

**International University Science Forum**



# **SCIENCE EDUCATION PRACTICE**



**Toronto 2020**



International University  
Science Forum

# SCIENCE EDUCATION PRACTICE

Part 2

TORONTO, 2020



Forum Scientifique  
International des Universités

SCIENCE  
ÉDUCATION  
PRATIQUER

Partie 2

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The collection includes scientific articles of participants of the International University Science Forum, the purpose of which is to present significant results of scientific research in the field of humanities, natural and technical sciences; the formation of a modern level of scientific knowledge, experience in transformation of theoretical science into the sphere of practical application of innovations; generalization of research and practical experience. The forum is a tool for establishing sustainable ties, as well as the exchange of experience between teachers and researchers of universities and research organizations.

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## DEVELOPMENT OF AN ALGORITHM FOR CONDUCTING BUSINESS PROCESS REENGINEERING

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*In this article, we will consider a standard set of sequential actions - an algorithm that is used when reengineering business processes of companies, regardless of which industry the company belongs to. As well as an overview of the algorithm with all the consequences and risks that it may entail.*

*Keywords: business process, reengineering, algorithm, information technology, production cycles, improvement, management, consulting, risks, factors.*

Currently, business processes are present in every company of any industry. With the development of technological progress and with the growing deterioration of the economy, every company in any industry avoids default and maintain its market niche. In this connection, there is an urgent need to improve existing business processes. Namely, in their simplification and shortening of production cycles. Thus, the company's management decides to conduct reengineering of business processes - a fundamental rethinking and radical reconstruction of business processes in order to achieve significant improvements in performance criteria that are critical in modern conditions, such as cost, quality, services, speed. [1]

With the globalization of the economy and the development of information technologies, new methods and tools appear on the market that help to develop and improve production cycles in enterprises, allowing such companies to remain competitive. One such tool is the reengineering of business processes. It is a mistake to believe that reengineering is used only during crisis situations in companies or, in general, in the market or industry. As practice shows, business process reengineering is also useful for creating healthy competition in the market, provided that its implementation is clearly controlled by the management team of the company and follows a strictly defined algorithm. [2]

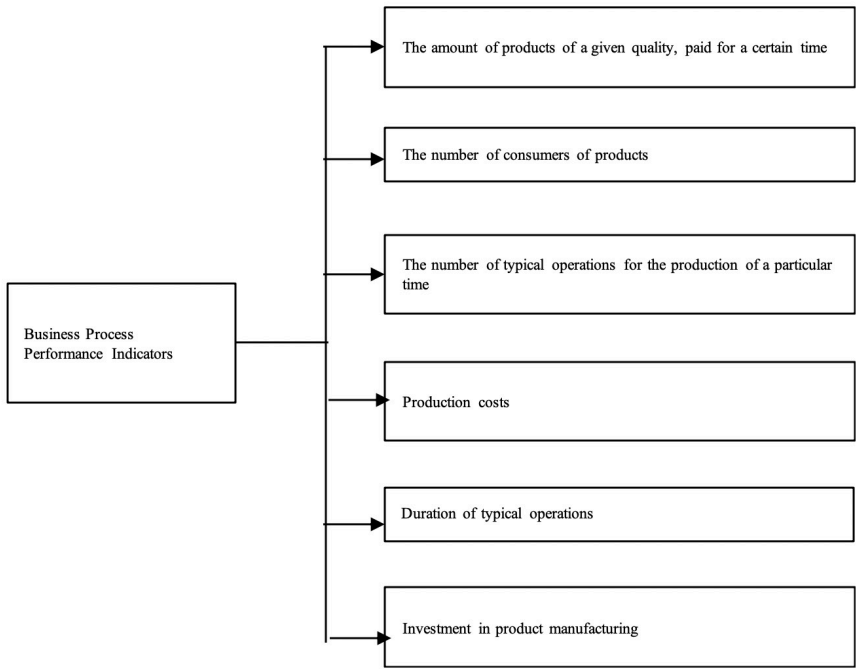
So, the main and important factors for the successful implementation of reengineering are the management team of the company, which during the crisis period makes decisions on reengineering, as part of a working group, they develop and approve an action plan to improve the state of the company, as well as predict possible risks and bear responsibility. As well as the availability of sufficient funds, since reengineering is a sufficient costly measure and requires investment not only to eliminate obsolete business processes, but also requires a thorough update of the technical component of these processes. [3]

Subject to the above factors, the company begins to search for a crisis manager or consulting company, in most cases it turns out to be an external auditor who will accompany the entire process of implementing reengineering and exercise control. It is a consultant from the outside who is able to objectively analyze the problems of the company, as well as select and draw up a step-by-step action plan. In addition, the selected consultant forms a team, the main part of which includes the head of the company, mid-level employees of the company, because they have a clear idea of the work of all business processes, as well as IT staff who accompany the technical side of the process, able to quickly update or replace software, hardware, etc. [4]

Most authors of literary publications call this an algorithm for reengineering, which should consist of the following standard steps:

1. Analysis of the strengths and weaknesses of the enterprise, its potential (including personnel, its qualifications and experience), assessment of potential and real markets in the most promising areas for the company.
2. Consideration of positioning alternatives for the most promising markets, assessment of opportunities (the opportunity to become a retail chain, a large wholesale dealer, manufacturer, etc.). Selection of the most acceptable alternatives and their further coordination within the enterprise.
3. The formulation of the general strategic goals of the enterprise and the goals of the business.
4. Development of medium- and short-term strategies for each business, which will achieve their goals.
5. The development of measures for the implementation of the selected strategies, the construction of the optimal organizational structure and planning, incentive and control systems.
6. The formation of budgets for each business, the compilation of the total budget, the correction of planned activities. An operational action plan is being built. [5]

