider it expedient to present one of the most important parameters: the structure of the budget effect expected by 2020 for the Vladimir region calculated by the author (Fig. 2). These priorities reflect the prevailing proportions between the main incomes that feed the regional budget.



*Fig.2 Composition and structure of the expected budget effect in the Vladimir region by 2020*

The structure is focused mainly on tax revenues, among which the main source is value added tax. This is due in large part to the changes in legislation that establish a VAT increase of 2%. The second and third place in the structure of the budgetary effect is given to payments to insurance funds, which account for 11%, and revenues from such taxes as the tax on the profit of organizations and on property with the same share of 9% for each source. Revenues from personal income tax are given the last place with a corresponding share of 5%. It is important to pay attention to the fact that these data do not include in the composition of any significant share of the budget effect, which could be achieved by using the capabilities of the combined special tax regimes.

As a result of the study, we can come to the following conclusions.

Expanding the possibilities of tax modeling through their use in relation to individual industrial-production groups of enterprises will provide an effective combination of a complex of modern methods and approaches. This will expand the methodological possibilities, increase the reliability of the results and the multiplicity of forecasts.

The main principle of the development and implementation of the integrated taxation models in the extended practice should be their approbation in certain areas with subsequent extension to other areas of activity. Ensuring that the specifics of the activities of individual clusters are taken into account will ultimately have a positive impact on the results of business activities in these segments and economic results as a whole.

The composition and structure of the expected budget effect reflects the main priority sources of its receipt. As an additional component, it is proposed to consider the possibility of including in this structure additional revenues from the introduction of the integrated taxation model for individual clusters on the basis of combining special regimes.

The modeling of tax processes in cluster formations will ensure the interconnection of mechanisms for the implementation of the region's investment strategy with the goals and objectives of cluster formation, balance, stability and stable dynamics of economic growth in the region.



整合农业经济过程金砖国家  
**INTEGRATION AGROECONOMIC PROCESSES  
BRICS COUNTRIES**

**Semin Alexander Nikolaevich**

*Doctor of Economic Sciences,*

*Professor, Academician of the Russian Academy of Sciences*

*Ural State University of Economics*

*Yekaterinburg, Russia*

注解。 本文讨论了金砖国家经济中农业部门的一体化合作问题。 特别注意发展与扩大农业生产贸易和投资有关的农业合作。 在金砖国家成员国的一体化互动过程中解决的分组任务和共同问题。

关键词: 一体化, 合作, 农业, 金砖国家, 竞争力, 世界市场。

**Annotation.** *The article deals with the problems of integration cooperation in the agrarian sector of the economy of the BRICS countries. Particular attention is paid to the development of agricultural cooperation related to the expansion of trade and investment in agricultural production. Grouped tasks and common problems that are solved in the process of integration interaction of the BRICS member countries.*

**Keywords:** *integration, cooperation, agriculture, BRICS countries, competitiveness, world markets.*

Despite various international economic sanctions from the US and EU countries, Russia still sees its economy as an open, on the path to integration into the BRICS and EAEU unions.

Integration in the agrarian sector, despite the heterogeneity of agriculture in the BRICS countries (see table), involves solving such problems as accumulating financial resources in order to more effectively develop agriculture and financially improve enterprises and organizations of the agro-industrial complex, developing under the influence of national and big challenges; development of mechanisms ensuring the promotion of agricultural products to new agrifood markets and overcoming the local monopolism of corporations; increasing employment and improving the material situation of the rural population [1; 4].

**Table.** *Main indicators of agricultural and fisheries development in the BRICS countries [3]*

	2000	2007	2008	2009	2010	2011	2012	2013	2014	2015
Area of arable land, million hectares										
Brazil	50	62	65	65	65	67	69	73	77	78
Russia	124	122	122	122	121	121	122	122	122	123
India	156	156	156	155	156	155	155	156	-	-
China	130	130	122	135	135	135	135	135	135	135
South Africa	-	-	-	-	-	12	-	-	-	-
Cereal production, million tons										
Brazil	45	67	77	68	73	75	87	98	98	103
Russia	65	81	108	97	61	94	71	92	105	105
India	186	216	220	203	226	242	239	246	235	235
China	405	456	478	482	496	519	539	553	557	572
South Africa	14	9	15	15	15	13	14	14	17	12
Meat production, thousand tons										
Brazil	10326	18517	19472	19532	20749	21575	22036	23248	23761	24073
Russia	4446	5790	6268	6719	7167	7519	8090	8544	9070	9565
India	1851	4011	4280	4566	4869	5514	5948	6235	6691	7020
China	60139	68657	72787	76497	79258	79651	83872	85350	87067	86250
South Africa	1666	2714	2777	2801	2968	2954	2911	3019	3136	3282
Fish catch, thousand tons										
Brazil	667	783	791	825	785	803	-	-	-	-
Russia	3776	3417	3333	3728	-	-	-	-	-	-
India	5655	7127	7616	7852	8231	8666	9040	9579	10072	10796
China	11607	9200	9511	9567	9870	10222	11618	11730	12509	12929
South Africa	-	-	-	-	-	-	-	-	-	-

The BRICS countries pay special attention to the development of agricultural cooperation, in particular, related to the expansion of trade and investment in agriculture, the use of modern technologies, including digital, the protection of the right to adequate and decent food, especially for the most vulnerable social groups of the population, by strengthening the family development of a basic agricultural information exchange system, mitigation of the negative impact of climate change on economic activities [6].

It can be stated that at the new stage of development of the world economy, the BRICS countries are becoming increasingly important. Under the economic envelope of the BRICS format, the contours of the new multipolar world actually sprout [2].

The position of Brazil, Russia, India, China and South Africa is based on the importance of the multilateral trading system as a means of facilitating global trade and ensuring global food security. At the same time, the agrarian policy pur-

sued by the BRICS countries and specific political measures taken to ensure food security remain uncoordinated.

Let us single out nine common problems characteristic of the agrarian sector of the BRICS countries [1, 5; 6]:

1. *Depletion of land and water resources, negative impact on the environment.*

The negative impact of climate change on agriculture and food security is a global problem of tremendous economic, environmental and social significance. BRICS can provide global leadership in this regard through the development and application of adaptation technologies that increase the sustainability of agricultural systems while increasing sustainable and environmentally friendly agricultural production.

2. *The increasing population of the Earth and, accordingly, the need for the growth of agricultural production.* At the same time, human resources development is of paramount importance for improving the overall agricultural technological potential of countries.

3. *The problem of hunger.* 795 million people suffering from malnutrition, 98% of whom live in developing countries. Extreme poverty and food insecurity are inextricably linked, aggravated by about three-quarters of the world's poor in rural areas. Poverty and food insecurity need to be addressed through a combination of social protection systems and measures aimed at a sustainable increase in agricultural production.

4. *Lack of capital from small and medium-sized farms.* Improving the investment climate needs to be carried out on voluntary principles of responsible investments in agriculture and food systems approved by the Committee on World Food Security (CFS) in 2014. It is important to attract investment at all stages of the food production chain and expand interaction with the private sector in these efforts, in particular through the public-private partnership mechanism.

5. *Disparity of prices.* Providing equivalent economic inter-sectoral relations is a complex task of state regulation of the economy with priority measures and mechanisms of non-direct impact.

6. *Underdevelopment of agricultural infrastructure of individual countries.* The implementation of the joint efforts of the BRICS countries in the development of the agrarian infrastructure is expected through the newly created BRICS Development Bank (NDB), which serves as a powerful instrument for financing projects.

7. *The monopoly position of agro-industrial transnational companies.* Analysis of the problems of the agricultural sector of the BRICS countries gives every reason to come to the conclusion that it is necessary to create the BRICS Agrarian Development Institute. It will contribute to solving problems related to improving the efficiency of production and processing of agricultural raw materials and the competitiveness of agricultural products in domestic and world markets.



8. *Risks to human health and the environment.* Investments in social protection systems should be seen as essential catalysts for sustainable development, creating nutrition-related social protection programs.

9. *Introduction of innovations in agricultural production.* Most small farms are experiencing problems with the introduction of scientific advances in agricultural production. To solve them, it will be necessary to create an institution of systematic support and promotion of innovations in agriculture, from technical to organizational. Strengthening family farming, in particular, is a prerequisite for eradicating poverty and hunger.

In conclusion, it is interesting to note that the BRICS member countries are not included in the “golden billion”, they demonstrate their own special development path, different from managing economies in other countries of the world, which in many cases, including during the financial and economic crisis demonstrates its effectiveness.

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由公司间联系引起的一致性特征和整合协同效应的评估  
**FORMATION FEATURES AND VALUATION OF THE EFFECT OF  
SYNERGY OF INTEGRATION, CAUSED BY THE INTERFIRM  
LINKS**

***Kasyanenko Tatiana Gennadievna***

*Doctor of Economic Sciences,*

*Candidate of Physical and Mathematical Sciences*

*Corporate Finance and Business Valuation Department,*

*St. Petersburg State Economic University, Saint-Petersburg, Russia,*

***Ivanov Dmitrii Arvidovich***

*Postgraduate, assistant,*

*Corporate Finance and Business Valuation Department,*

*St. Petersburg State Economic University, Saint-Petersburg, Russia*

抽象。 该研究的目的是建立一个计划,以形成整合这种类型的协同作用及其估值的整合协同效应的累积协同效应。 根据网络和聚类概念分析的结果,作者已经开发出一种形成一体化协同效应的协同效应的方案。 已经揭示了私人(物种)协同效应对由于实施产生一体化协同作用的措施(战略)而获得的累积协同效应的贡献机制。 给出了关于累积协同效应评估的建议,通过其对真实集群中特定参与者的计算示例进行说明。

关键词: 协同效应, 协同效应(SE), 集成, 企业间链接, 网络, 聚类, SE评估。

***Abstract.*** *The purpose of the study is to build a scheme for the formation of a total cumulative synergistic effect of integration synergy for the kinds of synergy that make up this type and its valuation. According to the results of the network and cluster concepts analysis, the authors have developed a scheme for the formation of an aggregate synergy effect of synergy of integration. The mechanism of the contribution of private (species) synergy effects to the cumulative synergy effect obtained as a result of the implementation of measures (strategy) that create the synergy of integration has been revealed. Recommendations on the valuation of the cumulative synergy effect are given, illustrated by the example of its calculation for a specific participant in a real cluster.*

***Keywords:*** *synergy, synergy effect (SE), integration, interfirm links, networking, clustering, valuation of SE.*

## Introduction

The article discusses the process of creating and valuing the *cumulative synergy effect of integration synergy (CESI)*, due to the emergence of *interfirm links* in the interaction of three and more businesses that maintain the autonomy of economic entities in the framework of integration synergy, in particular, the synergy between network and cluster structures [5]. The full list of such corporate commercial structures is extensive, many of them in the modern world have almost completely lost their relevance, for example, a cartel or a syndicate. Clusters and networks, on the contrary, are the most modern corporate structures - possible drivers of the future development of the regions, since a *synergy effect (SE)* is inseparably linked with clusters and networks. More common *network* designs. *The cluster* is being tested, which in Russia has already been recognized as a tool to improve the competitiveness of enterprises in the context of integration, as well as the socio-economic development of the regions and the country as a whole through joint efforts to bring together industry, scientific developments and education. This point of view is also shared by V.V. Putin and S.S. Sobyanyin [8], who discussed the idea of creating a special research and production cluster in Moscow to identify the “common synergy of this enormous potential”.

At the same time, the development of methods for quantitative assessment of the cluster's performance, based on the assessment of changes in the value of companies within the cluster, is at the very beginning of its development. Thus, the task of assessing the effectiveness of the functioning of the network/cluster as an integrated structure is highly relevant. An attempt to solve it is presented in this article.

### 1. Formation of synergy effects in the areas of operation of companies - members of the cluster/network

In the articles of the authors [2, p. 80-88; 3, s. 236-248] a typology of synergy (kinds and types) has been introduced that has a hierarchical character. Therefore, to study the sources of formation of *the cumulative synergy effect of integration synergy (CESI)*, first of all, it is necessary to understand how the synergy effects of subordinate level synergies are formed - according to the areas of companies functioning as members of the network/cluster. Consider these processes.

**Production synergy** (synergy of using cluster infrastructure). *The effect* of this kind of synergy is, firstly, in reducing the individual costs of its formation for each individual member of the cluster, and secondly, in reducing the costs of its further maintenance and use. In this case we are talking about the objects of transport, energy, engineering, housing and social infrastructure development of the cluster. Another aspect (source) of the synergy effect of industrial synergy in a cluster can be the so-called “synergy of conglomerate”, which consists in combin-

ing businesses with different stages of development or different dynamics of market conditions within a single structure, which reduces the overall cyclical nature of cluster development. The combination of cluster structures of technologically young, as well as mature, developed, stably functioning enterprises contributes to the efficient operation and sustainable development of the cluster.

**Managerial synergy.** Cluster use by participants of the logistics infrastructure, power systems, information networks, marketing developments, etc. allows you to get higher quality services for a lower price. Also, due to territorial proximity, the availability of counterparties increases and transaction costs decrease, i.e. *positive synergistic effects (PSE)* of *managerial synergy* of territorial agglomeration are manifested.

**Investment synergy.** The synergy effect in this case is determined by the fact of the existence of the cluster as an *integral economic system*. Confirmation of the existence of the cluster attracts attention of financial structures to its members, allows to receive assistance in building credit reputation, in disseminating company advertising within the cluster brand, attracts additional resources to the region. In general, the policy of attracting investment, pursued by the cluster as a single economic system, will take into account the majority of the interests of individual participants, if they do not directly contradict the agreed interests of the majority of participants or the cluster as a whole. Centralized attraction of financial resources by enterprises operating under the cluster brand (or rather, in the cluster format as an *organizational and economic form - OEF*), has more chances for success than individual attempts by individualized enterprises.

**Financial synergy.** In the context of Russian realities, the importance of cluster systematics is difficult to overestimate. The presence of a cluster in the region allows receiving state financial support within the framework of cluster and regional development programs, which leads to the further development of the regional economy, stimulation of economic growth and acceleration of solving social problems, especially acute in depressed regions.

Directed to promote the development of various types of *synergy effect* [2; 3] in clusters will improve the efficiency and degree of utilization of the potential of synergy of cluster structures as one of the types of synergy - *the synergy of integration*.

The analysis of the features of the formation of SE in the areas of operation of enterprises in the cluster allows you to go to the stage of determining the list of activities constituting *the synergy strategy* and necessary to carry out the synergy of integration within the framework of these areas to form a *chain of PSE creating*.

**2. The author's conception of the formation of the cumulative synergy effect of synergy of integration (CESI)**

Dedicated sources of creating synergies by kinds of functioning of enterprises within the cluster allow us to develop tables for the formation of PSE of this level of synergies on the way to assessing the *CESI* in the cluster. Imagine, for example, these chains of activities for the production area (Table 1).

*Table 1 - The chain of creating a positive effect of synergy of integration (PSE) in the field of production*

<b>Activities carried out under a certain kind of synergy of integration (production or operation synergy)</b>	<b>Expected Result</b>	<b>The manifestation of PSE</b>
<ul style="list-style-type: none"> <li>- implementation of joint initiatives to reduce costs and improve service quality;</li> <li>- increasing the degree of individualization of goods and services;</li> <li>- the shift of the “product assembly” stage closer to the end customer;</li> <li>- improving the processes of supplying raw materials and components (uninterrupted supply, non-rejected deliveries, deliveries “just-in-time”);</li> <li>- participation of partners in joint product development and optimization of production processes, development and launch of new products</li> </ul>	<ul style="list-style-type: none"> <li>- wider product range;</li> <li>- the direction of the released (from joint actions) staff, fixed assets and funds for internal development;</li> <li>- achieving the continuity of the production process;</li> <li>- obtaining market and technical information from partners;</li> <li>- improving the quality of cost forecasting in the production chain;</li> <li>- reducing the time to develop and launch new products</li> </ul>	<ul style="list-style-type: none"> <li>- reducing the costs of planning and forecasting;</li> <li>- growth of return on invested capital;</li> <li>- increase in price premium;</li> <li>- reducing the cost of production;</li> <li>- reducing the percentage of fixed costs in the total amount of operating expenses;</li> <li>- additional income from the placement of the released funds;</li> <li>- reduction of delivery costs;</li> <li>- increase in revenues associated with the sale of a larger number of units of products or services of the company in the cluster;</li> <li>- growth of cost reduction due to the contribution of suppliers;</li> <li>- reduced operating costs of the company due to the contribution of suppliers</li> </ul>

Source: compiled by the authors.

Table 1 can be supplemented (continued) by the formation (planning) of activities with those expected from their implementation of the PSE and in other areas of the enterprise (financial, investment, marketing and management) [2]. These synergy effects, in turn, are due to the appearance of *interfirm links* in the cluster.

Just as it was shown in the article of the authors [4, p. 79-82] (for the case of *synergy of restructuring*), in this case, when forming the PSE of *synergy of integration*, within each of the kinds of synergy on the basis of the scope of operation of the enterprise, **a synergy effect from the use of interfirm links may occur**. Their number in general depends on the number (n) of participants as follows:

$$N = C_n^k = n! / (n - k)! * k!$$

In the case of a minimum number of network/cluster participants equal to three (triad), the total number of *double links* (N) between the participants is equal to

$$N = C_3^2 = 3! / (3 - 2)! * 2! = 3.$$

So, if companies A, B and C are involved in network integration, the quality of connections should be analyzed: A with B, A with C and B with C. In the case where the cluster/network consists of 4 participants, the number of *double links* to be analyzed, it is already 6. There may be fewer connections, even in the case of three participants, if the triad structure is not *circular*, but *linear* [1; 6].

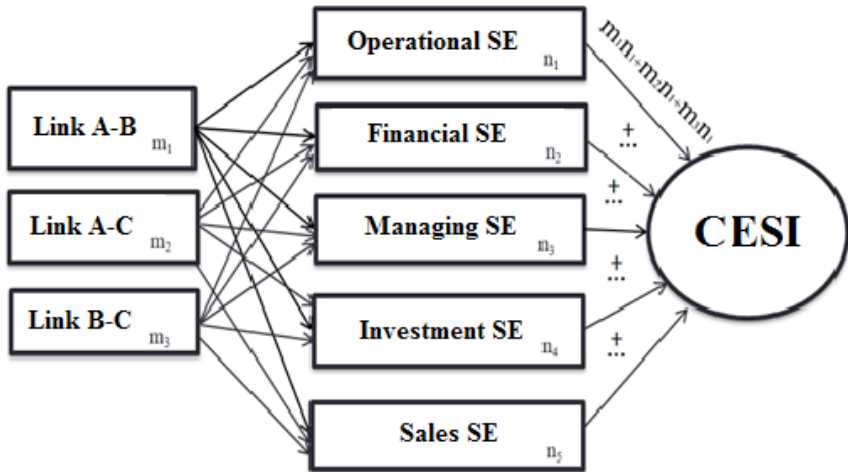
Let us denote the SEs of the kinds of synergy for each of the double links between partners in the cluster by (m1, m2, m3). In turn, the number of SEs of kinds of synergy by areas of activity of the enterprise, as always, is five: (n1, n2, n3, n4, n5) (these are managerial, operational, financial, investment and sales (marketing) synergies). As a result, we obtain the matrix R (Table 2) of all common SEs, which together will give the desired **cumulative synergy effect of integration synergy (CESI)**.

**Table 2 - Matrix R for building chains of formation of the cumulative synergy effect of integration synergy (CESI)**

	n1	n2	n3	n4	n5
m1	m1n1	m1n2	m1n3	m1n4	m1n5
m2	m2n1	m2n2	m2n3	m2n4	m2n5
m3	m3n1	m3n2	m3n3	m3n4	m3y5

Here m1 is a connection of A with B, m2 is a link between A and C, and m3 - of B and C.

The general scheme for creating *a cumulative synergy effect of integration synergy (CESI)* is as follows (Fig. 1):



**Fig. 1 - Scheme of formation of the cumulative synergy effect of integration synergy (CESI) for the case of three network participants (the ring triad of companies A, B and C)**

In this case, the *cumulative synergy effect of integration synergy* will be expressed by the formula:

$$CESI = \sum \sum (SE)_{\min j} \quad (1)$$

by i from 1 to 3  
by j from 1 to 5

Next comes the task of valuing *the partial synergy effects* arising from the components that make up the R matrix, as well as the CESI (Fig. 1).

The *cumulative synergy effect of integration synergy* of a cluster can be valued as the sum of *the net cash flows increments* ( $\Delta CF$ ) of the companies participating in the cluster discounted at the appropriate discount rate (see example below).

### 3. An example of valuation of the synergy effect of *integration synergy*

Let us estimate the synergy effect arising due to inter-company links for the Lebedinsky Mining and Processing Plant (we denote “L”) as one of the participants in the metallurgical cluster formed in the Belgorod Region, within which the project of introduction of partial combustion was implemented<sup>1</sup>.

The share of this metallurgical cluster accounts for almost 34% of all-Russian iron ore mining, 100% of hot briquetted iron, 6% of finished rolled products. Clus-

<sup>1</sup>It was used updated data of the paper [7, p. 23-30].

ter enterprises produce about 23% of the gross regional product of the Belgorod Region and provide about a quarter of the taxes that go to the consolidated budget of the region. The core of the cluster consists of “Lebedinsky GOK” (mining and processing plant) and “Stoilensky GOK”, which lead to the extraction of iron ore by the open method, “KMARuda Combine”, which carries out its underground mining, and “Oskolsky Electrometallurgical Combine” [9].

Cluster enterprises annually increase production volumes, including products with a higher degree of *added value (VA)* due to the implementation of *investment projects within this cluster*, aimed at building new, modernizing and modernizing existing facilities. Let us define *the cumulative synergy effect of integration synergy (CESI)* from the entry of the “Lebedinsky mining and processing plant” (“L”) into the cluster when it implements the project of introduction of the partial combustion technology. In the course of the analysis of the financial and management reports of the cluster entities, initial information was obtained for the calculations (Table 3).

**Table 3 - Information for valuation the CESI in the implementation of "L" project of the introduction of partial combustion technology within the cluster. Data are presented in thousand dollars**

№	Indicators	Years of the forecast period (IP horizon)					
		1	2	3	4	5	PPF <sup>2</sup>
1	The change in net profit "L" as a member of the cluster	4243	4249	4256	4262	4269	
2	Accrued depreciation	1454	1454	1454	1454	1454	
3	Change in cash flows - ΔCF (1+2)	5697	5703	5710	5716	5723	CF <sub>6</sub> = 5 730
4	Discount factor (F) at a discount rate of 12%	0,893	0,797	0,712	0,636	0,567	TV = 47 750
5	Discounted ΔCF and terminal value (TV)	5087,4	4545,3	4065,5	3635,4	<b>3244,9</b>	<b>PV(TV) = 27 074</b>

The result of the summation of the values of the discounted ΔCF is *a quantitative valuation of the CESI* (from participation in the cluster) for “L” thanks to the introduction of the project of implementation of the partial combustion technology within this cluster:

$$CESI = 5087,4 + 4545,3 + 4065,5 + 3635,4 + 3244,9 + 27\ 074 = 47\ 652,5 \text{ thousand dollars.}$$

<sup>1</sup> PFP = Post-Forecast Period.



Thus, the assessment of the effectiveness and level of development of integration structures can be based on the valuation of the *cumulative synergy effect of integration synergy*, which refers to the effect caused by the coordinated in space and time action of dissimilar in nature mechanisms leading to qualitative changes in the system.

Accordingly, in order to obtain a ***pure SE of integration synergy*** for “L” (in the authors' notation - ***NetSynInt***), the *total costs of this enterprise for joining the cluster* should be subtracted from the estimated *CESI*. The sum of *NetSynInts* of all cluster members will give ***a measure of the effectiveness of clustering*** performed by cluster members.

#### 4. Conclusions

1. The author introduced the conception of forming the *cumulative synergy effect of integration synergy (CESI)*, due to the emergence of *interfirm links in an integrated structure*. The subtraction of *the total cluster formation costs* from the estimated *CESI* sets the *pure SE of integration synergy - NetSynInt*.

2. The valuation of the *CESI* in the case of a cluster can be based on the *value indicators* of the activities of enterprises - cluster members. The most accurate quantitative valuation of the *SE* of a cluster can be obtained by using the *Income Approach* (in the business valuation theory).

3. Table 1 shows that the total *value added* of the cluster enterprises, expressing the *CESI*, is a consequence of the development of inter-company relations (interfirm links) between the participating companies, which manifest themselves in *various areas of functioning* of the companies - cluster members (and which stimulate, in particular, competition between cluster companies, effective exchange of information and technologies within the cluster, etc.).

4. Recommendations on the valuation of the *CESI* are given, illustrated by the example of its valuation for the “Lebedinsky Mining and Processing Plant” when it implements a project for the introduction of partial combustion technology as a member of the cluster.

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Khanty-Mansiysk Autonomous Okrug-Ugra社会经济发展的战略管理  
**STRATEGIC MANAGEMENT  
OF SOCIO-ECONOMIC DEVELOPMENT  
OF THE KHANTY-MANSIYSK AUTONOMOUS OKRUG-UGRA**

**Semin Alexander Nikolaevich**

*Doctor of Economic Sciences, Professor, Academician of the Russian  
Academy of Sciences*

*Ural State University of Economics*

*Yekaterinburg, Russia*

**Lylov Anton Sergeevich**

*Head of Computer Technology Center*

*Ural State Mining University*

*Yekaterinburg, Russia*

注解。 本文讨论了汉特 - 曼西斯克自治区 - 乌格拉的战略社会经济发展领域，直到2030年。它通过应用新的科学战略规划方法，揭示了区域战略形成的方法论特征。 和管理，允许制定优先事项和分析各个部门在区域经济中的经济作用。 乌拉尔国立矿业大学的作用得到了强调。 提供了在自治区别列佐夫斯基地区更有效地使用褐煤和泥炭的路线图。

关键词：战略，优先事项，发展，新挑战，路线图

**Annotation.** *The article discusses the strategic socio-economic areas of development of the Khanty-Mansiysk Autonomous Okrug-Ugra for the period up to 2030. It reveals the methodological features of the formation of the district strategy, through the application of new scientific methods of strategic planning and management, allowing to develop priorities and analyze the economic role of individual sectors in the regional economy. The role of the Ural State Mining University is highlighted. A roadmap for more efficient use of brown coal and peat in the Berezovsky district of the autonomous region is provided.*

**Keywords:** *strategy, priorities, development, new challenges, roadmap*

Each subject of the Russian Federation has its own problems and its own development prospects, different from others. The economic and social spheres of the constituent entities of the Russian Federation are subject to new challenges, or more precisely, to the challenges of the new time (both national and global - “big

challenges”). In order to counter the challenges of extreme impact, sustainable development of a particular subject of the country, taking into account the multi-factor impact of national challenges (such as the need to solve the tasks of spatial development of Russia), national projects, federal programs and strategies of various levels are developed and implemented.

Considering the prospects of socio-economic development of the Khanty-Mansiysk Autonomous Okrug-Ugra, let us turn to the development strategy of this unique region of Russia. It gives certain answers to the challenges of the present autonomous district.

They consist in the following: the need to avoid single-industry specialization by creating new mechanisms for economic diversification, introducing lean production technologies into the activities of all participants in economic relations, developing civil society institutions, implementing new industrial and agricultural policies, and national entrepreneurial and technological initiatives. The ambitious tasks of innovative development of the Ugra economy require new approaches.

The methodological peculiarity of the Strategy 2030 is the application of new scientific methods of strategic planning and management, which make it possible to work out priorities and analyze the economic role of individual sectors in the regional economy. For this, the methods of multiplicative analysis (analysis of the impact of changes in a particular sector of the economy on the economy of a region or a country as a whole) and analysis of the performance of certain types of economic activity were applied. Another methodological feature is the zoning of the territory in the interests of optimizing state administration. Also in Strategy - 2030, the principle of marketing thinking and the associated paradigm of cluster development are applied, allowing to determine the mechanisms for ensuring the competitiveness of the economy. The strategy contains options for the development of intersectoral clusters, as the most effective for generating innovation.

The strategic goal of Ugra development is to solve a complex of problems ensuring the improvement of the quality of life of the population of the Autonomous Okrug through the implementation of a new paradigm of sustainable development of the region. At the same time, current tasks in modern conditions are grouped into three priority blocks.

The first block is the formation of a new model of “smart economy” based on the innovative transformation of the oil industry, the introduction of marketing thinking as the basis for diversification and the formation of the autonomous region as a technological springboard of Russia in the development of the North and the Arctic.

The second block is the formation of globally competitive human capital: achieving the world level of competitiveness of specialists through training, creating conditions for good health and a high life expectancy, cultural, spiritual and

moral development; guaranteeing the rights of indigenous minorities of the North, as well as their integrated socio-economic and cultural development [1; 4].

The third block of tasks is the creation of conditions for the formation of a favorable environment, based on the breakthrough development of innovative “green oil production” technologies and waste management, the formation and implementation of rational environmental management standards in order to preserve the natural potential of Ugra for future generations [1; 4].

Effective management of socio-economic development will be based on the principles of lean production and the zonal approach as a spatial form of implementing the concept of “Lean Region”, the development of civil society, and effective state and municipal services. One of the tools for implementing the Strategy-2030 will be integrated marketing and territory branding.

Ugra as a young region that has attracted people with an active lifestyle for decades, is one of the leaders in the development of civil society. Strategy 2030 is based on the best qualities and values of the Ugra people. The scientists of the Ural State Mining University also contribute to the development of the strategic directions of this unique region.

Developed by researchers "Ural State Mining University" "The concept of using local fuels: brown coal and peat from Berezhovskiy district of the Khanty-Mansiysk Autonomous Okrug - Ugra in order to ensure the generation of heat and electricity" (contract No. 35-201-18 from 05.09.2018) fits in well with the targets of the Strategy for Socio-Economic Development of the Khanty-Mansiysk Autonomous Okrug - Ugra until 2020 and for the period until 2030 and the Strategy for Socio-Economic Development of the Berezhovskiy District (substrategy of Strategy -2030).

The strategy of socio-economic development of the Berezhovskiy district until 2030 determines the priorities, goals and objectives of the long-term socio-economic development of the municipal entity of the Berezhovskiy district, the mechanisms for achieving the strategic goals, the main directions of activity of the administration of the Berezhovskiy district for the long-term period.

The main goal of the Municipal Education Strategy is to improve the quality of life and well-being of the population of the municipality, develop the socio-economic sphere of the territory and strengthen its competitive position among the municipalities of the Khanty-Mansiysk Autonomous Okrug - Ugra.

The strategy takes into account the scenarios and priority directions of development of the regional and domestic economy, including "Thrifty region", "Civil Society", "Project Management", "Investment Strategy", "Financial Mechanisms", "National Entrepreneurial Initiative", "Implementation of information and communication technologies (Information society)".

The implementation of the Strategy will result in a qualitative change in the

life of the Berezovsky District as a fast-growing, efficient territory with a developed socio-cultural space [3].

Long-term studies of scientists of the Ural State Mining University, the results of work of local executive authorities, as well as the development of the Development Fund of the Khanty-Mansiysk Autonomous Okrug - Ugra, confirm the feasibility of developing the mineral resource potential of the Berezovsky district and the need to create a transport and energy infrastructure there [2].

Thus, according to preliminary estimates of the Development Fund of the Khanty-Mansi Autonomous Okrug-Yugra, the volume of investments in infrastructure will require about 46 billion, and in production facilities - over 50 billion rubles. At the same time, the multiplicative effect of a cluster can be up to 6% of the gross regional product of the Autonomous Okrug of Ugra.

The concept of using local fuels: brown coal and peat from the Berezovsky district of the Khanty-Mansi Autonomous Okrug-Ugra to generate heat and electricity, proposed by scientists of the Ural State Mining University, is a system of scientific views, completed R&D, concrete measures and practical recommendations. aimed at studying the characteristics and possibilities of using local types of fuel in order to ensure the generation of heat and electricity for the needs of Berezovsky district.

Based on the diversity of types and classes of concepts, this concept refers to the scientific and practical. The proposed concept is, first of all, a "point of growth", which should be the basis for further development, adjustment and addition of the Strategy for Social and Economic Development of the Berezovsky District until 2020 and for the period until 2030, including in terms of the activities of its roadmap. We are talking about individual sections of the roadmap: "Ensuring sustainable economic growth"; "Formation of a favorable investment climate"; "Improving the quality of life of the population"; "Employment and unemployment", etc. The roadmap for the implementation of this concept is presented in the table:

### Measures

for the implementation of the roadmap of the concept of using local types of fuel: brown coal and peat from Berezovsky district of the Khanty-Mansiysk Autonomous Okrug-Ugra in order to ensure the generation of heat and electricity

№	Event complexes	Expected results	Deadlines and estimated costs	Responsible performers, collaborators	Name of the state (municipal) program and other documents within which the event is being implemented
<b>Development of the fuel base on the basis of the brown coal deposit of the Borisov area of the Lyulinskoye deposit</b>					
1.	Obtaining a license (for the right to use subsoil)	Obtaining	3 months	Project participants	
2.	Development of pre-project technical solutions	Issuance of tasks for research	6 months (500 thousand rubles)	Project participants	In accordance with the Order of the Ministry of Natural Resources of the Russian Federation No. 218 dated June 25, 2010
3.	Engineering survey	Holding	6 months (10 million rubles)	Project participants	
4.	Development of design documentation for testing	Development	6 months (3,5 million rubles)	Project participants	In accordance with the Order of the Ministry of Natural Resources of the Russian Federation No. 218 dated June 25, 2010
5.	Development of project documentation section (environmental impact assessment)	Development	2 months (1 million rubles)	Project participants	In accordance with the Order of the Ministry of Natural Resources of the Russian Federation No. 218 dated June 25, 2010
6.	Conducting public hearings (based on environmental impact assessment)	Holding hearings	1 month	Project participants	
7.	Environmental review of project documentation	Environmental assessment	2 months (700 thousand rubles)	Project participants	

8.	Passing the main state examination	Expertise	3 months (1 million rubles)	Project participants	
9.	Coordination of project documentation in TsKR-TPI "Rosnedra"	Matching	1 month	Project participants	
10.	Development of the mining allotment project	Allotment project	1 month (300 thousand rubles)	Project participants	
11.	Receiving specified boundaries	Receiving	1 month	Project participants	In accordance with the Order of the Ministry of Natural Resources of the Russian Federation No. 218 of June 25, 2010 and the Safety Rules for Mining and Solid Minerals Processing (2013)
12.	Development of a forest clearing project and land lease	Project	0,5-2 months (500 thousand rubles)	Project participants	
13.	Construction of an enterprise	Construction	1,5 months (292 million rubles)	Project participants	
The total project implementation period is 34-36 months. Total costs - 309.5 million rubles.					

With regard to the use of local peat reserves, the experts proposed two options. In the first embodiment, milling peat is mined (43.3 thousand tons). Created CHP with fuel storage. Delivery is carried out on the winter road.

The second option involves the creation of a site for the extraction of lump peat (56.4 thousand tons). In the first and second options, direct costs amount to about 400 million rubles.

The choice of a variant of the mining cluster associated with the use of local types of fuel: brown coal and peat from Berezovsky district of the Khanty-Mansiysk Autonomous Okrug-Ugra in order to ensure the generation of heat and electric energy remains to be done. It is with the executive and legislative branches of the district, with the participation of investors, experts and scientists of the Ural State Mining University.



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论现代俄罗斯法律意识的新兴属性  
ON THE EMERGENT PROPERTIES OF MODERN RUSSIAN  
LEGAL CONSCIOUSNESS

**Demchenko Tamila Ivanovna**

*Doctor of Juridical Sciences, Professor*

*Law Institute of the North Caucasus Federal University*

注释：本文论述了在研究法律意识作为一种理想和现象的现象，以及所使用的线性方法，非线性方法是必要的，特别是波，协同。论法律意识要素的相互作用，其稳定性确保了法律意识的完整性，对人，社会群体，国家和法律生活行为产生积极影响的能力。

论古代俄国时期发展起来的法律意识的归属属性，在后来的时期，它反复强烈地豁免了反复尝试用不属于他的思想来填补国家法律意识的内容并改变它。

关于违反稳定性的法律意识要素在各种因素，内部和外部性质的影响下的比例，以及负面关注的新兴财产的出现。

事实上，俄罗斯出现这种性质的新兴物业引发了另一种西方化，其现代浪潮被称为比彼得大帝时代更强大。

事实上，这些属性，由于西方文化对法律意识的某些要素的积极外部影响，其相关性的方面和局限，显著改变了俄罗斯法律意识的内容，侵犯了其完整性，破坏了社会生活的稳定。

关键词：线性，非线性方法，协同方法，法律意识完整性，法律意识属性属性，法律意识要素相互作用的稳定性，法律意识的突现性，法律意识要素相互作用的稳定性。

**Annotation:** *The article deals with the fact that in studying the legal consciousness as an ideal and phenomenal phenomenon, along with the linear methods used, non-linear approaches are necessary, in particular, wave, synergetic. On the interaction of elements of legal consciousness, the stability of which ensures the integrity of legal consciousness, its ability to exert a positive influence on the behavior of people, social communities, on the state and legal life.*

*On the attributive properties of legal consciousness, developed in the Old Russian period, which in subsequent periods served as a strong immunity against repeated attempts to fill the content of national legal consciousness with ideas that were not characteristic of him and change it.*

*About violation of stability in the ratio of elements of legal consciousness under the influence of various factors, internal and external nature and the emergence of emergent properties with a negative focus.*

*The fact that the emergence of such a nature of emergent properties in Russia led another westernization, the modern wave of which is called more powerful than in the times of Peter the Great.*

*The fact that these properties, resulting from the active external influence of Western culture on certain elements of legal consciousness, aspects and limits of their correlation, significantly changed the content of Russian legal consciousness, violated its integrity, destabilized the life of society.*

**Keywords:** *linear; nonlinear approaches, synergistic approach, integrity of legal consciousness, attribute properties of legal consciousness, stability of interaction of elements of legal consciousness, emergent properties of legal consciousness, violation of stability of interaction of elements of legal consciousness.*

The study of Russian legal consciousness as a very complex system, as an ideal and phenomenal phenomenon, implies a multifactorial approach to its consideration. It allows, along with linear methods, to use nonlinear approaches to the study of sense of justice from the position of cyclicity, waviness, from the position of synergetic principles of cognition.

Of course, a linear approach cannot be excluded from the arsenal of cognitive aids, especially in the context of an increasing orientation towards progressive progressive movement, but it cannot be absolutized, since all known trends are fixed only for a limited period of time. For long periods, they can act in the opposite direction. Therefore, the theory of infinite progress P. Sorokin calls erroneous [1]. With regard to scientific methodology, it is necessary to understand the boundaries and the conditions for its applicability, since any methodology says I.D. Nevvazhay, leads to delusion, if it is unjustifiably universalized and is regarded as the only possible one [2].

The linear approach, in particular, the systematic method based on the recognition of the integrity of legal consciousness, consisting of multi-level structural elements, is useful in analyzing the physical legal consciousness, correlation, development, improvement of elements and legal consciousness as a phenomenon within the materialist worldview and concrete historical conditions. But focusing only on him when analyzing legal consciousness gives incomplete, one-sided knowledge.

The complex use of various methodological methods of cognition makes it possible to identify the non-linearity of the internal processes of legal consciousness, its unconditional, supra-temporal essence [3], the deep specifics of the intangible origin, non-dualism of being and true purpose.

It allows you to comprehend various ways of interconnecting elements, the significance of the constancy of this interaction to preserve the qualitative specificity of legal consciousness, its wave nature, the violation of the limits of which leads to the destruction of the integrity of legal consciousness as a system.

In ancient Chinese philosophy, the understanding of the essence of being and order in it was consistently associated with ignorance and the violation of constancy - disorder [4]. The basis of constancy is the wave character, the stability of the relationship of elements of justice, the preservation of its attributive properties.

The non-linear approach is associated with the understanding of legal consciousness as a phenomenal and ideal, physical and superpsytic phenomenon, as a spiritual-moral, proper legal, formal legal education, called upon to create the righteousness of state-legal existence on the basis of super-temporal and concrete historical truth.

All these forms of legal consciousness are formed in the process of direct and indirect, rational and irrational response, instinctive and emotional-sensory perception, logical analysis, mental and spiritual, intuitive comprehension of the surrounding world.

Many of them do not immediately and not always acquire the usual form of expression, especially a scientific concept. But always determine the processes of cognition, the state of justice and its elements, the content and nature of internal and external relationships, their stability or violation in them.

Elimination leads to violations [5], which is actively used in modern conditions. On the one hand, the role of rational aspects, logical, conceptual thinking is elevated and all that the people were guided by besides the rational one is rejected. Moral and other ideals of national sense of justice are not recognized. On the other hand, more and more attention is focused on instincts, biological needs [6], low-lying properties and actions are stimulated (almost according to Dulles).

The direct basis of state-legal being is the physical legal consciousness, which today is actually a legal consciousness that arises as a result of reflective activity carried out within the specific historical conditions. In relation to this consciousness, the use of nonlinear methods is necessary to identify the patterns of its occurrence, the directions of internal and external interactions of elements, the properties arising on this basis, their influence on the legalization of consciousness and the entire state and legal life.

The external conditions on which the reflective activity of consciousness is directed are characterized by imperfect, contradictory, spurious, besides infinitely changing legislation with an increasing number of prohibitive laws and taxes levied [7]. They determine the content, nature of the modern properties of the elements and the legal consciousness in general, their demoralization, legalization, direction of action, give them a negative value, violate the stability of the interaction.

Serious violations are caused by a conscious and aggressive intrusion into the process of interaction of elements of external foreign factors, as a result of which emergent properties with a negative orientation may arise.

Attempts to change the nature and content of the domestic legal consciousness have been repeatedly made in the history of the country. They took place in the IX-X, XIV-XV, XVII, XVIII-XIX, XX centuries. In the IX-X centuries, this was mainly due to external influence, with the Christianization of the Vedic and pagan consciousness, which spread to the territory of the old Russian statehood [8], north-western and south-western Russia.

A powerful wave of Christianization was aimed at changing the outlook of the ancient Russian people, the essence and content of legal consciousness, state order and concepts about them. Attention is drawn to the coincidence of actions, almost simultaneously aimed at introducing a new dynasty, a new religion, a new writing [9]. Various facts testify to the active intervention of both Byzantium and Rome in the affairs of Russia, their political pressure on Russia and rivalry in this.

In the process of Christianization, a confrontation took place - ideological, ideological, religious, which led to the struggle for power, the internecine wars of the princes, among which were adherents of ancient and new knowledge. And borrowing and use of ancient knowledge.

This feature of the interaction did not lead to a change in the essence of justice. It allowed the Russian people to pass through their consciousness, based on the absolute thought of the unity of spiritual and material being, of divine justice and human righteousness, new ideas and to perceive the Christian God as the highest truth, as the truth in generalized expression.

The people managed to do this thanks to inner spiritual strength, which is fixed in the legal consciousness in the form of a conservative instinct, expressed in the form of myths, commandments, traditions, legends, princely teachings, and political treatises.