Based on the practice of Western countries, the above stages of the reengineering process are quite effective for any industry. In this case, it is important to comply with the speed of implementation. Despite considerable efforts in preparing for reengineering, the observance of important steps and quality control at each stage will allow the company to quickly increase the quality of services provided, while at the same time reducing costs and the production cycle. The sequence of actions, the algorithm, may also look as follows: [6]



**Figure 1. Step-by-step action plan for reengineering [7]**

Figure 1 shows a more detailed action algorithm that is understandable to any user. As a rule, a similar action plan is used after the formation of the team. Comparing the data shown in Figure 1 and Figure 2, we can conclude that the steps are similar. For example, setting goals usually takes place as part of an analysis of the strengths and weaknesses of the company, its potential. These processes include an analysis of the financial condition, condition of assets, the level of loading of technological resources and production capacities, and forms the cost structure of

the enterprise. According to the results of the analysis, a comprehensive assessment of the performance of both the enterprise as a whole and its structural divisions is carried out. On this basis of diagnosis, key problems and necessary tasks are formed for the further successful functioning of the enterprise. The analysis allows us to formulate the right tasks, to place emphasis on the main areas of the company, eliminating the erroneous concentration on secondary problems. [8]

As soon as the analysis of the company is carried out, clear tasks are defined and a strategy is chosen, it is necessary to go to the next step for successful reengineering - the choice of method. Among which are the following.

Methods of M. Hammer and H. Champi. M. Hammer and H. Champi defined the reengineering of business processes as “a radical change or fundamental rethinking of the entire business process in order to achieve the most effective indicators in the cost, quality and cost of production or services”. From this definition it follows that during reengineering, all parts of the organization undergo changes: employees, workplaces, managers, value parameters, and this happens because these parameters are in close relationship with each other. However, today this method is not so popular, since the use of only a human resource, the lack of introduction of new technologies, and the lack of analysis are the basis for the failure of this method. [1]

The next method, which is most often used at present and is one of the most popular, is the method of T. Davenport and H.E. Shot. The latter, in their method of reengineering, put information technology in the first place and recognized the existence of a recursive connection between information technology and reengineering, based on the importance of supporting IT new or changed processes through reengineering. Despite focusing on technology and innovation, scientists also paid attention to organizational structure and human capital and proposed the use of traditional management techniques such as planning, decision management and communication. Of course, focusing on the introduction of new IT technologies, while using human resources for their management - the optimal ratio for the company and the economy as a whole. In addition, this method is an effective process for creating new operations. [9]

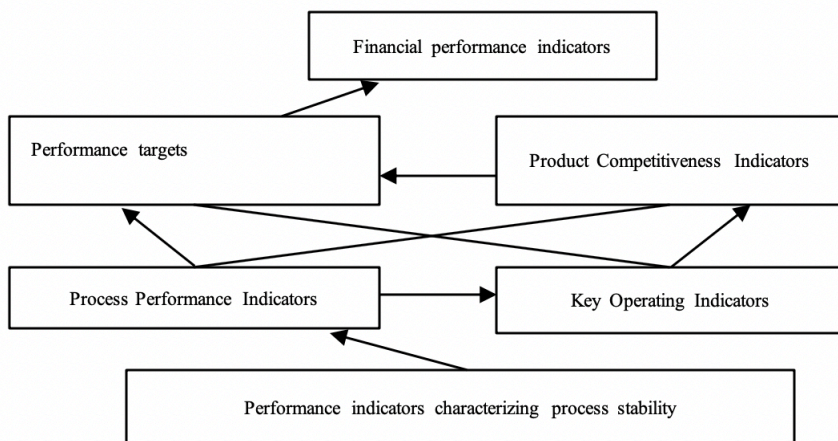
In addition to the above methods, one can also note the objectively oriented methodology and the method of process analysis and design (PADM). Similar methods that are used on the basis of information technology at each stage of the implementation of reengineering. These methods are at the heart of the changes by technical updating and comput-

erization, which saves time, simplifies the process, and cuts costs due to minimal use of human resources. The use of such techniques allows companies to completely change outdated processes and evaluate their effectiveness during the control phase, with the possibility of their refinement or change. [10]

Based on the chosen reengineering method, the team, led by a consultant and company manager, should determine the future corporate strategy. The team needs in the process of discussions and meetings to ensure that the management of the company had an idea about: basic conceptual concepts of business process reengineering.

- methodologies for reengineering business processes.
- the importance of leadership involvement in the process.
- the need to act as leaders, move from an autocratic style in management to a style of participation in teamwork.
- the vital role of effective cross-functional teamwork for the success of this initiative.

The manager, in turn, needs to correctly state his vision of the changing business process, what results they should get. The consultant determines the viability of the proposed changes, conducts a comparative analysis (benchmarking), assesses the needs and values of customers and consumers. This information will allow the team to take the correct motion vector. [11]



**Figure 2. Balanced scorecard.**

Figure 2 shows a simplified diagram of the development of key indicators. Regardless of the industry, the company that implements re-engineering seeks to consolidate its position in the market, namely, to increase the number of sales, possibly by applying or developing new technologies, thereby increasing the flow of profits to the company and, if possible, preserving jobs. With the latter criterion, problems often arise. Given that reengineering provides for radical changes that are likely to entail a reduction in the staff of the company. Such changes are rather painfully perceived by company employees and most often they act as a kind of brake upon the introduction of reengineering. [12]

In order to avoid resistance from middle and lower-level employees, the practice of Western countries has shown that the application of the model of the American psychologist and sociologist Kurt Levin will help to successfully and painlessly implement all changes in business processes. The first stage of the model is “DEFROST” - company employees are reporting that significant changes are coming in the management structure, and as a result, they experience emotions and resistance to these changes. The second stage - “MOVEMENT” - with the right approach from the leadership, motivation and involvement of employees in the team, the latter in a short time realize the importance of changes and take the leadership side. The third, most important, stage - “FREEZING” - consolidation of the achieved reengineering result, which is achieved by correctly made decisions. At this stage, it is also important to remember that for the complete completion of reengineering, constant monitoring and control of the changed processes is necessary. [13]

Having completed all organizational and preparatory work, having defined the tasks and corporate strategy, the company proceeds to the final stage of reengineering - redesign and implementation. The introduction of a new business model into the economic reality of the company. All elements of the new business model are being put into practice. At this stage, the company needs to update the software and technical equipment, if provided for by the plan, to approve the document base of new or updated business processes. A new model is being tested - a new model is applied on a limited scale. At this stage, only part of the employees involved in new business processes is involved. Upon successful completion of testing a new company model, employees who have studied its work will train the rest of the employees. Skillful coupling and the transition from old processes to new ones is important here, so that the process executors do not feel the disharmony of the work environment and do not experience the state of work stress. The elasticity of the transition is largely

determined by the degree of thoroughness of the preparatory work. [14] The above reengineering activities are based only on theoretical knowledge or on the practice of Western countries. Reengineering, as a tool that helps companies maintain their competitiveness in the market, should firmly take their positions in post-Soviet countries, as the main tool to improve the quality of services and / or production. Strict adherence to its simple algorithm, regular improvement of technical equipment, will allow companies to remain successful for a long time and minimize possible risks. In addition, the unstable situation in the global economy forces many companies to revise the management and production policies, therefore, applying the process of reengineering business processes, domestic enterprises will not only be able to survive the crisis in a relatively short period of time, but also enter a new stage of development.

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## METHODOLOGICAL ASPECTS OF THE ANALYSIS OF INFORMATION OF FINANCIAL STATEMENTS OF A MODERN ENTERPRISE

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*The modern organization of economic activity is characterized by the presence and application of information technologies for business management. When making management decisions in relation to commodity operations, financial transactions, investment projects, market entities primarily focus on the financial statements of potential counterparties. At the same time, most users employ widespread methods of analysis and evaluation of financial information based on retrospective indicators of profitability and operating efficiency, which determines the pattern of increasing interest of owners and managers in the new conceptual management system based on the use of reporting as a business card. Today, business development management is aimed at generating future cash flows in the process of economic activity, which cannot be achieved without using a high-quality accounting and analytical system, in the center of which is financial reporting and its analysis methodology. Improving the methodological aspects of the analysis of financial reporting information may be one of the most important tasks of ensuring the successful development of a market entity.*

*Keywords: Financial statements, financial ratio, liquidity, solvency, financial stability, profitability, business activity.*

In the current conditions of entrepreneurial activity, it is extremely important for any economic entity to receive timely information not only about the state of affairs of its business. The owners and management of the enterprise are interested in obtaining information about the financial condition of regular contractors, potential buyers and customers of products, commercial and financial opportunities of suppliers, investors and lenders. The most important and unique thread that allows you to link the information needs of economic entities of the market at this stage of eco-

conomic development is the financial statements of the enterprise.

It is the financial statements that are recognized by most users today as the main information source due to the following factors:

- the final data of the financial statements are formed on the basis of primary accounting documents and registers, which ensures the possibility of their verification and control;
- the data in the financial statements are systematized according to the accounting rules and principles that are common to all entities, which allows for comparability of the reporting data and dynamic analysis of indicators;
- toughening market competition and focusing on the digitalization of the economy require economic entities to create an official website and ensure the publicity of economic activity, which allows interested users to access the financial information of the enterprise;
- the financial statements of individual economic entities are subject to external control by audit organizations, tax firms, banking and government agencies, which determines its bona fide and responsible formation [7, p. 70].

The manifestation of the described factors together allows us to hope that the financial statements of the company formed in strict accordance with the requirements of the legislation are distinguished by a certain quality and reliability of the reporting data, the use of which for analytical purposes will allow interested users to receive the necessary financial information.

The information needs of interested users vary widely. Reporting data cannot fully satisfy all the information needs of users. Financial reporting information is designed to meet the needs common to user groups [1, p. 11] (table).

**Table. Users of financial statements and their interests**

<b>Users</b>	<b>Business contribution</b>	<b>Compensation claims</b>	<b>Directions of information and goals analysis</b>
Proprietors	Share of contribution, profit capitalization	Dividends	Return on equity maximizing market value
Administration, management	Management functions	Remuneration for labor	Business efficiency, management decision making
Staff, employees	Labor functions	Remuneration of labor	Business performance, salary and incentive opportunities
Investors, lenders	Credits and loans	Interest rates	Creditworthiness, providing refunds

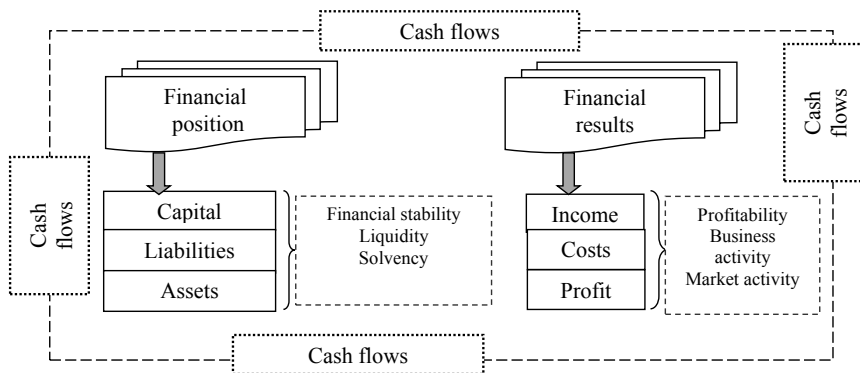
Suppliers	Supply of resources	According to a contract	Liquidity and solvency, debt repayment
Buyers, customers	Purchase of products (works, services)	According to a contract	Sustainability of development, ensuring the quality of supply and regularity of supply
Tax authorities, state	Consultations, services, budget support	Taxes, fees and charges, government procurement	Efficiency and sustainability of activities, ensuring tax and fees payments, targeted use of budget funds
Audit organizations	Consultations, services	According to a contract	Various
Educational institutions	Consultations, services	According to a contract	Organization of activities, participation in the implementation of educational programs
Statistical authorities	Society services	Statistical Information	Statistical generalizations

An enterprise operating on the market, pursuing the goal of sustainable business development and increasing the efficiency of economic activity, is obliged today to use financial statements as an information resource for proving the reliability of a business and the benefits of mutual cooperation.