As a result of the complex interaction of elements of the ancient and new legal consciousness, it was filled with emergent properties, representing a terminological and semantic combination of Vedic, pagan and Christian knowledge, which were also rational, logical, and irrational, and spiritualized.

On this basis, ideas were developed, spiritually, morally illuminated, emotionally colored, which expressed the essence of national existence and were of enormous historical significance for the unification of the people and the creation of a strong centralized state.

First of all, this is the idea of truth, as thoughts about the unconditional, natural, united and just, as a human expression of the perception of divine energy and glorification (hence Orthodox), its creative power. As a sense of co-knowledge [10], duty, responsibility. The comprehension of the idea of truth, which was nourished by an intuitive sense of justice, was associated with an understanding of law that elevated it above selfish interests and formal institutions.

The comprehension of this idea was associated with the realization of the pro-

Slavic, then the Old Russian, Russian people of their national-cultural characteristics, their historical mission. The ideas of truth and Orthodoxy, which permeate the legal consciousness and the entire state and legal life, will later be called the source of the Russian idea by domestic thinkers.

The essence of national existence is reflected in the Vedic ideas of the unity of material and spiritual being, the integrity of consciousness, as an absolute reality and as a physical phenomenon [11]. On the basis of these ideas was born an understanding of the significance of the unity of the Russian Land, the danger of violating its integrity and the need to serve it. Russian Land, founded, according to MF. Vladimírsky-Budanov, on territorial relations, to which the significance of both the population and the authorities was transferred, was a peculiar form of expression of the statehood of a complex multi-ethnic entity [12] that constituted the Russian people.

These ideas formed the basis of state sense of justice with elements of a single, strong, independent, independent state power, which later will be included in the content of the concept of state sovereignty.

The essence of national existence is expressed in the ideas of the state of truth, the law of truth, righteous government, spiritual, moral and intellectual qualities of the ruler [13]. In the ideas of law as truth, supreme justice and law as a rational measure of human existence, therefore it is an appearance of law. Ideas of freedom, internal, spiritual and external, existing through social restrictions.

These ideas were attributive properties of legal consciousness, constituted the content of the right cultural ideal, which in subsequent periods served as a strong immunity against historical adversity, against repeated attempts to fill the content of legal awareness with ideas not characteristic of it, to change its national properties.

Another attempt to change the national identity was made in the 90s. last century, when the transition from socialism to capitalism began. The transition, accompanied by a powerful wave of westernization, orientation to the Western model of state-legal development, which is not universal, is not universal the Western civilization itself, which, according to A.I. Kovler, is "no more than the thinnest layer on the thickness of local civilizations and cultures ..." [14].

Another Westernization, the modern wave of which is more powerful, according to some authors, than in the times of Peter the Great, accompanied by active external influence of the Western worldview, culture, liberal democratic principles, high informational load, progressive orientation, globalization, - legal life, led to serious changes in the Russian sense of justice.

They are characterized by a change in nature, directions, aspects of the ratio of interacting elements of legal consciousness, the emergence of emergent properties that influenced its content, integrity. According to V.N. Sinyukov, there was a change of cultural landmarks in the country [15].

The content of individual and public, including the state sense of justice has changed. There has been a liberalization and legalization of the formation, development, understanding and rethinking of state legal consciousness, its fundamental ideas. State legal consciousness has ceased to focus on the essential features of the state, state power, state ideology, national interests, on the integrity of their being, based on a reasonable combination of progressive and protective ideas.

The state is perceived and built as a corporation, and not as an organization of supreme power, designed to embody the ideal and express the moral and psychological state of the nation. The supreme power is identified with a governing authority that is not independent.

The idea of a goal orienting to achieve the meaning of state and legal life, the idea of justice, as a correspondence to the truth, a just order, should be removed from the state sense of justice [16]. Deformed ideas about the properties of the supreme state power.

Priority to the legal field. The legal law is recognized so significant that it is put in one row and in fact is identified with the law, which represents the value of the highest order. The guiding principle defines and constitutionally establishes external freedom, with which the idea of contractual origin and the structure of the state is connected. For the sake of individual freedom, the denial of the nation as a whole actually goes [17], and in the contractual way and in the theory justifying it, there is a tendency to deviate from the idea of the state, the most important idea of state sense of justice.

External freedom does not correspond to the essence of being of the manifested material world, all the material elements of which are within strictly defined boundaries. Under the rule of law based on external freedom and formal law, people with their individual, deformed sense of justice, tend not to truth-based on mutual recognition, respect and cooperation, but to success, unprincipled struggle and victory by all means, often at the expense of other people.

Individual sense of justice, freed from meaning, ideal, moral principles, emotion-oriented and successful life, is an arena of struggle, which includes almost all of its elements, levels and states, including deep ones, in which information about their own ideals is preserved. Not everyone succeeds in preserving true values in this psychological struggle, especially since they are not honored today.

The state has been removed from the transfer of true traditional values, from real educational and pedagogical activity. And private media carry the “new” principles of market being to the masses. Freed from debt, from the obligation of labor, as the basis of life, from other vital principles, people begin to focus on external values, on pragmatic interests, on selfishness, benefit, utility.

Orientation to physical (legal) being, to material wealth, the technicalization of modern state and legal life made the legal conscience conditional, limited, one-

sided, fragmentary, aimed at the formation of highly specialized knowledge. They made him equal to legal consciousness. Analysis, not synthesis, lies at the heart of the study of legal consciousness and other political and legal phenomena.

In the context of such legal consciousness, said IA Ilyin, no one takes seriously either his or her own will. Under such conditions, the idea of law is trampled, and deception remains from the rule of law [18].

The conditions of such sense of justice and the rule of law have led to the fact that the negative consequences of modern political and legal activities are far ahead of positive trends. They can lead to a change in the essence of legal consciousness, the destruction of it as a national phenomenon in a given quality and of the entire Russian state-legal being. Time calls for national identification and the development of positive trends.

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6. But if biological law prevails, said E.N. Trubetskoy, if instinct, food, drink is everything in life, if there is nothing biological in it, then the sounds of the sky, color, music, art, in general spiritual trembling and their super biological understanding of meaning do not mean anything. See: E. Troubetzkoy. Selected Works. Rostov-on-Don. 1998. p. 46, 52-57, 65-67, 79-81.



7. *When laws and orders grow, the number of thieves and robbers grows, Lao Tzu said. When there are many prohibitive laws in the country, the people become poor. See: Tao Te Ching // Tao. Harmony of the world. - Moscow, Kharkov, 2000. p. 27.*

8. *Academician V.L. Yanin, a long time engaged in the excavations of Novgorod, believes that the core of the ancient Russian statehood was formed in the area of Ladoga, which was the capital until the XI century, and Novgorod, which became the capital from the XI century. A huge number of birch bark letters found during the excavations of Novgorod testify to this. See: Birch bark documents: 50 years of discovery and study. Ed. V.L. Yanin. - Moscow, 2003.*

*Perhaps this period of ancient Rus was a certain echo of the Slavic-Aryan civilization. Interest in these issues is increasing. The expedition, organized by the editors of the Komsomolskaya Pravda on the Kola Peninsula in the summer of 2018, claims that there is evidence of the Hyperborean civilization.*

9. *Cyril and Methodius created the Church Slavonic alphabet for the Christian church on the land of Rus. Based on the initial letter, consisting of 49 letters. Each letter had a certain image - Az, God, Veda, etc. Image: O - Similarity; Bd God; Ra - Shining, the Light of the Most High; Az-As - Man. It turns out: the Image is God, and Man is like him. Understanding the image, its meaning and conformity gave him strength, made him powerful. Cyril and Methodius removed the letters that transmitted throat sounds, some modified and began to translate from Greek. Losing voice sounds, people lost a special vibration. The loss of nasal sounds adversely affected the functions of the pituitary gland, which is the center of the will.*

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现代教育技术在大学无机化学教学中的人性化  
**MODERN EDUCATIONAL TECHNOLOGIES  
IN THE HUMANIZATION  
OF TEACHING INORGANIC CHEMISTRY AT THE UNIVERSITY**

**Beisekova Aliya Alpysbaevna**

**Utemissova Arailym Zhubatkanovna**

*Abai Kazakh National Pedagogical University*

**Gavranskaya Yulia Yurievna**

*Doctor of Pedagogical Sciences, Professor*

*Herzen State Pedagogical University of Russia*

抽象。人性化学习无机化学的想法是基于个人和社会的价值观与自然科学内容的整合。有机无机化学教学人性化系统的实质部分包括与人文学科融合的元素,如历史,艺术,外语,以及生态学;培养了分析,综合,比较,分类概括以及道德和精神价值的基本智力技能。程序部分将传统形式的讲座,实验课程,独立工作与混合,项目,互动,项目和游戏培训的现代教育技术相结合。无机化学教育人性化概述的主要方面:历史,环境,发展和价值相关,与哈萨克斯坦教师的民族文化遗产和学生的国民教育理念相关联。

关键词:教育人性化,化学教学,教育技术。

**Abstract.** *The idea of humanizing learning inorganic chemistry is based on the integration of the values of the individual and society with the natural science content. The substantive component of the methodical system of humanization of teaching inorganic chemistry includes elements of integration with the humanities such as history, art, foreign languages, as well as with ecology; developed basic intellectual skills of analysis, synthesis, comparison, generalization of classification and moral and spiritual values. The procedural component combines traditional forms of lectures, laboratory classes, independent work with modern educational technologies of mixed, project, interactive, project and game training. The outlined main aspects of the humanization of inorganic chemistry education: historical, environmental, developmental and value-related, are connected with the ethnopedagogical heritage of Kazakh teachers and the idea of national education of students.*

**Keywords:** *humanization of education, teaching chemistry, educational technology.*

The ideas of humanization are widespread in education, especially in recent decades. Based on the understanding of education as the unity of education, upbringing and development, supporters of humanization pay special attention to the processes of personal self-development associated with a responsible attitude to nature, society and knowledge. At the same time, in school education, first of all, they talk about personal and metasubject results, at universities - about universal or key competences, and subject results, especially when studying natural sciences, such as chemistry at school or inorganic chemistry at a university, are in the background. However, the study of chemistry has a great humanistic potential, realized through the humanization of content and modern learning technologies [5].

The aim of our study was to identify the possibilities of modern educational technologies in the humanization of learning inorganic chemistry. The study of chemistry in both school and university begins with this section of chemistry. Inorganic chemistry examines and describes the composition, structure, properties, reactivity of chemical elements and their compounds. The number of known inorganic substances is in the hundreds of thousands, so the area of their distribution or use in everyday life, technology and nature is so vast that every person not only encounters them daily, but eats (salt), drinks (water), breathes (oxygen air). The theoretical basis for inorganic chemistry is primarily the Periodic Law, as well as a series of exercises that form the basis of the four conceptual systems of chemistry.

Humanization of learning inorganic chemistry is a system of forming the values of self-development and the interaction of man with society and nature through the process of mastering the subject chemical content. The functioning of the system is provided by the interaction of key components - meaningful and procedural-activity, with the participation of motivational-targeted and evaluative-effective components, as well as the activities of participants in the humanization process.

The substantive component of the humanization system of teaching inorganic chemistry is represented by humanitarian and environmental content, that is, by incorporating into the content of education the components of humanitarian knowledge: history, artistic culture, foreign languages, local history, and chemical ecology and environmental chemistry. There are many studies that reveal the humanization of the content of training in inorganic chemistry. Historical aspects in chemical education are considered by the authors [2, 9]. Thus, in the works of I. M. Titova [9] the interrelation of chemistry and art is revealed, the chemical nature of paints, materials of applied and decorative art, the preservation and restoration of monuments are affected. Features of the introduction of the content of chemistry of the elements of a foreign language are discussed in [3, 4, 6]. The integration of chemical and environmental knowledge was investigated by O.G. Rogova [8].

In addition to the humanitarian and environmental material in addition to the chemical, the informative component includes intellectual skills developed on the

basis of chemistry, as well as moral and spiritual values. Basic intellectual skills underlie the same experimental methods of chemistry - chemical analysis and chemical synthesis; Comparison of the composition, structure and properties of individual chemicals leads to their generalization and classification; abstraction is associated with the formation of a system of chemical concepts and the establishment of cause-effect relationships between chemical substances and chemical phenomena. The formation of a value system in teaching inorganic chemistry was discussed by us in [1].

The procedural component of the methodical system of humanization of learning inorganic chemistry includes forms and learning technologies that contribute to the development of humanitarian content. In addition to traditional lectures and laboratory classes, there are two types of independent work — independent work of students and independent work of students with a teacher. Note that the last type of independent work contributes to the development of the student's subjectivity to a greater degree than the others. In order to achieve the results of the humanization of learning inorganic chemistry, in principle, both modern and traditional learning technologies can be used. The main function of educational technology is the formation of personality in accordance with the order of society; and from this point of view, all pedagogical technologies correspond to the ideas of humanization. In the present study, the technologies of project, interactive, mixed and game learning were used.

Given the diversity of content, forms and educational technologies, we have identified four aspects of the humanization of learning inorganic chemistry: historical, environmental, developmental and value. First, the development of chemistry, starting with the first substances and the chemical processes developed by man - burning, clay burning, metal smelting, through a complex, long way of accumulating knowledge and developing laboratory techniques to the development of four conceptual systems of modern chemistry (teaching about the composition of matter, teaching on the structure of matter, the study of chemical process, evolutionary chemistry) reveals the historical aspect of humanization. Secondly, the close connection of chemistry with an understanding of the chemical foundations of life, chemical ecology, environmental pollution problems, the spread of chemophobia, etc., creates conditions for the formation of a person who responsibly uses the knowledge and competences gained in interacting with nature and the surrounding man-made world. Thirdly, the study of chemistry as a subject traditionally considered difficult for students contributes to the activation of intellectual activity and the culture of knowledge, namely it contributes to the formation and development of intellectual skills. Those concepts that are formed and used in chemistry are based on images of material objects that are almost impossible to see, feel (atom, molecule) or are abstract (valence, degree of oxidation). The

mental operations with him or their visualizations are one of the ways of human self-development. The task of forming an intellectual nation in higher education of the Republic of Kazakhstan is one of their priorities. Fourthly, axiological questions are always involved in the study of chemistry. The student performs cognitive and practical actions in the study of chemistry, focusing on the learned moral and spiritual values. In Kazakh higher education, this aspect is associated with the idea of national education of students [1, 2], ethnopedagogical heritage.

We linked the highlighted aspects of the content with the forms and technologies of training (Table 1).

**Table 1.**  
*Technologies, forms and content of the humanization of learning inorganic chemistry*

<b>№</b>	<b>Applied technologies</b>	<b>Forms of study</b>	<b>Content</b>	<b>Examples</b>
1	Technology blended learning in the modification of the "Inverted Class"	Lecture	Humanitarian content (historical aspects of the formation of theories and laws of chemistry)	Theory of Electrolytic Dissociation
2	Project Learning Technology	Laboratory	Environmental content (environmental aspects of the use of chemicals and chemical production)	Project on the study of hydrochemical parameters of groundwater of the Aral Sea
3	Interactive learning technology	Independent work of students	Intellectual skills developed on the material of chemistry (mnemonic, mental, imaginative)	Virtual Chemical Experiments
4	Gaming technology	Independent work of students with a teacher	Spiritual values (responsible use of acquired knowledge and competence, focusing on the learned moral values)	Role-playing game "Trial of Inorganic Chemistry"

As part of the research, it was revealed that the most important aspects of the humanization of learning inorganic chemistry are historical, environmental, developmental and value aspects, implemented through humanitarization of the content and implementation of humanitarian technologies in chemistry education.

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文本文本的文字类型的语义感知作为年轻学生语言发展的一个因素  
**MNEMIC TYPE OF SEMANTIC PERCEPTION OF THE TEXT  
OF THE TEXT AS A FACTOR IN THE LANGUAGE DEVELOPMENT  
OF YOUNGER STUDENTS**

**Yurtaev Sergey Vasilyevich**

*Doctor of Pedagogical Sciences, Professor  
State Humanitarian University of Technology  
Orekhovo-Zuyevo*

注解。研究主题选择的相关性取决于文本的语义感知对人类认知能力发展的价值，学生对这种感知的不充分形成，其在教学过程中的可用储备。该研究的目的是确定学习过程的管理领域，包括为年轻学生准备认知活动。如果我们描述了学龄儿童陈述的文本中出现的句子之间的语义变化，那么就可以通过实验验证这一目标来实现这一目标。

本文描述了文本中句子之间语义关系的转换，供年龄较小的学生介绍。这里公开了教育信息文本的小学生的技术，作为其预先确定语言选择的主要特征之一。

关键词：语义关系，句子，文本，小学生，认知活动，语义感知，发展。

**Annotation.** *The relevance of the choice of the research topic is determined by the value of the semantic perception of the text for the development of human cognitive abilities, the insufficient formation of this perception among schoolchildren, the available reserves of its improvement in the pedagogical process. The purpose of the study is to identify areas of management of the learning process, involving the preparation of younger students for cognitive activity. Achievement of this goal is seen through experimental verification of the position that the reserves for preparing children for cognitive activity are revealed, if we characterize the changes in semantic between the sentences that occur in the texts of the schoolchildren's statements.*

*The article describes the transformation of semantic relations between sentences in texts for presentation by younger schoolchildren. Here the technology of teaching younger schoolchildren of informative text is disclosed, as one of its main features that predetermine the choice of language.*

**Keywords:** *semantic relations, sentences, text, younger schoolchildren, cognitive activity, semantic perception, development.*

### **Introduction**

One of the most important pedagogical tasks of the modern school is to prepare students for independent cognitive activity. This task is becoming more urgent. Every year the flow of information increases. In this information you need to be able to quickly navigate, choose the main content. The ability to grasp the essence of the perceived material and pass it on to others is an urgent problem of cognition of reality.

Great importance in the formation of the ability to work with information has such a method of language development of schoolchildren as a concise presentation.

From the point of view of the psychology of speech, succinct presentation consists of two interrelated speech-thought processes. On the one hand, it is prepared by the perception of the text. On the other hand requires its reproduction.

As noted Artamonov D.G. In their article "Psychological features of the process of semantic perception of the text," many psychologists and linguists were engaged in the study of the relevant issue. At the same time, they emphasized its complexity, the procedural nature of receiving and processing information. [1, p. 15-18] The complex nature of the semantic perception of the text is explained by the fact that the collision of the human psyche with the reality surrounding it always turns into a solution of the problem with many unknowns. [2, p. 221]

Text perception is a process of "disclosing word-mediated connections and relationships" [4, p. 5], which constitutes his understanding, "the subject of understanding is always the disclosure of certain connections and relations" [5, p. 304]. The fact that perception and understanding form a unity is noted in the works of many researchers of speech: "We perceive speech on the basis of its understanding and we understand on the basis of its perception" [3, p. 113].

The understanding of the text in its perception is the analytical-synthetic work of thinking [4, p. 10].

The success of perception of the text largely depends on the mastery of the techniques of analytical and synthetic work of thinking. Possession of these techniques can be traced. To this end, it is possible to take into account changes in the syntactic relations between the sentences that schoolchildren make in the relations between the sentences of the primary text, the text for written retelling.

The purpose of the study is to identify possible areas of management of the learning process, involving the preparation of younger students for cognitive activity. Achieving this goal is seen through an experimental verification of the fact that the reserves for preparing children for cognitive activity are revealed, if we characterize the changes in the semantic relations between the sentences that occur in the texts of the schoolchildren's statements.



### **Materials and research methods**

One of the methods of obtaining scientific data was the pedagogical experiment, which consists in creating the conditions under which students compiled texts of succinct presentations. Pedagogical experiment was carried out in class. The lesson was conducted according to his methodology, which has traditionally been established over many decades. This was done for a number of reasons. The experiment was conducted in the fourth year of study. Violation of the generally accepted educational process would affect the results. In addition, other requirements would be unusual for schoolchildren, which would also affect the expected outcome.

The lesson of compressed presentation included the conversation of the teacher before reading the text, his reading. Then the teacher turned to the class with questions about the content that the children could adopt, with tasks to repeat the spelling. Then the schoolchildren proceeded to the grammatical formulation of a concise presentation of the text.

Another method of research is a comparative analysis of the semantic relations between the sentences of the educational text and the texts of the student's succinct presentation.

On separate cards from the text of the training were written suggestions for groups. Moreover, the proposals were carriers of microthemes. In addition, a card file was compiled of proposals for carriers of microthemes of student texts. Offers of cards with student offers were compared. Cards with the same semantic changes were combined into one type. Offers of cards of the same type were compared with the proposals of cards of the educational text. The semantic relations between the reproduced sentences were compared with the semantic sentences of the text presented for perception.

Let us dwell on the characteristics of the structure of the educational text.

Referring to the content of the text. It is represented by the following microthemes: the sailors' find, the cat in love, changes in the cat's behavior, the notion of the sailor Ozhygov, boots for the cat, the attitude of the cat to the boots, an angry cat. The author's speech plan to tell how the sailors saved the cat is a uniting microtheme as a whole.

Let us turn to the plan for the expression of the content of the educational text. This plan is represented by the proposals that form the groups.

Between the sentences of the first microtheme, a semantic relationship takes place between the first and second, second and third sentences, the consequences and mode of action between the third and fourth, fourth and fifth sentences. In the sentences of the second microtheme, the message is transmitted by establishing a cause-effect relationship ensuring the connection of the second, third, fourth sentences to the first. In the sentences of the third microtheme, a thought is expressed by means of a connecting, causal, clarifying relationship.

The following sentences convey content by establishing causal and interconnecting sentences between sentences. The sentences of the fifth and sixth microthemes are in the same paragraph. In the sentences of the fifth microthem, there is a definitive meaning relationship between the first and second sentences and the mode of action between the second and third sentences. In the sentences of the sixth microtheme, there are additional-semantic relations. The last sentences include a comparative relation between the first and second sentences, an opposing reference between the second and third, a connecting-indicating between the third and fourth, clarifying between the fourth and fifth, the reasons between the fifth and sixth sentences.

Let us characterize the changes in the semantic relations between the sentences of the texts of the student's succinct presentations that made up the mnemonic type. To do this, as an illustration of reflection, take the presentation of Denis L.

Changes in semantic relations between sentences will be considered in paragraphs in the way that the student has designed.

1. Once a ship sailed in the open sea, the sailors of which noticed a cat in the sea. He swam in the trough. They saved the cat. He was called the Theme.

Here, there is a reproduction of syntactic units close to those presented, the preservation of the order of the semantic relations between them. At the same time, the semantic relation of the investigation is excluded.

2. The second microtheme is not expressed.

3. Soon the sailors noticed that the cat was afraid to go on deck. One sailor explained. The cat does not tolerate electrical currents.

The exception of the semantic relationship between the first and second sentences is traced. Reproduced only the information that the cat was afraid to go on deck. Of the proposals for the causes of changes in the behavior of the cat reproduces one. Omitted from them, which contains additional, to the already stated, information. And, therefore, the specifying semantic relation is excluded.

4. Everyone wanted to help Temka. The cobbler told the captain about sewing the cat's boots.

The semantic relations between the sentences on the work of the sailor Ozhigov, the connecting-additional relations are subject to the exception.

5. The cat did not want to wear boots. Soon the cat got used to the boots.

Exceptions have been made to the proposals on how the boots turned out.

### **Decisions and discussions**

For an example of a text of a concise presentation, simple sentences resembling sentences presented for retelling are typical. And if there are complex sentences, they are also similar to those that occur in the educational text. In addition, outside the semantic perception of the text by the schoolchild are such semantic relationships as consequences, clarifications, additions, definitions, comparisons.

Of course, the absence of such semantic relations does not interfere with the understanding of the text; they do not affect its main content. Thus, it can be argued that possession of information analysis and synthesis techniques is indicative.

However, semantic perception, focused mainly on information of a prepositional nature, paragraph-based introduction, calls for its incomplete perfection. The incompleteness of this perception lies in the insufficient use of the method of summarizing information.

Formation of the generalization of information is possible in the process of work to give the student's utterances such a feature of the text as informative.

Let us reveal the training of younger schoolchildren informative text, using some of the material of the author's article. According to Yurtaev S.V. in the article "Formation of the concept of" text ", the methods of work of the teacher should be the creation of problematic speech situations (PS), types of special exercises.

We give examples of problematic speech situations, exercises.

Initially, the teacher introduces schoolchildren to the role of the theme in the work on the content of the text.

PS 1: The teacher in the classroom asked second graders to talk about the onset of autumn. Ivanov Peter raised his hand and said: "I like the summer better. You can go to the river, eat berries in the garden, play football. You can't do this in the fall. Therefore, I do not meet autumn very readily. "

- Did the boy do the job? Why?

Types of exercises: defining the topic of the text in the hearing process; prediction of the topic of the text by title; observation of the reflection of the theme of the text in the title; formulation of the theme of the utterance; understanding of the process of disclosing topics when reading works of art.

The next stage in learning to work on the content of the text falls on the formation of an idea about the development of a theme in a statement. The concept of this correlates well with the assimilation of such a term as "microtheme".

PS 2: In the world around us objects, phenomena, events are in close relationship. Imagine what would happen if the sound was interrupted while watching a cartoon? If you had missed several school days due to illness? If the books suddenly disappeared? And what happens if the sentences in the text are written as in this example? (The text is written on the board.)

Nest

The bird fluttered out from behind a bush and spun over our heads. We carefully parted the branches. They were not afraid of us. Nestlings grew and flew away. Chicks appeared. We often came to the nest. We did not touch the nest, did not even touch it. Chicks are used to us. We went to the city. Houses often recalled the warm summer and our unsuspecting birds. (According to I. Sokolov-Mikitov)

- What needs to be done to get the text? Call it a topic. What should be dis-

cussed at the beginning? What can you tell, secondly, thirdly? (About the finding of people, about the attachment of chicks to people, about the parting of people and birds.) How many subtopics happened? Can these subtopics be further divided into subtopics?

Types of exercises: the formulation of microthemes; finding the boundaries of the microthemes; disclosure of microthemes.

The third stage of the work on the content of the text involves the students' understanding of the presence of subject and semantic content in the statements.

PS 3: Listen to a fragment of the poem. Determine who we are talking about, then what is said about them. (The teacher reads the text twice: first, skipping words enclosed in parentheses, second, skipping words enclosed in square brackets.):

... (I) sent to the bazaar (eccentrics), / Dal (eccentrics) Pyatakov. / One penny - on the sash, / Another penny - on the cap, / And the third penny - so. / On the way to the bazaar (cranks) / They mixed up all the Pyataks: / Which pyataks - on the sash, / That pyataks - on the cap, / And which pyataks - so ... (Y. Vladimirov. Eccentrics)

- Why there were difficulties in carrying out my task? What you need to remember, opening the topic?

Types of exercises: comprehension of the subject and semantic content on the teacher, for example, when reading a poem; comparison of single-text texts; expression of thoughts about the general subject of speech. [6, p. 55-56]

### **Conclusion**

The predisposition of many younger students to memorize prepositional syntactic structures in the process of semantic text perception leads to a decrease in the depth of its understanding, since the information specifying, complementary, investigative, comparative nature has the degree of human penetration into the essence of objects, phenomena of the world. As a result, there is a need to work on adjusting this perception. Correction of the semantic perception of the text by younger students is carried out in terms of work to increase the awareness of schoolchildren of such a feature of the text as its informativeness. Schoolchildren single out the subject of the text, observe its expression in the headings, learn to isolate micro-themes, find the limits of their disclosures, determine the objective and semantic content of the utterance. In this way, they develop their cognitive abilities, master the skills of linguistic expression of information. In general, they follow the path of language development.

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在患有糖尿病, 肥胖症和高血压的疾病的条件下, 适合矫正男性健康  
**FITNESS FOR THE CORRECTION OF MEN'S HEALTH IN CASES  
OF THE DISEASE DIABETES, OBESITY AND HYPERTENSION**

**Golovanov Sergey Aleksandrovich**

*Candidate of Pedagogical Sciences, Associate Professor  
Director of the Center of physical culture and sports,  
State University of management*

**Rasulov Maksud Muhamedjanovich**

*Doctor of Medical Sciences, Professor  
Head of Department  
State research Institute of chemistry and technology  
of Organoelement compounds*

注解。 研究了使用2型糖尿病合并1-2度肥胖和高血压的男性健康适应性体育方法进行矫正的可能性。 已经证实, 在适应性条件下, 通过程序“TANITA”自动控制给定的物理负荷有助于降低动脉压, 血液中的葡萄糖水平以及肥胖程度。 在健身自动化过程中使用, 实时客观控制体育活动, 提高健康方法和适应性体育文化。

关键词: 健身, 糖尿病, 高血压, 肥胖, «TANITA»计划。

**Annotation.** Studied the possibility of correction using the methodology of adaptive physical culture of men's health with type 2 diabetes mellitus complicated by obesity of 1-2 degrees and hypertension. It is established that the use of automatic control of the given physical load by the program «TANITA», in conditions of fitness, helps to reduce the level of arterial pressure, glucose in the blood, as well as the degree of obesity. Use in the process of fitness automatic, objective control of physical activity in real time improves the methods of health and adaptive physical culture.

**Keywords:** fitness, diabetes, hypertension, obesity, «TANITA» program.

Recently, the total number of patients with diabetes mellitus and pronounced general health changes has extremely increased all over the world and nowadays it is stably occupying the second place after cardiovascular diseases [3, 4]. This problem occurs not only in Russia. This is a problem of a planetary scale, according to the data of the World Health Organization [1, 5]. Consequently, the

problem is multifaceted, complex and *relevant*. Besides, men of 35-45 years old are the main and widespread group with recurrence conditions. Nevertheless, the possibility of using training and restorative fitness techniques for correcting health of patients with diabetes mellitus and concomitant diseases has not been studied enough, which determined the *purpose* of this study - the development and testing of training methods in fitness conditions for patients with diabetes, obesity and Stage 1-A hypertension.

**Methods and Organization of the Study.** All studies were conducted on the basis of a fitness premim class club «Svelte» in Moscow. The total observation period was 6 months per year, which is due to the peculiarities of the training cycle, as well as to the peculiarities of the analyzer «TANITA». An experimental group of men at the age of 35-45 years, suffering from type 2 diabetes, obesity and hypertension 1A, consisted of 16 people.

All subjects independently kept unified diaries of a diabetic patient, as well as of a patient with hypertension. Before the training began, all subjects underwent mandatory medical check-up and had a brief instruction. The fitness expert made adjustments to achieve the fastest and correct result for the trainee. With the help of aerobics (walks in the fresh air (at least 10 km per day), jogging, swimming, cycling, elliptical training, etc.), it is possible to effectively and safely reduce blood sugar, even in patients having complicated form of diabetes for many years. It is proved that the effective physical activity for the body of men, must be taken at heart rate up to 130-140 beats per minute [2]. Each lesson consisted of 3 stages: preparatory, main and final. Each training session was followed by a day of rest.

*The preparatory stage* of the training took 15 minutes and consisted of two parts: a general warm-up and a special one. The lesson started with a warm-up on the treadmill or bicycle, depending on the characteristics and limitations of the locomotor system (LMS). The task was to activate the LMS and the activity of the internal systems of the body, raising the heart rate (up to 120-130 beats per minute) during 10 minutes. Then the gymnastics was done for all muscular groups within 5 minutes, to increase the coordination of movements, to prepare and mobilize the muscular apparatus, the nervous system, the ligaments for the upcoming physical activity.

*The main stage* of the training took 45 minutes and consisted of two parts. The first part of the training phase was the work on the simulators and with small free weights (light dumbbells, body bars). All the exercises were simple and were performed strictly one after another in a circle (circuit training) for 25 min. There were 6 exercises in total. The work was conducted uninterruptedly, at a low speed, one exercise after the other. Working weights were not high. There were 8-10 exercises in one set. There were 3 laps, after each of them the trainees had a 5-minute rest until they were completely recovered. Mandatory and constant monitoring

of heart rate was performed during the exercises and the rest. During the circuit training, the method of multiple reps of non-maximum load was used. During the exercises, the trainer and the medic monitored the heart rate pulse zone - no more than 140-145 beats per minute. If exceeded, then the load was not raised any more in order to prevent the recurrence of diabetes in the trainees. The second part of the stage was aerobic exercises performed for 20 minutes. It included work on a cardio-simulator (treadmill or bicycle) with a particular heart rate (no more than 40% of max.), above which aerobic exercises were not applied any more. The maximum of the heart rate was calculated according to the formula ( $220 - \text{age} = \text{max HR}$  and from this result they calculated 40%). In such operating mode, energy is provided by fat oxidation (50% or more).

*The final stage* of the training session was cool-down exercises that lasted 15 minutes and included walking on a treadmill or a bicycle, depending on the characteristics of the LMS. Exercises for relaxation with deep breathing were performed. This stage was aimed at a soft exit from the main stage of training. There was a gradual decrease in the functional activity of the organism of the trainee and stabilization of the heart rate. Then there were breathing exercises and an easy stretching. At this stage, the training perspectives were determined for each trainee.

The data obtained were processed statistically using Student's method.

**Results and discussions.** The conducted observations showed that taking physical exercises in the operating modes described above among the patients with diabetes of type 2, obesity of stage 1-2 and hypertonia 1A leads to a stable decrease of the systolic blood pressure levels (SBP), as well as of the levels of diastolic blood pressure (DBP), blood sugar and lipo (table).

*Table. Changes in somatic status and arterial blood pressure in subjects*

Time	Lean body mass (kg)	Lipo mass (%)	The level of sugar (un.)	SBP(mmHg)	DBP(mmHg)
start	54,8± 3,9	38,9± 2,3	11,1±1,4	135,5±5,2	92,2±3,3
finish	55,9±2,9	37,1±2,2	8,1±0,9	128,2±3,5	88,4±3,1

Note: \* -  $p < 0,05$

To adapt to the physical load in the gym, it is advised to have no more than 3 lessons per week. Before the physical exercises, a full warm-up is required within 10-15 minutes. The warm-up can be carried out on a treadmill, it is possible to use a bicycle, an ellipse, a stepper. It is necessary to stretch the local parts of the body, joints, ligaments, tendons. To do this, you need to do some exercises for your joints. Then there goes the main part of the workout. And in the end, trainees do the final part of the training or cool down exercises, for 10-15 minutes, during



which they can use a track and a bicycle. The main task is to reduce the pulse zone and calm down the body after the exercises. During the exercises, it is necessary to strictly control the pulse zone. We found the best training methods for safe and effective training sessions with the given group of men, that will significantly expand the boundaries of training capabilities of adaptive physical culture.

**Conclusion.** The presented results prove the possibility of strengthening the health of training men of 35-45 years old having type 2 diabetes and concomitant obesity of 1-2 stages and hypertension 1A. They also prove the effectiveness of physical training using the body analyzer «TANITA». The obtained data supplement the theory of physical rehabilitation by justifying the structure and content of the method of health training; allow expanding the existing understanding of the necessity to create conditions for health training.

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人口安全和社会信心水平标记因子分解 (基于托木斯克地区研究)  
**POPULATION SECURITY AND SOCIAL CONFIDENCE LEVEL  
MARKERS FACTORISATION (BASED  
ON TOMSK REGION STUDIES)**

**Romanchukov Sergey Viktorovich**

*Postgraduate*

**Berestneva Olga Grigorevna**

*Doctor of Technical Sciences, Professor*

**Ivankina Lyubov Ivanovna**

*Doctor of Technical Sciences Professor*

*Tomsk Polytechnic University*

注解。这项工作是在俄罗斯基础研究基金会的支持下,在第18-37-00344号项目“分析和模拟该地区社会 and 经济发展参数的相互关系”的框架内进行的,并致力于确定数据库中的潜在变量是根据“该地区的社会和文化肖像”项目所包含的团队的社会学研究形成的,以及来自联邦国家统计局的数据,以确定影响经济过程的因素该地区的发展。这项工作考察了人口主观安全感指标与社会机构信任程度之间的关系。相关分析方法证实了这些变量集之间存在关系,这使我们能够进行因子分析,减少描述所选问题块的变量数量。

关键词: 人口安全指标, 信任度, 置信度, 社会福祉, 相关性, 因子分析。

**Annotation.** *This work was carried out with the support of the Russian Foundation for Basic Research in the framework of project No. 18-37-00344 "Analysis and modeling of the interrelationships of parameters of social and economic development of the region" and is dedicated to identifying latent variables in a database formed on the basis of a sociological study of the team included in the project "Social and cultural portrait of the region", and data from the Federal State Statistics Service, in order to identify factors that influence the process of economic development of the region. This work examines the relationship between the indicators of the subjective sense of security of the population and the level of trust in social institutions. Correlation analysis methods confirmed the existence of relationships between these sets of variables, which allowed us to carry out factor analysis, reduce the number of variables describing the selected block of questions.*

**Keywords:** *population security indicators, trust, confidence level, social well-being, correlation, factor analysis.*

**Introduction.** The project “Analysis and modeling of the relationships of the parameters of social and economic development of the region”, as its name implies, focuses efforts on analyzing indicators of social well-being with a view to their relationship with economic indicators. In this case, this kind of relationship may be mediated.

There are research showing that a sense of security and, accordingly, confidence in one’s own future, as well as the degree of development of the institution of trust [1], directly affect the economic behavior of individuals and legal entities, especially regarding plans for the short and medium term. Instability and insecurity (whether actual or imaginary) adversely affects both the readiness of domestic economic agents for long-term investments and the investment climate in general [2].

This research is devoted to finding relationships between the markers of the respondent’s subjective sense of security and the level of trust in various social institutions, with the aim of further reducing the dimension of this space of signs, which fits into the general philosophy of the project No. 18-37-00344: select from the Rosstat data and results of various research groups a large number of variables characterizing the social environment, and then consistently reduce their number, revealing hidden patterns.

**Initial data.** In the collected data set, the group of parameters illustrating the social well-being of the population of the Tomsk region in 2016-2018 includes 20 variables divided into two categories: the respondents are protected from various threats and the level of trust to social institutions (in only one matrix of data accumulated during the project “Social and Cultural Portrait of the Region”, the total number of variables describing the sample reaches three hundred [3]). The importance of sociological data collected in the Tomsk Region is due to regional specifics (Tomsk Region is one of the regions that demonstrate good indicators of modernization and the “informational” component of the economy), which is important for describing trends in social phenomena in the modernization processes in the Russian Federation.

The variables included in two sets of issues were considered: a sense of security from various threats and a level of trust in socio-political institutions.

These parameters were expressed in the ranking scales and divided into two groups:

- A. Subjective sense of security from:
  1. environmental threat;
  2. harassment based on age or gender;
  3. arbitrariness of officials;
  4. ethnic harassment;
  5. harassment on the basis of religious affiliation;

- 6. arbitrariness of law enforcement agencies;
- 7. persecution for political convictions;
- 8. poverty;
- 9. loneliness and abandonment;
- 10. crime;

B. The degree of trust or distrust:

- 1. to the court;
- 2. to the president;
- 3. to the unions;
- 4. to the prosecutor's office;
- 5. to the police;
- 6. to the government;
- 7. to the regional offices of political parties;
- 8. to Legislative Assembly, the Duma of the region;
- 9. to the mass media;
- 10. to local governments.

**Correlation analysis.** At the initial stage, Spearman’s rank correlation coefficient was used to identify possible relationships between the selected variables. The calculations were performed in the SPSS package. In tab. 1 shows the values of the Spearman correlation coefficients between the first and second groups, for which significant correlations were found (with  $p \leq 0.01$ ).

*Table 1 - Correlations of trust markers to social institutions and feelings of security*

	<b>B.1</b>	<b>B.2</b>	<b>B.3</b>	<b>B.4</b>	<b>B.5</b>	<b>B.6</b>	<b>B.7</b>	<b>B.8</b>	<b>B.9</b>	<b>B.10</b>
<b>A.1</b>	0,256	0,242	0,222	0,199	0,223	0,268	0,278	0,279	0,114	0,208
<b>A.2</b>	0,217	0,232	0,214	0,219	0,220	0,197	0,193	0,182		0,168
<b>A.3</b>	0,288	0,393	0,340	0,294	0,329	<b>0,400</b>	<b>0,406</b>	0,375	0,190	0,365
<b>A.4</b>	0,122	0,150	0,118	0,114	0,102	0,0926				
A.5	0,111	0,216	0,114	0,146	0,132	0,113		0,095		
A.6	0,385	0,391	0,308	0,360	<b>0,446</b>	<b>0,413</b>	0,342	0,355	0,169	0,351
<b>A.7</b>	0,236	0,283	0,172	0,256	0,280	0,270	0,156	0,197	0,102	0,206
<b>A.8</b>	0,293	0,329	0,259	0,235	0,317	0,336	0,297	0,343	0,168	0,283
<b>A.9</b>	0,192	0,227	0,196	0,205	0,216	0,242	0,176	0,185	0,129	0,225
<b>A.10</b>	0,275	<b>0,307</b>	<b>0,302</b>	<b>0,320</b>	<b>0,367</b>	<b>0,378</b>	<b>0,2901</b>	<b>0,320</b>	0,168	0,276

\* Correlation coefficients with a significance level of more than 0.01 are excluded from the table..

As can be seen from table 1, in the selected set of data there are numerous reliable correlations, which may indicate the presence of hidden factors in the sample [4] explaining its behavior in a space with a lower dimension.

**Factor analysis.** The nature of the source data allows the categorical principal component method (CATPCA) to be applied to them. A categorical analysis of principal components can be considered as a type of multiple correspondence analysis, where some of the variables are declared ordinal or numeric. Categorical analysis of principal components is alternative to calculating correlations between non-numeric scales and their standard analysis using the principal component method or factor analysis, which allows to avoid nontrivial shifts in the estimation of correlations [5].

The use of factor analysis algorithms made it possible to single out three factors in the data array used. The fourth and subsequent components are cut off by the accepted stopping criteria — the Kaiser / scree criterion [6].

In tab. 2 shows the coefficients of determination and Cronbach's alpha for selected factors.

*Table 2 – Statistical indicators of identified factors*

<b>№ components</b>	<b>Cronbach's alpha</b>	<b>coefficient of determination</b>
1	0,919	7,872
2	0,757	3,567
3	0,394	1,599
Total	0,972(a)	13,038

*a. Cronbach's alpha calculated for eigenvalues.*

The fourth and subsequent factors account for an extremely small percentage of the sample variance and are poorly matched. Indicators of load variables on the identified components are presented in Table. 3

*Table 3 – Load component (factors)*

	Variables	Components		
		1	2	3
Security from ...	A.1	0,559	0,336	0,259
	A.2	0,530	0,496	-0,260
	A.3	<b>0,709</b>	0,222	0,279
	A.4	0,453	<b>0,669</b>	<b>-0,620</b>
	A.5	0,455	<b>0,645</b>	<b>-0,610</b>
	A.6	<b>0,746</b>	0,334	0,235
	A.7	0,589	<b>0,533</b>	-0,098
	A.8	<b>0,656</b>	0,337	0,449
	A.9	0,559	0,436	0,333
	A.10	<b>0,687</b>	0,353	0,406
The trust	B.1	<b>0,638</b>	-0,350	0,011
	B.2	<b>0,656</b>	-0,282	-0,048
	B.3	0,590	-0,305	-0,077
	B.4	<b>0,633</b>	-0,388	-0,090
	B.5	<b>0,694</b>	-0,352	-0,061
	B.6	<b>0,745</b>	-0,432	-0,094
	B.7	0,670	<b>-0,453</b>	-0,093
	B.8	<b>0,706</b>	-0,441	-0,105
	B.9	0,445	-0,334	-0,172
	B.10	<b>0,691</b>	<b>-0,452</b>	-0,102

The first of the identified latent variables, as we can see from Table 3, is heavily loaded - in the range from 0.445 for a variable describing the degree of trust / distrust of the mass media to 0.746 in the characteristic of protection from police arbitrariness. At the same time, markers of a sense of security from arbitrariness of public servants (officials and police officers), crime and poverty, as well as trust in structures and institutions of state power, legislative, executive and judicial (president, government, Duma of the region, local authorities law enforcement agencies, courts and prosecutors).