The main purpose of the financial statements is to provide users with data showing HOW the financial relationships of the interested parties were carried out, how well the business transactions are in line with the expectations of economic benefits that the business entity was counting on. Analysis of the reporting indicators of the enterprise allows you to get the necessary information about the resources at its disposal, the effectiveness of their use (Fig. 1).

The main elements of the financial statements are assets, capital and liabilities, income and expenses [4, p. 23]. We believe that it is also necessary to add cash flows to the reporting elements, the circulation of which is closely related to the formation of the company's income and expenses.

To study and analyze financial reporting information, widespread methods of economic analysis are used. In our opinion, *the method of financial analysis* represents a systematic, comprehensive study and measurement of the financial condition of the enterprise, identifying the influence of factors on the change in its financial performance by processing reporting information with special analytical techniques and methods [3, p. 8].



**Fig. 1. The mechanism for transmitting financial information through reporting elements [2]**

The objects of financial analysis are the financial condition of the enterprise (solvency, liquidity, financial stability, creditworthiness) and financial results (profitability, business and market activity).

*The main goal* of the analysis of financial statements is to determine the development trend of the organization, identify the reasons for the change in the financial condition and financial performance, analyze the quality of profit and cash flows, develop recommendations for improving the organization's business management policy in order to ensure the sustainability of its development. For this, it is necessary:

- Assessment of the dynamics of changes in the volume of property and sources of its financing, the efficiency of the use of resources and their impact on the financial position of the organization based on a study of the cause-effect relationship between different indicators of production, commercial and financial activities of the organization;
- Forecasting in the long term financial results of operations, business profitability; modeling the financial condition of the organization with a variety of options for attracting and using financial resources;
- Development of specific measures aimed at improving the efficiency of capital use and strengthening the financial stability of the enterprise.

The financial statements are generally quantitative. They characterize the volume, size of the used production resources: capital volume, sales volume, cost of sales of products, value of working capital, payroll of employees, net profit of the enterprise, etc. To assess the quality of use of production resources use relative indicators (ratios). They are formed from quantitative indicators according to certain rules and dependencies [5, p. 30].

Coefficients - are benchmarks, simplified characteristics that help assess the financial position and main activities of an enterprise and compare them with previous years or with other organizations. The main goal of coefficient analysis is to identify areas of further research [1, p. 53]. There are various classifications of the aggregate of analytical ratios calculated on the basis of financial reporting data.

Currently, dozens of indicators used to assess the property and financial condition of companies are known in the world accounting and analytical practice [7, p. 481].

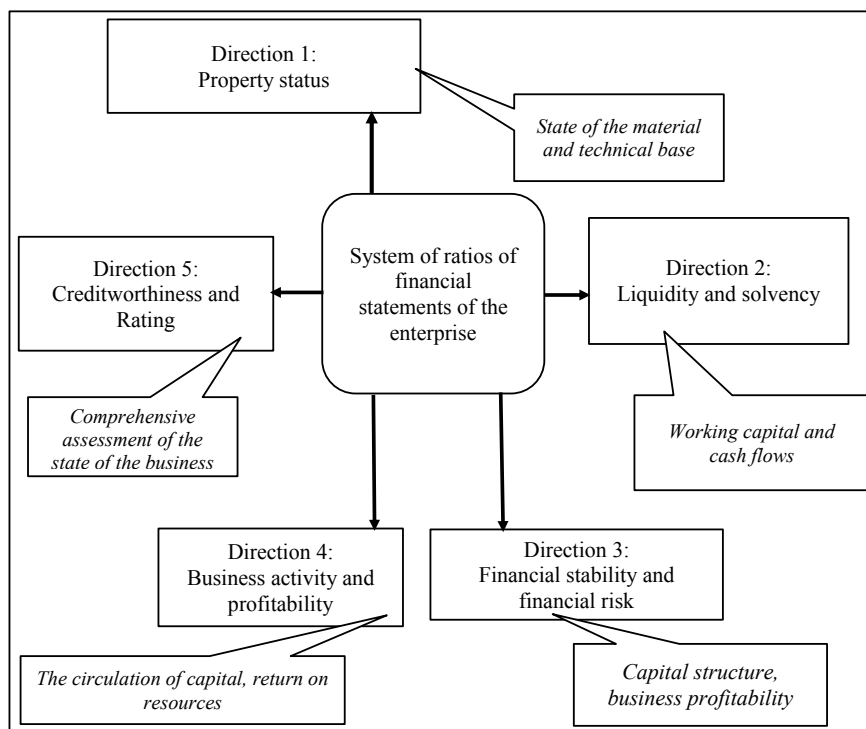
In our opinion, financial coefficient calculated according to the reporting data can be grouped into five main groups in order to generalize and systematize analytical calculations and obtain conclusions on the following main directions of analysis (Fig. 2).

The property status of the enterprise is reflected in the composition and structure of assets, the state of the material and technical base, the deterioration of fixed assets, and the dynamics of their movement. In this area of analysis, the analysis of the state and use of fixed assets as the main elements of long-term capital of an enterprise is of utmost importance.

The objective of the analysis of balance sheet liquidity arises in connection with the need to assess the solvency of the enterprise, that is, the ability to timely and fully settle all its obligations. The absolute indicator of the liquidity of the balance sheet of the enterprise is the value of its own working capital, which reflects the share of own sources of funds in the current assets. The main purpose of own working capital for industrial enterprises is to cover the current needs of production in inventories. The analysis of solvency is to assess the ability of the company to provide a stable flow of cash inflows to cover cash costs. This analysis can be carried out in the short term, analyzing the ability of an enterprise to fulfill its obligations under current expenses, and in the long term, by assessing the ability of an enterprise to pay all its obligations in the long term. In this case, the analysis of long-term solvency may be called the analysis of creditworthiness.

The financial stability of the enterprise is formed in the process of economic activity, its degree depends, first of all, on the availability of the enterprise's ability to generate profits and increase the amount of equity. Indicators of financial stability determine the capital structure of the enterprise, reflecting the share of own and borrowed sources in financing activities. In the general case, it is generally accepted that the higher the share of the company's own sources of funds, the higher the

degree of its financial self-sufficiency and independence in carrying out business activities. Each enterprise has its own borrowing limit, which will ultimately determine the most rational ratio of equity and borrowed capital shares. Indirectly, it will show the best option for the distribution of risks and income between owners and creditors [8, p. 170]. In the practice of financial analysis, risk is understood as the probability (threat) of an enterprise losing part of its resources, revenue shortfalls, or additional costs arising from activities. All business transactions are subject to financial risks. Therefore, it is possible to determine the feasibility of their implementation, provided that the value of the potential financial risk is previously determined. The risk coefficient reflects the ratio of the maximum possible loss and the amount of the investor's own financial resources [6, p. 587].



**Fig. 2. Directions for analysis of financial reporting information**

Business activity of an enterprise is a subject of study for external and internal users of financial statements. Business activity (in the broad sense) covers all areas of the enterprise that contribute to its promotion in the market of products, labor, capital in order to maximize profits [9, p. 308]. Analysis of business activity involves the study of indicators reflecting the dynamism of the enterprise in the direction of the goal. When analyzing business activity, the main attention is paid to the dynamics of estimated indicators (sales and profits), which directly depend on the speed of turnover of funds, their turnover. The analysis of indicators is carried out mainly on current assets as a whole in terms of their size, and for each element separately. The higher the value of the current assets turnover ratio, the better the working capital of the enterprise is used.

Profitability reflects the level of efficiency or rentability. Numerous profitability indicators can be calculated according to the financial statements, since different indicators can be used in the numerator and denominator of the fraction: in the numerator - accounting profit (before tax), profit from sales, net profit; the denominator is revenue, cost of sales, average cost of assets, average cost of equity, average cost of fixed assets, etc. The most common indicator in the group of indicators of profitability is the profitability of assets. This indicator is also called the rate of profit; it reflects the balance of economic interests of internal and external business participants achieved at the enterprise [6, p. 327].

The creditworthiness of an enterprise is a complex characteristic, represented by a combination of formal and informal criteria, which makes it possible to evaluate the enterprise's capabilities in full and in due time to pay off its debt obligations to creditors [10, p. 237]. Analysis and assessment of creditworthiness can serve as one of the stages in conducting a rating assessment of an enterprise.

The purpose of the rating assessment is to determine the rank of each of a certain number of studied enterprises by a certain set of financial ratios. Conducting a rating assessment allows you to determine the place of the enterprise among its competitors, to determine the strengths and weaknesses of the enterprise. The final rating score takes into account the most important parameters (indicators) of the financial activity of the enterprise. When building it, data on production potential, product profitability, efficiency of use of production and financial resources, condition and allocation of funds, their sources, etc. are used.

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## STRATEGIZING, ECONOMIZING, AND SYNERGIZING\*

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*In this paper the connection between economizing and strategizing is examined conceptually and theoretically. These two concepts, being inter-related and functioning together, nevertheless, have different strength. According to Williamson, the priority belongs to economizing; however, such conformation may lead to underestimation of the meaning of strategizing. Each of these concepts has to fulfill its own specific function: economizing – transformational and strategizing – transactional. From this point of view there is meaningless to speak of priority, because both phenomena are complementary. Nevertheless, Williamson prefers one of them, although in a certain sense the meaning of strategizing can be regarded even as more important. The reason is its ability to take emphasis on the elements of awareness and reflection, the scarcity of which is acutely felt in the practice of creating and implementing strategies by business entities at various levels of the Russian socio-economic system.*

*The paper emphasizes the need to systematically take into account the significance of both concepts in such a way as to achieve synergy. In this sense, we can talk about a third concept, coined as synergizing, which brings together economizing and strategizing into a single harmoniously balanced system.*

*Methodologically, the study is based on the system analysis and institutional theory, especially transaction cost economics, while the practical significance is based on the possibility of applying the results of the work in the activities of federal and regional authorities involved in the strategic management.*

*Keywords: strategizing, economizing, transformation and transaction costs, system approach, transaction cost economics, synergizing.*

**JEL Classification Codes:** B52, D01, D02, D81, D91.

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## 1. Introduction

“Economy”, Oliver Williamson once observed, “is the best strategy”. Then he added, it doesn’t mean that “strategizing efforts... are unimportant” (Williamson, 1991, p. 75). However, his accent on the priority of economy over business strategy may lead to misunderstanding of the very essence of strategizing and its underestimation as an important economic and institutional phenomenon. To avoid such situation, there is necessary to make a clear distinction between these two concepts and aspects of governing / managing economic activity, namely, the actual strategy, or the formulation and implementation of strategic objectives, and the pursuit of purely economic objectives, or the pursuit of economic efficiency.