The second highlighted factor varies in a wider range, capturing positive and negative values. All variables describing the respondents' perceptions of their degree of protection against various threats have positive indicators, and confidence in social and political institutions is negative. In general, according to the second factor, there is a clear division of the initial variables into two groups describing security from threats and trust to the authorities.

The third variable is the least loaded. In relation to it, baseline indicators are grouped into three categories. One of them with the most positive values includes indicators of the feeling of being protected from poverty, crime, loneliness and abandonment, arbitrariness of officials, environmental threat, police brutality. Further, there is a drop in jumps to about zero values in the “zero” group (small posi-

tive and negative loads) there are indicators of trust to political institutions. The group of indicators of protection against racial, age and religious discrimination has extreme negative values on this scale.

**Interpretation of factors.** The revealed factors confirm the fact of hidden variables. The first factor that unites markers of protection from threats emanating from various authorities, and trust in government institutions, in essence, characterizes respondents' confidence in the socio-political stability and effectiveness of government structures, as well as trust in government.

The second factor, which fixes the link of trust to local authorities with a sense of protection from various forms of discrimination, is an indicator of the confidence (uncertainty) of the respondents in the ability to defend their rights in direct contact with the authorities and implement in practice the equality before the law, the feasibility rights in general.

The third factor, which is practically unrelated to confidence indicators of any socio-political institutions and opposes a sense of protection from crime and poverty with discrimination by sex and age, is characterized by a subjective sense of personal security.

**Conclusion.** Thus, in the considered set of variables, three main factors are identified, which will further facilitate the inclusion of this group of parameters in the developed model of the interrelation of social and economic parameters of the region, as social parameters - indicators of trust in government, confidence in equality before the law and a sense of personal security . Discovered latent variables effectively cover the entire set of source variables.

In the future, it is intended to refer to an array of data obtained in other regions, which will confirm or deny the identified factors.

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专家和专家知识：俄罗斯的发展前景  
**EXPERTS AND EXPERT KNOWLEDGE: PROSPECTS  
OF DEVELOPMENT IN RUSSIA**

**Andriyanova Elena Andreevna**

*Doctor of Sociology, head of the department of philosophy, humanitarian sciences and psychology*

**Chernyshkova Elena Vyacheslavovna**

*Doctor of Sociology, head of foreign languages department*

**Paraschenko-Korneychik Larisa Nikolaevna**

*lecturer of foreign languages department*

*Saratov State Medical University n.a. V.I. Razumovsky, Saratov, Russia*

注解。 本文讨论了对科学专家知识研究的主要方法的分析。 展示了形成专家知识范式及其对社会变化依赖的重要阶段。

关键词：专家，专家知识，社会发展。

**Annotation.** *The article deals with the analysis of the main approaches to the study of expert knowledge in a science. The important stages in formation of paradigms of developing expert knowledge and their dependence on social changes are shown.*

**Keywords:** *expert, expert knowledge, social development.*

The study of the most important characteristics of society during its transition to a qualitatively new level at the end of the XX century was carried out within the framework of post-industrial and information society paradigms. D. Bell [1] determined the conditionality of the main features of Western society in the last quarter of the XX century with a new role of theoretical knowledge. From his point of view, it is precisely that becomes the main source of technological innovations, which makes it possible to move from the production of mainly goods to the production of mainly services. As a result, the basis laid for the domination of professional and technical class over traditional proletariat, as well as for emergence of intelligent technologies that allow us to set goals and control technological and social development. However, the Bell's concept of a post-industrial society is an analytical construct, and not a picture of a specific society.

Referring to the wave theory of a historical process, A. Toffler [2] in the frame-

work of the second paradigm, created a theory of information society, the appearance of which determined the ubiquitous distribution of computers, turbojet aviation and flexible technologies. The leading role in this society was assigned to a service sector, science and education. However, the high rate of transformation processes lead to the need of taking into account the indomitable dynamics of changes that took place.

Among Russian authors in the field of research of modern society, the works of V. Inozemtsev, who offered the model of a post-economic society arising on foundation of an informational type of management [3], as well as V. Anurin [4], devoted to the transition from industrial to post-industrial civilization, in which the author tried to determine the parameters of changes in this transition.

The fixation of a special role of people who can professionally operate knowledge in modern societies goes back to the concepts of expertocracy, meritocracy and technocracy [5]. Nevertheless, the analysis of experts' and intellectuals' role in social system proposed in these concepts belongs to the third quarter of the XX century and is mainly predictive in nature. In the Russian scientific literature, the concept "expert" is not fully developed, despite the studies on specifics of intellectuals' status in information society [6].

The problem of becoming a class of intellectuals and technical intelligentsia, as well as its social functions, was posed by O. Gouldner, who revealed the role of this class in historical process of the XX century special work [7]. He developed the concept of autonomy of a new class – a group of highly educated professionals whose income was not determined by the property, but was directly proportional to the high creative potential. This class had a culture of critical discourse, a kind of reflexive speech communication, which involves self-worthless discussion and interpretation of all aspects relevant to its participants. This discourse created a specific communicative reality. The latter did not coincide with real social background of its course, distributed it and formed its own “communicative space” of intellectuals.

The critical discourse of a new class, according to O. Gouldner, is a means of achieving autonomy, which are both the goal and the way of intellectuals' existence. When entering the micro social level of analysis, supplemented by the study of various professional fields, the concept of autonomy, developed by O. Gouldner, has methodological value and is of particular interest.

However, the transition to microanalysis is impossible without taking into account the background of macro social changes. The last three decades have been marked by a new character of social transformation process, the specificity of which can be captured with help of the term “globalization”. This phenomenon is widely reflected in scientific literature. Here it is necessary to mention the studies of such authors as U. Beck, D. Harvey, M. Waters and others [8-10]. In their

works, a new organization of social practices is considered in the context of a weakening of geographical restrictions of social and cultural structure in connection with development of system for sea economy and technology.

In connection with changes in social, political, economic and cultural spheres of social life, it becomes especially relevant to make adjustments to the existing tradition of considering the role and status of experts. This allowed filling gaps in the system of knowledge about society. So, it is particularly relevant to study the phenomenon of Russia's entry into modern information society, as well as an appeal to the role of experts and intellectuals whose activities change the mechanisms of power functioning in this process. Literature devoted to the theory of risks notes the works that analyze the problem of existence of modern societies under conditions of uncertainty and immanent risk [11-13].

The problem of transforming power relations in the image of a political sphere in transition from industrial to post-industrial society requires a socio-political slice of analysis. Here it is advisable to turn to the theory of social representations of the French sociologist – S. Moscovici [14]. Generalizing almost a century of experience in the study of masses psychology, on the one hand, he was trying to pose new problems in the study of mass society, originally studied as becoming industrial, and then passing on to a qualitatively new level of development. The phenomena and processes that made this transition possible were analyzed by representatives of the Frankfurt School of Social Philosophy – H. Marcuse.

The successor of the critical tradition, who to a certain extent developed the Marcusean line of theorizing, is J. Baudrillard [15]. He was exploring the information society directly and made predictions based on the experience of transition from industrial to post-industrial. On the basis of the Marcusean-Baudrillard concept, we can state the specifics of changing one-dimensionality of consciousness generated by the principle of productivity, total simulation, when multidimensionality becomes cleverly generated by mass media of a new reality. The analysis of latter is impossible without considering experts' activities at projecting this reality in the world, still trying to live according to the laws of an industrial society, as evidenced by mass protests of antiglobalists, unprecedented terrorist acts, etc. Such formulation of the problem is of great interest nowadays due to its lack of knowledge.

At the age of information more and more spheres of human activity are functioning by incorporating systems of expert knowledge and expertise into their structure. The examination serves as a practical application of knowledge aimed to analyze, develop criteria for the development of a social system and evaluating the results of social activities. The handling of expert knowledge is carried out on the basis of the latest information technologies by people possessing competence in the field of their professional activity, independence from the object of evaluation or from actors of the expert evaluation space, as well as creativity.

The specificity of power relations in emerging information society is that they are in the process of constant adaptation to fundamental changes in economic sphere of society' life. Changing economy requires finding new forms of regulation and optimization, or at least modernizing old ones. Experts are faced with the following mega-task: the development of a system of values that will organically intertwine with all elements of society that have been drawn into the processes of globalization. But without an extensive mechanism for implanting this system into the consciousness of citizens of a single, but multidimensional, i.e. divided into many micro-worlds of the global society, it is impossible to avoid negative social phenomena, such as numerous forms of radicalism and extremism, which take on a massive and organized nature

Naturally, the process of centralization of funds designed to form a global consciousness, controlled by experts, is unthinkable without mastering the latest broad political powers or close interaction with those who have the ability to implement expert solutions (thus expanding the boundaries of global expert consciousness). As a result, experts, carrying out their decisions through the political subsystem of society, have a decisive influence not only on the face of world globalizing politics, but also on the development rates themselves and the patterns of change in all other spheres of the life of the information society.

Class of experts stands out as an independent social group, the specificity of which is revealed in such properties as autonomy, mobility and activity, and the activity is aimed at creating intelligent technologies that ensure rational planning of technological and social development. The interpretation of information produced by an expert comprehensively mediates the interaction of people in the information age, with the result that cultures of knowledge, practices, attitudes and processes serving it, change the structure of social space.

Activity of population stimulates stratification processes in social space. The following are the scenarios of global autonomy of experts:

- a) formation of life practices, styles and values of an innovative nature, carried out and implemented in the process of the activities of experts;
- b) distancing experts from the existing social background through the exteriorization of the space of their interaction, aimed at the implementation of socially significant goals;
- c) structuring the examination space through the institutionalization of social actions.

Access of experts to technologies that are international in nature, knowledge of the principles of their operation and the purpose of use, and the ability to realize the potential capabilities of these technologies not directly provided by their developers, lead to the fact that the social practices of experts are freed from local constraints and freely cross spatial boundaries.

Fixing this situation allows us to talk about the influence of experts on the specifics of power relations. The basic principle of this space functioning is the principle of direct interaction of the leader with the masses – is replaced by the principle of mediated interaction through information technologies. As a result, this leads to emergence of new dimensions of power relations, described in terms of virtuality and cyberspace. Feedback in the process of such interaction is formed by correlating images of leader and public opinion, designed by experts in various fields.

The role of experts in modern power relations is to develop norms, rules and ideal models of political space, both global and regional, in generating ideas and ideologies of a democratic nature, as well as in instrumental support of strategies of power, such as the creation of electoral technologies, the formation of public opinion and development of new ways of organizing human activities.

Participation of expertise in power relations is aimed at minimizing the risks of modern society, and therefore the emergence of global risks is primarily associated with the expertise and transformations adopted on its basis.

Class of experts plays a significant role in these processes. Its interests are met by this transformation of power relations. Not recognizing national, political and geographical boundaries, the new ruling class for its reproduction seeks to fix the social system in its static nature as clearly as possible, only under this condition it is possible to preserve and successfully reproduce the main value of modern society – information. In this regard, it is important to consider two main problem points:

1) Crisis dimension of functioning of illusory political alternativeness in information society, both at global and at Russian level; 2) role of expertise (both positive and negative) in this process.

In connection with the above mentioned, it becomes obvious that studies of influence of experts on specifics of power relations in information society are quite promising.

Opportunities for development of a civilized institute of expertise in Russia are connected with the formation of scientific base necessary for development of criteria for efficiency, optimality and openness of expert activities. Obviously, the time to create special educational programs aimed to developing processes of expertise' professionalization in Russia has come.

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沟通是健康维护实践的形成因素  
**COMMUNICATION AS THE FACTOR OF FORMATION  
OF HEALTH MAINTENANCE PRACTICES**

**Sidelnikov Sergey Alekseevich**

*Candidate of Medical Sciences,  
Head of Department of mobilization training  
of health and disaster medicine;*

**Chernyshkov Danila Vsevolodovich**

*Lecturer of department of physical training;*

**Andriyanov Stanislav Victorovich**

*Lecturer of department of physical training*

*Saratov State Medical University n.a. V.I. Razumovsky, Saratov, Russia*

**摘要。** 本文介绍了在健康维护形成实践的背景下对交际过程的基本方法的分析。作者指出了可以通过患者和医生之间以及治疗相互作用的所有主体之间的成功沟通获得的健康维护的益处。

**关键词：** 医疗保健，健康维护，沟通。

**Summary.** *The article presents analysis of basic approaches to communicative process in the context of formation practices for health maintenance. The authors point out benefits for health maintenance that could be got from successful communication between a patient and a doctor as well as between all subjects of therapeutic interaction.*

**Key words:** *healthcare, health maintenance, communication.*

Public health is one of the indicators of the state's successful social policy. In their research programs sociologists are interested in healthcare, its interpretation as an incentive and reference point for everyday practice, which is perceived by a significant part of Russians as a priority value. Studying health preservation, the majority of authors focused on the behavioral features of representatives of different social groups [1, 6, 7, 9]. Currently it is impossible to assess the trends in development of healthcare without understanding a certain dichotomy: health preservation is a vital need of an individual or a benefit "given by" the healthcare system. It is important to point out that due to the fact that restrictions in the field of health insurance and the monetization of healthcare services have led to a complex and ambiguous situation of access to diagnostics and treatment at the proper

level [3, 10] each individual and the population as a whole, as well as individual social groups. Another important condition for optimizing the process of health protection is the successful communication of all subjects of therapeutic interaction. This position seems promising and new, taking into account the modern 4P-medicine paradigm – innovative development of healthcare.

According to the viewpoint of N. Gerasimenko, the fundamental principles of 4P-medicine include: 1) predictivity; 2) prevention; 3) personalization; 4) participation. Use of the first principle allows to predict diseases based on the individual characteristics of genome (the creation of a probabilistic health prediction based on genetic studies). The second principle makes it possible to work ahead of the curve – preventing appearance of diseases through their prevention, as well as vaccines and preparations for repairing damaged genes. The third principle is based on an individual approach to each patient (creating a unique genetic passport for the treatment and control of a patient's health). The fourth principle is focused on broad cooperation of various medical specialists and patients [4], it includes the communicative aspect of treatment process, which we consider to be very important.

Within the framework of Sociology of medicine, traditional scheme of communicative process is structured as follows: "doctor/medical personnel – patient", "patient – patient", "family – patient" [5-7], implemented in health schools for patients with different diseases (tuberculosis, asthma, diabetes, hepatitis).

The subject of our scientific interest lies in the framework of a communicative approach to the analysis of health maintenance practices. It is necessary to clarify that we proceed from the definition of health maintenance as a process of preserving and strengthening health, requiring an increase in value attitude to one's own health and health of others on the basis of awareness of personal responsibility [11, 12, 14]. Interpreting health maintenance at the level of micro-processes, it can be dissected through a person's life situation, considered as a direct given, fixed through objective parameters. This reality is mediated, perceived and evaluated by him/her through subjective personal cognitive, motivational and reflexive processes. In this case, it is possible to clarify the structure of concepts of health maintenance through the inter-subjective characteristics of knowledge about oneself, developed in the framework of A. Schütz's school of phenomenological sociology, and in the tradition of social construction, P. Berger and T. Luckmann [13, 2].

A person is given an idea of himself, which is included in the corpus of a more general knowledge of the social world, which, according to A. Schütz, constitutes the inter-subjective world of an everyday life. The latter is a semantic universe consisting of a set of meanings that a person interprets in order to acquire support in the world, comes to an agreement with him. Such a combination arises and is formed in the human actions of contemporaries and their predecessors. Any inter-



pretation of the world is based on a previous acquaintance with it – our personally or passed on with us by parents and teachers. This experience in the form of “present knowledge” acts as the scheme which we correlate to all our perceptions and experiences [13].

This scheme is based on the typology and individualization of a number of objects that are in relation to other, previously perceived, forming a self-evident field of experience that is not questioned. In the interaction process individuals “connect” everyday worlds, thereby ensuring the social distribution of knowledge, including knowledge of other people. Through the understanding of other people, the typical way of their activity is constituted; the adaptation of one’s own self-understanding, one’s own activity and its motives takes place. At the same time, an idea is gained of how he himself “reflects” in others’ the minds, what is an objectification of his self-presentation.

In a situation of mutual communication, the concept of inter-subjectivity is based on the actualization of the experience of various subjects. Inter-subjectivity, in contrast to objectivity, does not denote the universality itself and universality. It is always associated with the micro-community, with the recognition of not the whole society, but only a part of it, often small and only later this recognition becomes universal, and then the inter-subjectivity acquires the characteristics of validity [11]. In this sense, the term “inter-subjectivity” is methodologically suitable for describing mechanisms for maintaining self-presentation both in statics and in dynamics.

According to O. Golub and S. Tikhonova [5], everyday knowledge is the knowledge that a person shares with other people in their usual everyday life. With this understanding, everyday life is possible only when interacting with near and far, suggesting a constant correspondence between the eigenvalues of individuals and their values in social reality.

P. Berger and T. Luckmann revealed the typology of an individual's interactions with other people, the result of which is the formation of social roles and institutions, and the reverse process – the transformation of an individual into a person as a result of the impact on him of people who play key social roles for him and in the functioning of institutions [2, p. 13]. On the process of formation of individual ideas about health care has the specificity of human socialization. Socialization is the expansion of the individual’s everyday world, possible by expanding knowledge about the everyday worlds of other people and adapting the individual’s own world to the requirements of others. The authors divided this process into two stages - primary and secondary socialization. Primary socialization is understood as socialization, to which an individual is subject in childhood and as a result of which he becomes a member of society. Secondary socialization includes a sequence of processes that allow an already socialized individual to enter new segments of the objective world of his society [2, p. 213].

Formed within the framework of continuous inter-subjective communication, health preservation relies on numerous processes and mechanisms of consciousness and the activities of the individual. Experiencing for your own health is impossible without correlating a personal situation to opinions of other people, and especially significant others, including experts. Experiencing pain, fear, suffering, discomfort at the somatic level, a person reflexes his condition on the basis of their conclusions. Moreover, only by relying on them does he acquire faith or disbelief in his own ability to influence his diseases, on the basis of which coping strategies are built.

Based on the communication nature of the phenomenon of health protection, at the individual level, it can be represented as a product of certain communication systems. The very same communication system is a structured set of communicators, recipients, semantic messages, communication channels and means of communication [5, 11]. In the conditions of the spontaneous formation of the indicated communication flows, the information circulating in them comes to a state of dissonance, when imposing flows of information, additional barriers to its perception arise. The opinion of relatives and “knowledgeable people” blocks information from competent persons, which often results in the spread of self-treatment practices that become an extremely large-scale.

The development of a communicative approach to the analysis of health care practices in the framework of Sociology of medicine, taking into account the principles of 4P-medicine, allows us to expand our understanding of the possibilities of using communication resources in formation of health maintenance behavior. Communicative models considered in the framework of Sociology of medicine have shown that the effect of communication is aimed at making the patient a new social role, social adaptation of patient, formation of patient's information culture, and is an important condition for achieving compliance.

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研究社会对数字经济产品的看法和信心 (以50-65岁的用户群为例)  
**STUDY OF SOCIAL PERCEPTIONS AND CONFIDENCE  
IN DIGITAL ECONOMY PRODUCTS  
(BY THE EXAMPLE OF A USER GROUP OF 50-65 YEARS OLD)**

**Kostina Tatyana Anatolyevna**

*Leading Engineer*

**Noakk Natalia Vadimovna**

*Candidate of Psychological Sciences, Leading Researcher*

*Central Economics and Mathematics Institute, RAS, Moscow, Russia*

注解。本文介绍了作者进行的一项试点研究的结果,该研究旨在确定社会认知形成的心理机制以及俄罗斯各类用户对数字经济产品的信心。该研究的对象是一群年龄在55岁及以上的用户。特别是为了研究目的,作者开发了一个工具包,其中包括在线问卷调查和半结构化访谈。在线调查是使用Google表单服务进行的。基于统计方法使用数据的定性分析。研究结果以图表的形式呈现。他们表明,研究组的受访者在数字素养领域具有相当高的能力。这使他们能够使用数字经济的各种产品,通过互联网进行金融交易,并解决日常问题。在遇到困难时最优选的做法是联系近亲和朋友。

关键词: 数字经济产品, 术语设备, 研究工具, 数字素养, 消费实践。

**Annotation.** *The article presents the results of a pilot study conducted by the authors to identify psychological mechanisms for the formation of social perceptions and the confidence of various groups of Russian users to the products of the digital economy. The object of the study was a group of users aged 55 years and above. Especially for the purposes of the study, the authors developed a toolkit that includes an online questionnaire and a semi-structured interview. The online survey was conducted using the Google Forms service. A qualitative analysis of the data was used based on a statistical approach. The results of the study are presented in the form of diagrams. They showed that the respondents of the study group have a fairly high level of competence in the field of digital literacy. This allows them to use various products of the digital economy, make financial transactions via the Internet, and solve everyday problems. The most preferred practice in the event of difficulties is to contact close relatives and friends.*

**Keywords:** *products of the digital economy, terminological apparatus, research tools, digital literacy, consumption practices.*

## Introduction

The relevance of the study is substantiated both by external socio-economic factors - the formation of a new digital techno-warehouse, involving the use of new forms of communication and consumption - and the existing psychological problems of our sample in terms of *adaptation* to the new reality [1]. The main task of the research conducted by the authors at this stage was to identify the problems encountered by the respondents of the study group in the field of digital consumption, their degree of satisfaction with their skills, ideas about their capabilities and the need for additional training in the field of digital literacy. To form a *sample*, we contacted a group of people engaged in online education through social networks asking them to contact their parents and senior friends for conducting an online survey and a subsequent telephone interview. Thus, the conclusions formulated according to the research can relate only to this sample.

### Main part

**Terminological apparatus.** We relied on the understanding of the construct social representations made by S. Moscovici [3], who described two aspects of their existence in the form of a network of ideas, concepts, metaphors, images, values, on the one hand, and in the form of practices that arise in the everyday life of an individual and social community of people and allowing them to construct reality, to interpret and interpret it for a better orientation in the outside world, on the other hand. In the authors' earlier publications, the characteristics of effective *adaptation*, the sphere of its manifestation, were given, one of which is *adaptation* in the sphere of personal relations, establishing emotional ties with other people, in particular, with relatives and colleagues. The obtained results make it possible to consider this method as one of the possible consciously chosen strategies of the studied group of users. In developing the toolkit, the terminological apparatus for researching *digital literacy* as a set of knowledge and skills that are necessary to use the products of the digital economy has been used.

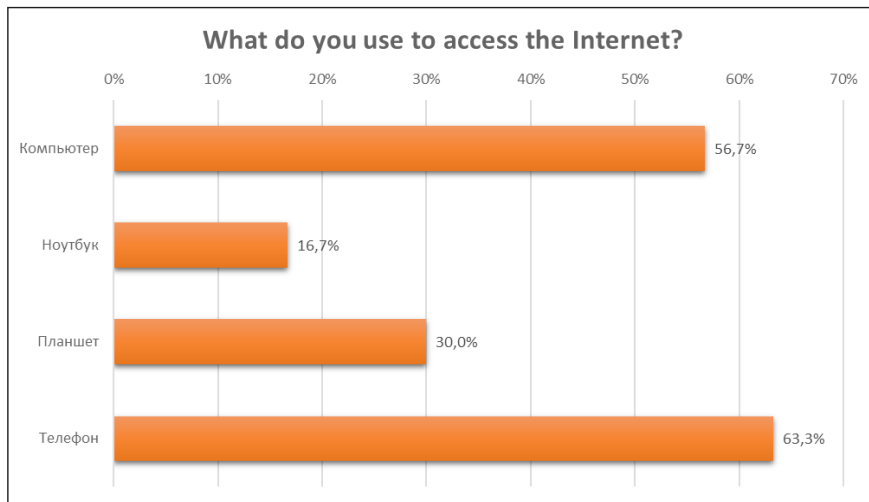
**Toolkit conducting research.** It includes an online questionnaire and semi-structured interview. The questionnaire consists of 17 questions aimed at identifying the difficulties in the field of digital consumption arising from the representatives of the studied user group, their degree of satisfaction with their skills, ideas about their capabilities and the need for additional training in the field of digital literacy. Respondents are invited to choose one or more answers to questions. Conducting a telephone interview solved the problem of confirming or refuting the data obtained in an online survey, that is, partially tested the methodology. Key interview questions were similar to online survey questions.

**The scheme of the study.** The sample survey consisted of 30 respondents, women and men, living in Moscow and the Moscow region. Respondents owned stationary computers and / or tablets, laptops, as well as mobile phones and smartphones. When selecting respondents, the requirement was also the use of the Inter-

net and mobile phone. The online survey was conducted using the Google Forms service. A qualitative analysis of the data was used based on a statistical approach. The description of the results obtained during the research is presented in the work.

### Research results

The majority of respondents aged 55 to 60 years old - 56.7%. The next largest group is 61-65 years old - 26.7%. The phone is the most frequently used product for Internet access (63.3% of the sample). 56.7% of respondents use computers. 30% use the tablet. 16.7% go online via laptop (see Fig. 1).



*Figure 1. Using digital economy products*

Information search is the main goal of access to the Internet for 86.7% of respondents. In second place is communication - 80%. For leisure activities (watching movies, reading books, studying news), 76.7% of respondents use the Internet. Solve domestic issues (enrollment in the clinic, receiving services on the portal Gosuslugi) - 40%. Purchase of goods via the Internet attracts 33.3% of respondents. And 20% buy tickets and book hotels via the Internet. Least of all, respondents use the Internet for work and education: 6.7% and 10%, respectively (see Figure 2).

The leading position is occupied by the use of the Instagram social network (56.7%). Classmates - in second place (46.7%). Third place - for Facebook (40%). But the Vkontakte network is only popular with 13.3% of respondents (see Fig. 3). For the solution of questions related to the use of digital technologies, our respondents most often turn to their relatives (90%). A rather large group tries to solve the problem on their own by finding the answer on the Internet (30%). Only 10% use the services of specialists (see Fig. 4).

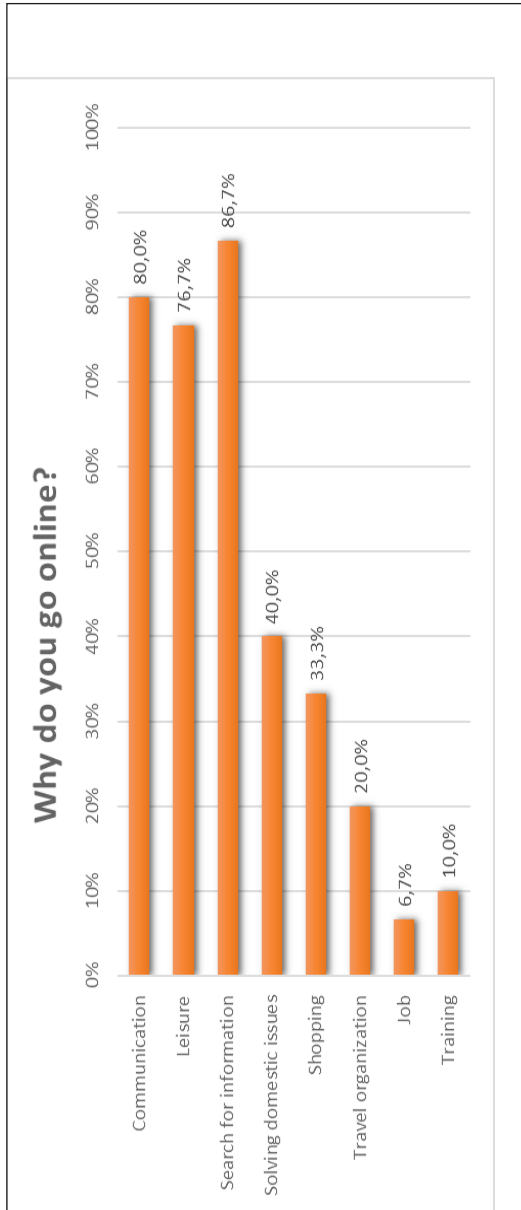
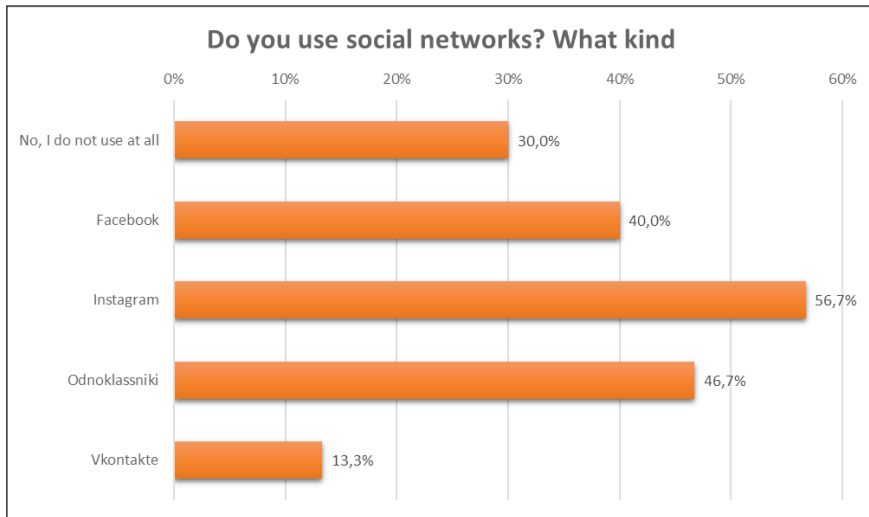
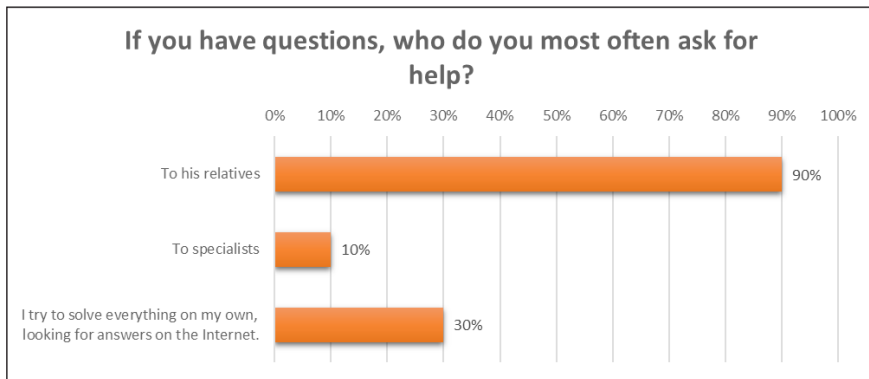


Figure 2. Goals for Internet access



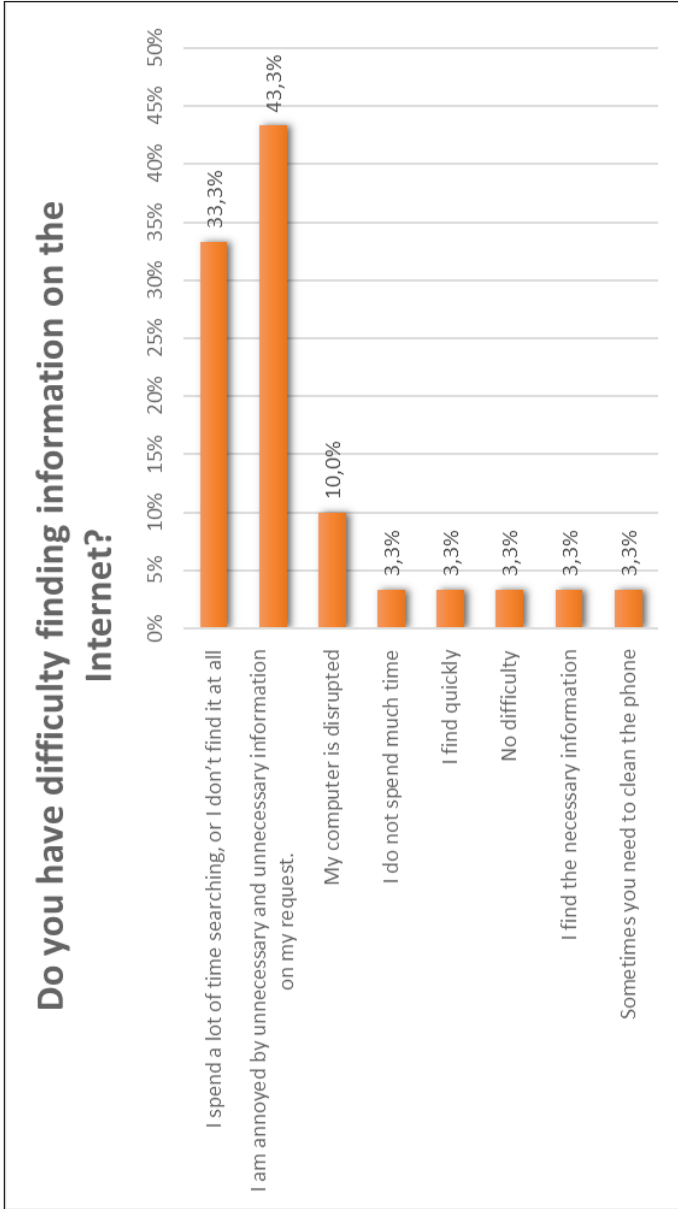
*Figure 3. Social Networking Practices*



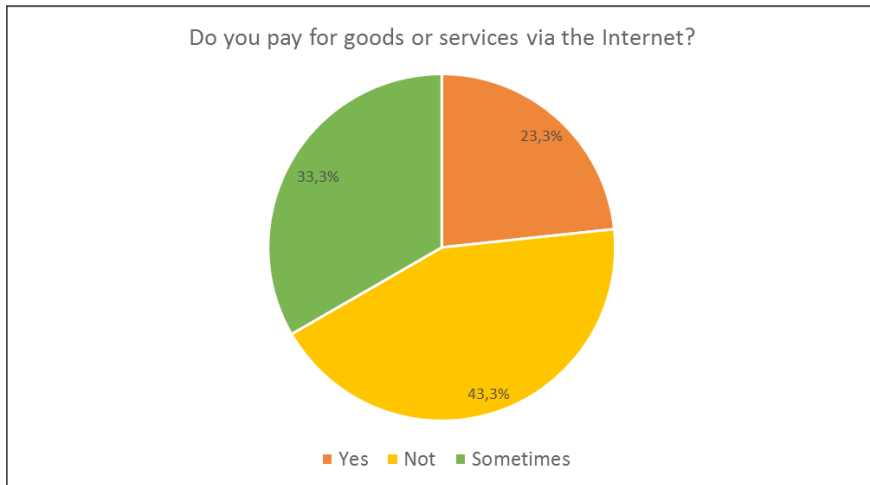
*Figure 4. Problem Solving Practices*

When searching for information on the Internet, most of the respondents are annoyed by the extra information that comes up on request (43.3% of responses). The next indicated difficulty is to spend a significant amount of time (33.3%). There is no difficulty in 20% of respondents (see Fig. 5). The majority of respondents make payments via the Internet (43.3%). Resort to this service only from time to time - 33.3%. Do not pay for goods or services via the Internet - 23.3% of the sample (see Fig. 6).



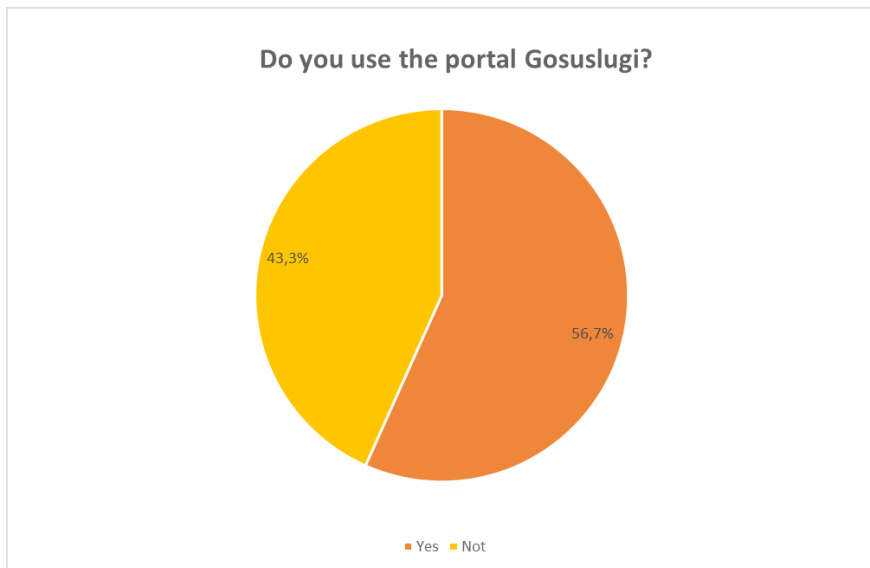


*Figure 5. Difficulties in finding information*



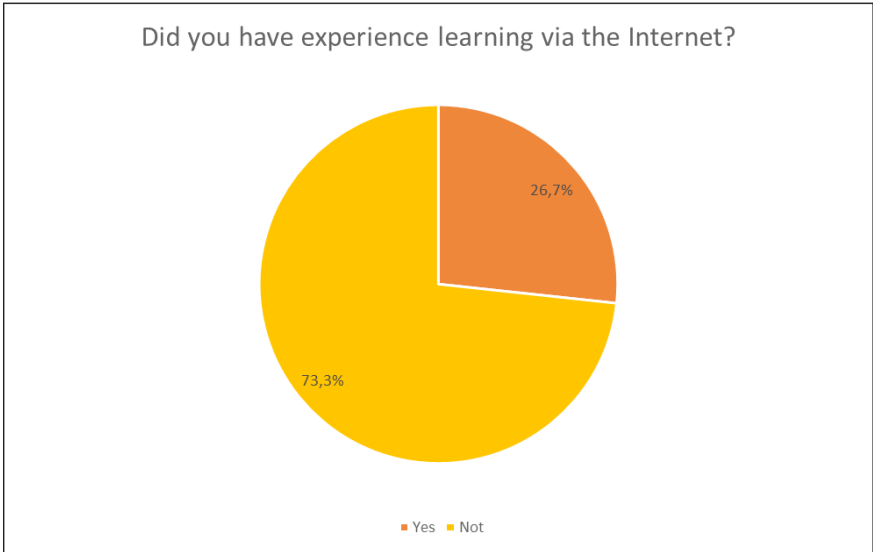
**Figure 6.** Financial Transaction Practices

The service of public services is popular with 56.3% of respondents (see Fig. 7).

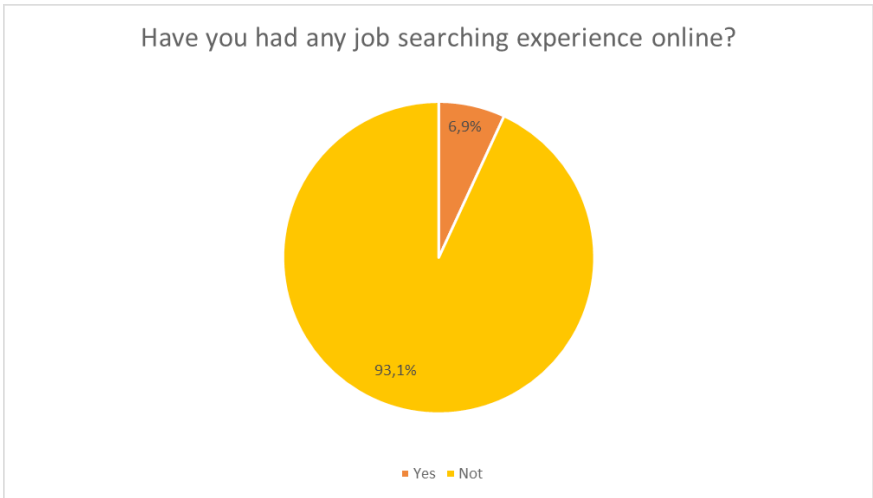


**Figure 7.** Practices of using the service on the state services portal

Only 26.7% of respondents completed online training. 73.3% answered negatively to this question. Perhaps the reason is the incomplete formulation of the question. (see Fig. 8). 93.1% did not look for work via the Internet (see Fig. 9).