In a narrow sense, the strategic planning deals with performing a transactional function, while the economic planning deals with performing a transformative (production) function. In fact, strategy does not concern the company, enterprise, organization and whatever itself, it goes beyond their limits, focusing on making a deal with other entities of the microeconomic level.

At the same time, the economic efficiency orientation implies the implementation of production, or transformative, in terms of J. Wallis and D. North (1978), function. In such understanding, there is reasonable to talk about two aspects of strategic planning: (i) transformative, or indirect for strategic decision makers, and (ii) transactional, or direct for them, as this is the purpose of the strategy. Although they used a distinction of two functions to represent the macroeconomic system in two sectors – transformational and transactional – this approach could also be used to analyze them at the microeconomic (firms, hierarchies, corporations) and mesoeconomic level (hybrid arrangements, network systems, ecosystems).

In order not to mix the immediate function of strategic planning with a systemic one that takes into account the pursuit of its own strategic and economic objectives, we will talk about strategic planning and governance, or simply strategizing, in a narrow and broad sense.

## 2. Transformation / Production Function of Economizing

Traditionally, economizing deals with firms operating on production functions and maximizing profits, and hence with firms’ efficiency analysis. The firm in orthodoxy acts as a “black box”, mathematically described by the production function, but ceases to be so in the transaction cost economics. That is why performance or efficiency analysis encompasses not only production costs, but also governance costs. Let us remind that the leading efficiency approaches are the resource-based and the dynamic capabilities approach. As to the transaction costs economics approach,

whether it “can help to explicate the strategic issues that the resource based and dynamic capabilities approaches have raised remains to be seen” (Williamson, 1991, 76).

A wide range of issues related to economizing could be found in transaction cost economics literature, namely first-order economizing, included effective adaptation (*ibid.*, p. 77), and second-order economizing, included bureaucracy and waste. To illustrate the difference between these two types of economizing, Williamson considers “a simple partial equilibrium welfare economics setup” (*ibid.* p. 78).

Williamson avers that economizing is much the fundamental phenomenon because strategizing is “relevant principally to firms that possess market power which are a small fraction of the total (ephemeral market advantages ignored)” (Williamson, 1991, p. 75). In addition he underlines “that a strategizing effort will rarely prevail if a program is burdened by significant cost excesses in production, distribution, or organization” (*ibid.*).

All this sounds very plausible and logical, but only if you share his point of view. Below we will try to show that the right to exist has another point of view as well. With this in mind, we will now proceed to consider the phenomenon of strategizing.

### **3. Transaction Function of Strategizing**

For the purposes of this study, it is useful to focus on the ability of strategizing to perform a transactional function and thereby influence the outcome of market or other transactions. In a narrow sense, the essence of strategizing can be expressed by the notion of a transaction function.

In terms of strategy as a practice, it is conceptually expressed as a socially implemented activity carried out through actions, interactions and negotiations of multiple actors and relevant practices on which they rely (Jarzabkowski, 2005). At the same time, it is useful to treat strategizing broadly as a two-period process of strategy formation and implementation. The first period can be called *ex ante* strategizing and the second one – *ex post* strategizing. Both processes are institutional, but in the first period designers are incorporated into existing institutions, and in the second period they deal with reforming institutions. In other words, two dimensions can be distinguished in strategy as an institutional process: the first dimension serves to distinguish between strategy *ex ante* and *ex post*, and the second to draw attention to the institutional nature of the strategy. The latter means that this institutional phenomenon can be seen more as a game itself, in the spirit of O. Williamson (institutions are play of the game) than its rules, as claims D. North (institutions are the rules of the game) (see for example: Yeznkyan, 2017, p. 89).

A metaphor of institutions-as-rules is of Douglass North. Here are two definitions of institutions given by him:

1. Institutions are sets of rules, compliance procedures, and moral and ethical behavioral norms designed to constrain the behavior of individuals in the interests of maximizing the wealth or utility of principals (North, 1981, p. 202).

2. Institutions are the rules of the game in society or, more formally, are the humanly devised constraints that shape human interaction. In consequence they structure incentives in human exchange, whether political, social, or economic (North, 1990, p. 3).

This treatment of institutions is closer to the 'new' rather than the 'old' institutional economics. North regards institutions as constraining agents and channelling their incentives. As for him, institutions act primary as constraints upon the behavior of given individuals and channel unchanging incentives; hence purposes or preferences are themselves changed by institutions.

A metaphor of institutions-as-plays is of Oliver Williamson (2000). Speaking of institution as a play of the game, he factually wants to accentuate process-type form of institution.

Broadly speaking, strategizing, along with performing a transaction function, involves a set of processes of forecasting, planning, managing, and shaping the future, and it can be viewed from different perspectives, for example, from the perspective of a phenomenon focusing on awareness and reflection. As to Dmitry Lvov, Russian version of strategizing was an attempt to understand, describe and design the ways of constructing a future-oriented economy. In general, this attempt was unsuccessful, and there are good reasons, one of which is the specificity of the economy and society formed in the country (Yerznkyan, 2016, p. 98).

The points and principles of the proposed by D.S. Lvov breakthrough strategy were in no way comprehensive and could "hardly concretize the ways of implementing the measures suggested", wrote at the reforms and early post-reform times Lvov (1995, p. 37), and that was true. However, true is also the fact that many of his theoretical and practical arguments and ideas remain their actual meaning even today, in our times (Yerznkyan, 2016, p. 98).

#### **4. Synergizing as a Synthetic Concept**

The setting, which gives priority to strategy, contrasts with Williamson's understanding that economic expediency orientation is more fundamental than pursuit of strategic objectives, or else "economy is the best strategy" (Williamson, 1991, p. 76). The explanation is as follows: the dif-

ference between strategizing and economizing is that strategy appeals to [market or other] power, while economy mainly deals with efficiency. And while both of these concepts convey the essence of business strategies, economizing has been said to act, according to Williamson, as a more fundamental category than strategizing. In terms of transaction cost economics, one explanation for this state of affairs is that strategy is only appropriate for a small subset of transactions, whereas economic performance is appropriate for all transactions (Williamson, 1991, p. 90).