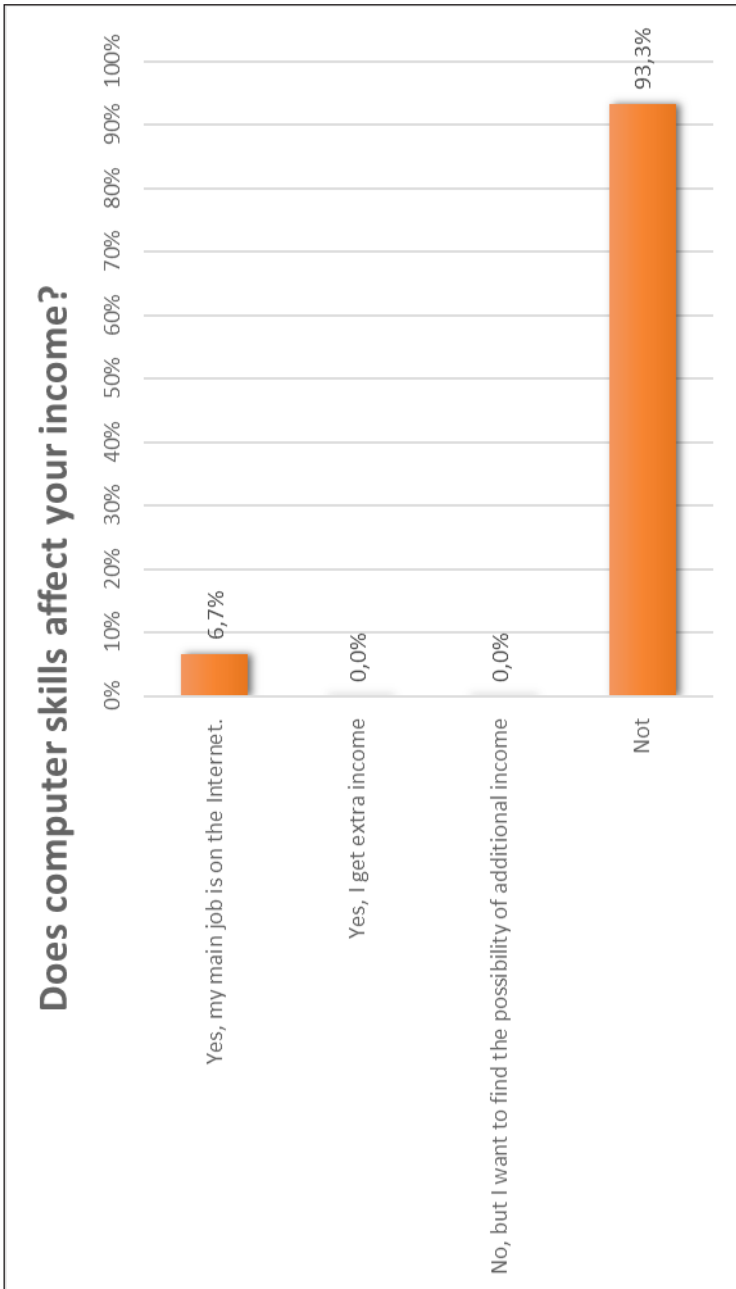


**Figure 8.** Online Learning Practices



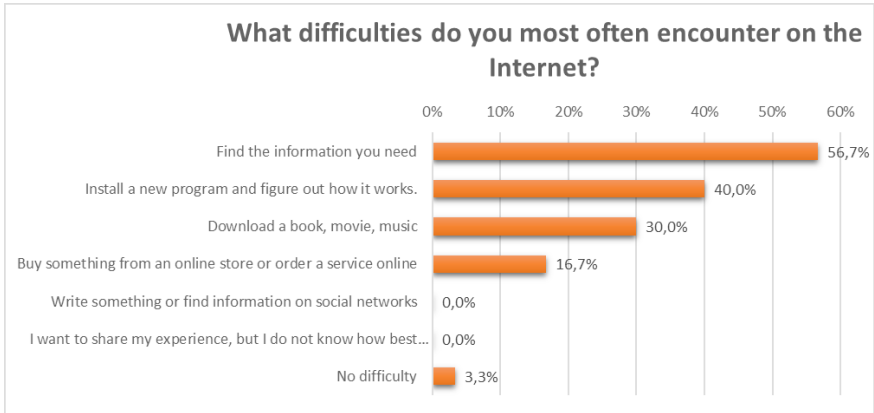
**Figure 9.** Internet job search practices

For 93.3% of respondents, computer skills do not help to generate additional income. Only for 6.7% of the main work is related to the Internet (see. Fig. 10).

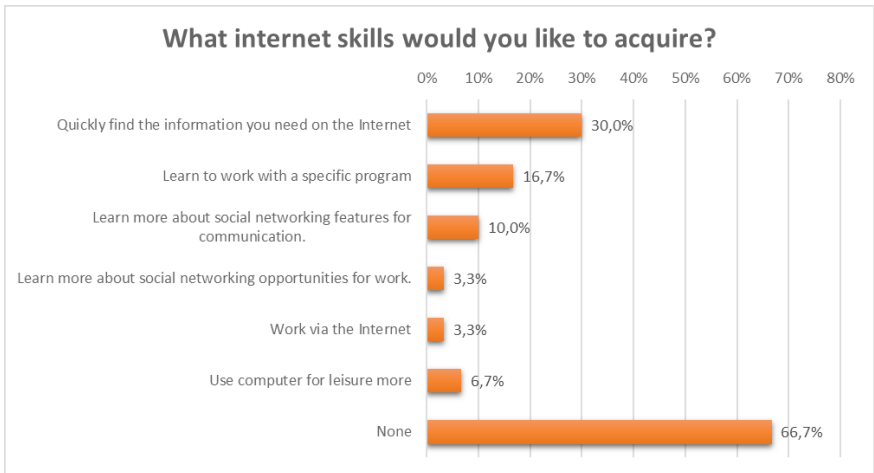


*Figure 10. The effect of computer literacy on income*

The main problems arise when searching for information in the network - 57.7%. Installing a new program and finding out how it works is difficult for 40% of respondents. 30% find it difficult to download a book, film, music (see Fig. 11). 66.7% of users are satisfied with their computer literacy level. 30% of respondents want to learn the right information faster. 16.7% of respondents want to learn how to work with a specific program. Learn more about the possibilities of social networks - 10%. And only 3.3% of the entire sample want to work via the Internet (see Fig. 12).



**Figure 11.** Perceptions about working on the Internet



**Figure 12.** Understanding New Skills Needed

16.7% of respondents are ready to take time for one or two consultations. Complete a course of 8-12 academic hours - 13.3%. 66.7% are not ready to devote time to training in this area. Of those who are ready to study, 23.3% chose to receive a one-time consultation. 6.7% are ready to spend 1-2 hours a week on training and the same amount to study every day. 56.7% are not ready to learn at all. 20% of respondents are ready to pay for training in the amount of 500-1000 rubles. Most respondents - 63.3% - are not willing to pay tuition.

### **Conclusion**

The results obtained in the course of the study allowed us to formulate the following conclusions.

1. The respondents of the studied group have a fairly high level of competence in the field of digital literacy, which allows them to use various products of the digital economy, social networks, make financial transactions via the Internet, and solve everyday problems.

2. An important task of the study was to identify *the perceptions* of users of digital economy products in the area of their everyday digital reality. According to our research, the practitioners in *the field* of digital reality preferred by the user group on the use of digital economy products are as follows: a) the preferential use of the phone for accessing the Internet, which contradicts the results of previous studies [2]; b) the predominant use of the Instagram social network (more than half of the sample), Odnoklassniki went to the second place, and the third place went to Facebook.

3. Of interest are the results obtained in the course of identifying the user's preferred method of *adaptation* to the new digital reality. Most of the respondents turn to close relatives and friends when solving problems arising from the use of digital economy products.

4. The initial hypothesis was confirmed only partially. The predominant part of the sample *does not consider* the Internet as a means of additional income. Internet for the studied group of respondents represents the possibility of self-development, broadening of life outlook, communication and leisure activities. Most of the respondents see on the Internet the opportunity to quickly obtain the necessary services.

5. The small sample size, as well as the method of its formation chosen by the authors, does not allow making large-scale conclusions; however, it is quite clear that subsequent research should be directed both at expanding the sample and at developing tools that allow specifying the ways of respondents' adaptation to the conditions of digital society, and *the identification* of user-specific ideas about the possibilities of using the products of the digital economy.

### **Thanks**

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用于研究社交认知和各种用户群对数字经济产品的信心的工具包  
**A TOOLKIT FOR RESEARCHING SOCIAL PERCEPTIONS AND  
THE CONFIDENCE OF VARIOUS USER GROUPS IN DIGITAL  
ECONOMY PRODUCTS**

**Kostina Tatyana Anatolyevna,**

*Leading Engineer*

**Noakk Natalia Vadimovna**

*Candidate of Psychological Sciences, Leading Researcher*

*Central Economics and Mathematics Institute, RAS, Moscow, Russia*

注解。本文描述了术语装置，它定义了用于解决研究各组用户对数字经济产品的信心的问题的术语。它包括数字素养的术语描述，社会表征，用户对数字经济产品的适应以及其他概念。提出了旨在识别数字经济产品不同用户群问题的研究工具，以及解决这些问题的方法。为此，该文章的作者专门开发了一份在线调查问卷，并根据调查进行了半结构化访谈。结果将允许确定受访者对各种用户群体关于与使用数字经济产品相关的主要问题的看法，解决这些问题的首选方法，以及确定受访者样本适应条件的特异性。数字现实。

关键词：数字经济产品，术语设备，研究工具，用户群，数字素养。

**Annotation.** *The article describes the terminological apparatus that defines the terms used to solve the problem of studying the confidence of various groups of users to the products of the digital economy. It includes a terminological description of digital literacy, social representations, user adaptation to products of the digital economy, and other concepts. Presented research tools designed to identify the problems of different groups of users of digital economy products, as well as ways to solve them. For this, the authors of the article specially developed an online questionnaire and conducted a semi-structured interview according to the survey. The results will allow to determine the respondents' views of various user groups about the main problems associated with the use of digital economy products, the preferred ways to solve them, and also to identify the specificity of adaptation of the respondents' sample to the conditions of digital reality.*

**Keywords:** *products of the digital economy, terminological apparatus, research tools, user groups, digital literacy.*



## Introduction

The problem of building the confidence of various groups of Russian users in the digital economy has attracted the attention of domestic researchers for several years. For our research, it is advisable to distinguish two main areas of its solution. The first is connected with the study of the factor of age differences of user groups and its role in the emergence of problems of their *adaptation* to the digital reality, as well as the identification of the most vulnerable in terms of *adaptation* of user groups of digital economy products - adolescents and the elderly. It introduces the concept of *digital literacy*, defined as a set of essential life skills and includes computer, information and communication components. The second line of research is related to the identification of various difficulties for the elderly people (the so-called 55+ group) to *adapt* to the problems of consumption of digital economy products, strategies used by representatives of this group to solve everyday and / or professional problems, as well as possible measures to be implemented to solve them at the public and state level. The latter include, for example, the creation of specialized institutions of additional education, the so-called institutions of the third age [3; four; 6]. However, despite the presence of research on specific issues, the problem of building confidence among various groups of Russian users in the digital economy products remains relevant due to the rapid development of both digital technologies themselves (in particular, due to recent global decisions taken at the state level) and social processes of stratification of once-sufficiently homogeneous groups of the population [8]. This necessitates the monitoring of ongoing changes, as well as the development of adequate methodological tools of research.

### Main part

#### *Terminological apparatus*

##### *The concept of digital literacy*

The first group of terms we use in research relates to *digital literacy* as a set of knowledge and skills that are necessary for the safe and effective use of digital technologies, products and Internet resources [2]. Digital literacy is the ability of a person to use the products of the digital economy (in the widest sense) for the benefit of themselves. Digital literacy includes: (digital) consumption and (digital) competence in using products of the digital economy. Consumption is based on the skills to use the products of the digital economy in certain household and production situations. The following areas can be distinguished in the consumption of products of the digital economy: Internet, digital devices and technologies, news, social networks, government services, cloud technologies for the consumption of various products of the digital economy. The competencies are based on practical skills of efficient use of technologies and products of the digital economy. Competences usually include searching for information using the functionality of digital economy products, using social networking functionality, online financial

transactions, online shopping, critical information perception. A large-scale study of the digital literacy of Russians was conducted in 2017 and is reflected in the report of domestic researchers [1]. The authors of the report predicted an increase in the level of digital literacy of citizens of the Russian Federation due to the involvement of the older population and the increase in digital literacy of people of older and retirement age. This once again confirms the relevance of the study of the selected group of users of digital economy products.

*Concepts of adaptation and social representations*

The second group of terms on which we relied in constructing the study relates to the field of *adaptation / maladaptation* of elderly Russians to the new digital reality, as well as their ideas about the existing (digital) products of the digital economy, their difficulties due to the need to use these products, the presence or absence of (their) own capabilities in their use, the need for additional developmental training. Without going into the terminological discussions on these terms, let us point out the following points from our close studies. All types of adaptation are due to both intrapsychic and environmental factors [11]. *Adaptation* is represented by two types of responses to environmental exposure. First, an effective response to external social expectations, and second, flexibility and efficiency in meeting new and potentially dangerous conditions, as well as the ability to give events the desired direction. This understanding of the *adaptation* of the personality is attractively contained in it, the idea of personality activity, the transforming nature of this activity, and manifests itself in the works of the interactionist direction of social psychology. Representatives of this direction make a distinction between adaptation (adaptation) and adaptation (adjustment). So, for example, according to T. Shibutani, the concept of *adjustment* refers to how (the organism) a person adapts to the requirements of specific situations, while *adaptation* refers to the decisions of a person of another level — ways of coping with typical problems. The main areas of manifestation of effective *adaptation* are, firstly, *adaptation* in the sphere of “extrapersonal” socio-economic activity, secondly, *adaptation* in the sphere of personal relationships, establishing emotional ties with other people, in particular, with relatives and colleagues. [9]. In Russian psychology, we rely on the works of A.K. Osnitsky [7]. As the most important determinant (mechanism) of personality *adaptation*, he considered deliberate, purposeful regulation, or self-regulation [5].

The inclusion in the study of the concept of *representations* of elderly people about the products of the digital economy and their abilities and needs to use these products is based on the concept of *social representations*, which is actively developed by both domestic and foreign researchers. The main provisions of the concept were developed by S. Moscovici and his followers in the second half of the last century [10]. Today, the concept of *social representations* is not uniquely

defined. However, the founder of the concept itself described them as a network of ideas, concepts, metaphors, images, values, practices arising in the daily life of an individual and the social community of people and allowing them to construct reality, interpret and interpret it for better orientation in the surrounding world.

### ***Research hypothesis***

It was assumed that people from the age of 55, experiencing certain difficulties in everyday life in the field of consumption of digital products and mastering digital technologies, need to be educated in order to master new skills in working on a computer, on the Internet. One of the key determinants was supposed to receive additional income, improving their financial situation. Looking ahead, we immediately make a reservation that our hypothesis was only partially confirmed. In that part, which concerned the improvement of the financial position of our respondents by means of computer technology, it was not fully confirmed.

### ***Description of the study***

The article describes how to conduct a pilot study in the framework of a project to study the psychological mechanisms for the formation of social perceptions and user confidence in the products of the digital economy. The study suggested a sample survey of the population aged 55 years and older. The objectives of the study were as follows: to identify the main directions in the consumption by our respondents of the products of the digital economy; identify their digital competencies; to identify respondents' *perceptions* about the need for training in the field of mastering the skills to consume products of the digital economy; determine which products of the digital economy they *trust*, if, in their opinion, they lack the competencies they have. It was also important to understand that for solving which household and production problems the older generation people use certain products of the digital economy and whether they have the need to acquire new knowledge and skills in this area.

The sample survey consisted of 30 respondents. It was formed in a special way. We contacted a group of people engaged in online education through social networks with a request to give contacts to parents and senior acquaintances to conduct a survey in the online format and a subsequent telephone interview. It was these older people (parents and older acquaintances) who became the sample of the research.

### ***Research toolbox***

***Online application form.*** The questionnaire consists of 17 questions. The questions are formulated in such a way that, on the one hand, to realize the tasks set before the research and the tasks described above, on the other - to present them in the most simple and understandable for respondents verbal form. Questions reflect: directions of consumption (Internet, digital devices and technologies, news, social networks, public services, cloud technologies of consumption

of various products of the digital economy), digital competencies (information search using the functionality of products of the digital economy, using the functionality of social networks, online financial transactions, online shopping, critical perception of information); *ideas about their difficulties* and opportunities, how to solve emerging problems, as well as the need to use the products of the digital economy as a means of additional income. Respondents are invited to choose one or more answers to questions. In addition, the column. *Other* was introduced, where a response is possible that is not listed. One question (question number 6) suggests a detailed answer. The online survey was conducted using the Google Forms service.

Instructions. *“Please take 7-10 minutes of your time, fill out the form. Answers to the questions will help to make the training course on work on the computer and on the Internet as useful as possible.”*

1. Enter your age. Select an answer option: 55-60; 61-65; 66-70; 71-75; over 75.

2. What do you use to access the Internet?

It is possible to choose several answers: Computer; A laptop; The tablet; Phone; Other.

3. For what purpose do you most often go online?

1. It is possible to choose several answers: Communication (Skype, social networks, correspondence); Leisure (watching movies, reading books, news); Search for information; Solving everyday issues (enrollment in a polyclinic, getting a service on the portal Gosuslugi); Buying goods in online stores; Travel arrangements (ticket purchase, hotel booking); Job; Training; Other.

2. Do you use social networks? If so, which ones?

3. It is possible to choose several answers: No, I do not use at all; Facebook; Instagram; Classmates; In contact with; Other.

3. If you have questions, to whom do you often ask for help?

It is possible to choose several answer options: To your relatives; To specialists; I try to decide on my own; I am looking for answers on the Internet; Other.

4. How often do you need help?

Detailed response

5. Do you have difficulty finding information on the Internet?

It is possible to choose several answers: I spend a lot of time searching, or I don't find it at all; I am annoyed by unnecessary and unnecessary information on my request; My computer is disrupted; Other.

6. Do you pay for goods or services via the Internet?

Select an answer option: No; Sometimes; Yes; Other.

7. Do you use the service of the state services portal?

Select an answer option: Yes; Not; Other.

8. Did you have experience learning via the Internet?

Select an answer option: Yes; Not; Other.

9. Did you have experience searching for work over the Internet?

Select an answer option: Yes; Not; Other.

10. Does computer skills affect your income?

It is possible to choose several answers: Yes, my main work is on the Internet; Yes, I get extra income; No, but I want to find the possibility of additional income; Not; Other.

11. What difficulties in working on the Internet do you more often encounter?

12. It is possible to choose several answer options: Find the necessary information; Install a new program and figure out how it works; Download a book, film, music; Buy something from an online store or order a service online; Write something or find information on social networks; I want to share my experience, but I do not know how best to do it; Other.

13. What internet skills would you like to acquire?

It is possible to choose several answers: Quickly find the necessary information on the Internet; Learn to work with a specific program; Learn more about social networking features for communication; Learn more about the possibilities of social networking for work; Work through the Internet; Use computer more for leisure; None; Other.

14. How much time are you willing to devote to training (academic hours)?

It is possible to choose several answers: Not at all; Get one or two consultations; Take a short course (5 - 7 academic hours); Take a course of 8-12 hours (about a month of training); Other.

15. What intensity is comfortable for you to learn?

It is possible to choose several answers: I am not ready to learn; 1-2 hours total; 1-2 hours per week; 1-2 hours 2 times a week; 1-2 hours every other day; 1 hour every day; Other.

16. How much are you willing to pay for tuition?

It is possible to choose several answers: Not at all; 500 rubles - 1000 rubles; 1000 - 2000 rubles; 2000-4000 rubles; 4000-7000 rubles; I am ready to pay more than 7,000 rubles.

***Semi-structured telephone interview.*** Conducting a telephone interview should have completed the task of confirming or refuting the data obtained in the online survey, and in part, the task of testing the methodology. The main interview questions were similar to those used in the online survey, although in some areas new questions were asked to deepen and expand the understanding of the respondents' answers. During the conversation, the answers received allowed to correct individual questions of the online questionnaire.

### **Conclusion**

The toolkit developed by the authors fulfilled its task: data were collected that made it possible in the first approximation to determine the respondents' ideas about the main problems associated with the digital products used, as well as their preferred solutions, which, in general, made it possible to identify the specific way the respondents *adapted* to the digital reality.

Interpretation of the results obtained in the course of the study, using methods of qualitative and quantitative analysis, as well as their visualization in the form of diagrams for some groups of users of digital economy products will be presented by the authors in other papers.

### **Thanks**

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教育学的心理生理学方面作为教育教学创新的现代概念  
**PSYCHOPHYSIOLOGICAL ASPECTS OF PEDAGOGY  
AS A MODERN THE CONCEPT  
OF PEDAGOGICAL INNOVATION IN EDUCATION**

**Golovanov Sergey Aleksandrovich**

*Candidate of Pedagogical Sciences, Associate Professor  
Director of the Center of physical culture and sports,  
State University of management*

**Rasulov Maksud Muhamedjanovich**

*Doctor of Medical Sciences, Professor  
Head of Department  
State research Institute of chemistry and technology  
of Organoelement compounds,*

注释: 由于教育过程的不充分变化和人的心理生理学可能性, 本文致力于教学的现代方面。 作者根据多年的教育学实践工作, 得出教师心理生理准备的变化。 在教育实践中应用健康创造技术需要改变。

关键词: 培训, 心理学, 创新

**Annotation:** *The article is devoted to modern aspects of teaching, due to inadequate change of the educational process and psychophysiological possibilities of man. The authors based on many years of practical work in pedagogics, concluded that the changes of psycho-physiological preparedness of teachers. Applied health-creating technology in practical education need to change.*

**Keywords:** *training, psychology, innovation*

**Introduction** In recent years, there has been a tendency to deterioration in the health of schoolchildren. Thus, according to the Institute of Age Physiology of RW, it has been established that from 1 st to 11 th class the number of children with diseases of the cardiovascular and digestive systems, organs of sight and hearing increases 2 times, and the endocrine system 5 times. Evaluation of chronic diseases has shown that in the first place in the first grade is dental disease, caries, and in the senior classes - a violation of the musculoskeletal system [1]. The education system, despite the need to introduce a health-saving approach and the widespread opening of schools of health, demonstrates health-cost trends. The state of health



of students in Russia, starting from the last century, is alarming and the reasons for this are as follows [2]:

First, school health risk factors are surprisingly “tenacious”, difficult to cope with, even in the conditions of health schools that consciously design a health-saving learning environment. The problem did not arise today; specialists started talking about school illnesses back in 1974. The health of children in Russia could never be called prosperous, and today the state of health of our children does not give grounds for comfort.

Secondly, the existing education system in Russia, the traditional Russian education system, is a huge knowledge system consisting of a large number of sciences. KD 130 years ago, Ushinsky wrote: “There is no teacher now who would not complain about a small number of hours at school.” Since that time, the teaching methods, technology and organization of the educational process no longer correspond to the functional capabilities of the child. Parents and the community themselves are loading children beyond measure. The requirements of the school become more stringent, and the child cannot cope with these requirements due to limited functional capabilities.

Thirdly, the school and the state at the beginning of the last century assumed responsibility for the health of children, thereby removing this responsibility from parents and society; it was the school that was supposed to provide a healthy lifestyle. But this is impossible, because first of all, it is a problem of society. Unfortunately, the situation has changed little, and the awareness of the value of health has not developed either in society or in the family.

Crises, informational and technogenic impacts, social cataclysms have resulted in disturbances in the functioning of ecosystems. Z. Freud wrote that “power over nature is not the only condition for human happiness, nor is it the sole goal of cultural development” [3]. Informational backwardness on the issues of health strategies accumulated by civilization, limited knowledge about holistic health, parallel coexistence in the minds of teachers of the categories “health” and “education” are combined with a consumer attitude to health. Such “ego life”, according to N. Maslova, is based on the understanding of “man as the king of nature”, which conquers and transforms it, showing a predatory attitude [4]. A. Loewen rightly noted that, “by conquering nature, we cut our own roots” [5].

We are consonant with the idea of E. Toffler about the need for the value reorientation of modern man from elevation above the environment, to a harmonious connection with nature. The author also writes about the unprecedented pace of scientific, technical, cultural, political and social changes, which are accompanied by an invasion of the chemical and biological stability of the human race. He sees this as a threat to people, a “shock of the future,” leading to “psychological numbness.” It is emphasized that each change and adaptive reaction to it require a physi-

ological "payment" from a person. They wear out the body gradually. There are limits to changes in the environment to which the body can adapt. If they are not determined in advance and the changes are rampant, people can not withstand the effects. With indiscriminate jumps in the mechanisms of change, a person not only undermines health, but also loses the ability to rationally respond to these changes. Capitulation to the stress of decision making under conditions of uncertainty and over-choice looks like deep apathy [6].

The quality of education is the "driving force" of the "social cycle of quality"; reflected in the quality of man, which is actualized in the process of his life and professional activity in specific social systems, in environmental management systems, in society [7].

In recent years, attempts have been made in Russia to improve the quality of education by planting "from above" non-reflected reforms, non-adapted, sporadic innovations. They were carried out in a dysfunctional, crisis educational environment. Education as an open dynamic system and social institution itself currently needs support, a caring attitude, healing, and transformation — in therapy. It, as well as the society as a whole, is characterized by disintegration, inconsistency, health - by expenses. Lost value-semantic benchmarks, goes.

"Revolutionary-innovative" transformations that are not accepted by teachers can not solve the problem of ensuring and improving the quality of education. Not understanding the essence of new educational technologies, they do not fill them with personal meaning, they cannot appropriate them. Therefore, these reforms only deplete educational resources, provoke emotional burnout, increase the "energy" payment for education, which affects the deterioration of the health of teachers, students and their parents. The characteristics of reforms, innovations largely coincide with signs of extreme conditions. Psychophysiological stress and overwork lead to a decrease in the adequacy of the social behavior of the individual, to passivity, indifference, depression, aggressiveness. Conservatism, reversionism (obsession with a return to previously successful patterns of adaptation, which are currently inappropriate and inadequate) teachers are also known "side" effects of the profession, ways of dealing with overloads. Not being able to adapt to new conditions, not having a clear understanding of the goals of their activities, many continue to automatically apply their traditional methods, increasingly breaking away from reality. Unable to adaptive capabilities of many teachers, innovation requirements impair the ability to make wise and responsible decisions.

L. Mitina, studying the professional health of teachers, also notes that "one of the most numerous professional populations is covered by moral apathy, ethical depression" [8].

Obviously, setting a diagnosis and charging teachers is unlikely to change the situation for the better. The crisis state is largely due to sporadic, incomprehensible to teachers innovations and inability to respond to them without loss of health. J.

Delors rightly says that no reform can lead to success without the help of teachers and their active participation in its implementation. They ask too much, they are required to correct the shortcomings of other institutions. The teacher feels lonely, not only because his activities are individual, but also because of the hopes that are placed on education, and also because of the often unfair criticism that falls upon him. First of all, he wants to respect his dignity [9].

We believe that psychotherapeutic methods of pedagogy can “soften” this situation, contribute to the improvement of education. By this we mean the normalization of disturbed processes of the relationship between teacher and student, as well as the relationship of teachers. One of its aspects is the training of a teacher as a psychotherapist in pedagogical interaction with respect to students and to himself. It is carried out by creating a psychotherapeutic educational environment, a communication space that contributes to the physical and mental healing of a person, the formation of his therapeutic competencies. Their indicators include readiness and openness to innovations in the professional sphere.

**Main part.** Our experience in the school of health in conducting trainings for personal growth for teachers, seminars on the introduction of innovative pedagogical technologies made it possible to understand that when the “threshold of sensitivity” to the new is artificially overestimated, people begin to persistently, often aggressively resist, defending their usual identity. Man emasculates the world, constricting it to the proportions within which he feels protected (R. May). A. Maslow noticed that the level of a person’s sense of security is difficult to change. Personality syndromes remain constant with fairly significant external changes. A striking source of resistance are methods of psychological protection. As a form of consciousness response to a threat, they are aimed at reducing anxiety, preserving the integrity of the image (I) in a traumatic situation.

In a state of heightened anxiety, “professional burnout,” it is impossible for a teacher to realize the value and price of his protective behavior, as well as to recognize his typical style of protection. Therefore, when retraining teachers, adjustments should be made on psychophysiological techniques and methods in pedagogy, which is necessary for the formation of a teacher's readiness for innovation, contributes to the development of empathic empathy with changes, adoption and organization of a system of occupations aimed at physiological adaptation to new conditions of activity.

A study we conducted among teachers of the Moscow School of Health No. 533 allows us to conclude that (73%) teachers want to learn something new about themselves. Most often, they readily participate in psychological testing and other diagnostic procedures (64%). But their “movement” towards their inner life usually ends with a formal acquaintance with the results of the test methodology, i.e. with its objectified psychological content. In further work, they try to keep control over

their actions and the actions of the psychologist, to avoid immediate experience and a sincere expression of needs, desires or emotions. Most often (78%), the main request from teachers is to require specific recommendations for the management of students. Their characteristic feature is also a tendency toward a deterministic view of life, of professional activity. This is manifested in the avoidance of responsibility, in the displacement of the locus of control outside, in an effort to suppress in itself risky attempts at change and to justify personal non-participation.

The psychophysiological approach implies a caring attitude and equal respect for the forces that call a person for change, development, and the stability forces that resist them. You must be sensitive to the natural anxiety facing the prospect of change and innovation. The deeper the change, the stronger the anxiety and resistance, the greater the risks. However, the practice confirms that, from the very beginning, concern and sensitivity towards resistance, fears, doubts, erroneous ideas existing in the teacher, can shift the balance in favor of the decision to move further in self-knowledge, self-change, self-therapy. It is important that educators teach innovative forms and methods against the background of a correct attitude to their experience and adaptation possibilities using such techniques that allow these adaptive possibilities to increase, for example, art therapy techniques, fitness trainings, etc. The purpose of such learning is not "reworking of the teacher, not broadcasting new information to him, not puzzling instructions. This is a holistic approach - creating conditions, stimulating internal readiness for innovations, which extends to life in general, and not just to pedagogical interaction as a fragment of the profession.

Modern literature offers simple and, at first glance, accessible recipes for educational transformation, designed to "simplify revolutionary discoveries to such an extent that all" mass market "customers can quickly and easily master them." It is emphasized that the mass introduction of innovations allows to overcome the existing gap with one jump and is the key to success, and "the main task now is to retrain all teachers in such a way that they know how to combine the best world information technologies with the best in the world methods of teaching and learning "[10].

The extremely "revolutionary way" of reforming education threatens with another irreplaceable loss of health. The global "conveyor" retraining of teachers is another powerful stress for all participants of pedagogical interaction. Most often, these innovations are not supported and are not accompanied psychologically. One example of ill-conceived innovation is, in our opinion, conducting external, independent testing of high school graduates. It has long-term goals, but is not yet provided with psychologically competent mechanisms of implementation. Attention is drawn primarily to populist aspects (the fight against corruption, equality of chances, etc.). However, the ethical problems of using tests should also be considered, since they do not always correspond to the goals set, adequately (in

accordance with the school curriculum) are compiled, correctly interpreted. Our practice of psychological counseling for graduate applicants shows that independent testing (as it is being done today) does not solve the tasks posed in terms of saving health, but, on the contrary, updates the state of anxiety and uncertainty.

Psychophysiological concern for the health of the younger generation implies a reduction in the level of anxiety in the educational environment. It is always associated with additional nerve overloads and is accompanied by known psychosomatic health disorders — headache, gastrointestinal dysfunction, arterial hypertension, asthma attacks, skin manifestations. The presence of ambulance representatives at independent testing sites during its conduct is a clear confirmation of this phenomenon. As a result, children, parents, schools (which in the eyes of graduates have lost their significance), universities (insufficiently “trained” school graduates will not be able to acquire a profession “by vocation” if they do not get points) suffer. Therefore, psychological support of all innovations in education is necessary.

"Revolutionary" in education, in particular, in pedagogical consciousness, is acceptable only in the form of insight as an instant solution to the problem, which provides a transition to a new cognitive structure (new understanding of previously unrecognized links between the present and the past), in accordance with which the character of behavioral reactions. Psychophysiological techniques and methods in pedagogy will contribute to the professional and personal insights of teachers.

An important role in improving education is played by the existential needs of teachers, the conscious desire and willingness to change, as well as attention to the subjective and procedural. Therefore, to improve the quality of education, it is not enough to train teachers, aimed only at “equipping” them with new methodological tools, at explaining “how” to implement innovative approaches in teaching practice. Excessive concern and dedication with means without awareness of procedural goals, or substitution of goals with means, which is indicative of the current trend of introducing interactive technologies to the detriment of their use, focusing on goals without paying attention to funds, rigidly structured, unambiguous, linear approaches when the goal is equal or binds "to a specific means, for example, in the development of a competence-based approach, these are one-sided, unproductive approaches that ignore human nature. In this regard, we consider it necessary to focus on interactive learning. Interactive forms and technologies are an integral component of school preventive programs. At the same time, the majority of school teachers enrolled in refresher courses could not or did not want to rethink this important experience and extend it further - to a holistic learning process, to study school subjects. However, we believe that learning in an interactive format allows you to "ground" the content, link it to the subjective experience. It is aimed at updating the internal reserves, developing the skills of corporate

interaction, social and psychological competences of students, students and teachers. In this process, the mentor has the opportunity to realize the psychotherapeutic functions in relation to the students and himself.

Situations of innovation, changes in the requirements for the profession are particularly stressful. The problems of industrial neuroses and stress worry the entire world community: the International Stress Management Association (ISMA) has been created, the European Union has adopted an agreement on the prevention of stress at work. Pedagogical activity is full of a variety of stress factors. However, concerns about the domestic pedagogical community in this matter have not yet been felt. Our health schools, declaring concern for the health of all participants in the educational process, in practice, at best, are trying to create a health-saving environment for their students. In general, this problem has become cumulative in the form of a general crisis of education. A necessary condition for its recovery is the correspondence between internal development trends and external "reform" influences.

In modern education, conscious, but unconscious distribution to the components is constantly carried out (for example, when setting goals). One element suppresses another, or develops at its expense. Today, in pursuit of the result of education, the process is being devalued. There is a distortion of the concept of "competence". It becomes static, linearly deterministic, subject to measurement, unambiguous interpretation and evaluation. The content of the competence is subjective. In our opinion, competence as a person's ability to act responsibly and independently in different problem situations, above all, reflects the process of holistic development. It is impossible to foresee what exactly at the moment will be relevant and necessary, which external influences will fall in resonance with the internal trends of self-development in one or another student or teacher. One can only speculate about the directions of development, offer a variety of adequate tools, non-traditional educational products. We proceed from the position that the personal-psychological and educational achievements of each student are different, depending on many factors.

Personally oriented, nature-like education, which is implemented through an individual educational program, cannot provide for the same result for everyone. Each person competencies are formed at different rates and different trajectories. Psycho-physiological techniques and methods in pedagogy allow, in a natural way, to direct the improvement of vocational education. The condition for its effectiveness is correct, caring, individually oriented support in the formation of stress tolerance and tolerance to change, based on acceptance and respect for the person. In this case, knowledge becomes personally significant, and new technologies - part of personal experience.

In the context of pedagogical therapy, we have identified a number of problems of modern education, because of which his health-creative function is not realized. Such "pain" points are: inconsistency between ends and means; underestimation

of the role of the subjective factor in the educational process; the dominance of the translational and controlling functions in the activities of the teacher; stressfulness of the formal regulatory system of education quality control; insufficient for creating a health-creating educational environment level of holistic professional health of a teacher; insufficiently coordinated interaction of psychologists and educators in matters of preservation of holistic health. Their awareness will contribute to internal movements in education in the direction of recovery.

The effectiveness and quality of pedagogical interaction, the quality of education as a whole will increase if regularities, conditions, principles and techniques of building psychophysiological relationships are taken into account. However, this problem is theoretically and practically almost unexplored. Implementation of educational therapy in the educational environment:

- contributes to the improvement of the quality of education;
- actualizes the value of the holistic health of the participants in pedagogical interaction, is a means of saving and replenishing resources in the educational environment;
- provides "psycho-physiological" support of educational innovations, based on the consideration of internal self-organizing processes in the educational environment and the adaptive capabilities of teachers; understanding and accepting their resistance trends; support in professional - personal development;
- contributes to the awareness of the inadequacy of the existential-humanistic tasks of personality-oriented education; means of their decision based on intensification, technologization, depersonalization, virtualization of the educational process; a pragmatic set of competencies as the intended outcome of education, reflecting cognitive goals and limiting personal development;
- actualizes a synergistic understanding of educational processes, promotes integration and interaction at all levels;
- focuses attention on integrity, subjectivity, procedural, nature conformance in education;
- contributes to the personal recovery of teachers through the creation of a therapeutic educational environment in the process of their preparation, the formation of psycho-physiological competence.

J. Budental noted that therapists are a "group of rescuers" who "release prisoners", help a person get out of his own inner prison and live more freely, help him to understand himself and find a way to his own strength [11]. Psychotherapeutic and psycho-physiological techniques and methods in pedagogy performs such a mission in relation to the educational process.

**Conclusion:** The problems of modern education are connected with the need for the value-oriented reorientation of the relationship between man and the environment, towards a harmonious connection with nature. The pace of scientific, technical,

cultural, political and social changes is accompanied by an invasion of the psychophysiological stability of a person. Education, as an open dynamic system, currently needs support, a caring attitude, healing, and transformation - in psychotherapeutic influence, new psychophysiological approaches. There is a search for new value-semantic orientations that are adequate to time. At the same time, the educational environment continues to be projected on the basis of traditional methodological approaches and stereotypes of stable orderliness, linearity, and unequivocal cause-effect relationships. Psychophysiological stress and overwork lead to a decrease in the adequacy of the social behavior of the individual, to passivity, indifference, depression, aggressiveness. Modern education, the educational environment requires the formation of special psycho-physiological approaches and methods of pedagogical culture, adequate to modern changes and modern health-creating technologies.

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文化史上的艺术类型：一种协同的方法  
**TYPES OF ART IN THE HISTORY OF CULTURE:  
A SYNERGISTIC APPROACH**

**Grushko Galina Igorevna**

*Candidate of Art Criticism, Teacher*

*Voronezh College of Music named after Rostropovich*

*Associate Professor*

*Voronezh State Pedagogical University*

注解。 本文论述了文化史上艺术类型之间的关系问题。 在协同方法的帮助下，揭示了其发展的一般趋势和模式：非线性，分形，“加速”，循环，实现“信息最大化”的愿望，这是最多样化的自组织系统的特征。 起源。 考虑到这个问题的心理方面，我们可以得出结论：艺术形式的“画廊”作为一种“训练场”，用于识别与人类需求相关的情绪情境，并依赖于传入和传入的信息。 在他们的互动中。

关键词。 文化，艺术形式，音乐风格，协同方式，自组织。

**Annotation.** *The article deals with the problem of the relationship between types of art in the history of culture. With the help of a synergistic approach, general tendencies and patterns of their development are revealed: nonlinearity, fractality, "acceleration", cyclicity, the desire to achieve an "information maximum", which is characteristic of self-organizing systems of the most diverse origin. Taking into account the psychological aspects of this problem, we can conclude: the "gallery" of art forms serves as a kind of "training ground" for identifying situations of emotion that are associated with human needs and depend on both incoming and on incoming information in their interaction.*

**Keywords.** *Culture, art forms, musical style, synergistic approach, self-organization.*

Each cultural and historical epoch "looks" at the world with its own eyes and gives rise to art, changing with its changes. We are talking about the historical types of Western culture, such as Primitive, Antique, Medieval culture, as well as the culture of the Renaissance, New Age and Modern culture, which are characterized by internal unity and a special "spirit" of time [1, 2]. From the depths of culture and art grows - it is experiencing the influence of this "spirit", which affects the dominance

of one or another kind or style: Medieval - architecture, Renaissance - painting, Baroque - theater and music, Classicism - music, Romanticism - literature, Modernism and Postmodernism - the synthesis of the arts. Indeed, art is the “mirror” of culture: the culture of the epoch — the art of the epoch — the style of the epoch.

So, the development of certain types of art is uneven: in different historical epochs one or another of its forms can dominate, which affects others and leaves its imprint on them. Many scientists are trying "to grasp certain regularities in the history of the relationship between types of art, to understand why this relationship is so variable in different eras and in different countries - from close coincidence to paradoxical discrepancy" [3, p. 495-496].

In particular, T. Livanova cites the following examples: XVI - XVII century - dramaturgy, theater. Shakespeare. There are no analogies in the musical art of Europe. XVII century (middle). Painting. Rembrandt. There are no full analogies in other arts of Holland and Europe. XVII century - Italian Baroque. Music "in the same vein" with the visual arts. XVIII century (first half) - I. Bach. There are no analogies in other arts of Germany and beyond. XVIII century (first half) - French Rococo. The unity of style is formed by music, painting, interior, decorative art, small plastic. The author does not doubt the ratio of types of art. Various “historical options” are possible, which depends on the specific features of each of them, the world perception of the era, historical traditions, as well as the degree of preparation of this artistic field.

However, according to A. Zisa, types of art can be classified as follows: spatial (visual arts and architecture), temporal (literature and music), spatial and temporal (theater, ballet, cinema) arts. It is in this ratio that they create a "complete artistic picture of the world" [4].

The phenomenon of “unevenness” in the development of art forms that experience reciprocal influences and strive for synthesis, A. Carmine explains by the fact that the processes of gradual enrichment of the content of culture, oriented to the standard, are interspersed with “explosions” that generate a rapid flow of innovations. Both “gradual” (evolutionary) and “explosive” (revolutionary) processes are necessary forms of the development of culture, therefore, arts [5, p. 355-356].

As we see, the opinions of experts do not differ in uniformity [1 - 6]. The purpose of our study: to identify trends and patterns of correlation of types of art, based on a synergistic approach and taking into account the psychological aspects of this problem.

From the point of view of modern science, any development is based on a succession of opposition shifts — states of order and chaos, connected by transition phases: self-organization serves as the basis for evolution. Every new thing originates from the structural decay of the former, which is consistent with the idea of continuity. Chaos turns out to be constructive in its destructiveness and leads to

the emergence of a new order. Thus, a non-linear “movement” from the initial to qualitatively new states takes place. The transition from one state to another forms a chain of bifurcations, or a sequence of acts of choice, which is accompanied by the generation of information. This is the way of development of self-organizing systems of very different origin, including the systems of culture - art - style.

The unity of culture, unique in its integrity, determines the style. Ability to develop is one of its most important characteristics (configuration of growth and decline): “Style is one of the threads of culture or civilization: it is a consistent, self-contained way of expressing a certain behavior, or performing some kind of action” [7, p. 903]. The history of art is the history of artistic styles that embody the mindsets of the era, its “spirit”. It develops thanks to the styles that appear at a certain time and place. A number of styles demonstrate a distinct cyclical nature, which is caused by alternately alternating ways of increasing the density of information. The implementation of the style "... is a process / structure for which the flow, historicity is the soul, a living nerve and content and form," which has certain patterns and trends [8, p. 151]. It is scientifically substantiated that the evolution of style, as well as culture and art, is cyclical and has a wave-spiral character, which is embodied in evolutionary models.

According to V.Tezhelov, the dominant art form plays the role of a “style-making element” It is he who defines the dominant style, interacting with secondary styles [9]. The concept of “style” can be “applied” to all types of art, between which “synchronous correspondences” are possible (common perception of reality, artistic method, form and content, image techniques), although progress in their development is associated with increasing specification and “deepening internal laws of their growth” [10]. This also applies to music.

Musical style is the highest form of artistic unity. In the process of evolution, differentiation and compression of its varieties (historical, national, genre, individual) occurs, then a game with historical accumulations arises and numerous modifications are formed. Following the promise of H. Riemann and G. Adler, the history of musical art is presented as the history of musical styles. Styles - steps in its development.

Since contradictory tendencies prevail in the culture of each epoch, which testifies to the complexity, conflict and diversity of social life, to the extent that different styles can coexist simultaneously. The integral set of interacting among themselves and interconnected by a single order of styles forms the System of musical style. National style, regional style, genre style, individual style, style of direction, style of school and so on, which reflect the signs of their time and have common style signs, interact with the dominant style. In addition, in the process of development, along with the dominant style, alternative styles are ripening, which indicates an increase in the scale of its growth and complication in the evolution-

ary process. Consider the phenomena and processes of the System of musical style with a synergistic approach [11].

From the point of view of synergy, the Musical Style System is an open non-equilibrium nonlinear system - self-organizing integrity. Recall that such systems interact with the environment and constantly balance on the verge of chaos. They receive signals from outside, assess their evolutionary capabilities and take response actions. Any development passes through states of instability (chaos), periods of crises and bifurcations, since states of stability (order) for them are the death and stopping of evolution.