Both of these settings, with a systemic approach to strategy and economy, offset the highlighting of one of the concepts as a priority and reconcile our approach with that of Williamson. Moreover, the realization of the system position allows to supplement both considered concepts, regardless of which priority is given, with the third concept, which can be called a term combining the first two into a new concept, implying the possibility of obtaining a synergistic effect – synergizing (Yerznkyan, 2019).

The desire for systemic, or synthetic, coverage of strategic and economic functions and their implementation with a view to obtaining a synergistic effect can contribute to the shift of the still largely non-stationary Russian economy towards more stationary. In this regard, it is advisable to draw new parallels – as opposed to distinguishing transformational and transactional functions in Wallis and North terminology – between economy and strategy.

The first is purely rational, the second is institutional. In the situation of economy, the subjects of action are economic agents, in the second situation – carriers of institutions, especially informal ones. Many of the first individuals form a society, many of the second ones are a society. Such a distinction, proposed by L.Evstigneeva and R.Evstigneev (2011) for characterizing a synergistic approach to mentality as a unity of mode of production and way of life, is fundamental, for, as they emphasize, the connection "between members of society is irrational, and therefore not objectified..." (Evstigneeva, Evstigneev, 2011, p. 52). The transformative function is then associated with the rational behavior of efficiency-seeking economic agents, transactional – with the institutional behavior of the social and economic actors rooted in the traditional institutional field.

### **5. Russian Experience and Perspectives of Development**

Synergizing implementation means solving a lot of problems. Some of them in order to revitalizing Russian economy and realizing a breakthrough strategy of Dmitry Lvov presented as failures spheres and strategic points are given in Table 1.

Table 1

***Spheres of Failures and Points for the Breakthrough to the Future***

	<b>Spheres of Failures</b>	<b>Points of Strategy</b>
1	Spiritual and moral degradation	The spiritual and moral renaissance of the nation is the starting point for the breakthrough
2	Immoral privatization of public revenue	As a result of three waves of privatization – (i) the voucher and (ii) mortgage schemes, and (iii) artificial (false) bankruptcy – state property was passed to private persons (the so-called «new management») and not to new stockholders
3	Liberalization of all factor of production, including labor as the most «depressed» factor	<p>The labor of productivity is much lower than in the Western countries however the level of wages cannot be excused by reference to lower productivity. In fact, Russian average worker produces three times more output per dollar of wage than a worker in the USA.</p> <p>There is need for a special income distribution policy and the way to achieve the goal of socializing the income of the «upper 10%» and using it to support social groups that need help to kick-start economic activity is taxation of real estate and luxury – the tax basis for local and state budgets.</p> <p>It is necessary to declare the principle of free housing for people on the lowest incomes, free land plots, and other social guarantees.</p> <p>State guarantees should be expanded to the other social, scientific and technological spheres: a fixed share of GDP must be reserved for education, medical care and science</p>
4	Failures of the voucher privatization schemes	<p>One of the strategic goals for the breakthrough is to correct the distortions that occurred as a result of the voucher privatization scheme.</p> <p>The essence of the current situation is as follows: economic power is being redistributed with the help of political power; political problems are being solved by alienating «tasty morsels» of public property.</p> <p>The solution is:  it should be not allowed government to lose its status;  it must be avoided governmental loss of the right to control the activities of corporate enterprises and to share their profits;  existing rights obtained through privatization should be retained by persons and companies</p>

5	Failures of the system of state property	It is necessary to perform a transition to the new system of state property with the major elements as follows: securing, through the Constitution, a significant part of the nation's natural resources in the ownership of society; open competitive market regulations should apply to the management of state property; a national dividend – part of the income of entrepreneurs and all rent from commercial use of national property – must be used as the main source of revenue for the social guarantees fund
6	The paradox of taxation on wages	The solution of the paradox of getting up to 70% of all taxes at the expense of the labor as the mostly abused factor of production is a shift of the tax burden from the wages onto rent
7	Problems of socialization of rent as the basis for constitutional development of society and of the state	Society must be declared to be the highest legal entity that owns territorial and natural resources. Using rent as the source of public revenue can be the material realization of the highest rights of society to territorial and natural resources

Source: (Yerznkryan, 2016, pp. 94-95) adapted according to (Lvov, 2001, pp. 48-55).

A systemic approach to strategizing and economizing, or simply synergizing, is given *inter alia* in (Lvov, 1995) where an attempt to catch the real problems of Russian post-reform economy to learn to assess the country's possibilities realistically, and to give the scientific grounding for designing and realizing the adequate future-oriented transformation of the Russian socioeconomic system is done (see Table 2).

Table 2

***Reforms from the Viewpoint of Modern Science***

	Aspects	Explanation
1	Social orientation	The thesis of the archaic character of the state and its discrepancy with market economy conditions can hardly be accepted for the sole reason that this system was introduced in the countries with the highly developed market economy

	Aspects	Explanation
2	Social and psychological factors	The psychological aspect plays a fundamental role in the complex of measures aimed at overcoming the crisis. Not only the national economy and political institutions must be reconstructed, but also the people's subjective attitude towards the reality
3	Correlation of old and new structures	There are many aspects of co-operation of the new and old economic structures
4	Openness of economy	The thesis of transition to the open economy as such does not evoke objection, however its general concepts do not necessarily mean that all exchanges are usually economically and politically effective and their terms are inessential
5	Privatization	Property is the central question of the economic reforms. However, in the situation of 1990's Russian reforms it could neither be solved nor correctly formulated
6	Inflation	In 1990s Russia, the true vehicle of inflation was not be excessive money demand but the economic behavior of technologically backward and monopolized producers

Source: (Yerznkyan, 2016, p. 96) adapted according to (Lvov, 1995, pp. 9-18).