The system of musical style is distinguished by the ability for self-organization and purposefulness. Therefore, all processes in it are interdependent and interdependent. It passes through periods of crises and bifurcations, develops a growth program, exchanges the necessary information with its environment and adapts to external influences, aiming for the future. Self-organization and serves as the basis of its evolution.

In the evolution of the System of musical style, as in the evolution of animate and inanimate nature, a number of general laws are discovered, which governs being and the formation of open non-equilibrium nonlinear systems. In the wave-like movement of the rhythms of the Universe lies the main meaning of the evolution of Humanity. Up - down, prosperity - decay, unification - separation: the rhythms of the Cosmos always balance on opposites.

It is no coincidence that the principle of cyclic development (general development, phylogenesis, model: tapering spirals; individual development, ontogenesis, model: expanding spirals) is recognized as universal. It has been experimentally proven: it can be applied in studies of the Universe, Cosmos, plant and animal life, ethnic group, man, history, culture and art.

Add from the standpoint of synergetics, we can consider the "movement" of the epochs of musical history, therefore, the history of culture and art, as a series of stages separated by bifurcations. The first stage is ... the era of the Middle Ages; the second stage is the Renaissance; the third stage is the Baroque era; the fourth stage is the era of classicism; the fifth stage is the era of Romanticism; the sixth stage is the epoch of Modernism; the seventh stage is the epoch of postmodernism. Each of them has its own musical style system and its own epochal style - medieval, Renaissance, Baroque, classical, romantic, modernist or postmodern. Interacting among themselves and interconnected in a single order styles contained in musical style systems form self-organizing integrity - the System of musical style, the system properties of which are embodied by its three-level structure of mega-, macro- and micro- (organization pattern).

The system of musical style reacts to any external changes (chaos) and adapts to them (new order). It evolves from simple to complex forms — systems of all

levels are involved in this process. Such states, the so-called states of deterministic chaos, are inherent, for example, to ecosystems passing through periods of crises and bifurcations, with the emergence of which the evolution becomes full of surprises and uncertainties.

Taking into account the psychological aspects of the problem, it is impossible not to notice that the types of art follow each other in a strictly established order: spatial arts (architecture, sculpture, painting) - spatial-temporal and temporary arts (theater, music) - temporary arts (music, literature) in the "accelerated" pace, which is characterized by certain time parameters. Such a pursuit of types of art, in essence, is a process of developing "aesthetic susceptibility", accumulation of knowledge and skills, selection and generation of information. Emotions and feelings make it possible to penetrate into the depths of the human "I", to self-improve, and are a means of understanding reality, which is fully reflected in art.

*The "gallery" of art forms is a kind of "training ground" for identifying situations of the onset of emotions that are associated with human needs and depend on both incoming and outgoing information in their interaction.*

The desire of art to merge - synthesis due to the action of universal laws. From the point of view of dialectics, for example, one can evaluate their transition to their opposite: from external to internal, from general to particular, from public to individual, from objective to subjective. By the end of the XIX century, the "information maximum" is reached, therefore, a transition to its opposite and to the synthesis of art forms becomes inevitable: thesis (architecture) - antithesis (literature) - synthesis (synthesis of arts).

We will specify the stages of development of this process: 1 - preparation and the beginning of the process, external movement (the Middle Ages, the Renaissance - spatial arts); 2 - the transformation of established norms (Baroque - spatial-temporal and temporal arts); 3 - development itself, sustainable existence on its own basis (Classicism - temporary arts); 4 - the destruction of the development process, reaching the highest stage of its existence and turning into a separate process, the transition to the internal movement (Romanticism - temporary art); 6 - the formation of a "new process" (modern era - the synthesis of the arts).

*Architecture, painting, theater, music, literature - these are the ratios of the dominant types of art in the historical aspect, which evolve from the divine to the human, from the religious to the secular, from the spiritual to the sensual, from the timeless and the eternal to the temporary and mutable.*

Christian theologian Augustine the Blessed, who developed the doctrine of grace and predestination, calls: "Do not wander outside, but go inside yourself" ("Confession"), then, as a romantic poet Novalis, who expressed the ideas of intuitive dialectics, polarity and intersection of all things, that "external disclosure of the inner world" ("Fragments") is possible. Consequently, we are talking about

the transition from the space of the external world - to the internal (or, on the contrary, from the space of the internal world - to the external).

With the help of a synergistic approach, it is possible to reveal the features of the historical dynamics of the system of art forms: the first phase of the Middle Ages - Renaissance - Baroque - Classicism - Romanticism (VI - XVII - end of XIX century) - alternation of the main types of art following each other in the established order. During this period, the selection and accumulation of information takes place, which is carried out at an “accelerated” pace. Achieving the “information maximum” and a turning point leads to the search for evolutionary alternatives, after which a transition to a new state, that is, to a new order; second phase Modernism - Postmodernism (middle - third quarter of the XIX – XXI century). Along with the birth of a new one, the processes of returning to the past are activated, which is associated with global dispersion, or dissipation of accumulated information, as well as with an increase in synthesis. Epochs: Middle Ages, Renaissance, Baroque, Classicism, Romanticism, Modernism, Postmodernism [12].

General tendencies and regularities in the relationship between types of art are manifested in cyclicity, “acceleration”, fractality, striving to achieve “informational maximum”, and most importantly - the intention to make the “right” *choice* from a fan of evolutionary possibilities that is characteristic of any self-organizing systems. The coexistence of different types of art and the alternativeness of their evolution indicate the nonlinearity of this process. The integrity of the system of types of art, taking into account the specifics of each of them, is determined by the *unity of diversity* arising procedurally.

From the standpoint of synergetics, the main phases of the development of the system of types of art are as follows: order is a turning point (chaos) —the birth of a new order. However, clear lines between the phases, as well as exact time parameters, cannot be detected. Rather, it is about identifying two diametrically opposed trends - the first, associated with the generation and accumulation of information, and the second, separated by global bifurcation, with reception and scattering of information. Bifurcation points signal alternatives to the evolutionary process. Predicting the future is possible, but rather probabilistic. Suppose that the alternation of types of art after a global bifurcation will occur in the reverse order - from their synthesis to ... architecture, that is, in reverse: everything turns into its opposite!

So, with the help of ideas and methods of synergetics, the general tendencies and patterns of the correlation of types of art in the history of culture are revealed, which leads to an understanding of the unity of the world and the unity of knowledge about it. As Z. Gippius says, “... on all phenomena lies the seal. One with the other as if merged. Having accepted one thing, I try to guess something else after it, that which is hidden.” So, ignorance passes into knowledge, and this is an eternal, natural process - the process of knowing the world and oneself.

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在全球化的条件下,保护和复兴suvaro-chuvash的文化身份  
**PRESERVATION AND REVIVAL OF CULTURAL IDENTITY  
OF SUVARO-CHUVASH IN THE CONDITIONS  
OF GLOBALIZATION**

**Almantay Vladimir Nikolaevich**

*Candidate of Cultural Studies, Deputy Director*

*Foundation of Historical and Cultural Studies named after K.V. Ivanova,  
Russia, Cheboksary*

**Petrova Galina Dmitrievna**

*Doctor of Philosophical Sciences, Professor*

*I. Yakovlev Chuvash State Pedagogical University  
Cheboksary, Russia*

注解。 本文致力于在现代全球化世界的条件下保护和复兴Suvaro-Chuvash的文化特征。 在全球化进程中,对传统文化的依赖使得Suvaro-Chuvash能够保持自己的身份,抑制破坏民族文化价值的风险,并确保在与其他文化交流方面作为种族群体的可持续发展的条件。

关键词。 文化认同,传统文化,复兴,认同, Suvaro-Chuvash, 全球化。

**Annotation.** *The article is devoted to the preservation and revival of the cultural identity of the Suvaro-Chuvash in the conditions of the modern globalizing world. In globalization processes, reliance on traditional culture allows the Suvaro-Chuvash to preserve their identity, restrain the risks of destruction of ethno-cultural values and ensure the conditions for their sustainable development as an ethnic group in terms of communication with other cultures.*

**Keywords.** *Cultural identity, traditional culture, revival, identification, Suvaro-Chuvash, globalization.*

In the conditions of the modern globalizing world, when the ethnocultural borders are being destroyed, a heightened interest in the basics of folk culture is manifested in Russian society. This is precisely the reason for the relevance of studying the problem of the cultural identity of a nation, ethnic group, and ethnos. Modern reality is such that ethnic groups often face a difficult choice: either to gradually abandon their authenticity, or to adapt to the ongoing transformations. Quite often, modernization processes are becoming a serious test for carriers of traditional culture.



Historically, the world being in time and space was conceived in the categories of causality, universal conditionality, harmony of multiplicity as a result of organizing and commensurate common beginning. For a person who is “inside the Tradition”, “all things are traditional in nature, since they are always considered in their direct connection with the basic principles,” wrote R. Guenon [1, 198].

However, in modern society, which has reached a high stage of informational and technological development, the transformation of traditional value orientations necessary for cultural identification becomes inevitable, respectively, and the level of instability, anxiety, and cultural entropy increases. In the process of major social transformations, there are always sooner or later conflicts of values, opposition of cultures and communities, as in this process the destruction of old forms of identity and the often painful formation of new ones takes place. For most Suvaro-Chuvash, the key identification marker is the traditional culture, which underwent significant changes in the XX – XXI centuries, as a result of which the “cultural core” of representatives of a given people is destroyed, gradually fading away.

The modern period of history for the Suvaro-Chuvash is a turning point in the life of the people, as it is associated with the search for a new vector of development of traditional culture: restoration and renewal of cultural identity, taking into account many factors, including the constitutional and regulatory factor of the common cultural space of Russia. Conducting a research of the state and characteristics of this turning cultural period will make it possible to outline and reveal in detail the problems of the loss and rebirth of identity, to discover their causes, to classify and streamline cultural identification processes and mechanisms. Therefore, at the present stage, the need for regional studies of traditional culture, primarily related to the study of the cultural identity of the Suvaro-Chuvash, has increased many times.

It should be noted that the Order of the Head of the Federal State Statistics Service of the Ministry of Economic Development of the Russian Federation No. 74, dated January 27, 2010, included the nationality of *Suvars* (code 1191).

In the Russian Federation, the Chuvash are the fifth largest nationality and identify themselves with the ancient Suvars, but to this day the Suvarian heritage of the modern Chuvash has not been studied and analyzed to the proper extent.

Against the background of the processes taking place in the globalization space, cultural identity is one of the main themes for both science and everyday life of society, it requires in-depth study. In this regard, modern Russian cultural policy should be aimed at an organic combination of the following imperatives: modernization and at the same time preserving the national identities of all the peoples of Russia, taking into account the cultural continuity and unity of the socio-cultural space. The traditional culture of the Suvaro-Chuvash is a part of the multinational culture of Russia; therefore, its analysis and the search for development vectors are an urgent problem of modern culturology, whose tasks include the preservation and actualization of the cultural heritage of Russia.

The task of cultural memory in the conditions of an impending global society, erasing ethnic and cultural features and unifying the “picture of the world”, is not easy to solve. Therefore, the analysis of the ethnicity’s entry mechanisms into an innovative society while preserving sociocultural codes identifying one or another ethnicity is an important value-semantic component of the culture of any nation, including Suvaro-Chuvash.

The speed and internal inconsistency of globalization processes carry axiological risks that negatively affect the preservation of the cultural identity of the Suvaro-Chuvash. However, cultural identity, based on historically established and symbolically imperatives, is able to create and maintain dominant vectors of their own sustainable development even under the conditions of unifying pressure of globalization, using the means and opportunities provided by globalization itself. Thus, the traditional culture in the aspect of identification can act as a tool for the self-preservation of the ethnic group and an effective strategy for cultural development.

The formation of new values in society is not only expressed in sociocultural changes, but also in rebuilding contextual areas of memorial culture. In this aspect, the historical-culturological research of the identity of the Suvaro-Chuvash, the search for a special vector of development of their traditional culture, take a key place. On the one hand, it is necessary to revive lost traditions. On the other hand, to master the new formats for the promotion and development of the traditional cultural heritage, which contributes to the assertion of the identity of the people and its positioning in the all-Russian cultural polyphony.

Analyzing cultural identity, it is necessary to clarify once again how globalization processes influence it, directed to the total integration of the world society, during which universalization and standardization of cultures and peoples take place. As A.V. Ryazanov noted, “the processes of globalization have given rise to their antipode — processes of concentration, i.e. localization, which refers to the return to its origins, roots; history, language, ethnicity and regional values” [9, 263].

Globalization is responsible for the growth of national identity and self-determination of peoples. In an unstable, rapidly changing world, this responsibility is a condition for the preservation and renewal of the identity of peoples.

Thus, considering the traditional costume of the Suvaro-Chuvash, which symbolizes the colossal way of the oldest cultural tradition of the Suvaro-Chuvash people, the main historical milestones in the development of the folk costume are revealed, its ensemble fully developed in the 17th century. Already in the 18th century, Suvaro-Chuvash costume and ornamentation began to flourish. At the same time, from the 19th century, in connection with the intensification of social and trade relations, a significant Russian influence on Suvaro-Chuvash clothing appears. Gradually, the entire old neck and chest complex is taken out of use: *теветь, ама, майса, шўлкеме*, etc., and belt decorations. From the middle of the 20th century, the old appearance of outer clothing has been intensively replaced by coats, jackets, etc. urban type.

The traditional costume of the Suvaro-Chuvash, as a constant marker and an important element of the material culture of the Suvaro-Chuvashes, objectively recorded cultural values and moral imperatives of the ethnos. Analyzing the symbolism of the national costume, which in antiquity accompanied Suvaro-Chuvash from birth to death, connecting man with nature and the entire universe, it is necessary to note the interrelation of traditional clothing with successive levels of materialization of the picture of the world, inextricably linked with each other. At the same time, proving that the Suvaro-Chuvash traditional costume is an artifact that has an active influence on modern culture, acting as a sociocultural marker of the identity of the Suvaro-Chuvash people.

The unique folk festival *Akatui*, like the traditional costume, clearly demonstrates how diverse the cultural texts of the Suvaro-Chuvash people are in artistic style. Understanding the holiday, followed by MM Bakhtin, the primary form of culture, the authors consider this phenomenon as a kind of model, reflecting the attitude of man to the universe, to the essence of being and the value system of his people. Holidays with deep roots serve as a basis for uniting people into a single nation, here the main meaning and complex structure of the *Akatui* national holiday is revealed. Literally translated from the Suvaro-Chuvash language as a “sowing wedding,” this holiday reflects the love of the native land. In it, the ancient Suvaro-Bulgars positioned and asserted themselves, their ethno-cultural integrity and showed their difference from other ethnic groups [1; 3].

So, not all nations, especially those associated with a nomadic way of life, had a celebration of the first furrow. In Suvar-Chuvash, where farming was the main occupation, the beginning of arable work was marked by the *Akatui* holiday, which was held in each community and was associated with this sacred ritual. Preparing for the celebration of *Akatui* in advance: bathed in a bath, put on clean white festive clothes, then after ritual actions, prayers and ceremonies started to work [4; 7].

Speaking as a cultural marker reflecting the collective self-consciousness of the Suvaro-Chuvash, *Akatui* becomes at the same time one of the defense mechanisms of the cultural identity of the Suvaro-Chuvash and the advancement of the Suvaro-Chuvash in the all-Russian cultural space.

In globalization processes, reliance on traditional culture allows the Suvaro-Chuvash to preserve their identity, restrain the risks of destruction of ethno-cultural values and ensure the conditions for their sustainable development as an ethnic group in terms of communication with other cultures [1; four].

Consequently, globalization processes, representing the enormous potential for expanding the space of functioning and interaction of national cultures, are at the same time a powerful test for the cultural identity of ethnic groups. This process in relation to the Suvar-Chuvash was manifested in the fact that the Suvaro-Chuvash,

as representatives of the Russian nation, were able to engage in the modernization processes launched by the global economy, on the other hand, they maintained their cultural identity through the respect for traditional culture. Intergenerational continuity of values and inter-ethnic cultural dialogue were the forms of preserving identity for the Suvaro-Chuvash. The concept of cultural-oriented modernization and the multivariate self-development of an ethnos is adequate to explain this process.

Information technology creates space for the preservation and development of cultural identity. As applied to the Suvaro-Chuvash ethnos, they manifest their specificity in regional branding, in the creation of diverse informational content and the application of various methods, including digitization of heritage in the fields of education, science and culture.

The Suvaro-Chuvash sites are, above all, image platforms of republican mass media, institutions of science and education, culture and press, as well as personal pages of representatives of science, culture and arts, containing historical, ethnographic, ethno-demographic and sociolinguistic references, scientific publications and educational manuals, information about cultural events and creative projects.

Thanks to such information resources as the site “Сувары.рф” and others, it is possible with the help of semiotic codes of traditional culture to exhaustively display the “polyphony” of the cultural picture of the world of Suvaro-Chuvash, to promote the development of intergenerational relations of representatives of this people, to expand the arsenal of means aimed at strengthening cultural identity of the ethnos, including in the limitless Internet space [1; 4; eight].

Among the variety of means for preserving cultural identity of Suvaro-Chuvash relevant is regional cultural policy. In most regions, it is being rebuilt from a model of assimilation to a multicultural one, while the traditional culture of ethnic groups becomes an effective tool for socialization. Modern Suvar-Chuvash become one of the key subjects of the cultural policy of the Chuvash Republic, which, in turn, opens the way to the strengthening and development of the cultural identity of the Suvaro-Chuvash in a multinational state, which is the Russian Federation [1; 7; 8].

Currently, the most enterprising participants in cyber communication are educational structures that have their own websites and equipment for digitizing printed documents. At the same time, the understanding of the inevitability of the presentation of linguistic diversity among the creators of Chuvash Internet resources is growing. In order to preserve the language of the Suvaro-Chuvash, to maintain the authority of the owners of a unique language and culture, there is a need for a targeted regional information and cultural policy.

Globalization with its informative potential maximally expands the space and accelerates the interacting processes of national cultures, but it in no way destroys them meaningfully, since it does not contain a program of discrimination against

their originality. By virtue of the informative potential of globalization, it became possible to communicate without difficulty with the Chuvash diasporas of other regions of a multimillion country and abroad, and cultural borders were expanded. The cultural heritage of the Suvaro-Chuvash has enormous reserves. Thanks to modern technologies, it is possible to strengthen branding, expand the arsenal of tools for working with the cultural heritage of the Suvaro-Chuvash.

The analysis proved that each subsequent historical stage of development of the cultural identity of the Suvaro-Chuvash did not abolish, but partially transformed, adapted, and continued the process of synthesizing the essential facets of traditional identification bases and innovations. Modern Chuvash, being descendants of the Suvaro-Bulgars, on their long historical path they preserved the ancestral traditions of their ancestors, avoiding the fate of being absorbed by other cultures. The potential of the traditional culture of this ethnos can be successfully realized at the present stage.

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低温后肥大细胞浸润大鼠肺部  
**THE RAT LUNGS INFILTRATION WITH MAST CELL  
AFTER HYPOTHERMIA**

**Guldaeva Zalina Nofelevna**

**Bobrov Igor Petrovich**

**Lepilov Aleksandr Vasilevich**

*Altai State Medical University  
Barnaul, Russia*

注解。这项工作的目的是评估Wistar大鼠在单次深度浸泡低温下的肺肥大细胞 (MC) 形态功能活动。该研究对25只大鼠进行。通过将动物置于温度为5°C, 温度为7°C的水中将动物置于水中来模拟低温。终止暴露于寒冷的标准是动物的直肠温度达到20的条件。 -25°C, 相当于深度低温。在实验过程中, 将动物分成4组。停止冷却后立即从实验中取出组1的大鼠, 组2的动物 - 2天后, 组3 - 7天, 和组4的动物 - 14天后。研究结果表明, 冷应激对MC的形态功能活性有显著影响。在实验动物的肺中低温后立即测定大的MC, 其中大多数处于粒细胞溶解状态。在实验的第2天, 许多小MC位于肺泡间隔中。第7天, 支气管周围组织中MC含量增加, 脱颗粒数减少。在实验的第14天, 在支气管外膜中发现单个MC。因此, MCs是肺部紧急适应性反应的重要因素, 并确保呼吸系统对低温效应的抵抗力。

关键词: 体温过低, 肺, 肥大细胞, 适应。

**Annotation.** *The aim of the work was an assessment the lungs mast cells (MC) morphofunctional activity in Wistar rats at a singletime deep immersion hypothermia. The study was performed on 25 rats. The hypothermia was modeled by placing the animals in individual cages into water at a temperature of 5 ° C at an ambient temperature of 7 ° C. The criterion for the termination of exposure to cold was the achievement by the animals of a rectal temperature of 20-25 ° C, which corresponded to a deep degree of hypothermia. During the experiment, animals were divided into 4 groups. Rats of group 1 were removed from the experiment immediately after stopping cooling, animals of group 2 - after 2 days, group 3 - in 7 days, and animals of group 4 - after 14 days. The results of the study showed that cold stress has a pronounced effect on the morphofunctional activity of MC. Immediately after hypothermia in the lungs of experimental animals, large MCs were determined, most of which were in a state of granulocytolysis. On the 2nd*

*day of the experiment, many small MCs were located in the interalveolar septa. On the 7th day, the MC content increased in the peribronchial tissue, the number of degranulating forms decreased. On the 14th day of the experiment, single MCs were found in the bronchial adventitia. Thus, MCs are an important factor in an urgent adaptive response in the lungs and ensure the resistance of the respiratory system to the hypothermia effects.*

**Key words:** *hypothermia, lungs, mast cells, adaptation.*

According to modern concepts, mast cells (MCs) are a key element in influencing the body's metabolic processes. They play an important role in many physiological and pathological states and their functions are very diverse. Thus, MC cytokines activate neoangiogenesis and can stimulate tumor growth [1, 2, 3]. The involvement of the mast cell population under stress conditions also has been revealed [4].

MC populations are an integral component of the microenvironment of the parenchymal components of most organs and in damage, due to the release of a range of biologically active substances, mast cells are involved in regeneration and compensatory-adaptive processes [5, 6, 7]. Morpho-functional activity of MCs can also be stimulated with hypoxia. Thus, in rats with acute massive blood loss, the reaction of MC of various tissues is total in nature and is manifested by an increased migration and massive degranulation [8].

But these multifunctional cells not only play a significant role in various physiological and pathological states of the body, but they also participate in its' adaptation to extreme factors impact, which allows some authors to hypothesize that they can form a single, independent regulatory system. The redistribution of motile MCs between tissues during stress, damage or hypoxia can be considered as an important component of the adaptation syndrome [9].

In the lungs, MCs are important in view of the diverse physiological capabilities and extensive functional interactions with the cellular environment, as well as the presence of direct and inverse relationships with the nervous, endocrine and immune systems. Thus, in particular, with massive exocytosis of granules, they secrete a large amount of histamine, which causes spasm of smooth muscles, mainly small bronchi, hypersecretion of goblet cells and glands of the tracheobronchial system submucosis, increases the capillaries permeability of the interalveolar septa, resulting in activating of fibroblasts and macrophages, causes the migration of lymphocytes and neutrophils into the lungs [10].

At the same time, despite an intensive study of the morphology of MCs in the respiratory system under physiological conditions and in pathology, their morpho-functional characteristics in lungs under action of extreme factors and hypothermia, including, are not well understood.

**The aim of the work** was to study the effect of a single-time deep immersion hypothermia on the morphological and functional activity of mast cell population in lungs of Wistar rats in the experiment.

**Materials and research methods.**

The study was performed on 25 male Wistar rats weighing 200-240 grams. The hypothermia was modeled by placing the animals into water in individual cages at a temperature of 5 °C at an ambient temperature of 7 °C.

The criterion for the exposure termination was the achievement by the animals of a rectal temperature of 20-25 °C, which corresponded to a deep degree of hypothermia. The exposure time was individual and averaged  $40 \pm 5$  min. During the experiment, rats were divided into 4 groups. Animals of group 1 ( $n = 5$ ) were removed from the experiment by decapitation immediately after cooling was stopped, animals of group 2 ( $n = 5$ ) after 2 days, animals of group 3 ( $n = 5$ ) after 7 days and animals of group 4 ( $n = 5$ ) - after 14 days. Five animals placed in individual cages into water at a temperature of 30 °C, at an ambient air temperature of 22–25 °C were taken as controls. The exposure time corresponded to the cooling time of the animals of the experimental group.

For histological examination, lung samples were fixed in 10% neutral formalin for 24-48 hours, then the material was taken in a TISSUE-TEK VIPTM6 machine (Sakkura, Nagano, Japan) and embedded in Histomix paraffin (TISSUE-TEK TEC 5 paraffin filling station, Sakkura, Nagano Japan). Sections of 5-7  $\mu\text{m}$  thick were made on a Accu-Cut SRM rotary microtome (Sakkura, China), stained with hematoxylin and eosin in a TISSUE-TEK Prisma automat (Sakkura, Nagano Japan) and placed under the film in a TISSUE-TEK Film automat (Sakkura, Nagano Japan). Staining of MC was carried out using a set of "Toluidine blue for staining mast cells" company "Biovitrum" (St. Petersburg). The preparations were photographed using a Nikon Eclipse E200 microscope (China) with a VIDI CAM digital video camera (Russia) at x400 magnification. In the program Image Tool 3.0. we calculated the average distribution density of the MC in 5 fields of view at x400 magnification. The field of view area of the microscope was 0.365 mm<sup>2</sup>.

The degranulation index of MC (IDMC) was estimated (as a percentage ratio of degranulated cells to the total number of analyzed MC). Morphometry of MC was performed using the licensed morphometric program "VideoTest - Morphology 5.2". Statistical processing of the data was performed using the statistical package Statistica 6.0.

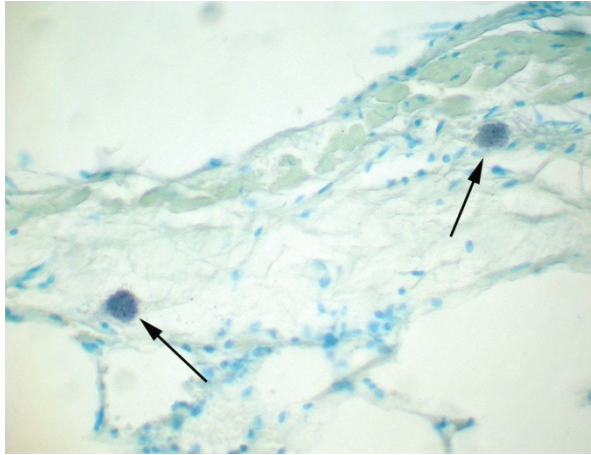
**Research results and discussion.**

When toluidine blue stained, the MC in the lungs of the control group animals were visible around the bronchioles, bronchi, vessels, and pleura. They had a rounded shape, small size and were located one by one. The distribution density of MC in the lungs of intact animals, on average, was  $2.0 \pm 0.5$  in the field of view



at x400 magnification. The cells area, on average, was  $82.5 \pm 3.6 \mu\text{m}^2$ . The number of compact forms of MCs was equal to  $87\% \pm 10.1$ , forms in the state of degranulation it was  $23\% \pm 10.1$ .

Immediately after a single time immersion deep hypothermia in the experimental animals, MC was determined in the peribronchial tissue. They were large, pale-violet, round or oval in shape (Fig. 1).



**Fig. 1.** Rat lung. Directly after deep hyperthermia, a small amount of large MC in a state of granulocytolysis (shown by arrows) is located in the peribronchial tissue. Coloring toluidine blue. Magnification x400

The distribution density of MC directly after hypothermia averaged  $2.7 \pm 0.8$  in the field of view, the cells area averaged  $184.5 \pm 14.9 \mu\text{m}^2$ . Most of the MC was in a state of granulocytolysis and devastation as a result of the secretion of granules. The number of MC in the state of degranulation was  $75\% \pm 17.1$ . The compact forms of MC, in which the granules were contained compactly, were  $25\% \pm 17.1$  (Table).

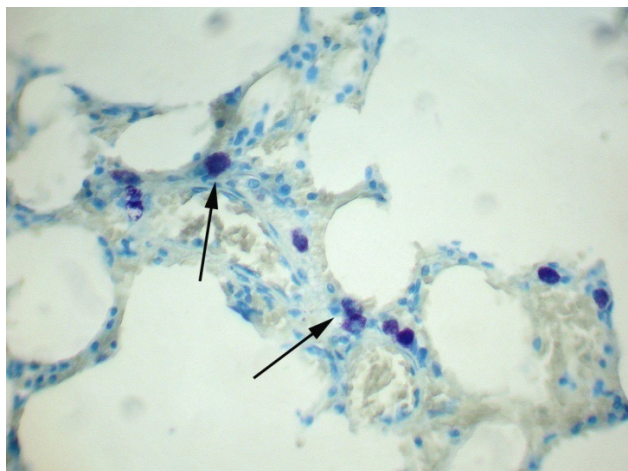
**Table**

*Quantitative and morphometric characterization of lung mast cells in rats depending on the duration term after singletime experimental deep immersion hypothermia*

Parameters of mast cell infiltration	The duration of the experiment			
	Directly after hypothermia (1)	2 days after hypothermia (2)	7 days after hypothermia (3)	14 days after hypothermia (4)
MC number	2,5±0,8	6,6±0,5	8,0±1,0	4,3±0,3
The number of compact MC (%)	25,0±17,1	52,0±8,9	76,7±8,6	70,7±12,2
The number of degranulating MC (%)	75,0±17,1	48,0±8,9	23,3±8,6	29,3±12,2
MC area (µm <sup>2</sup> )	184,5±14,9	84,2±3,5	107,9±7,3	90,8±6,2

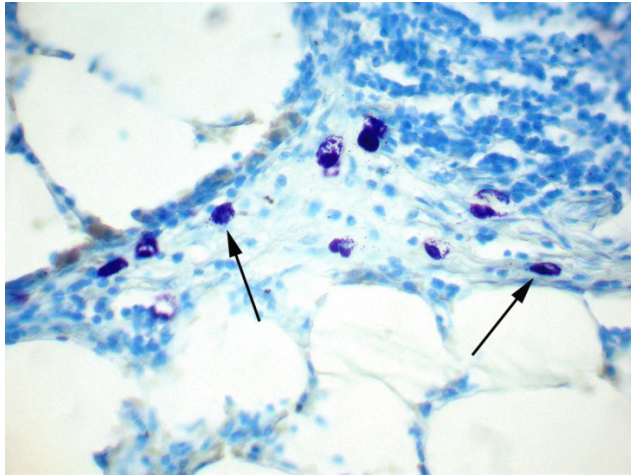
Note: for the number of MC  $P_{1-2}, P_{1-3}, P_{1-4} < 0,01$ .  $P_{2-3}, P_{2-4} < 0,04$ .  $P_{3-4} < 0,001$ . For the number of compact MC  $P_{1-2}, P_{1-3}, P_{1-4} < 0,001$ .  $P_{2-3} < 0,01$ . For the number of degranulating MC,  $P_{1-2}, P_{1-3}, P_{1-4} < 0,03$ .  $P_{2-3} < 0,04$ . For the MC area  $P_{1-2}, P_{1-3}, P_{1-4} < 0,000005$ .  $P_{2-3} < 0,0004$ .

On the 2nd day of the experiment, in the lung tissue, the MCs were located in groups in the interalveolar septa (Fig. 2). They were small and rounded or oval in shape. The distribution density of the MC in this study period was  $6.6 \pm 0.5$  in the field of view, their area, on average, was  $84.2 \pm 3.5 \mu\text{m}^2$ . The number of compact forms of MC was  $52.0\% \pm 8.9$ , degranulating forms were  $48.0\% \pm 8.9$  (Table).



**Fig. 2.** Rat lung, 2 days after the hypothermia. The MCs are located in the capillaries of the interalveolar septa (shown by arrows). Coloring toluidine blue. Magnification x400.

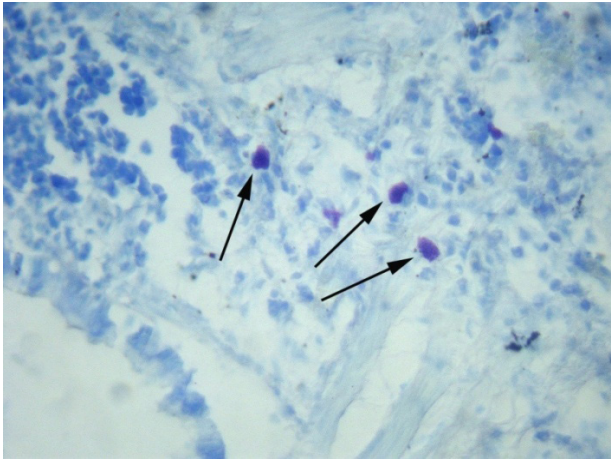
On the 7th day of the experiment, the movement of MCs to the bronchi and bronchioles, where they were located in the peribronchial connective tissue, was noted, the number of MCs in the interalveolar septa significantly decreased (Fig. 3).



**Fig. 3.** Rat lung. 7 days after hypothermia, MC migrated from the interalveolar septa to the peribronchial tissue (indicated by arrows). Coloring toluidine blue. Magnification x400

At this period of the study, in their morphological characteristics, the MC differed from the cells of the previous study period: they were more intensely colored, of larger size, the cells of elongated and irregular shape prevailed. The distribution density of the MC in this study period was  $8.0 \pm 1.0$  in the field of view, their average area increased to  $107.9 \pm 7.35 \mu\text{m}^2$ . The compact forms of the MC were  $76.0\% \pm 8.6$ , the MC in the state of degranulation  $23.3\% \pm 8.6$  (Table).

On the 14th day of the experiment, the MCs were located mainly one by one around the bronchioles and bronchi. Compared with the previous experimental period, the MC were small in size, the cells were round in shape (Fig. 4).



**Fig. 4.** Rat lung. 14 days after hypothermia, the MC decreased in size and were located mainly in the peribronchial tissue (indicated by arrows) Coloring toluidine blue. Magnification x400.

The distribution density of the MC in this study period was  $4.3 \pm 0.3$  in the field of view, the cells area, on average, was equal to  $90.8 \pm 6.2 \mu\text{m}^2$ . The number of compact forms of the MC was  $70.7\% \pm 13.2$ , in the state of degranulation was  $29.3\% \pm 12.2$  (table).

#### **Discussion.**

Thus, the data obtained indicate that a singletime deep immersion hypothermia had a significant impact on the morphofunctional activity of the lung MC of rats.

Immediately after exposure to hypothermia, most MC were in a state of granulolysis or total degranulation, which may indicate depletion of the system of these cells when exposed to cold stress. In the post-hypothermic period, on the 2nd day after hypothermia, the MC population increased, most cells were small and they were localized in the capillaries of the interalveolar septa, which may indicate replenishment of the MC population reserve due to the migration of their young forms from the blood to the lungs. On the 7th day of the experiment, the MC moved from the alveoli to the peribronchial connective tissue, the number of degranulating forms decreased and on the 14th day the content of such forms was the smallest, and the number of MC was close to normal.

The detected dynamics of changes in the morphofunctional activity of the MC population with a singletime deep immersion hypothermia, in our opinion, was due to adaptation processes. As is known, in the development of adaptive reactions there are two stages: 1) the stage of urgent, but imperfect adaptation; 2) the stage

of long-term sustainable adaptation. The urgent adaptive response stage develops immediately after the onset of stimulus exposure and is implemented on the basis of ready-made, previously formed biological mechanisms. At this stage, the adaptation effect is not fully provided, and the body's response is carried out at the limiting physiological possibilities. The most important component of the urgent adaptive response is the stress response with all its manifestations: damage and maximum mobilization of the functional capabilities of the organism, including the population of mast cells. Therefore, we detected changes in the morphofunctional activity of the mast cell population which can be attributed to manifestations of urgent adaptation to the effects of hypothermia, which were characterized by MC hypertrophy, granulo-lysis and active migration of activated young forms of MC from the bloodstream.

The migration of MC into the lungs and their redistribution during hypothermia can be considered as part of an adaptation syndrome. Similar data received Artashyan O. S. et al. (2012) in rats subjected to immobilization stress. When exposed to stress, the authors observed redistribution and migration of MC to organs: their number increased in the skin, stomach, intestines, liver, adrenal glands, while in the thymus and bone marrow their number significantly decreased [9].

#### **Conclusion.**

Thus, activation of MC under the influence of hypothermia is a natural process, since MCs express many biologically active substances that stimulate the regeneration of lung tissue after injury. MCs are important factors that ensure the resistance of the respiratory system to the effects of hypothermia. The MC reaction determines the course of the regeneration processes, changes in the microcirculatory bed, restoration of the microenvironment, nutrition of parenchymal elements and development of adaptation mechanisms under the action of hypothermia.

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低温后肥大细胞浸润大鼠肺部

**MORPHOFUNCTIONAL CHARACTERISTICS OF LIVER  
NUCLEOLAR ORGANIZERS REGIONS UNDER EXPERIMENTAL  
COLD STRESS AND IN THE POST-HYPOTHERMAL PERIOD**

**Dolgatov Andrej Yurevich**

**Bobrov Igor Petrovich**

**Lepilov Aleksandr Vasilevich**

*Altai State Medical University  
Barnaul, Russia*

注解。这项工作的目的是评估实验性冷应激和低温期间大鼠肝细胞核仁组织区 (AgNOR) 的形态功能活性。该研究在20只Wistar大鼠上进行。通过将动物置于5°C的温度和7°C的环境温度的单独笼中的水中来模拟低温。

暴露终止的标准是直肠温度为20–25°C的大鼠的成就，这对应于深度低温。在实验过程中，将动物分成4组。冷却后立即杀死第1组大鼠，在暴露于低温后2天从实验中取出第2组动物，5天后检查第3组动物的肝脏，并在暴露于第14天后研究第4组动物。冷系数。研究表明，冷应激对大鼠肝细胞的核仁装置有显著影响。在实验动物的肝细胞中低温后立即注意到AgNOR的形态功能活性降低，这与冷因子的破坏作用有关。在实验的第2天（在适应的初始阶段），观察到AgNOR形态功能活性的广泛异质性，其与新核仁的形成过程相关。在第5天，AgNOR的定量和形态学参数最高，这是核仁肥大的结果。在实验的第14天，AgNOR的活性显著降低。因此，冷应激下肝细胞的核装置受损，但在低温期，核仁的肥大和扩增发生，这导致核糖体合成的激活和肝细胞的再生。

关键词：体温过低，肝脏，核仁组织区，核糖体合成。

**Annotation.** *The aim of the work was to evaluate the morphofunctional activity of nucleolar organizer regions (AgNOR) of rat hepatocytes during experimental cold stress and in the posthypothermic period. The study was performed on 20 Wistar rats. The hypothermia was modeled by placing the animals in individual cages into water at a temperature of 5 °C at an ambient temperature of 7 °C.*

*The criterion for the exposure termination was the achievement at rats of a rectal temperature of 20–25 °C, which corresponded to a deep degree of hypothermia. During the experiment, animals were divided into 4 groups. Rats of group 1 were killed immediately after cooling, animals of group 2 were removed from the*

*experiment 2 days after exposure to hypothermia, the liver of animals of group 3 was examined after 5 days and animals of group 4 were studied 14 days after exposure to cold factor. The results of the study showed that cold stress has a pronounced effect on the nucleolar apparatus of rat hepatocytes. Immediately after hypothermia in the liver cells of experimental animals, a decrease in the morpho-functional activity of AgNOR was noted, which was associated with the damaging effect of the cold factor. On the 2nd day of the experiment (in the initial period of adaptation), a wide heterogeneity of the AgNOR morphofunctional activity was observed, which was associated with the process of formation of new nucleoli. On the 5th day, the quantitative and morphometric parameters of AgNOR were the highest, which was a consequence of nucleoli hypertrophy. On the 14th day of the experiment, the activity of AgNOR was significantly reduced. Thus, the nuclear apparatus of the liver cells under cold stress is damaged, but in the posthypothermic period, hypertrophy and amplification of the nucleoli occurs, which leads to activation of the ribosomal synthesis and regeneration of the liver cells.*

**Keywords:** *hypothermia, liver, nucleolar organizer regions, ribosomal synthesis.*

The nucleolus is a dynamic cell organelle and its structure reflects the levels of the three main processes associated with ribosome biogenesis: preribosomal ribonucleic acid synthesis, processing and migration of ribonucleoprotein fragments to the nucleoplasm [1]. One of the remarkable properties of the nucleoli is their high plasticity, which is manifested in changes in size, morphology and localization in the nucleus in response to many external stressors, as well as in adaptation to adverse factors [2, 3]. According to some authors, the nucleolus can be considered as a central figure coordinating the cellular response to stressful effects [4]. So, according to N. Chuchkova. et al. (2016) experimental alimentary hypercholesterinemia in rats was accompanied by reactive rearrangement of the liver cells nucleolar apparatus (the number of small and dense nucleoli increased), which indicates a decrease of hepatocytes synthetic activity [5]. Solin A.V. et al. (2016) showed that during adaptation to prolonged immobilization stress, an increase in the number of nucleoli in rat liver cells was observed [6]. Many authors have also noted an increase in the nucleolar number and area and the nucleolar-nuclear ratio during reparative regeneration of the liver, in particular, in experimental cirrhosis and other pathologies [7, 8].

In the literature there is a small number of works devoted to the morphology of the nucleolus of liver cells during hypothermia. Kapelyants A.S. et al. (1985) in hepatocytes subjected hypothermia, noted the movement of the nucleolus to the nucleus membrane, which the authors attributed to increased nuclear-cytoplasmic relations and increased regulatory influence of the nucleus on the cytoplasm [9]. According to other authors data, under the influence of low temperature (2 hours at 0–4 °C), the rat liver hepatocytes nucleoli degranulated, and 10 hours after placing the



animals back to normal temperature, the nucleoli ultrastructure was restored [10]. Molodykh O.P. (2001) with electron microscopy in the nucleoli of the liver cells under cold stress, noted the phenomenon of granular and fibrillar components segregation, which reflects a ribosomal RNA low level synthesis and, as a consequence, a low level of metabolism in general [11]. Studies of nucleolar liver cell organizers by silver plating after the cold temperature exposition were not found in the literature.

**The aim** of the study was to evaluate the morphofunctional activity of rat hepatocyte nucleolar organizers during experimental cold stress and in the post-hypothermic period.

#### **Material and research methods.**

The study was performed on 20 white Wistar rats. The hypothermia was modeled by placing the animals in individual cages in water at a temperature of 5 °C at an ambient temperature of 7 °C.

The criterion for the experiment termination was achievement of the animal rectal temperature of 20-25 °C, which corresponded to a deep degree of hypothermia. The exposure time was individual and averaged  $40 \pm 5$  min. During the experiment, animals were divided into 4 groups. Group 1 animals ( $n = 5$ ) were killed immediately after cooling was stopped, group 2 animals ( $n = 5$ ) were removed from the experiment in 2 days after cooling termination, group 3 animals ( $n = 5$ ) was examined in 5 days after cooling, and group 4 animals ( $n = 5$ ) were studied in 14 days after the cessation of hypothermia.

The use of rats in experiments was carried out in accordance with the European Convention for the Protection of Vertebrate Animals used in the experiment and the directives -86 / 609 / EEC [12]. Anesthesia and killing of animals was carried out in accordance with the "Rules of work using experimental animals." The material was fixed in 10% neutral formalin buffered by Lilly. Degreasing and dewatering of the material was carried out in isopropyl alcohol using a carousel posting machine type TISSUE-TEK VIPTM6 (Sakkura, Japan), embedded in paraffin using a TISSUE-TEK TEC 5 paraffin filling station (Sakkura, Japan). Histological sections 4–7  $\mu\text{m}$  thick were obtained using a Accu-Cut SRM semi-automatic rotary microtome (Sakkura, Japan). Samples were stained with hematoxylin and eosin in a machine for automatic coloring of micro-preparations TISSUE-TEK Prisma (Sakkura, Japan) and made preparations for film in a machine for automatic conclusion of micro-preparations TISSUE-TEK Film (Sakkura, Japan). On histological specimens stained with hematoxylin and eosin, were calculated the number of hepatocytes (in 5 view fields with magnification x400) and the alteration index (percentage of necrotized hepatocytes).

At magnification x 1000, under the oil immersion microscopy, the number of nucleoli, the total area of argyrophil granules (AgNORs) per nucleus, the area of one nucleolar organizer and the nucleolar – nuclear ratio (nucleolus / nucleus)

in relative units (rel. units) were calculated. Morphometric measurements were performed using a hardware-software complex consisting of the software for morphometric analysis VidoTest-Morphology 5.2., a VIDIA CAM digital camera (Russia), adapted to a Nikon Eclipse E200 light microscope (Japan) and a personal computer. At least 25–30 hepatocyte nuclei were examined in each animal.

Statistical processing of the material was performed using the statistical package Statistica 6.0. If the distribution of data was normal when testing statistical hypotheses, then parametric statistics were used (Student's t-test), and if the data obtained did not meet the criteria of normal distribution (Shapiro-Wilk test  $W = 0.89$ ,  $p < 0.01$ ) used methods of non-parametric statistics: the Kolmogorov-Smirnov test or the Mann-Whitney U-test. Data was considered reliable at  $p < 0.05$ .

**Research results.**

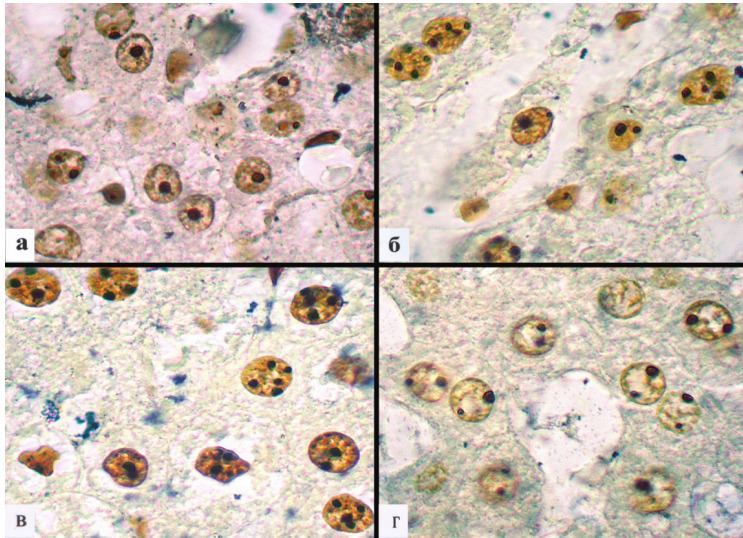
When staining histological sections of the liver of experimental animals, nucleolar organizers were clearly identified as black granules (AgNORs) against a yellowish background of the nucleoplasm of the nucleus. Immediately after hypothermia, the average number of AgNORs was  $1.2 \pm 0.1$  per nucleus. The average area of AgNORs was  $2.7 \pm 0.2 \mu\text{m}^2$  per nucleus. The average area of 1 AgNORs was  $2.1 \pm 0.1 \mu\text{m}^2$ . The nucleolus / nucleus ratio was  $0.11 \pm 0.01$  rel. units (tab. 1) (fig. 1 a).

**Table**

*Morphofunctional characteristics of nucleolar organizers of hepatocytes, depending on the duration of the experimental deep hypothermia (M ± m)*

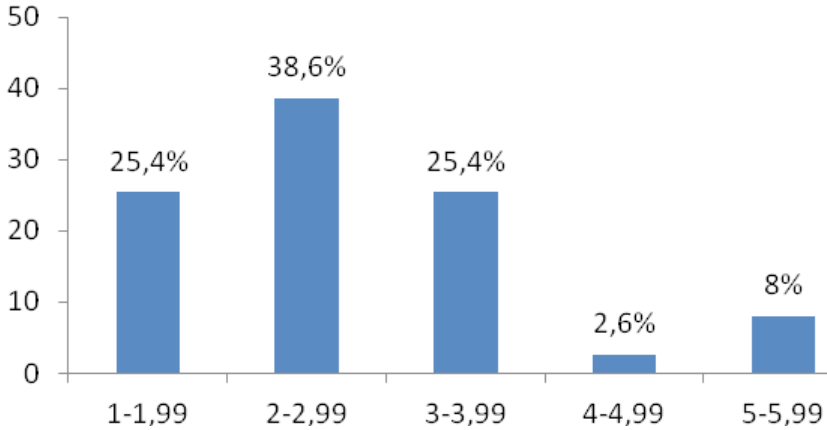
Hepatocytes characteristics	The duration of the experiment			
	Immediately after hypothermia	After 2 days	After 5 days	After 14 days
Number AgNORs per 1 nucleus	1,2±0,1*	2,35±0,1*	3,4±0,1*	2,0±0,1*
Area AgNORs per 1 nucleus (μm <sup>2</sup> )	2,7±0,2*	5,6±0,2*	8,7±0,2*	4,2±0,2*
Area of 1 AgNORs (μm <sup>2</sup> )	2,1±0,1	2,2±0,020000220,1*	2,6±0,1*	2,1 ±0,1*
Nucleolus/nucleus (rel. un)	0,11±0,01*	0,15±0,004*	0,16±0,004	0,11±0,004*

Note: \* - data are reliable at  $p < 0.05$ .



**Fig. 1.** Nucleolus organizers in hepatocyte nuclei under cold stress. AgNOR coloring according to I. P. Bobrov. Magnification  $\times 1000$ :  
*a* - isolated AgNORs immediately after the hypothermia affection;  
*б* - the beginning of the increase in the number of AgNORs on the 2nd day of the experiment; *в* - further increase in the number of AgNORs on the 5th day of the experiment; *г* - decrease in the content of AgNORs on the 14th day of the experiment.

We constructed histograms characterizing the distribution of the cellular elements of the liver over the area of AgNORs per nucleus. Analysis of the histogram characterizing the distribution of AgNORs immediately after hypothermia showed that hepatocytes with an area of AgNORs from 1 to  $1.99 \mu\text{m}^2$  amounted to 25.4%, from 2 to  $2.99 \mu\text{m}^2$  - 38.6%, from 3 to  $3.99 \mu\text{m}^2$  - 25.4%, from 4 to  $4.99 \mu\text{m}^2$  - 2.6% and from 5 to  $5.99 \mu\text{m}^2$  - 8%. The histogram has a shift to the left and a high peak in the region of cells with an area of AgNORs from 2 to  $2.99 \mu\text{m}^2$  per nucleus (Fig. 2).

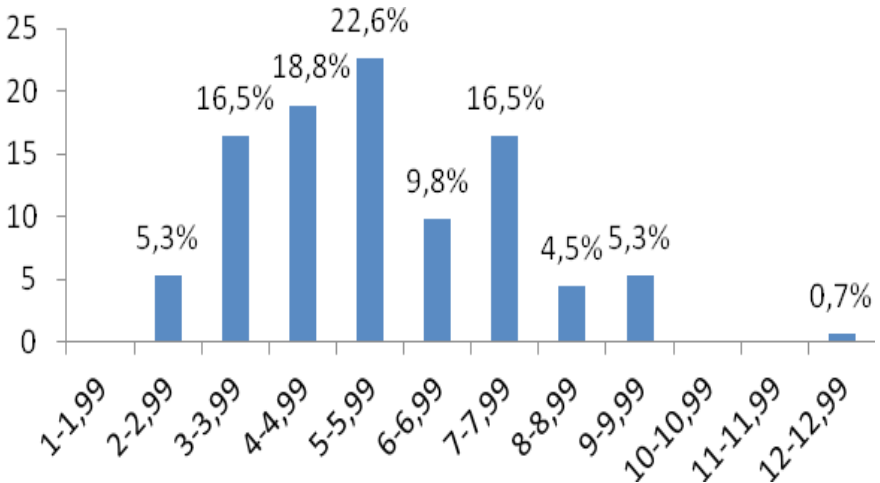


**Fig. 2.** A histogram characterizing the distribution of liver cells over the area of AgNORs per 1 nucleus immediately after hypothermia

The abscissa axis is the area of AgNORs (μm<sup>2</sup>) per nucleus; the ordinate axis is the percentage of cells.

In 2 days after hypothermia, the average number of AgNORs was  $2.35 \pm 0.1$  per nucleus. The average area of AgNORs was  $5.6 \pm 0.2 \mu\text{m}^2$  per nucleus. The average area of 1 AgNORs was  $2.2 \pm 0.1 \mu\text{m}^2$ . The nucleolus / nucleus ratio was  $0.15 \pm 0.004$  rel. units (Tab. 1, Fig. 1 b).

An analysis of the histogram characterizing the distribution of liver cell elements over the area of AgNORs 2 days after hypothermia showed that hepatocytes with an area of AgNORs from 1 to  $1.99 \mu\text{m}^2$  were 0%, from 2 to  $2.99 \mu\text{m}^2$  - 5.3%, from 3 to  $3.99 \mu\text{m}^2$  - 16.5%, from 4 to  $4.99 \mu\text{m}^2$  - 18.8%, from 5 to  $5.99 \mu\text{m}^2$  - 22.6%, from 6 to  $6.99 \mu\text{m}^2$  - 9.8%, from 7 to  $7.99 \mu\text{m}^2$  - 16.5%, from 8 to  $8.99 \mu\text{m}^2$  - 4.5%, from 9 to  $9.99 \mu\text{m}^2$  - 5.3%, from 10 to  $10.99 \mu\text{m}^2$  - 0%, from 11 to  $11.99 \mu\text{m}^2$  - 0% and from 12 to  $12.99 \mu\text{m}^2$  - 0.7%. When reviewing the histogram, there is a wide heterogeneity of cells over the area of AgNORs per nucleus. At the same time, the number of liver cells containing AgNORs with an area from 1 to  $3 \mu\text{m}^2$  decreases. The highest peak is observed in the area of clones of cells containing from 5 to  $5.99 \mu\text{m}^2$  per 1 nucleus. At the same time, at this period of the experiment, new clones with an area of AgNORs from 6 to  $6.99 \mu\text{m}^2$  - 9.8%, from 7 to  $7.99 \mu\text{m}^2$  - 16.5%, from 8 to  $8.99 \mu\text{m}^2$  - 4.5 and from 12 to  $12.99 \mu\text{m}^2$  - 0.7% (Fig. 3) appear.



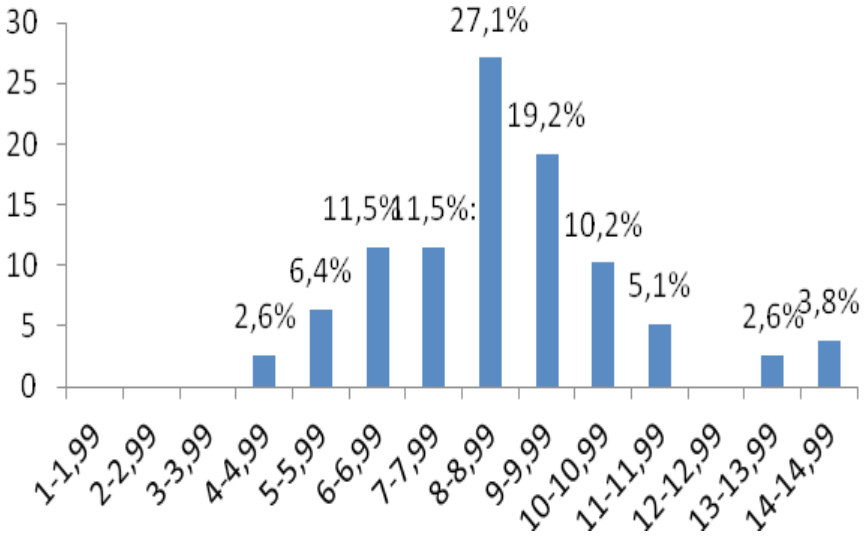
**Fig. 3.** - A histogram characterizing the distribution of liver cells over the area of AgNORs per 1 nucleus in 2 days after hypothermia

The abscissa axis is the area of AgNORs ( $\mu\text{m}^2$ ) per nucleus; the ordinate axis is the percentage of cells.

After 5 days after hypothermia, the average number of AgNORs was  $3.4 \pm 0.1$  per nucleus. The average area of AgNORs was  $8.7 \pm 0.2 \mu\text{m}^2$  per nucleus. The average area of 1 AgNORs was  $2.6 \pm 0.1 \mu\text{m}^2$ . The nucleoli / nuclei ratio was  $0.16 \pm 0.004$  rel. units (tab. 1) (fig. 1 c).

An analysis of the histogram characterizing the distribution of liver cell elements over the area of AgNORs in 5 days after hypothermia showed that hepatocytes with an area of AgNORs from 1 to  $1.99 \mu\text{m}^2$  were 0%, from 2 to  $2.99 \mu\text{m}^2$  - 0%, from 3 to  $3.99 \mu\text{m}^2$  - 0%, from 4 to  $4.99 \mu\text{m}^2$  - 2.6%, from 5 to  $5.99 \mu\text{m}^2$  - 6.4%, from 6 to  $6.99 \mu\text{m}^2$  - 11.5%, from 7 to  $7.99 \mu\text{m}^2$  - 11.5%, from 8 to  $8.99 \mu\text{m}^2$  - 27.1%, from 9 to  $9.99 \mu\text{m}^2$  - 19.2%, from 10 to  $10.99 \mu\text{m}^2$  - 10.2%, from 11 to  $11.99 \mu\text{m}^2$  - 5.1% and from 12 to  $12.99 \mu\text{m}^2$  - 0%, from 13 to  $13.99 \mu\text{m}^2$  - 2.6% and from 14 to  $14.99 \mu\text{m}^2$  - 3.8%.

When reviewing the histogram, it can be seen that there are no liver cells with an AgNORs area from 1 to  $3.99 \mu\text{m}^2$ . The highest peak is observed in the area of cells containing from 8 to  $8.99 \mu\text{m}^2$  per 1 nucleus. At the same time, the number of cell clones with the AgNORs area from 8- $8.99 \mu\text{m}^2$  to 27.1%, from 9- $9.99 \mu\text{m}^2$  to 19.2%, from 10- $10.99 \mu\text{m}^2$  to 10.2% and from 11 to  $11.99 \mu\text{m}^2$  to 5.17% increases. At the same time, new clones appear with an area of AgNORs from 13 to  $13.99 \mu\text{m}^2$  - 2.6% and from 14 to  $14.99 \mu\text{m}^2$  - 3.8% (Fig. 4).

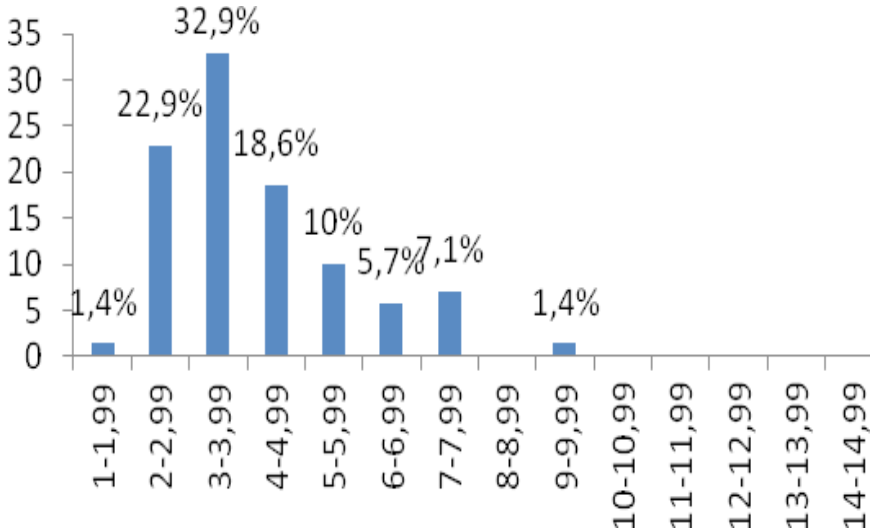


**Fig. 4.** A histogram characterizing the distribution of liver cells over the area of AgNORs per nucleus, 5 days after hypothermia.

The abscissa axis is the area of AgNORs ( $\mu\text{m}^2$ ) per nucleus; the ordinate axis is the percentage of cells.

On day 14 after hypothermia, the average number of AgNORs was  $2.0 \pm 0.1$  per nucleus. The average area of AgNORs was  $4.2 \pm 0.2 \mu\text{m}^2$  per nucleus. The average area of 1 AgNORs was  $2.1 \pm 0.1 \mu\text{m}^2$ . The nucleoli / nuclei ratio was  $0.11 \pm 0.004$  rel. units (Tab. 1, Fig. 1 g).

An analysis of the histogram characterizing the distribution of cellular elements over the area of AgNORs per nucleus on day 14 of the experiment showed that hepatocytes with an area of AgNORs from 1 to  $1.99 \mu\text{m}^2$  were 1.4%, from 2 to  $2.99 \mu\text{m}^2$  - 22.9%, from 3 to  $3.99 \mu\text{m}^2$  - 32.9%, from 4 to  $4.99 \mu\text{m}^2$  - 18.6%, from 5 to  $5.99 \mu\text{m}^2$  - 10%, from 6 to  $6.99 \mu\text{m}^2$  - 5.7%, from 7 to  $7.99 \mu\text{m}^2$  - 7.1%, from 8 to  $8.99 \mu\text{m}^2$  - 0%, from 9 to  $9.99 \mu\text{m}^2$  - 1.4%, from 10 to  $10.99 \mu\text{m}^2$  - 0%, from 11 to  $11.99 \mu\text{m}^2$  to 0%, from 12 to  $12.99 \mu\text{m}^2$  to 0%, from 13 to  $13.99 \mu\text{m}^2$  to 0%, and from 14 to  $14.99 \mu\text{m}^2$  to 0%. When analyzing the histogram, it can be seen that there are no liver cells with an area of AgNORs from 10 to  $14.99 \mu\text{m}^2$ . The highest peak is observed in the area of cell clones containing from 3 to  $3.99 \mu\text{m}^2$  per nucleus (32.9%). At the same time, at this period of the experiment, the number of clones with a small area of AgNORs increases from 1 to  $4.99 \mu\text{m}^2$  (Fig. 5).



*Fig. 5. A histogram characterizing the distribution of liver cells over the area of AgNORs per nucleus 14 days after hypothermia*

The abscissa axis is the area of AgNORs ( $\mu\text{m}^2$ ) per nucleus; the ordinate axis is the percentage of cells.

### **Discussion.**

Thus, the results of the study showed that cold stress has a pronounced effect on the activity of the nucleolar apparatus of the cellular elements of the liver. Immediately after hypothermia in the liver cells of experimental animals, a decrease in the morphofunctional activity of AgNOR was noted, which may be due to the damaging effect of the cold factor on the nucleolar apparatus.

. Further, on the 2nd day of the experiment (during the regeneration period), the wide heterogeneity of the morphofunctional activity of AgNOR was observed, which was probably due to the process of new nucleoli formation. On the 5th day (during the adaptation period), the quantitative and morphometric parameters of AgNOR were the highest, which is a consequence of nucleoli hypertrophy, and then on the 14th day of the experiment, the morphofunctional activity of nucleolar organizers decreased significantly.

Thus, the nucleolar apparatus of the liver cells undergoes damage during cold exposure, but in the posthypothermic period (during the adaptation period), hypertrophy and amplification of the nucleoli is observed, which leads to normalization of the ribosomal synthesis and regeneration of hepatocytes.

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实验性低温下的病理形态学骨骼肌和微循环血管床  
**PATHOMORPHOLOGY OF SKELETAL  
MUSCULATION AND MICROCIRCULATORY BEDS AT  
EXPERIMENTAL HYPOTHERMIA**

**Kruchkova Natalya Gennadevna**

**Bobrov Igor Petrovich,**

**Lepilov Aleksandr Vasilevich**

*Altai State Medical University*

注解。这项工作的目的是研究实验中对大鼠骨骼肌和微血管的低温效应。该研究在15只Wistar大鼠上进行。通过将动物置于温度为5°C，环境温度为7°C的单个笼中的水中来模拟低温。终止暴露的标准是动物的直肠温度为20-25的成就。<sup>°C</sup>，相当于深度低温。

在实验过程中，将动物分成2组。在终止冷却后立即杀死第1组动物，冷却终止后2-5天的动物。

此外，对完整动物进行形态学研究。在所有动物中研究了肢体横纹肌的组织学结构，微血管状态，分布密度和巨噬细胞和肥大细胞的形态。随着对肌肉组织和微血管系统的破坏性影响，低温已被证明是肥大细胞和巨噬细胞活性的有效激活剂。间质肥大细胞和巨噬细胞是生物体适应过程中对低温影响的重要因素。

关键词：低温，微循环床，肥大细胞，巨噬细胞。

**Annotation.** *The aim of the work was to study the hypothermia effect on skeletal muscles and the microvasculature of rats in the experiment. The study was performed on 15 Wistar rats. The hypothermia was modeled by placing the animals into water in individual cages at a temperature of 5 ° C at an ambient temperature of 7 ° C. The criterion for the termination of exposure was the achievement by the animals of a rectal temperature of 20-25 ° C, which corresponded to a deep degree of hypothermia.*

*During the experiment, the animals were divided into 2 groups. Animals of group 1 were killed immediately after the termination of cooling, animals of group 2 - 5 days after termination of cooling.*

*Also, morphological studies were carried out on intact animals. The histological structure of the striated muscles of the limbs, the state of the microvasculature,*

*the distribution density and the morphology of macrophages and mast cells were investigated in all animals. Along with the damaging effects on muscle tissue and the microvasculature, hypothermia has been shown to be a potent activator of mast cell and macrophage activity. Interstitial mast cells and macrophages are important factors in the organism adaptation process to the effects of hypothermia.*

**Key words:** *hypothermia, microcirculatory bed, mast cells, macrophages.*

The study of laws of the organism adaptation to environmental factors is a fundamental task of forensic medicine [1]. Hypothermia is the most important factor affecting the human body.

Despite numerous studies on the death in the cold, the diagnosis of cold death and, consequently, fatal hypothermia continues to be relevant. At present, many aspects of the harmful effects of the cold factor on the human body have been thoroughly studied, and diagnostic and differential diagnostic criteria for death from hypothermia have been developed, but there is no complete idea about adaptation of the body to cold in forensic science and practice to date [2]. The study of this issue can greatly contribute to experimental research.

It is known that local and general overcooling of the body often contributes to the occurrence of myodystrophies. At the same time, clinical observations using functional research methods only exacerbate differences in views on the role of the cold factor in the occurrence of this phenomenon [3]. Therefore, the results of experimental morphological studies on the muscle fibers reaction to hypothermia are important [4,5].

The microcirculation system (MC) is one of the first systems that are involved in pathological processes with various effects on the body [6]. The speed and originality of the MC response to extreme effects makes it promising to study this system as well as the patterns occurring during hypothermia [7]. However, there are very few experimental works devoted to studying the effect of hypothermia on MC in the literature.

According to modern concepts, mast cells (MC) are a key element in influencing metabolic processes during adaptation to stress and hypoxia [8, 9, 10]. At the same time, only a few studies [11, 12] are devoted to the value of MC in hypothermia. So, Bobr O.A. et al. (2006) observed an increase in the number of MC in the tissues of rats subjected to hypothermia. The works devoted to the morphological features of macrophages during hypothermia have not been found in the literature.

Thus, the aim of the work was to study the effect of hypothermia on the morphology of skeletal muscle tissue, the microvasculature, mast cells, and rat macrophages in the experiment.

#### **Materials and research methods.**

The study was performed on 15 Wistar rats. The hypothermia was modeled by placing the animals into water in individual cages at a temperature of 5 ° C at an ambient temperature of 7 ° C. The criterion for the termination of exposure

was the achievement by the animals of a rectal temperature of 20-25 ° C, which corresponded to a deep degree of hypothermia. The exposure time was individual and averaged  $40 \pm 5$  min. During the experiment, the animals were divided into 2 groups. Animals of group 1 were killed immediately after the cooling termination, animals of group 2 – in 5 days after termination of cooling. Also, morphological studies were carried out on intact animals, which served as a control group.

Anaesthesia and killing of animals were carried out in accordance with the “Rules of work with the use of experimental animals.”

Material was fixed in 10% neutral formalin buffered by Lilly. Degreasing and dewatering of the material were carried out using isopropyl alcohol with a carousel posting machine type TISSUE-TEK VIPTM6 (Sakkura, Japan), embedded in paraffin using a «TISSUE-TEK TEC 5» paraffin filling station (Sakkura, Japan). Histological sections of 4-7  $\mu\text{m}$  thick were obtained using an Accu-Cut SRM rotary microtome (Sakkura, Japan) and stained with hematoxylin and eosin. Collagen fibers were stained according to Van Gieson's, elastic fibers by Weigert resorcin-fuchsin and 1% alcoholic solution of orcein, argyrophilic fibers according Gomori's silver impregnation, neutral glycosaminoglycans by MacManus Schiff-solution and acidic glycosaminoglycans with 1% alcian blue solution in 3% acetic acid (pH 2.5) according to Steedman. Mast cells were detected with a 0.1% aqueous solution of toluidine blue (pH - 3.9).

Digital micrographs of microscopic preparations were obtained using a Zeiss Standard 20 microscope (Germany) and a VIDI CAM digital video camera (Russia). Calculation of muscle fibers distribution density (DMF), vessels of the microcirculatory bed (VMCB), macrophages (MF) and mast cells (MC) was performed in 5 fields of view with a microscope magnification x400. Calculation of the Kernogan's index (the ratio of the vessel wall thickness to the width of the hollow) also was performed. Morphometry was carried out in the morphometric programs UTHSCSA Image Tool 3.0 (developed at the University of Texas Health Science Center of San Antonio, Texas), and Image J.

Statistical processing of the material was performed using the statistical package Statistica 6.0. If, when testing statistical hypotheses, the distribution of data was normal, then methods of parametric statistics were used (Student's t-test), and if the data obtained did not meet the criteria of normal distribution (Shapiro – Wilk test  $W = 0.89$ ,  $p < 0, 01$ ), then the methods of non-parametric statistics were used: the Kolmogorov-Smirnov test, or the Mann-Whitney U-test. Data were considered reliable at  $p < 0.05$ .

### **Research results and discussion**

The results of the study showed that in the rats of the control group (without exposure to hypothermia) the striated muscles were not subjected to morphological changes (Figure 1, a).

On the longitudinal sections, the transverse striation of the muscle fibers (MF) was clearly visible. The density of muscle fibers (DMF) in 5 fields of view with

x400 microscopy magnification was  $36.2 \pm 2.2$ . The MF width was  $30.8 \pm 1.9 \mu\text{m}$ , the diameter was  $34.1 \pm 1.3 \mu\text{m}$ , the cross-sectional area was  $1039.6 \pm 43.3 \mu\text{m}^2$  (Table 1).

Rod-shaped or oval nuclei located on the periphery of muscle cells. The average nuclei area was  $36.3 \pm 2.9 \mu\text{m}^2$ . In endomysium, between MF, in an insignificant amount, subtile argyrophil fibers were located. Phenomena of inflammation were absent, only single lymphocytes and plasma cells were observed in the muscle tissue.

**Table 1**  
*Morphometric parameters of muscle fibers of rat skeletal musculature in normal and after hypothermia*

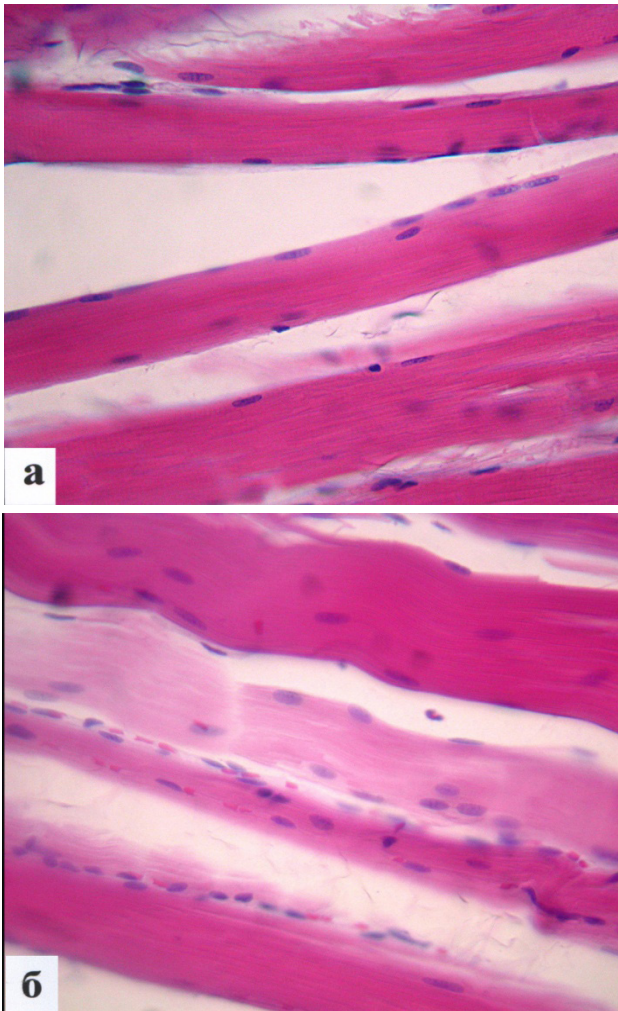
Parameters of muscle fibers	Control (n=5)	Immediately after hypothermia (n=5)	5 days after hypothermia (n=5)
DMF	36,2±2,2*	25,8±1,9*	23,8±1,0
Thickness (μm)	30,8±1,9*	50,4±3,0*	51,6±2,6
Diameter (μm)	34,1±1,3*	66,4±2,3*	94,9±5,9*
Cross Sectional Area (μm <sup>2</sup> )	1039,6±43,3*	2764,3±270,3*	4156,7±394,9*
Nuclei area (μm <sup>2</sup> )	36,3±2,9*	55,1±2,0*	61,9±4,9*

Note - \* data are reliable at  $p < 0.05$ .

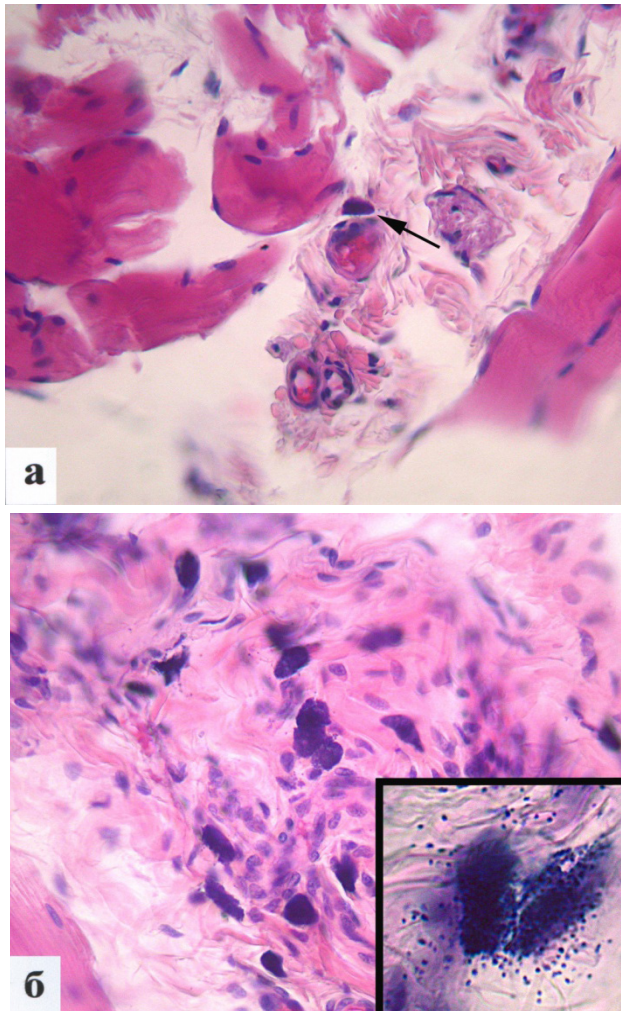
The vessels in the rats of the control group had a rounded hollow, contained a small number of erythrocytes. Density of VMCB (DVMCB) in 5 fields of view amounted to  $- 9.6 \pm 1.7$  (magn. x400). The Kernogan's index was  $4.0 \pm 0.5$  (Table 2). In the course of the vessels, the MF and MC were located (Fig. 2, a).

MFs had a round or oval shape and were located individually or in groups of 2-5 cells. The average number of MFs was  $3.6 \pm 0.5$ , the area of the MFs was  $116.2 \pm 7.5 \mu\text{m}^2$ .

MCs had a rounded or elongated shape, their number varied from 1 to 2, the average was  $1.2 \pm 0.2$ . The MC area was  $94.0 \pm 20.7 \mu\text{m}^2$ . Granules in the cytoplasm of MCs were located compactly, degranulation was noted in a small number of cells. IDMC (index of degranulated mast cells) amounted to 26.8%. Also was revealed the presence of single MCs in the nerve trunks.



**Fig. 1.** (a) - striated muscle fibers of a usual histological structure in a rat of the control group; (b) dystrophic changes and myo-cytolysis of muscle fiber in a rat on day 5 after exposure to deep hypothermia. Stained with hematoxylin and eosin. Magnification x400.



**Fig. 2.** (a) - single mast cell in rat muscle tissue of the control group (indicated by an arrow); (b) - a larger number of mast cells in the muscle of a rat on day 5 after exposure to deep hypothermia (in the right corner, frame, mast cells in a state of degranulation).

*Stained with hematoxylin and eosin. Magnification x400*

**table 2**

*Morphometric parameters of the microvasculature, mast cells and macrophages of rat skeletal muscles in normal and hypothermia*

Characteristics	Control (n=5)	Immediately after hypothermia (n=5)	5 days after hypothermia (n=5)
DVMCB	9,6±1,7*	6,6±0,7*	5,8±0,7*
Kernogen's index (units)	4,0±0,5	4,4±1,5*	1,6±0,2*
The macrophages number	3,6±0,5	3,0±0,2	3,6±0,2
Macrophage area (µm <sup>2</sup> )	116,2±7,5*	142,9±14,2*	188,2±15,6*
Mast cell number	1,2±0,2*	1,8±0,4*	4,6±0,4*
Mast cell area (µm <sup>2</sup> )	94,0±20,7*	130,9±16,9*	167,1±13,4*
IDMC (%)	26,8	30,7	83

Note - \* data are reliable at p <0.05.

When death occurred immediately after deep hypothermia, the striated muscles were in a state of marked edema. On longitudinal sections in the muscles, the transverse striation was not clearly visible. The DMF was  $25.8 \pm 1.9$ . The area of pale stained MF was determined. The MF width was  $50.4 \pm 3.0 \mu\text{m}$ , the diameter was  $66.4 \pm 2.3 \mu\text{m}$ , the cross-sectional area was  $2764.3 \pm 270.3 \mu\text{m}^2$  (Table 1).

The MF nuclei were enlarged and located not only around the periphery, but also in the center of the cells. The MF nucleus area was  $55.1 \pm 2.0 \mu\text{m}^2$ . Between MF, in endomysium, the phenomena of pronounced interstitial edema and pronounced infiltration by inflammatory infiltrate cells, which were represented by lymphocytes, plasma cells, monocytes and neutrophils, were noted. The phenomena of pronounced perineural and perivascular edema were noted.

Vessels at death immediately after hypothermia were paretically expanded and full-blooded. DVMCB was  $6.6 \pm 0.4$ . The Kernogan's index was  $4.4 \pm 1.5$  (Table 2). In the course of the vessels and around them MF and MC were located. MFs had a predominantly elongated shape. The number of MFs varied from 2 to 4, their average number was  $3.0 \pm 0.2$ , the area of MF was  $142.9 \pm 14.2 \mu\text{m}^2$ .

MC had an oval or irregular shape, their number varied from 1 to 3 in the field of view, the average number of MC was  $1.8 \pm 0.4$ . The MC area was  $130.9 \pm 16.9 \mu\text{m}^2$ . The number of degranulated cells increased in comparison with the control group, the IDMC was 30.7%. The presence of MC in the nerve trunks also was noted.

On the 5th day of the experiment, after hypothermia, the striated muscles were in a state of marked edema. In the longitudinal sections, the transverse striation of the MF was not clearly visible, in the transverse sections there were phenomena of hydropic dystrophy, individual muscle fibers were in a state of myocytolysis (Figure 1, b).



The DMF was  $23.8 \pm 1.9$ . The MF width was  $51.6 \pm 2.6 \mu\text{m}$ , the diameter was  $94.9 \pm 5.9 \mu\text{m}$ , and the cross-sectional area was  $4156.7 \pm 394.9 \mu\text{m}^2$  (Table 1). The nuclei in most cases were located in the center of the MF and had an oval or round shape, the number of nuclei in the muscle cells was increased. The average nucleus area was  $61.9 \pm 4.95 \mu\text{m}^2$ . In endomysium, marked interstitial edema was observed. There were diffuse and perivascular inflammatory infiltrates between MF, which consisted of lymphocytes, plasma cells, neutrophils, monocytes, eosinophils and fibroblasts.

The vessels on the 5th day of the experiment had a hollow round shape, were full of blood, but their hollow was narrowed. DVMCB was  $-5.8 \pm 0.7$ . An accumulation of acid glucosaminoglycans was noted in the artery walls. The value of the Kernogan's index was  $1.6 \pm 0.2$  (Table 2). The phenomenon of perivascular sclerosis was determined around the vessels. The capillaries had a convoluted character and were inner lined with swollen endothelium. In the course of the vessels and in their adventitia were MFs and MCs.

MFs had fusiform or irregular shape. The number of MFs varied from 3 to 4, their average number was  $3.6 \pm 0.2$ , and the cross-sectional area -  $188.2 \pm 15.6 \mu\text{m}^2$ . MCs were mostly of irregular shape, their number was 2-12 in the field of view, the average number was  $4.6 \pm 0.4$ , and the cross-sectional area was  $167.1 \pm 13.4 \mu\text{m}^2$ .

Most of the cells were in a state of degranulation (Fig. 2, b). IDMC significantly increased and amounted to 83%. The increase in the number of MC inside the nerve trunks was noted.

Thus, the results of the study showed that deep hypothermia has a damaging effect on the skeletal muscles and the microvasculature in rats. Damage is manifested by signs of pronounced inflammation, vacuolar dystrophy, muscle fibers myocytolysis, reduction of blood vessels and a decrease in the Kernogan's index value. But at the same time, against the background of tissue alteration and hypoxia, the distribution density and cross-sectional area of MCs and MFs, which are known to be activated by hypoxia and are the most important remodelers of connective tissue and angiogenesis activators, were increased. So, on the 5th day of the experiment, 83% of the MC was in a state of degranulation, which may indicate a high activity of the tumor-cell population and the processes of remodeling the microvasculature. Also during this period of the experiment, MCs were also found in the nerve trunks, which may indicate the processes of repair occurring in the nerve fibers.

Thus, along with the damaging effects on muscle tissue and the microvasculature, hypothermia also is a powerful activator of MC and MF activity. Interstitial MCs and MFs can be important factors in the adaptation processes to hypothermia. A study in the forensic practice of the morphofunctional activity of a mast-cell population upon death from hypothermia may be an additional differential diagnostic criterion.

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肿瘤预后意义的研究 肾癌的相关巨噬细胞 (CD68)  
**STUDY OF THE PROGNOSTIC SIGNIFICANCE OF TUMOR  
ASSOCIATED MACROPHAGES (CD68) IN KIDNEY CANCER**

**Klimachev Ilya Vladimirovich<sup>1</sup>**

**Bobrov Igor Petrovich<sup>1,2</sup>,**

**Cherdanceva Tatyana Mihajlovna<sup>1</sup>**

*<sup>1</sup>Federal State Budgetary Educational Institution of Higher Education  
«Altai State Medical University»*

*of the Health Ministry of Russia, Barnaul*

*<sup>2</sup>Altai branch of the «N.N. Blokhin National Medical Research  
Center of Oncology» of the Health Ministry of Russia, Barnaul*

注解。在这项工作中，研究了肿瘤相关巨噬细胞 (TAM) 计数在肾细胞癌 (RCC) 中的预后意义。该研究的材料是56名肾癌患者的手术材料。患者的平均年龄为  $58.8 \pm 1.1$  岁。有27名男性 (48.2%) 和29名女性 (51.6%)。确定肿瘤中TAM分布密度与疾病临床分期之间的相关性 ( $r = 0.28$ ;  $p = 0.04$ )，肿瘤节点的大小 ( $r = 0.29$ ;  $p = 0.03$ )，区域和远处的存在转移 ( $r = 0.46$ ;  $p = 0.0001$ )，根据Fuhrman的肿瘤分级 ( $r = 0.58$ ;  $p = 0.0001$ ) 和患者的术后存活率 ( $r = -0.31$ ;  $p = 0.02$ )。肿瘤中TAM的数量与患者的性别 ( $r = -0.10$ ;  $p = 0.45$ )，年龄 ( $r = -0.15$ ;  $r = 0.27$ ) 和肿瘤的组织学类型之间没有相关性 ( $r = -0.02$ ;  $p = 0.87$ )。癌症中TAM数量的增加可被视为可能发生转移的标准。肿瘤中高含量的TAM是预测患者生存的不利因素。

关键词：肾癌，巨噬细胞，预后。

**Annotation.** *In this work, the prognostic significance of tumor-associated macrophages (TAM) counting in renal cell carcinoma (RCC) is investigated. The material for the study was the surgical material of 56 kidney cancer patients. The average age of patients was  $58.8 \pm 1.1$  years. There were 27 men (48.2%) and 29 women (51.6%). Were determined the correlation of the TAM distribution density in the tumor between the clinical stages of disease ( $r = 0.28$ ;  $p = 0.04$ ), the sizes of the tumor node ( $r = 0.29$ ;  $p = 0.03$ ), the presence of regional and distant metastases ( $r = 0.46$ ;  $p = 0.0001$ ), gradation of a tumor according to Fuhrman ( $r = 0.58$ ;  $p = 0.0001$ ) and postoperative survival of patients ( $r = -0.31$ ;  $p = 0.02$ ). No correlation was found between the number of TAMs in the tumor and the gender ( $r = -0.10$ ;  $p = 0.45$ ), age ( $r = -0.15$ ;  $r = 0.27$ ) of patients and the histological type*

*of the tumor ( $r = -0,02$ ;  $p = 0.87$ ). An increase in the number of TAMs in carcinomas can be considered as a criterion for the possible occurrence of metastases. The high content of TAM in the tumor is an unfavorable factor in predicting the survival of patients.*

**Key words:** kidney cancer, macrophages, prognosis.

Interest in studying the microenvironment of malignant neoplasms, including tumor-associated macrophages (TAM), has persisted over the past decades [1, 2, 3, 4, 5, 6, 7]. According to modern ideas, TAMs play a key role in tumor cancer and progression of cancer. Through the secretion of numerous agents, such as: growth factors (bFGF, GM-CSF, TGF- $\alpha$ , IGF-I, PDGF, VEGF / VPF, TGF- $\beta$ ), cytokines and monokines (IL-1, IL-6, IL-8, TNF- $\alpha$ , substance P, prostaglandins, interferons, thrombospondin 1), proteases (MMP-2, MMP-9) TAM can cause the proliferation of tumor cells, remodel the stroma of malignant tumors, stimulate angiogenesis, induce invasion and metastasis of tumors [8].

In the literature there is a small number of works devoted to the study of the prognostic significance of TAM during RCC. A high TAM content in the tumor, according to some authors, in renal cancer correlates with the appearance of metastases [9,10]. According to Toge H. et al. (2009) [11] the high number of TAMs in carcinomas was interconnected with the development of relapses. At the same time, Hutterer G.C. et al. (2013) [12] showed that the presence of TAMs in the tumor was statistically significantly associated with favorable prognostic parameters, including low clinical stage, small size of the tumor site, negative lymph nodes, and low gradation of the tumor according to Fuhrman.

At the same time, 5-year postoperative survival of patients with high TAM values in the tumor was 93.5%, compared with 72.5% in patients with no TAM in the tumor.

Thus, the works devoted to the prognostic significance study of the assessment of intratumoral stromal MC during RCC are few and contradictory, and therefore this element of the tumor microenvironment needs further study.

The aim of the work was the study of intratumoral stromal MCs with RCC, the search for relationships with important clinical and anatomical prognostic factors rather with postoperative survival of patients.

#### **Material and research methods.**

The operational material of 56 patients with RCC was studied. The average age of patients was  $58.8 \pm 1.1$  years. There were 27 men (48.2%) and 29 women (51.6%).

In all cases, the RCC was classified according to the WHO 2004 classification [13].

On the histological structure of the tumor were presented as follows: clear cell

cancer - 42; papillary cancer - 3; chromophobic cancer - 9; spindle-specific (sarcomatoid) cancer – 2 accidents.

The incidence of tumor was assessed according to the TNM classification of malignant tumors (TNM Classification of Malignant Tumors, edited by Sobin L.H., 2002) [13]. Among our patients, I of the clinical stage (T1N0M0) corresponded to 35 (62.5%) observations; II stage (T2N0M0) - 10 (17.9%) observation; III stages (T1N1M0, T2N1M0, T3N0M0, T3N1M0) - 9 (16.1%) and IV stages (T4N0M0, T4N1M0, T<sub>any</sub>N<sub>any</sub>M1, T<sub>any</sub>N<sub>any</sub>M1) - 2 (3.5%). The degree of malignancy of tumor cells was assessed by Fuhrman S.A. et al., (1982) [14]. The degrees of anaplasia G1 corresponded to 16 tumors (28.6%), the degrees of anaplasia G2 - 20 (35.7%) tumors, the degrees of anaplasia G3 - 14 (25%) and the degrees of anaplasia G4 - 6 (10.7%).

Carcinoma with regional and distant metastases was 8 (14.3%), localized tumors were 48 (85.7%).

The average size of the tumor site was  $6.8 \pm 0.3$  cm.

Kidney tissue taken from the areas most distant from the tumor was used as a control, without any marked inflammation and sclerosis.

The material was fixed in 10% neutral buffered formalin for 12-24 hours. Histological preparations were stained with hematoxylin and eosin and for acidic mucopolysaccharides sections were stained with the colloidal iron by Hale method. TAM was detected by immunohistochemistry using monoclonal murine antibodies CD68 (clone PG-M1, DAKO) according to the protocol recommended by the manufacturer. The average number of TAM was counted in 3 fields of view with microscope objective x400 magnification.

Information on the survival rate of patients was obtained according to the register of malignant diseases and outpatient cards (2010-2016).

Statistical processing of the material was performed using the statistical package Statistica 10.0. In the normal distribution of data, the methods of parametric statistics (Student's t-test) were used to verify statistical hypotheses, and if the data obtained did not meet the criteria of the normal distribution (Shapiro-Wilk test  $W = 0.89$ ,  $p < 0.01$ ), then Kolmogorov-Smirnov test or Mann-Whitney U-test were used. Data was considered reliable at  $p < 0.05$ . The construction of «survival» curves was carried out according to the Kaplan-Meier method, the reliability of differences in survival rates was assessed using a log-rank test.

### **Research results and discussion.**

The results of the study showed that in the unaltered kidney tissue macrophages had a round, oval, or process shape and were located in the interstitial tissue, near the vessels, between the tubules and in the glomeruli. On average, the number of macrophages in the interstitial tissue of the kidney was  $1,6 \pm 1,2$ .

Among all patients with RCC, regardless of gender, age, histological type and

other clinical and morphological prognostic indicators, the spread of average values of TAM distribution density ranged from 1 to 137. The average value of TAM distribution density at RCC was  $14.5 \pm 1.2$ .

Comparison of the average number of TAMs in the stroma of the tumor with prognostically important clinical and anatomical factors of RCC revealed some correlation relationships. The distribution density of TAM was interrelated: with the clinical stage of the disease ( $r = 0.28$ ;  $p = 0.04$ ), with the size of the tumor site ( $r = 0.29$ ;  $p = 0.03$ ), with the presence of regional and distant metastases ( $r = 0.46$ ;  $p = 0.0001$ ), with a degree of tumor anaplasia according to Fuhrman ( $r = 0.58$ ;  $p = 0.0001$ ) and with postoperative survival of patients ( $r = -0.31$ ;  $p = 0.02$ ).

No relationships were found with gender ( $r = -0.10$ ;  $p = 0.45$ ), age ( $r = -0.15$ ;  $r = 0.27$ ) of patients and the histological type of the tumor ( $r = -0.02$ ;  $p = 0.87$ ) (table. 1.).

**Table 1.**

*Correlation relationships of the distribution density of MC with the clinical and morphological parameters of RCC*

Clinical and morphological parameter	Correlation coefficient (r)	St. reliability (p)
Clinical stage	0,28	0,04
Tumor node size	0,29	0,03
Presence of regional and distant metastases	0,46	0,0001
The degree of tumor anaplasia by Fuhrman	0,58	0,0001
Postoperative survival of patients	- 0,31	0,02
Gender of Patients	- 0,10	-
Age of patients	- 0,15	-
Histological type of the tumor	- 0,02	-

The average MC value in tumors in men was  $15.9 \pm 1.3$ , in women -  $13.5 \pm 2.1$  ( $p = 0.3$ ).

Depending on the age of the patients, the average TAM numbers were: in patients aged 30 to 39 years old -  $8.3 \pm 1.45$ ; from 40 to 49 years old -  $15.5 \pm 2.5$ ; from 50 to 59 years old -  $16.4 \pm 2.7$ ; from 60 to 69 years old -  $16.0 \pm 1.65$  and from 70 to 79 years old -  $4.7 \pm 0.4$ . Thus, the highest values of MCs in the tumor stroma were observed in the age group of patients from 50 to 59 years old, and the lowest in the group from 70 to 79 years old.

When analyzing the content of TAM depending on the clinical stage of the disease, according to TNM, the following results were obtained: in patients with stage I, the average number of TAMs was  $12.3 \pm 1.6$ ; at stage II, the TAM number increased to  $14.1 \pm 1.9$  ( $p = 0.3$ ); at stage III, the number of TAMs increased to

$23.4 \pm 3.2$  ( $p = 0.002$ ) and in stage IV it was  $21.5 \pm 2.7$  ( $p = 0.18$ ). Thus, at the III and IV clinical stages, an increase in TAM was observed as compared with the I and II stages.

Depending on the histological variant of RCC, the highest average number of TAMs was found in spindle cell carcinoma ( $45.8 \pm 18.7$ ), and the lowest value was chromophobic carcinoma -  $9.2 \pm 2.1$ . The intermediate position was occupied by clear cell ( $14.6 \pm 1.2$ ) and papillary ( $13.0 \pm 1.6$ ) cancers. Thus, the largest number of TAMs was detected in the spindle cell variant of the cancer, and the smallest in the chromophobic one.

When comparing the degree of nuclear atypia according to Fuhrman with the number of TAM, the following results were obtained: with G I, the number of TAM was  $7.8 \pm 0.7$ , with G II -  $7.7 \pm 0.9$  ( $p = 0.9$ ), with G III it increased to  $26.2 \pm 3.2$  ( $p = 0.0000001$ ) and at G IV it was  $26.9 \pm 3.7$  ( $p = 0.9$ ). Thus, an increase in the number of TAM with an increase in the degree of anaplasia of tumor cells was found.

With a tumor site of  $<7.0$  cm, the number of TAMs in the tumor was  $12.5 \pm 1.5$ , and with a size of  $\geq 7.0$  cm, it significantly increased to  $19.1 \pm 1.9$  ( $p = 0.01$ ).

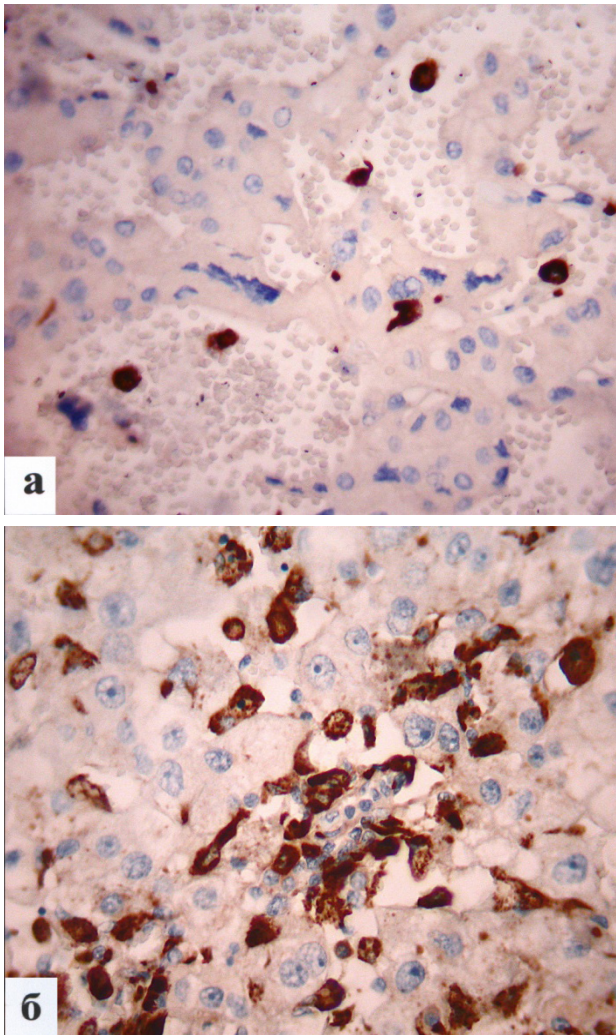
In tumors of patients without regional and distant metastases, the TAM content was  $11.6 \pm 0.9$ , and in the presence of metastases, it significantly increased to  $31.4 \pm 4.8$  ( $p = 0.0000001$ ) (Table 2.) ( Figure 1; a, b).

**Table 2.**

*The content of TAM in the tumor, depending on the clinical and morphological parameters of RCC*

<b>Clinical and morphological parameter</b>	<b>TAM content</b>	<b>St. reliability (p)</b>
Gender: men women	15,9±1,3 13,5±2,1	-
Age: 30 – 39 y.o. 40 – 49 y.o. 50 – 59 y.o. 60 – 69 y.o. 70 – 79 y.o.	8,3±1,45 15,5±2,5 16,4±2,7 16,0±1,65 4,7±0,41	p = 0,005 - - -
Clinical stage (TNM): I st. II st. III st. IV st.	12,3±1,61 14,1±1,9 23,4±3,2 21,5± 2,7	- p = 0,002 -
Hystological type of tumor: chromophobic papillary clear cell spindle cell	9,2±2,11 13,0±1,6 14,6±1,2 45,8±18,7	- - P = 0,000005
Graduation by Fuhrman: G I G II G III G IV	7,8±0,7 7,7±0,9 26,2±3,2 26,9±3,7	- - p = 0,0000001
Tumor node size: < 7,0 cm ≥ 7,0 cm	12,5±1,5 19,1±1,9	p = 0,01
Metastases: N0 N+	11,6±0,9 31,4±4,8	p = 0,0000001

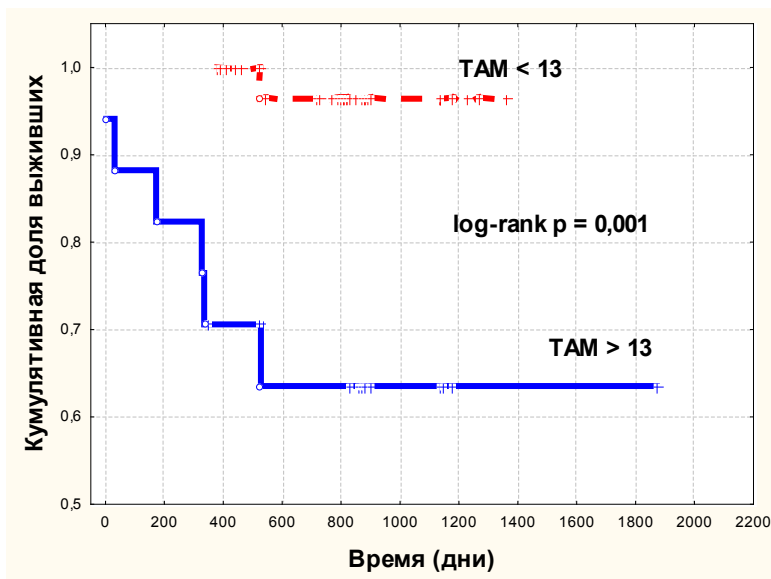




*Fig. 1. The content of TAM in the tumor stroma, depending on the presence of metastases: a - localized tumor; b - metastatic tumor. Immunohistochemical staining for CD68. Magn. x400.*

To assess the long-term results of 5-year postoperative survival of patients, depending on the average number of TAMs in a tumor, we divided the neoplasms into 2 groups. The 1st group consisted of carcinomas with a smaller number of TAMs (<13), the 2nd group consisted of carcinomas with a larger number of TAMs ( $\geq 13$ ).

When analyzed by Kaplan-Meier, it was found that when the number of TAMs in a tumor was <13, the cumulative fraction of survivors by 1800 days was 0.96 (96%), and when the number of TAMs in the tumor was  $\geq 13$ , then the cumulative proportion of 1800 days decreased to 0.63 (63%). When comparing the survival of patient groups using a log-rank test, it was found that the differences in the data are significant (log-rank  $p = 0.001$ ) (Fig. 2.).



*Fig.2. The cumulative proportion of 5-year survival of RCC patients, depending on the number of TAM.*

Thus, the results of the study showed that the number of TAMs in the tumor was interrelated with a number of prognostically important clinical and anatomical factors of RCC and therefore this parameter can be used as an additional prognostic factor. An increase in the number of TAMs in a tumor can be considered as a criterion for the likely occurrence of tumor metastases. The interrelation between the number of TAM and the survival rate of patients was revealed. High levels of TAM is an unfavorable factor for 5-year postoperative survival of patients with CRP.

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肾细胞癌中核蛋白/ B23表达和核素表达的新生成条件对肾细胞癌的影响

**INFLUENCE OF NEOANGIOGENESIS CONDITION  
AT NUCLEOPHOSMIN/B23 EXPRESSION AND ACTIVITY  
OF NUCLEOLAR APPARATUS IN RENAL CELL CARCINOMA**

**Myadelec Mihail Nikolaevich<sup>1</sup>,  
Bobrov Igor Petrovich<sup>1,2</sup>,  
Cherdanceva Tatyana Mihajlovna<sup>1</sup>**

*<sup>1</sup>Federal State Budgetary Educational Institution of Higher Education  
«Altai State Medical University»*

*of the Health Ministry of Russia, Barnaul*

*<sup>2</sup>Altai branch of the «N.N. Blokhin National Medical Research  
Center of Oncology» of the Health Ministry of Russia, Barnaul.*

注解。在这项工作中，作者根据肿瘤新生血管的状态分析了核细胞核/ B23核蛋白的表达以及肾细胞癌中肿瘤细胞核仁装置的形态功能活性参数。检查了109例切除癌症的肾脏。研究了核仁装置的以下参数：每个核的核仁数；核仁形成区域面积和每个核心纤维中心数量；每1个核的环状，过渡和核仁形态功能型核仁的百分比。

通过免疫组织化学检测核磷蛋白/ B23和CD34的蛋白质的表达。结果表明，在具有低密度微血管的癌细胞中，核磷蛋白/ B23的表达和核仁装置的参数显著增加。

血管化不良的肿瘤中的缺氧导致核磷蛋白/ B23的过度表达和肿瘤细胞的核仁活性的增加，这导致肾细胞癌的进展。

关键词：新生血管形成，核磷蛋白，核仁，肾癌。

**Annotation.** *In this work, the authors analyzed the expression of nucleofosmin / B23 nucleolar protein and the parameters of the morphofunctional activity of the nucleolar apparatus of tumor cells in renal cell carcinoma, depending on the state of tumor neoangiogenesis. 109 kidneys resected for cancer were examined. The following parameters of the nucleolar apparatus were studied: the number of nucleoli per nucleus; the area of the nucleolus-forming zones and the number of fibrillar centers per nucleus; the percentage of ringed, transitional and nucleolomnemal morphofunctional types of nucleoli per 1 nucleus.*

*The expression of proteins of nucleophosmin /B23 and CD34 was detected by immunohistochemistry. It was shown that the expression of nucleophosmin / B23 and the parameters of the nucleolar apparatus significantly increased in carcinoma cells with a low density of the microvasculature.*

*Hypoxia in poorly vascularized tumors causes overexpression of nucleophosmin / B23 and an increase in the nucleolar activity of tumor cells, which leads to progression of renal cell carcinoma.*

**Key words:** *neoangiogenesis, nucleophosmin, nucleolus, kidney cancer.*

In recent years, the attention of researchers has been drawn to the study of the hypoxia phenomenon in a tumor [5,15]. It has been shown that hypoxia, which occurs in the microenvironment of tumor cells, plays a key role in regulating the metabolism of neoplasia and is of great clinical and prognostic significance [7,4,13].

Hypoxia induces factors activating the transcription of genes that trigger a response to hypoxic exposure [8,6]. The factors induced by hypoxia first of all include the most studied factors of the HIF family (hypoxia-inducible factors): HIF-1 $\alpha$ , HIF- 2 $\alpha$ , and HIF-3 $\alpha$  [12]. These factors switch the metabolism of tumor cells from the aerobic to the anaerobic metabolic pathway, which gives the cells much greater potential for invasion and metastasis.

Nucleophosmin / B23 is a polyfunctional nucleolar phosphoprotein with a molecular weight of 38 kD and its functions are: participation in the intermediate and late stages of preribosome assembly, transport of the ribosomal protein components from the nucleus to the cytoplasm, and control of duplication of centrosomes [10]. There is evidence that the synthesis of this protein can be activated by hypoxia. Experimental studies have shown that since a lack of oxygen in the nucleoli of the malignant cells in cultures, overexpression of nucleophosmin / B23 is observed [9]. Overexpression of nucleophosmin / B23 has prognostic significance in a number of cancer sites [2,11,14].

Studies of the morphofunctional activity of the nucleolar apparatus and the expression of nucleophosmin / B23 under hypoxic conditions in renal cancer are absent in the literature.

**The aim of this work** was to study the expression of nucleophosmin / B23 and the morphofunctional activity of the nucleolar apparatus in cells of the renal cell carcinoma, depending on the effect of hypoxia.

#### **Materials and research methods.**

The material for the study was 109 kidneys resected for cancer in the Altai branch of the NMRCO Blokhina N.N. RAMS, Barnaul. The average age of patients was  $58.0 \pm 0.8$  years. There were 53 men (48.6%) and 56 women (51.4%).

In the preparation of histological sections the method of tissue matrices was used. In each case, the tissue columns were taken with a puncher needle of internal diameter of 2.0 mm out of the paraffin blocks (donor units) after previewing. Next, the tissue columns (10-15 pcs.) were placed into paraffin recipient blocks  $20 \times 20$  mm in size. With a rotary microtome, serial histological sections of 4  $\mu$ m thick were made of recipient paraffin blocks and transferred into glass (from two paraffin blocks per one glass).

The study of tumor cells nucleoli was carried out by histochemical and immunohistochemical methods. Histochemical staining of the nucleoli was performed according to the method of Daskal Y., et al., 1980, in our modification [1]. Nuclei dyeing was performed with 1% methyl green solution. The nucleoli were classified according to the morpho-functional classification of the nucleoli by Chelidze P.V. and Zatsepina O.V. (1988). [3].

The following parameters of the nucleolar apparatus were calculated: the average number of nucleoli per nucleus; the average area of the nucleolus-forming zones (NIFZ) per nucleus; the average number of fibrillar centers (FC) per nucleus; average content of ring-shaped (RSh), transitional (Trans), and nucleolonemous (Nln) types of nucleoli per nucleus.

Immunohistochemical detection of nucleophosmin nucleolar protein (B23) was performed using monoclonal antibodies - nucleophosmin n / B23, mouse mAb23 clone (Labvision). The nucleophosmin / B23 integral optical density (IOD) in the nucleolus was evaluated using a computer image analysis system consisting of a Leica DME microscope, a Leica EC3 digital camera (Leica Microsystems AG, Germany), a personal computer, and Video Test Morphology software 5.2. The values of IOP nucleophosmin / B23 were expressed in arbitrary units (a.u.).

In order to study the density of the microvasculature (DMV) in the tumor, immunohistochemical staining of the vascular endothelium was performed on CD34 (clone QBEnd / 10, Ventana). The preparations were photographed with a digital camera in 5 fields of view at magnification x400 and saved the photograph in JPG format. Then the images were processed in Adobe Photoshop 6.0. and calculated the average number of vessels in 5 fields of view in Image Tool 3.0. using the Count and Tag tool.

Statistical analysis was performed using the Statistica 6.0 program. While comparing the average values the Student's criterion was used. Differences were considered statistically significant at  $p < 0.05$ . Correlative relationships were assessed using the Pearson criterion.

### **Research results and discussion**

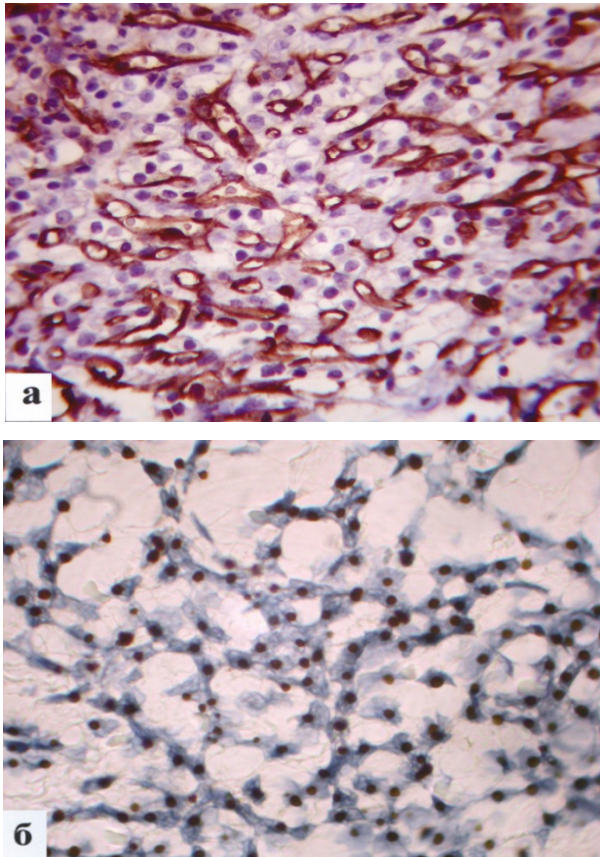
The results of the study showed that the DMV with CRP averaged  $30.9 \pm 2.2$  in 5 fields of view, the range of fluctuations in the number of vessels was from 3.6 to 104, the median was 28 vessels. Since the median number of vessels was 28 vessels, we chose this value for the critical point of vascularization of the tumor allowing to divide patients into 2 groups. Group 1 consisted of patients with well vascularized tumors containing  $> 28$  vessels, Group 2 consisted of patients with poorly vascularized tumors having  $< 28$  vessels i.e. in a state of hypoxia.

In the study of nucleophosmin / B23, protein expression was clearly visible in all tumor cells, and only nucleolar localization was detected by the coloring of the nucleoli from light yellow to brown colors.

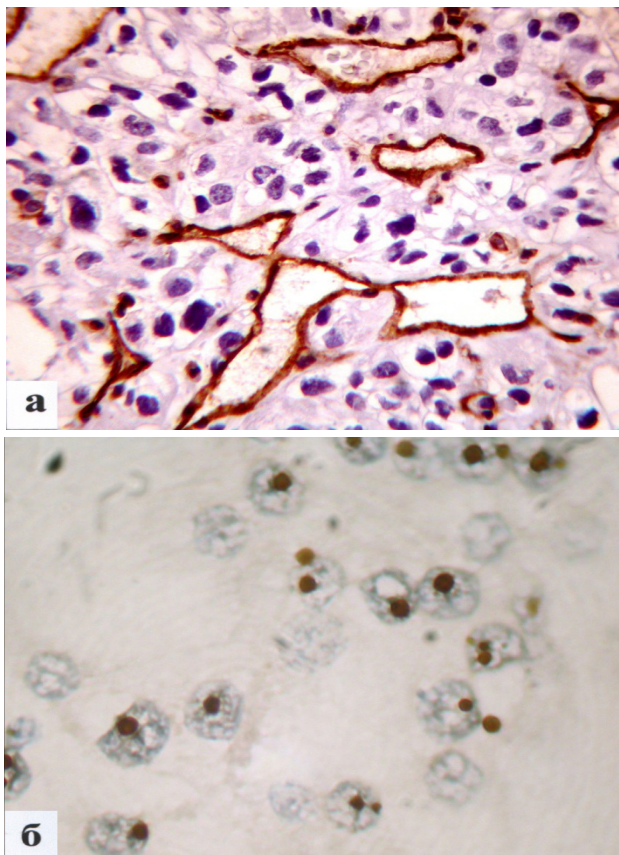
In general, in tumor cells, IOD of the nucleophosmin / B23 was  $1,551.1 \pm$

51.35 a.u. per 1 nucleus, the IOD value ranged from 118.9 to 15779.1 a.u., the median was - 890 a.u. In the group of patients with well-vascularized carcinomas, the IOD protein was  $963.7 \pm 66.3$  a.u., and in the group of patients with poorly vascularized tumors, the IOD significantly increased to  $2036.0 \pm 79.15$  a.u. ( $p = 0.0000001$ ) (Fig. 1.2; table).

IOD of nucleophosmin / B23 correlated with the DMV of the tumor ( $r = 0.46$ ;  $p = 0.0001$ ); with presence of necrosis in the tumor ( $r = 0.43$ ;  $p = 0.0001$ ); with tumor size ( $r = 0.45$ ;  $p = 0.0001$ ) and with the presence of metastases ( $r = 0.40$ ;  $p = 0.0001$ ).



**Fig.1.** Tumor with high DMV and low IOD nucleofosmin / B23 per nucleus:  
(a) - immunohistochemical reaction to CD34, magnification x 400;  
(b) - immunohistochemical reaction to nucleophosmin / B23, magnification x 1000.



**Fig. 2.** Tumor with low DMV and high IOD nucleophosmin / B23 per nucleus: (a) - immunohistochemical reaction to CD34, magnification x 400; (b) - immunohistochemical reaction to nucleophosmin / B23, magnification x 1000.

In the study of the nucleolar apparatus, it was found that the number of nucleoli in tumors with high DMV was  $1.6 \pm 0.05$  per 1 nucleus, and in carcinomas with low DMV it increased significantly to  $1.8 \pm 0.04$  ( $p = 0.0009$ ). The average area of NFZ per nucleus in tumors with high DMV was  $1.7 \pm 0.06 \mu\text{m}^2$ , and from low -  $2.9 \pm 0.08 \mu\text{m}^2$  ( $p = 0.0000001$ ). The content of RSh, Trans, and NIn in the nuclei of tumor cells with high DMV was 27.3%, 52.7%, 19.9%, and in carcinomas with low DMV, 21.7%, 40.2% and 38.6%, respectively. In tumors with low DMV, the number of fibrillar centers (FCs) per nucleus was significantly increased to  $10.9 \pm 0.4$ , compared with carcinomas with high DMV ( $5.0 \pm 0.2$ ) ( $p = 0.0000001$ ) (table).



**Table**

*The parameters of the nucleolar apparatus of the tumor cells of RCC, depending on the DMV of the tumor*

Parameters of nucleolar activity	DMV	
	< 28 vessels	> 28 vessels
IOD nucleophosmin/B23 (a.e.)	2036,0±79,15*	963,7±66,3*
Number nucleoli per 1 nucleus	1,8±0,04*	1,6±0,05*
Area NIFZ (mcm <sup>2</sup> )	2,9±0,08*	1,7±0,06*
Number FC per 1 nucleus	5,0±0,2*	10,9±0,4*
Number RSh per 1 nucleus (%)	21,7	27,3
Number Trans per 1 nucleus (%)	40,2	52,7
Number Nln (%)	38,6	19,9

Note: \* p < 0.05.

### Discussion

Thus, the results of the study showed that in poorly vascularized carcinomas, as compared with well vascularized ones, an increase in the expression of the nucleolar protein of nucleophosmin / B23 was noted. This phenomenon influenced the morphofunctional characteristics of the nucleolar apparatus of the RCC tumor cells.

Thus, in the tumor cells, the number of nucleoli and the area of the nucleolus-forming zones per nucleus increased. Also, overexpression of nucleophosmin / B23 in cell nuclei was accompanied by a change in the distribution of morphofunctional nucleoli types: in tumors with high density of the microcirculatory bed, the number of ring-shaped and transitional variants of the nucleoli decreased and the content of nucleolonemal nucleolus increased. These rearrangements of the nucleolar apparatus ultimately led to a significant increase in the number of fibrillar centers in the nucleoli in tumors with low density of the microvasculature.

As shown by present time researches, hypoxia has a significant effect on progression, metastasis of the tumor and has a prognostic significance. This study showed that one of the pathogenetic mechanisms of the of low oxygenation effect on tumor progression is the activation of expression of the nucleolar protein nucleophosmin / B23, which leads to an increase in the growth rate of tumor cells due to an increase in ribosomal synthesis. Understanding the mechanisms of activation and regulation of expression of nucleophosmin / B23 is also important due to the fact that target drugs inhibiting this protein are being actively developed, which will improve the quality and prolong the life of cancer patients.

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莫尔多瓦共和国妇女高危人乳头瘤病毒基因型流行和谱系的区域特征  
**REGIONAL FEATURES OF THE PREVALENCE AND SPECTRUM  
OF HIGH-RISK HUMAN PAPILLOMAVIRUS GENOTYPES IN  
WOMEN OF THE REPUBLIC OF MORDOVIA**

**Vinogradova Olga Pavlovna,**

*Doctor of Medical Sciences, Professor*

*Penza Institute for Advanced Medical Studies*

**Epifanova Olga Victorovna**

*Obstetrician-gynecologist*

*Mordovia Republican Central Clinical Hospital*

**Andreeva Natalya Anatolievna**

*Candidate of Medical Sciences,*

*Associate Professor*

*Ogareva Mordovia State University*

注解。 该文件根据对育龄妇女的调查，反映了俄罗斯联邦莫尔多瓦共和国高致癌风险人乳头瘤病毒流行的频率。 描述了人乳头瘤病毒感染与宫颈上皮内瘤形成的关系。 建立了流行病学上重要的风险特遣队，用于发展宫颈癌的病理学。

关键词：人乳头瘤病毒感染，宫颈上皮内瘤变，人乳头瘤病毒，宫颈癌，聚合酶链反应。

**Annotation.** *The article reflects the frequency of the prevalence of human papillomavirus of a high carcinogenic risk in the Republic of Mordovia of the Russian Federation on the basis of a survey of women of reproductive age. The relationship of human papillomavirus infection with cervical intraepithelial neoplasias is described. Established epidemiologically significant risk contingents for the development of cancer pathology of the cervix.*

**Key words:** *human papillomavirus infection, cervical intraepithelial neoplasia, human papillomavirus, cervical cancer, polymerase chain reaction.*

Given that cervical cancer (CC) is a potentially preventable disease, and cervical intraepithelial neoplasias have recently become one of the most frequent pathological conditions of the female reproductive system and constitute a step for a possible transition to invasive neoplastic processes, human papillomavirus infection deserves increasing attention (3).

According to epidemiological estimates, 630 million people are infected with the human papillomavirus (HPV) in the world, 5.5 million people are exposed to HPV infections every year. (2)

The study of the epidemiological and regional characteristics of the prevalence and variations in the frequency of occurrence of HPV genotypes allows you to create the necessary measures for the early diagnosis of CC and its prevention.

For better organization of targeted interventions for early diagnosis and prevention of CC, not only information about the percentage of human papillomavirus infection, but also HPV type specificity data in each region of the Russian Federation is extremely important.

However, to date there are no reliable data on HPV infection in certain regions due to the lack of official registration and registration of this infection (4).

**Objective:** to conduct an epidemiological study of the high oncogenic risk of HPV in women of the Republic of Mordovia.

**Material and research methods:**

We carried out laboratory screening for the presence of high risk HPV by the method of polymerase chain reaction (PCR) in 1509 outpatients receiving female consultations in Ruzaevka and Saransk (Republic of Mordovia, Russia). The age of the examined women ranged from 18 to 55 years, the average was  $27, 9 \pm 1.04$  years. All women included in the study are residents of the Republic of Mordovia.

The patients underwent a comprehensive examination, which included the following stages of diagnosis: history taking, active detection of complaints, clinical examination, examination of the cervix in the mirrors, extended colposcopy, cytology of smears from the cervical canal and cervix, determination of the quantitative and qualitative composition of the microflora using microbiological research, DNA - PCR typing of human papillomavirus of high carcinogenic risk.

Material for HPV detection was taken from the cervical canal, transitional zone and exocervix using a disposable cyto-brush cervical brush and placed in a transport medium contained in a single eppendorf-type test tube.

In scraping epithelial cells of the urogenital tract by PCR with real-time detection, DNA types of HPV 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59 were identified that belong to the high oncogenic risk group.

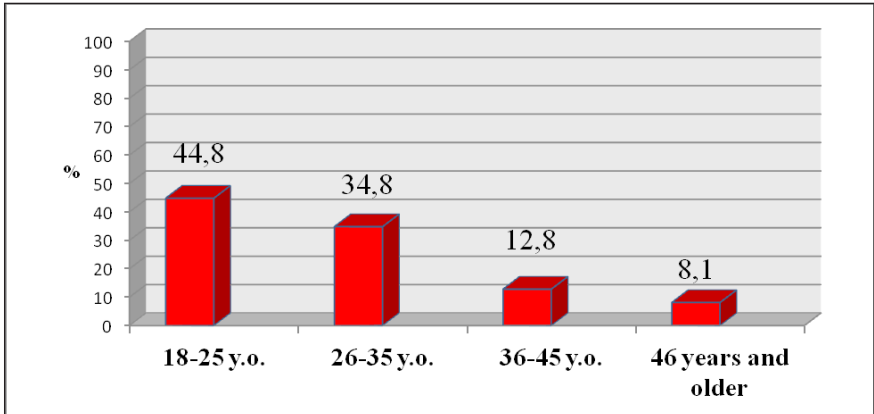
**Research results**

Anamnesis collection allowed us to assess the social status of patients and their lifestyle. Thus, the largest group consisted of a group of female students aged 18 to 25 years old, actively living sex without contraception and having more than one sexual partner,  $n = 755$  (50.5%). Only 22% of women surveyed used a barrier method using a condom.

Laboratory studies revealed in 43% of the I-II observations the degree of purity

of the vaginal contents and in 57% of the examinations the presence of key cells, mobilunkus, leptotriksa, Candida fungi.

The human papillomavirus was most commonly detected in women aged 18–25 years (44.8%), more rarely in the age group 26–35 years (34.3%). In women of older reproductive age, the incidence of infection with high oncogenic virus types tended to decrease, reaching 12.8% in the group aged 36–45 years and 8.1% in the group aged 46–55 years.



*Fig. 1. The frequency of detection of high-risk HPV in surveyed women depending on age*

The leading genotype among HPV BP was the 16th type, which is found in 19.5% of cases in the examined women of the Republic of Mordovia. According to statistics, this indicator does not exceed the figures of other regions of the Russian Federation. For example, in the Chelyabinsk region, HPV type 16 was detected in 27.8% of women, in the Sverdlovsk region - 23.6%, in the Moscow region 18.2%. (one)

The pattern of the maximum detection of HPV genotypes of high oncogenic risk 16, 18 types with the severity of the pathological process on the exo- and endocervix of the cervix is traced.

It is worth noting that 95 women were potentially healthy and did not have deviations according to the result of cytological diagnosis and extended CPS. The prevalence of human papillomavirus infection among women with a normal cytological picture averaged 8–11%.

In 36 patients with chronic exo-, endocervicitis, HPV DNA was detected in 16.6% of cases. Moreover, in this group of women, the following serotypes were detected: 51 type - in 50%, 56 type - 33.3%, 35 type - 16.6%, respectively.

The results of the virological examination of patients according to cytological findings, corresponding to the classification of the Bethesda (TheBethesda System - TBS 2014) CIN I, CIN II, indicate that in 74.3% of cases HPV16 was detected and in 59.6% of cases - 18 types.

### **Conclusion**

Thus, the variability of the distribution of HPV serotypes in women of the Republic of Mordovia strictly reflects the severity of the pathological process in the cervical tissue. The most common infection of HPV types 16 and 18 occurs with cervical lesions corresponding to the cytological manifestations of LSIL and HSIL according to TheBethesda System.

Due to the fact that the protection of the reproductive health of the population is a priority and decisive task of state health care policy, the need to introduce in all regions of the Russian Federation a virologic study on HPV of high oncogenic risk is indisputable in all contexts. This will allow a differentiated approach to the tactics of management of women with HPV-associated cervical pathology, which contributes to the prediction and early prevention of cervical cancer.

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雅库特人群中的脂肪量和肥胖相关基因多态性  
**FAT-MASS AND OBESITY-ASSOCIATED GENE POLYMORPHISM  
IN YAKUT POPULATION**

**Pavlova Nadezhda Ivanovna,**

*Candidate of Biological Sciences, temporary acting chief scientific officer - head of the laboratory of heritable pathology;  
Federal State Budgetary Scientific Institution  
“Yakut Science Center of Complex Medical Problems”*

**Kurtanov Khariton Alekseevich,**

*Candidate of Medical Sciences, Chief Scientific Officer -  
Head of the Department of Molecular Genetics,  
Federal State Budgetary Scientific Institution  
“Yakut Science Center of Complex Medical Problems”*

**Diakonova Aleksandra Timofeevna**

*Junior researcher of the laboratory of heritable pathology;  
Federal State Budgetary Scientific Institution  
“Yakut Science Center of Complex Medical Problems”*

抽象。 本文介绍了雅库特群体中FTO基因rs9939609多态性的研究数据。 发现T等位基因频率的患病率，男性为72.7%，女性为77.1%。 将来，测试FTO基因的rs9939609多态性将有可能开发出体重减轻的个体饮食，以及确定推荐的强度和体力活动类型。

关键词：FTO基因，rs9939609，超重，肥胖，雅库特种群

**Abstract.** *The article presents the data of studies of the rs9939609 polymorphism of the FTO gene in the Yakut population. The prevalence of the T allele frequency was found, which was 72.7% in men and 77.1% in women. In the future, testing of the rs9939609 polymorphism of the FTO gene will make it possible to develop an individual diet with a decrease in body weight, as well as to determine the recommended intensity and type of physical activity.*

**Key words:** *FTO gene, rs9939609, overweight, obesity, Yakut population*

### **Introduction**

The development and introduction of new high-tech methods for analyzing the human genome made it possible to determine the individual characteristics of

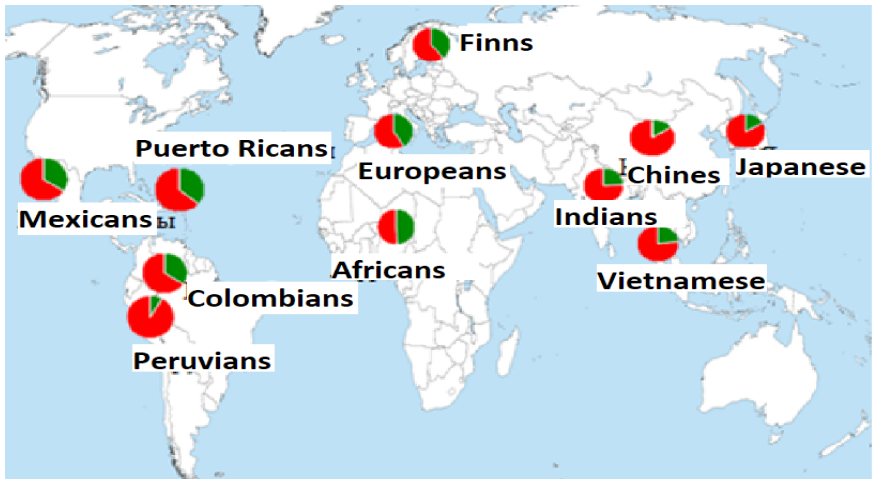
the structure of genes and the features of their functioning in all chromosomes. The study of the structure of the human genome makes it possible to identify and analyze individual hereditary-determined differences of a particular person. For many years, the problem of losing weight has remained relevant for the training of athletes in many sports.

To date, about 200 human genes are known that are associated both with sports activities directly and with various indicators that have a direct impact on the achievement of high results by athletes and their health (anthropometric, biochemical, echocardiographic indicators, features of the metabolism of nutritional components, biologically active compounds and pharmaceutical substances).

The full genomic search for associations (GWAS) showed that single nucleotide polymorphism (SNP) rs9939609 in the first intron of the fat mass and obesity gene (FTO) was significantly associated with obesity in different ethnic populations in both children and adults [5]. The FTO gene encodes one of the regulators of lipolysis, participates in the control of adipocyte differentiation, energy homeostasis, and leptin-independent appetite control. Products in adipose and muscle tissue decrease with age. The polymorphic allele A of the FTO gene is associated with reduced lipolysis, with an impaired control of appetite, a lack of satiety after an adequate meal. Phenotypic manifestation of A-alleles - overweight, obesity due to overeating.

According to the national center for biotechnology information (NCBI), the frequency of allele of FTO mutants is 46-51% among residents of Western and Central Europe and West Africa, and only 16% in China [6]. It was found that the carriers of this allele have an average body weight of 1.2 kg higher compared to people without allele; the presence of two alleles is accompanied by an increase in body weight by an average of 3 kg [9, 10, 11].





*Picture 1. Degree of incidence of allelic polymorphism of rs9939609 of the FTO gene in various populations.*

Red color - T allele, green color - A allele. Data are obtained from the database of the 1000 Genomes project (8).

#### **Materials and methods**

Materials and methods of the researches: The experimental part of the *FTO* gene rs9939609 polymorphism genotyping was carried out in the molecular genetics department hereditary pathology laboratory of the Yakut Science Centre of complex medical problems. The informed consent to carry out a genetic research was received from each participant of the research. Material of a research were DNA samples of Yakuts from a collection of biomaterial (DNA) of populations of the Republic Sakha (Yakutia) Yakut Science Centre of complex medical problems, Yakutsk. Tested 70 people (48 women and 22 men) aged 19 to 55 years.

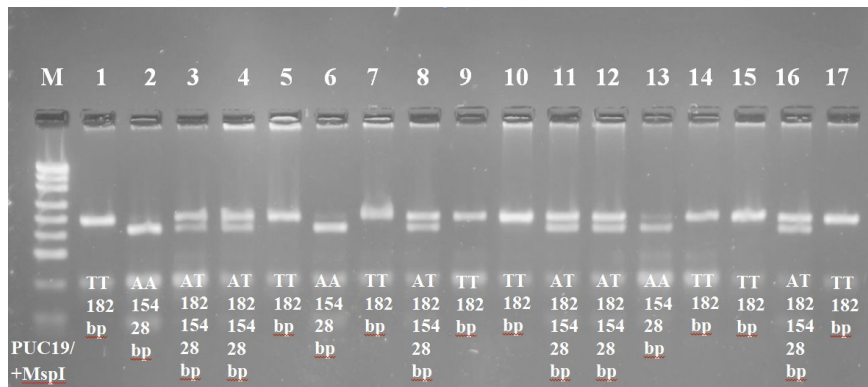
For carrying out PCR and RFLP analyses, genomic DNA samples allocated from whole blood of patients by a standard phenol-chloroform extraction. A single nucleotide polymorphism (SNP) was defined by the polymerase chain reaction (PCR). Specific primers were used (forward primer: 5'-AACTGGCTCTTGAAT-GAAATAGGATTCAGA-3' and reverse primer: 5'-AGAGTAACAGAGAC-TATCCAAGTGCAGTAC-3') (LLC Biotekh-Industriya, Moscow, Russia). The temperature-time regime for PCR carrying out is optimized for amplification of this nucleotide sequence and presented in Table 1.

*Table 1. PCR conditions.*

Gene	Amplificate	Length of restriction fragments	Temperature protocol PCR
<i>FTO</i>	182 bp	AA – 154, 28 AT – 154, 28, 182 TT – 182	1. 95 °C – 4min 2. (94 °C – 30 sec; 58 °C – 30 sec; 72 °C – 1 min)*35 3. 72 °C – 10 min

bp - base pair.

Detection of the PCR products was carried out by means of horizontal electrophoresis in a plate of 4 % agarose gel with addition of ethidium bromide — specific fluorescent DNA (RNA) intercalating dye — using of the standard Tris-buff with the field gradient of ~ 20 V/cm for 30 minutes. Later, the PCR amplification was exposed to restriction with *ZrmI* endonuclease (LLC Sibenzim, Novosibirsk, Russia) (Picture 2).



*Figure 2. Electrophoregram of the product of amplification of the region of the FTO gene in a 4 % agarose gel*

bp - base pair.

**Results and discussion**

A comparative analysis of the frequency distribution of alleles and genotypes of the polymorphic gene *FTO* (rs9939609) in the Yakut sample showed a predominance of allele t frequency, which was 72.7% in men and 77.1% in women. The frequency distribution of alleles and genotypes of polymorphism rs9939609 of the *FTO* gene is presented in table 2

**Table 1.** Frequency distribution of alleles and genotypes of polymorphism rs9939609 of FTO gene

Cohort	n		Genotype			Allele		H <sub>o</sub>	H <sub>e</sub>	X <sup>2</sup>	p
			TT	AT	AA	T	A				
Women	48	O	58,3	37,5	4,2	0,771	0,229	0,375	0,353	0,180	0,67
		E	59,4	35,3	5,3						
Men	22	O	45,5	54,6	0,0	0,727	0,273	0,546	0,397	3,09	0,08
		E	52,9	39,7	7,4						

n - quantity; O – observable; E – expected; X<sup>2</sup> – chi-square; H<sub>o</sub> - observed heterozygosity; H<sub>e</sub> -expected heterozygosity

A population genetic analysis of the distribution of genetic polymorphism by the FTO gene (rs9939609) among Yakuts showed that in the group of men the highest level of observed heterozygosity is H<sub>o</sub> = 0.546. The distribution of the genotypes of the rs9939609 polymorphism was in Hardy-Weinberg equilibrium in the studied samples (p> 0.05).

**Summary:**

As a result of this work, the FTO gene in Yakuts was investigated, and it was established that the frequency distribution of alleles and genotypes of the FTO gene (rs9939609) is in accordance with the Hardy-Weinberg law. It should be noted that the association of the rs9939609 polymorphism of the FTO gene with overweight in the Yakut population has not yet been studied. In this connection, it is necessary to further study the FTO gene in Yakuts with different levels of body mass index and with a level of moderate or pronounced ability to lose weight.

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使用小波变换算法处理衍射图的软件方法  
**SOFTWARE METHODS FOR PROCESSING DIFFRACTOGRAMS  
USING WAVELET TRANSFORMATION ALGORITHMS**

**Sergeev Alexander Nikolaevich**

*Senior Lecturer*

**Sidorova Yekaterine Igorevna**

*Postgraduate*

**Marudov Andrey Alekseevich**

*Bachelor*

*P.G. Demidov Yaroslavl State University*

注解。考虑使用Daubeci和Simlet小波从噪声中清除信号的方法。已经研究了使用各种算法来自动确定MatLab环境中用于清洁在ARL X' TRA衍射仪上获得的信号的阈值的效率。

关键词：阈值处理，小波分析，噪声净化，MatLab，小波工具箱。

**Annotation.** *The method of cleaning signals from noise using the Daubeci and Simlet wavelets is considered. The efficiency of using various algorithms for automatically determining the threshold in the MatLab environment for cleaning the signal obtained on an ARL X' TRA diffractometer has been investigated.*

**Keywords:** *thresholding, wavelet analysis, noise purification, MatLab, Wavelet Toolbox.*

Currently, a new method of noise control based on algorithms of the developing wavelet theory has appeared. It consists of software-controlled threshold processing of detail wavelet coefficients. This method is called trashholding (TSH). Since the wavelet transform has the property of redundancy, this allows you to “cut off” partially or fully the wavelet coefficients of a certain level without losing information. The noise components are transferred at high frequencies and are contained in the detail coefficients of the lower levels of the signal decomposition.

The noise removal procedure is performed using orthogonal wavelets and includes the following operations [1]:

1. The wavelet decomposition of the signal to level N. The value of level N is determined by the frequency spectrum of the information part of the signal, which

should be left in the series of approximating coefficients. The type and order of the wavelet can significantly affect the quality of signal cleaning from noise, depending on both the waveform and the correlation characteristics of noise.

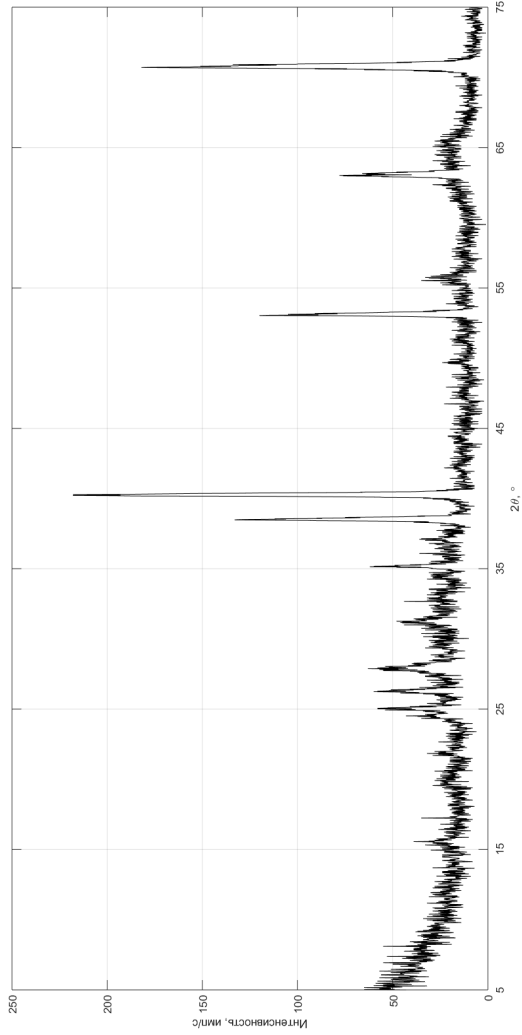
2. Setting the type and threshold levels of cleaning according to known data on the nature of noise or on certain criteria of noise in the input signal. Threshold cleaning levels can be flexible (depending on the number of the decomposition level) or global.

3. Modification of the detail coefficients of the wavelet decomposition in accordance with the established cleaning conditions.

4. Restoration of the signal based on approximation coefficients and modified detail coefficients.

In this paper, we compare the efficiency of using for the noise purification of diffractograms of various threshold determination algorithms presented in the Wavelet Toolbox expansion package of the MATLAB computer system.

The diffraction pattern obtained on an ARL X'TRA X-ray powder diffractometer (Fig. 1) was processed. The decomposition was carried out by the fifth-order Dobeshi and Simlet wavelets, since they do not distort the source information contained in the diffractogram and have minimal values of the standard deviation.



*Figure 1. Diffractogram of V-O films*

**TSH-1 algorithm.** The first and easiest of them is the use of default parameters. This procedure is implemented by the following functions [2]:

$[thr, sorh, keepapp]=ddencmp('den', 'wv', s);$

$[sd, cd, ld, p0, pl2]=wdencmp('gbl', s, wname, N, thr, sorh, keepapp).$

The first one sets the default parameters:

- global threshold  $thr = \sqrt{2 \ln L} \cdot E$ , where  $L$  is the signal length,  $E$  is the noise level;

- approximating factors are not subject to TSH ( $keepapp=1$ );

- “soft” threshold method ( $sorh='s'$ ).

The second one, using the obtained parameters, performs signal cleaning with a given wavelet ( $wname$  variable).

**TSH-2 algorithm.** The following was considered the algorithm for determining the threshold for the Birge-Massart strategy. Its application is reduced to discarding at the  $i$ -th level of all coefficients, except  $n_i$ , the largest. Their number is determined by the expression:

$$n_i = \frac{m}{(j + 2 - i)^\alpha} \quad (1)$$

where  $j$  is the decomposition level,  $m$  and  $\alpha$  are the parameters.

In MATLAB, the operation for calculating the threshold and post-processing is [2]:

$[c, l]=wavedec(s, N, wname);$

$[thr, nkeep]=wdbc(m, c, l, alpha, m);$

$[sd, cd, ld, p0, pl2]=wdencmp('lvd', s, wname, N, thr, sorh).$

The best result is achieved when using the “soft” threshold method and the values of the parameters  $\alpha = 1.5$ ,  $m = 2L(1)$  ( $L(1)$  is the number of coefficients at the first level of decomposition).

**TSH-3 algorithm.** Another processing option uses an adaptive threshold, which is set by choosing the evaluation criterion  $R$  as used:

1) *rigrsure* is an adaptive threshold using the Stein principle of unbiased risk assessment [3];

2) *sqtwolog* - threshold, similar to the default;

3) *heursure* - heuristic variant of the threshold;

4) *minimaxi* - minimax threshold.

The decisive software function of the algorithm is:

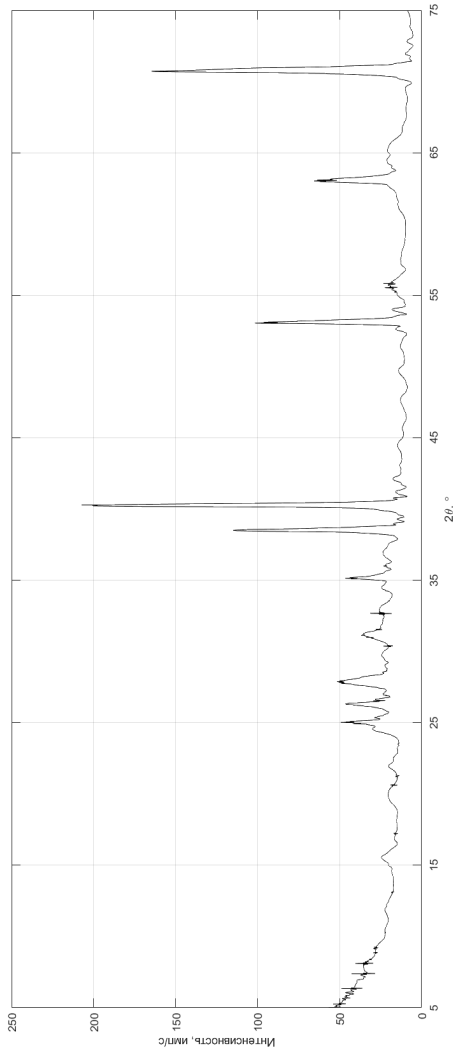
$sd=wden(s, R, sorh, scal, N, wname)$

The variable *scal* defines the type of noise rescaling, which is used when its structure deviates from the “white” model in the interval  $[0, 1]$ . The parameter has the following text values:



- 1) '*one*' – without scaling;
- 2) '*sln*' – rescaling using a single noise level estimate based on the first level decomposition coefficients;
- 3) '*mln*' – rescaling using level-dependent noise level estimates.

Of all the criteria  $R$  in the TSH-3 algorithm, the minimax was the most suitable for our task. The logarithmic criterion is almost completely analogous to what is used by default. The heuristic and '*rigrsure*' criteria for our signal do not have differences, and give a much more noisy result than when using the minimax signal. Regarding the type of noise rescaling, the optimal solution would be to use *sln*-rescaling, because *mln* distorts the original shape of the peaks, and processing without scaling gives an unsatisfactory result. The diffractogram after the noise purification procedure is shown in Fig. 2



*Figure 2. Diffraction pattern of V-O films after processing*

Of all the considered methods for choosing the threshold, the most suitable for our task was an adaptive thresholding algorithm with a minimax estimation criterion and the use of noise rescaling based on the coefficients of the first decomposition level.

The processing of Daubechi wavelet using this threshold allowed us to get rid of most of the noise without generating extra bends and distorting the shape of the peaks. This makes it possible to more accurately distinguish the local features of the signal.

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氧化铝作为环境污染的来源

## ALUMINA AS A SOURCE OF ENVIRONMENTAL POLLUTION

**Ozerskiy Andrey Yurevich**

*Candidate of Geology-Mineralogical Sciences,*

*Director*

*MONITECK Co., Krasnoyarsk*

### 1. Introduction

The primary aluminum production is one of the “blue chip companies” of the Russian domestic business that is considered to be the source of Russian well-being. Primary aluminum production as well as any other metallurgical process influences all major components of the environment. According to average world statistics a production of one alumina metric ton is accompanied by 10-14 tons of waste [2]. About 70 % of waste are low-toxic overburden rocks of bauxite deposits but the other 30 % represents rather toxic mud and slime produced during metallurgic production.

Alumina ( $Al_2O_3$ ) is the raw material for producing primary aluminum. Alumina is produced from bauxite or sometimes from nepheline ores. Russia is the only country producing  $Al_2O_3$  from sources other than bauxite. Smelting one ton of aluminum demands about two tons of alumina, and also 0.5 ton of carbon anode, 0.03 ton of aluminum fluoride  $AlF_3$ , and 0.0015 ton of cryolite ( $Na_3AlF_6$ ) [9]. The melting of 1 ton of aluminum is accompanied by the formation of solid waste from 0.3 to 0.8 tons that has a complex chemical and mineral composition. These waste is found to consist of C (12 - 85 %), F (13 - 32 %), Al (11 - 33 %), Na (3 - 17 %), Fe (0,4 - 3 %), S (0,05 - 2,5 %), Si (0,05 - 0,5 %) and other elements [1]. Melting of aluminum also produces emissions of dust and gases ( $CO$ ,  $CO_2$ , F, HF) [2].

Solid waste is transported into slime reservoirs. Slime water is very dangerous to the environment and human health. At the reservoir of Krasnoyarsk Aluminum Plant an extensive collection of toxic elements such as fluorine (average concentration is  $7980 \text{ mg}\cdot\text{L}^{-1}$ ), sulphate ( $16600 \text{ mg}\cdot\text{L}^{-1}$ ), aluminum ( $8.5 \text{ mg}\cdot\text{L}^{-1}$ ), iron ( $9.4 \text{ mg}\cdot\text{L}^{-1}$ ), boron ( $47 \text{ mg}\cdot\text{L}^{-1}$ ), barium ( $16.7 \text{ mg}\cdot\text{L}^{-1}$ ), lithium ( $8.9 \text{ mg}\cdot\text{L}^{-1}$ ), nickel ( $5.2 \text{ mg}\cdot\text{L}^{-1}$ ), lead ( $2.6 \text{ mg}\cdot\text{L}^{-1}$ ), vanadium ( $59 \text{ mg}\cdot\text{L}^{-1}$ ), and others was found. Leakages from slime reservoirs create chemical contamination of groundwater [4].

Alumina is the main source of chemical contamination of the environment due to the process of aluminum smelting. That is why aluminum companies do not publish data on trace elements in alumina.

The aluminum production in Russia is not sufficiently supplied with home mineral resources. As Russia produced 4.5 million tons of alumina and 3.6 million tons of aluminum in 2014, it imported about 2.7 million tons of alumina containing toxic elements. After alumina processing (aluminum smelting) a lot of toxic trace elements are left in Russia in the form of wastes.

Thus, the objective of this study was the detection of toxic elements in alumina and also the evaluation of its hazards for the environment and specifically groundwater.

## 2. Methodology

We analyzed four industrial alumina samples at four plants produced from different ores (Fig. 1). The first sample (A) was produced at Achinsk Alumina Combine from a nepheline ore, the second sample (B) at Bogoslovsky Aluminum Plant from Ural Paleozoic bauxite, the third sample (N) at Nikolayevsky Alumina Plant (Ukraine) from Guinea Cenozoic bauxites, and the fourth sample (P) at Pavlodarsky Aluminum Plant (Kazakhstan) from Turgay Cenozoic bauxite. Chemical elements in all four samples were analyzed with chemical and ICP MS methods. Alumina samples were tested at the Central Laboratory of the "Krasnoyarskgeologia Mining Geological Company" that possesses the Russian certificate for analysis of rocks, ores and raw minerals. All analyses were carried out in three laboratory sample weights for every chemical element. Average contents of elements are given in Table 1.

For an assessment of the pollution level or its risk, Russian geochemists use the *total pollution index*  $Z_C$ . To calculate this index they compare the results of laboratory tests and the average concentrations of elements in the Earth's crust. Yuriy Sayet et al. [8] have given the following equation for calculation of  $Z_C$ :

$$Z_C = \sum_{i=1}^n K_C - (n - 1) \quad (1)$$

where  $Z_C$  – total pollution index;  $K_C$  – coefficient of concentration of chemical element;  $n$  - number of analyzed elements. The coefficient of concentration is calculated by dividing the concentration of the element in the studied object on the concentration of the same element in the Earth's crust. Equation for  $K_C$  is given as follows:

$$K_C = C_i : C_E \quad (2)$$

where  $C_i$  – concentration of the element in the studied object;  $C_E$  - concentration of the same element in the Earth's crust [3, 6]. It is assumed that the higher total pollution index corresponds to a higher pollution. If the total pollution index exceeds 16, the soil is considered to be contaminated. Using the analogy with contaminated soil it can be regarded that all substances are contaminated if their  $Z_C$  is above 16. The pollution is considered as hazardous if the total pollution index exceeds 32.

Although pure aluminum oxide is insoluble in water, industrial alumina contains some admixtures that may be hazardous to the environment. These contaminants can migrate into the soil and natural water during transportation or storage of industrial alumina. Soluble components were studied in water extracts from all four alumina samples. Water extracts were prepared by dissolving 0.1 kg alumina in 0.5 kg double-distilled water. Chemical components in solutions were determined by standard chemical methods and also atomic absorption spectroscopy (AAS) and inductively coupled plasma mass spectroscopy (ICP MS).

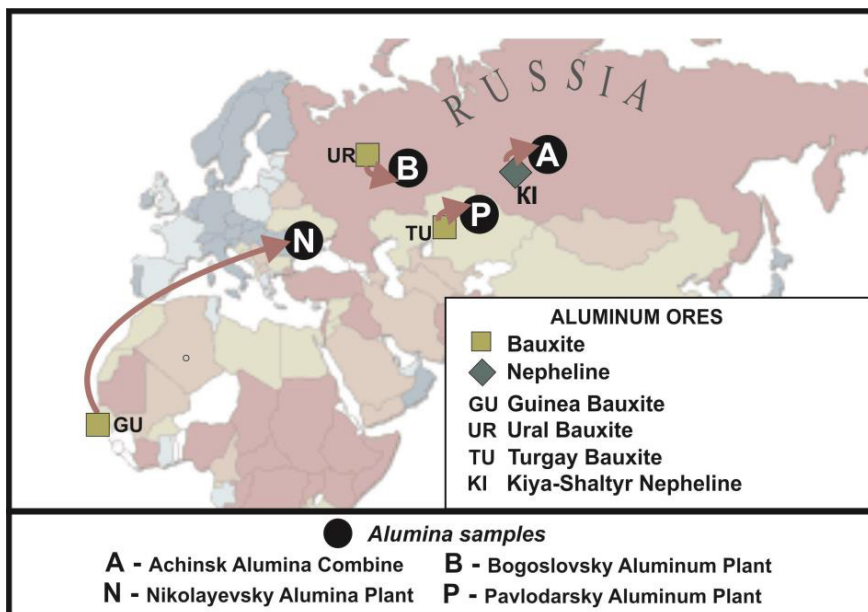


Fig. 1 Alumina Samples

### 3. Results

The occurrences of trace elements in bauxite are variable and difficult to understand because their mobility during weathering is influenced by many contradictory factors [6]. However, Bayer process erases the geochemical differences between different bauxite directing the greater part of the small elements to the waste (red mud). Only a small proportion of chemical elements can be accumulated in alumina. Therefore, alumina originated from various ores is characterized by similar chemical composition.

Only ten elements were found to enrich the alumina compared with the Earth's crust. These elements are Mo<sub>17,7</sub>, As<sub>12,4</sub>, Al<sub>6,2</sub>, C<sub>4,4</sub>, B<sub>3,3</sub>, Rb<sub>3,1</sub>, Be<sub>2,7</sub>, Ga<sub>2,2</sub>, Hg<sub>1,8</sub>, S<sub>1,5</sub>

(index near symbol shows the coefficient of concentration calculated by Equation 2). Only three elements of these ten are not considered to be toxic (C, Ga, and Rb). The other seven elements are hazardous for the environment (especially mercury, beryllium and arsenic). All seven elements are considered to be toxic to the water and all of them were found in groundwater near waste dumps of aluminum plants.

The given seven elements (Al, As, Be, C, Ga, Mo, Rb) are common to all four samples. Geochemical differences between samples are due to an accumulation of only one or two elements. Achinsk alumina (Sample A) is characterized by the accumulation of mercury and sulfur. Boron and mercury are accumulated in Bogoslovsky Ural's alumina (Sample B). Vanadium is concentrated in alumina from Nikolayevsky Alumina Plant (Sample N). At last sulfur and boron define geochemical features of alumina produced at Pavlodarsky Aluminum Plant (Sample P). The accumulation of other elements in alumina is much lower.

The average *total pollution index*  $Z_c$  of alumina is equal to 31.7 (Table 1). This value corresponds to a moderately dangerous categories of soil pollution and it is close to the upper threshold of this category ( $Z_c = 32$ ). The alumina of the Nikolaev Alumina Refinery derived from Cenozoic Guinean bauxite has almost the same *total pollution index*  $Z_c$  ( $Z_c = 32.3$ ).

**Table 1.** Composition of Alumina's Samples and the Earth's Crust in parts per million (ppm)

Element	Earth's Crust	Alumina's Samples				Average of alumina
		A	B	N	P	
Al*	80700	505588	499235	505588	496059	501618
As**	1.8	22	25	31	11	22
B*	9	0	100	0	20	30
Be*	2	5	9	4	4	5
C	200	818	764	900	1036	880
Ca	38100	786	464	443	400	523
Ce	61	21	22	23	19	21
Cr**	92	0	11	11	10	8
Cu**	53	2	2	10	2	4
F**	640	190	190	280	130	198
Ga	17	31	42	29	45	37
Hg**	0.072	0.20	0.15	0.10	0.08	0.13
K	21300	597	340	216	216	342
Li*	25	0	21	0	10	8
Mg	22600	84	84	78	78	81
Mn**	900	18	26	20	19	21
Mo*	1.2	22	21	22	20	21
Na*	23800	2300	2523	2300	2894	2504
Ni**	70	10	0	10	10	8
P*	1000	74	74	65	74	72
Rb	110	320	310	340	390	340
S**	330	560	75	410	900	486
Si*	279900	229	191	411	229	265
Sn	2.3	1	1	1	1	1
Sr*	370	10	11	10	10	10
Ti*	5300	42	42	54	48	47
V**	12	13	12	18	17	15
Zn**	68	62	86	46	47	60
Zr	160	54	55	59	56	56
Z <sub>c</sub>	–	28.4	41.3	32.3	24.6	31.3

Note: \* – Element toxic for water. \*\* – Element toxic both for soil and water.

The lower *total pollution index* characterizes the alumina produced from Turgai Cenozoic bauxite ( $Z_c = 24.6$ ) and of nepheline ( $Z_c = 28.4$ ). The highest *total pollution index* ( $Z_c = 41.3$ ) is typical for by domestic alumina, derived from the most ancient (Paleozoic) Ural bauxite. Sample P of Pavlodarsky Aluminum Plant is different from the other samples by a higher concentration of sulfur (as sulfates).

The total content of toxic trace elements listed in Table 1 is 3500 – 4500 ppm or



0.35 – 0.45 %. According to these values Russia imported 10-14 thousand tons of toxic elements together with 2.7 million tons of imported alumina in 2014. A large proportion of the toxic elements migrates to aluminum while metal processing [9]. However some toxic elements remain in Russia as waste after the aluminum smelting [5].

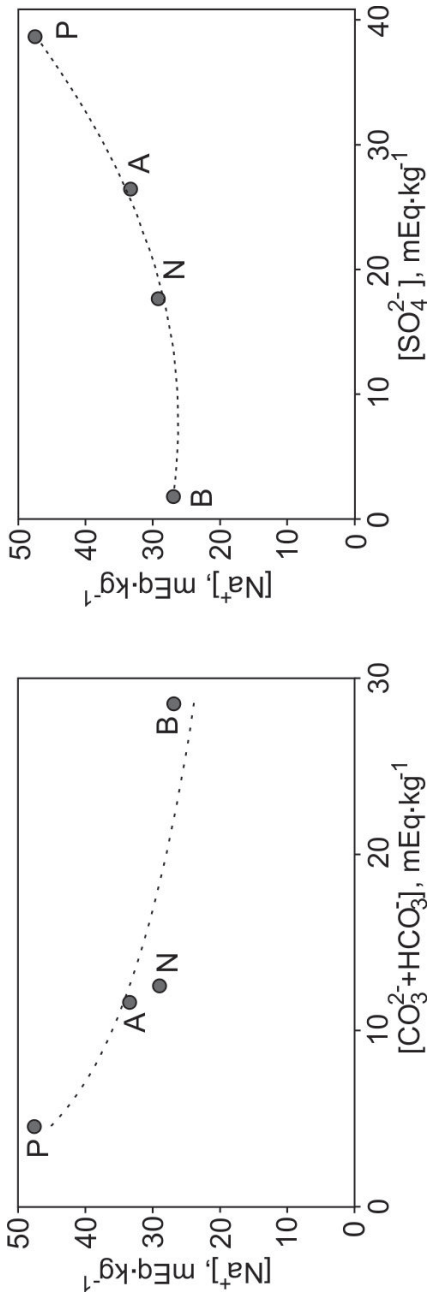
The chemical composition of water extract’s solutions comprises the results of dissolution of various admixtures to the different alumina. Alumina contains a very small portion of soluble salts. Solubility of alumina varies from 2500 up to 3000 ppm (0.25-0.30 %). Dissolution of soluble salts forms a slightly alkaline liquor (pH 8.3-9.3). Both the low solubility of alumina and the alkaline condition are considered less hazardous to the environment than the impact of high concentrated and acidic liquors (Table 2).

From a hydrochemical point of view only two substances (salts) are responsible for the formation of the chemical composition of solutions. First one is sodium carbonate that forms  $\text{HCO}_3^-$ –Na solution from domestic Ural’s alumina (Sample B). Second salt is a sodium sulfate that was found in the other three samples of alumina, and it forms  $\text{SO}_4^-$ –Na solution (Sample P). Both substances are present in samples A and N, however sodium sulfate is predominant over the carbonate. Therefore, solutions of water extracts from samples A and N refer to  $\text{HCO}_3^-$ – $\text{SO}_4^-$ –Na hydrochemical water type. Thus, bicarbonate and sulfate are the main anions in water solution from alumina, while the share of other anions is less than 1 % (Table 2).

**Table 2.** Chemical Composition of Water Extracts from Alumina Samples in mg·kg-1 (ppm)

Components*	Alumina’s Samples				Average in Solutions
	A	B	N	P	
$\text{CO}_3^{2-}$	130	340	72	86	157
$\text{HCO}_3^-$	440	1100	620	270	608
$\text{Cl}^-$	14	66	18	210	77
$\text{SO}_4^{2-}$	1270	82	850	1860	1016
$\text{NO}_3^-$	0	0	1.48	0	0.37
$\text{NO}_2^-$	0.20	0.26	0.46	0.24	0.29
$\text{F}^-$	0.95	0,68	1,35	0,54	0,88
$\text{Ca}^{2+}$	0	1	0	1	0,5
$\text{K}^+$	57	16	5	8	22
$\text{Na}^+$	770	618	660	1090	785
$\text{NH}_4^+$	1.5	1.5	1.5	1.5	1.5
$\text{Al}^{3+}$	13	1.8	1.9	11	6.9
Salt content	2500	1900	2600	3000	2500
$\text{CO}_2$ free	0	22	0	0	5.5
pH (pH units)	9.15	9.34	8.88	8.32	8.9
Type of Water	$\text{HCO}_3^-$ – $\text{SO}_4^-$ –Na	$\text{HCO}_3^-$ – Na	$\text{HCO}_3^-$ – $\text{SO}_4^-$ –Na	$\text{SO}_4^-$ –Na	$\text{HCO}_3^-$ – $\text{SO}_4^-$ –Na

\* Note: ions of magnesium and iron were not found.



**Fig. 2** Cross plots of  $[Na]$  vs  $[CO_3 + HCO_3]$ , and  $[Na]$  vs  $[SO_4]$  in water extracts from alumina. A, B, N, P – samples of alumina

The alkaline reaction is caused by the high sodium content, the portion of which reaches 92-99 % of the total weight of cations. The high sodium content is mainly created by the dissolution of the sulfates, while the dissolution of carbonates is accompanied by decreasing of sodium concentration (Fig. 2). This can be explained by a complicated interaction of aluminum oxide with sodium carbonate that creates complex chemical compounds such as sodium tetrahydroxoaluminate  $\text{Na}[\text{Al}(\text{OH})_4]$ , and similar to it. On the other hand the sodium sulfate is higher soluble so it prevails in liquor of water extract.

Both salts (sodium carbonate and sodium sulfate) are harmful for soil and vegetation especially in arid and semiarid climates. Therefore, dust emissions from alumina plants can pollute the environment.

Only twelve trace elements were found in water solutions from alumina (Ag, B, Ba, Cr, Cu, Ga, Mn, Mo, Ni, Pb, Sn, V). The total content of trace elements varies from 0.27 to 0.87 ppm. The maximum content of trace elements was found in the  $\text{HCO}_3^-$ -Na solution (Sample B), while the  $\text{SO}_4^-$ -Na liquor (Sample P) was characterized by the minimum content of trace elements.

The concentrations of most trace elements do not exceed 0.1 ppm therefore they probably do not represent environmental hazards. Only four trace elements are characterized by higher concentrations in water extracts. These four elements are barium (0.42 ppm in Sample B only), chromium (0 – 0.4 ppm), manganese (0.03 – 0.2 ppm), and vanadium (0.04 – 0.11 ppm). All these four trace elements are considered to be dangerous for soil and water.

#### 4. Conclusion

Alumina is involved in the production of primary aluminum in Russia can be considered as a source of pollution of the environment and groundwater. The largest aluminum plants are located in Siberia near cities Krasnoyarsk, Bratsk, and Abakan. These smelters use domestic and imported alumina that contains different portions of toxic elements. Domestic alumina derived from the most ancient (Paleozoic) Ural bauxite was found to contain more toxic elements, while alumina derived from Cenozoic bauxite and nepheline is less dangerous. The toxicity of alumina is due to the strong accumulation of seven elements: Mo, As, Al, B, Be, Hg, S.

Main soluble salts of alumina are sodium carbonate and sodium sulfate that form  $\text{HCO}_3^-$ -Na,  $\text{SO}_4^-$ -Na and  $\text{HCO}_3^-$ - $\text{SO}_4^-$ -Na types of water solutions. Both salts are toxic for soil and vegetation. Four toxic trace elements (Ba, Cr, Mn, and V) have high concentration in the water solutions from alumina.

Toxic elements migrate from alumina into the solid waste and also into dust emissions during aluminum smelting, and also during transportation and storage of alumina. Solid waste and dust emissions cause environmental pollution in the vicinity of aluminum plants.

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乳制品中含有食品添加剂和亚硝酸盐的乳酸盐  
**LACTATE CONTAINING FOOD ADDITIVES AND NITRITES  
IN MEAT PRODUCTS**

**Eveleva Vera Vasilievna**

*Candidate of Technical Sciences, Leading Researcher*

*All-Russian Scientific Research Institute of Food Additives – Branch of  
“Federal Scientific Center of Food Systems named after V.M. Gorbатов”  
of RAS,*

*St. Petersburg, Russia*

注解。研究了含有乳酸和乳酸钠的膳食补充剂对减少熟香肠中亚硝酸钠残留量的影响。建立了在腌制之前在填料中引入含乳酸盐的添加剂的可行性。与通过添加剂和固化成分获得的碎肉相比，这有助于使碎肉的水分结合能力增加37%。在填料中添加添加剂可降低煮熟香肠中亚硝酸钠在其制造和储存过程中的残留量。当乳酸钠的含量相对于碎肉的质量为6.0%时，煮熟的香肠中亚硝酸钠的残留量为2.8mg%，而不含添加剂的香肠中的残留量为4.2mg%。注意到用含乳酸盐的添加剂制备的脂肪氧化产物含量的降低，感官特性的改善和煮熟的香肠产品的产率的增加。

关键词。含乳酸的食品添加剂，熟香肠，亚硝酸盐

**Annotation.** *The effect of a dietary supplement containing lactic acid and sodium lactate on reducing the residual content of sodium nitrite in cooked sausages was investigated. The feasibility of the introduction of lactate-containing additives in the stuffing before salting is established. This contributes to an increase in the moisture-binding capacity of minced meat by 37% compared with the minced meat obtained by adding the additive together with the curing ingredients. The addition of the additive to the stuffing reduces the residual content of sodium nitrite in boiled sausage in the process of its manufacture and storage. When the content of sodium lactate is 6.0% relative to the mass of minced meat, the residual content of sodium nitrite in boiled sausage is 2.8 mg% compared to 4.2 mg% in sausage without additives. A decrease in the content of fat oxidation products, an improvement in organoleptic characteristics, and an increase in the yield of boiled sausage products prepared with a lactate-containing additive were noted.*

**Keywords.** *Lactate-containing food additives, cooked sausages, nitrites*

The range of food supplements is extremely diverse, both in nature and purpose. In the production of meat products use various additives that prevent microbial and oxidative damage, accelerating the processes of maturation and color formation, etc.

Food additive sodium nitrite (E250), used as a color fixer for meat products, due to its multifunctionality is almost indispensable for technologists. In the process of technological processing, the meat changes or loses its original color and acquires an unattractive appearance. A crucial role in the formation of the color of meat is played by myoglobin and its derivatives contained in muscle tissue.

It is generally recognized that the pink-red color of salted and boiled meat products is due to the presence of nitrosopigments. Their formation occurs in the process of salting meat with the use of sodium nitrite. In the process of heat treatment, nitrosomyoglobin is transformed into denatured globin and nitrosomiochromogen (nitrosomiochrome), which determines the pink-red color of salted and boiled meat products. The effectiveness of the formation of color depends on the ratio of nitrite and muscle pigments, the reaction of the environment and other factors. The shift of the reaction towards the formation of nitrosomyoglobin occurs when the excess concentration of nitrite at the beginning of the salting and the active acidity of the medium is from 5.2 to 6.0 units. pH In the process of formation of nitrosomyoglobin, not all of the nitrite introduced is consumed, part of it is stored in the product in the form of “free nitrite”, which represents a danger to human health. In addition, nitrosamines that are carcinogenic can be formed in products treated with nitrites. There is evidence of prooxidant effects of sodium nitrite, which is reflected in a decrease in the content of sulfhydryl groups and an increase in the number of disulfide bonds [1].

In this regard, research is being conducted on the search for alternative food additives or components of microbiological origin, which exclude or reduce the use of sodium nitrite in meat products [2]. Evidence has been obtained that the introduction of lactic acid bacteria *Lactobacillus sakei* into sausages leads to their dominance in the general microflora and complete inhibition of the growth of pathogenic microorganisms, such as *Escherichia coli* and *Enterobacteriaceae* during the fermentation of sausages, reducing the nitrite content from 100 ppm to 9,6 ppm and improved consumer properties [3]. The efficiency of using lactic acid bacteria for producing sausage free from nitrites was confirmed in [4]. Thus, the inoculation of *Lactobacillus fermentum* in sausage meat in the amount of 108 CFU/g of meat allows you to get sausage, identical in the spectra of pigments to a control sample with sodium nitrite in the amount of 60 mg/kg of meat.

Taking into account the data presented, it is of interest to use in meat products safe for human health and technologically effective lactate-containing ingredients - lactic acid and lactates.

Lactic acid and its salts, in particular sodium lactate, also belong to multifunctional food additives and are used to improve the quality of finished meat products and increase the duration of their storage. These additives exhibit a bacteriostatic effect, have a high diffusion rate and create favorable conditions for the directional flow of biochemical processes that positively affect the structure, texture, taste and nutritional value of products. Lactic acid and sodium lactate contribute to the rapid and uniform distribution of food ingredients in muscle fibers, while providing an inhibitory effect on fat oxidation and changes in tissue pigments. With the introduction of these additives, mass transfer processes, changes in moisture binding capacity and the formation of the microstructure of the finished product occur more intensively due to the directional development of enzymatic processes in the presence of curing substances, flavor and aroma formation, and color stabilization of the product [5], [6].

This paper presents the results of studies of the effect of lactate-containing food additives on reducing the nitrite content of cooked sausages.

The determination of sodium nitrite was carried out using a photolorimetric method according to the intensity of staining of protein-free filtrates as a result of the reaction of nitrite with N-(1-naphthyl)-ethylene diamine dihydrochloride and sulfanilamide.

In the process of research, it has been established that it is advisable to introduce a lactate-containing additive into mincemeat before salting, which contributes to an increase in the moisture-binding capacity of mincemeat by 37% in comparison with samples obtained by adding the additive together with or after the cabbage ingredients.

The dynamics of changes in the content of sodium nitrite during storage of boiled sausage depending on the presence and composition of lactate-containing additives was investigated. Table 1 shows the results of the analysis of boiled sausages produced from minced meat containing 0.1% lactic acid, (3-6)% sodium lactate and 8.9 mg% sodium nitrite. It is shown that the introduction of minced additives based on lactic acid and sodium lactate into the mince significantly reduces the residual content of sodium nitrite in boiled sausage during its manufacture and storage. Thus, with a sodium lactate content of 6.0% (relative to the weight of minced meat), the residual content of sodium nitrite in boiled sausage is 2.8 mg%, in control (without additive) - 4.2 mg%.

*Table 1 - The content of sodium nitrite in model samples of boiled sausage during storage*

Content of additives % by weight of minced meat		Sodium nitrite content (average) mg%, with storage time, days			
<b>lactic acid</b>	<b>sodium lactate</b>	<b>1</b>	<b>3</b>	<b>7</b>	<b>10</b>
0	0	4,7	4,5	4,4	4,2
0,1	3,0	4,6	4,4	4,2	4,0
0,1	4,0	4,4	4,0	3,9	3,7
0,1	5,0	3,9	3,7	3,5	3,4
0,1	6,0	3,3	3,1	3,0	2,8

The experimental data obtained suggest that the lactate-containing additive affects the transformation of sodium nitrite in color formation processes. As a hypothetical idea of the mechanism of the participation of lactate ions in color formation and, accordingly, the transformation of sodium nitrite, it can be assumed that the sixth coordination bond of the divalent iron atom of the heme myoglobin can be occupied by the  $\text{CH}_3\text{CHOHOHOO}^-$  ligand capable of forming a strong bond with the central iron atom. Lactate ion, acting as a competitor to the oxidizing agent — oxygen in the air, promotes the formation of nitrosomyoglobin and nitrosohemoglobin, with pinkish-red and pinkish colors, respectively, and prevents the oxidation of nitroso pigments.

In the course of research, changes in peroxide and acid values characterizing the accumulation of fat oxidation products in cooked sausages prepared with lactate-containing additives and a decrease in the value of these indicators was found compared to the control (without additives) and with an increase in the content of the added additive. The use of lactate-containing additives can significantly reduce the speed of oxidative spoilage processes of boiled sausages, the primary product of which is peroxide, increase the shelf life and increase the safety of the product, since the toxicity of hydroperoxides, isolated in its pure form, has been experimentally proven.

The positive effect of the complex additive on organoleptic quality indicators and the yield of finished products has also been established.

Thus, studies have shown that the additive, including lactic acid and sodium lactate, allows you to adjust the pH and moisture-binding capacity of minced meat, reduce the content of residual sodium nitrite, improve organoleptic characteristics and increase the yield of cooked sausages, which gives reason to recommend it for use in production meat products.



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