In the view of Dmitry S. Lvov, synergizing (although he did not use this term), could help "to build an economy reflecting the common interests of the people and their natural endowments, the organizing mechanism for which would be a restructured public interest" (Harrison, 2001, p. 7). This is a significant moment, for social and economic development is possible *inter alia* "only when the public conscience forms the basis of the will of government" (Lvov, 2001, p. 48).

## 6. Conclusion

Strategizing and economizing are interdependent phenomena (concepts) and as such they fulfill two complementary functions: the first transaction function and the second transformation (production) function. From the point of view of some authors, the transaction function of strategy dominates, from the point of view of others leading role belongs the transformation function of economizing. In this paper, we assumed that both functions are strictly complementary, and taking attention just on the one of them has sense only in certain research purposes. In ad-

addressing these two phenomenological concepts with their functions from a systemic perspective, it is important to achieve such fulfillment of the functions that promote synergies. That is why the concept of synergizing is also introduced.

In the paper, we considered also the institutional nature of the strategizing which implies a fundamental reinforcement of the process of strategic planning and management of adequate institutional policies aimed not only at maintaining the normal functioning of established institutions, but also at updating and modernizing them, if necessary.

Besides, strategizing is a dynamic process of targeted changes in the economic system of a certain level, and as such this process intersects with other dynamic processes, in particular, changes in institutional and organizational forms of management and changes due to long-wave dynamics.

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## **GESTION DE LA PERFORMANCE BASÉE SUR DES DONNÉES ÉCONOMÉTRIQUES. PROBLÈMES ACTUELS D'ÉCONOMÉTRIE.**

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*Dans cet article on a examiné le rôle des recherches économétriques dans le système de gestion de la performance et leur valeur pratique. Les conditions historiques préalables de la formation de l'économétrie en tant que science sont décrites, les conceptions différentes de sa position dans le système des sciences et son impact sur les domaines contigus de la connaissance sont exposées, des exemples de recherche et leur importance pratique pour l'économie sont présentés, les méthodes des recherches économétriques en économie sont indiquées. L'article met l'accent sur la question de la fiabilité des données primaires conformément auxquelles l'analyse économétrique est effectuée.*

*Mots - clés: économétrie, recherches économétriques, méthodes de recherche, méthodes d'évaluation, gouvernance d'entreprise, administration publique, information, économie souterraine, comptabilité.*

Dans le cadre du concept de gestion de la performance appliqué à l'administration publique et à la gouvernance d'entreprise, il est souvent nécessaire d'utiliser des données quantitatives différentes. Grâce à ces données, il est possible de gérer de manière la plus efficace, car les connaissances des tendances différentes et des principes de fonctionnement de la société permettent de créer une vision la plus globale du monde. Une caractéristique spécifique de l'activité du gestionnaire est un travail dans des conditions d'incomplétude des données initiales et de manque d'information. Cependant, il existe une science qui, dans une certaine mesure, peut combler cette lacune et faciliter considérablement les activi-

tés de gestion dans un monde en rapide évolution. L'économétrie est une des sciences essentielles ciblées à la quantification et l'évaluation qualitative des processus économiques. L'aspect principal de l'économétrie est l'analyse de telle information, qui exige des méthodes spéciales. Notamment, l'identification des principes de fonctionnement est un des objectifs principaux de l'économétrie. L'histoire de l'origine de cette science est aussi intéressante.

Ainsi que la conception de gestion de la performance, l'économétrie a parcouru un chemin particulier de la formation et du détachement dans un domaine indépendant des connaissances. W. Petty, G. King, C. Davenant au XVII<sup>e</sup> siècle. ont fait les premières tentatives des recherches quantitatives en économie, ils appliquaient systématiquement des chiffres et des faits dans leurs recherches, en particulier dans le calcul du revenu national. Ce qui a incité intensément le développement de la science basée sur des données quantitatives différentes de l'économie. Le point de départ de la formation de la science de l'économétrie a été la tentative de I. Fisher de fonder un groupe des scientifiques en 1912 qui s'occuperaient du développement de la théorie économique liée aux mathématiques et aux statistiques. Cependant, cette tentative a échoué, mais n'a pas disparu sans laisser de trace, puisque déjà en 1930, à l'initiative de I. Fisher et des certains autres scientifiques, une société économétrique a été créée, et I. Frisher a donné le nom «économétrie» à cette science.[1]

En 1933, I. Fricher a fondé la revue "Econometrica". Il y a donné telle définition à cette science: «l'Économétrie n'est pas la même chose que les statistiques économiques. Elle n'est pas identique à ce que nous appelons la théorie économique, bien qu'une grande partie de cette théorie soit quantitative. L'économétrie n'est pas un synonyme de l'application des mathématiques à l'économie. L'expérience montre que chacun des trois points de départ – statistiques, théorie économique et mathématiques – est une condition nécessaire, mais pas suffisante, pour comprendre les relations quantitatives dans la vie économique contemporaine. C'est l'unité des trois composantes. Et cette unité forme l'économétrie.»[2]

En résumant la définition ci – dessus, on peut donner la définition suivante à l'économétrie: «l'Économétrie est une science qui donne une expression quantitative des relations entre les phénomènes et les processus économiques». Cependant, ce n'est pas une seule définition de l'économétrie. Par Exemple, E. Malinvaud a défini comme ça: "l'Économétrie est toute application des mathématiques ou des méthodes statistiques à l'étude des phénomènes économiques "[3]

Le débat entre Tinbergen et Keynes sur la méthode économétrique de la recherche présente un intérêt particulier dans l'histoire du développement de l'économétrie pendant sa formation. Dans un de ses articles célèbres, Keynes a écrit ces mots à propos de Tinbergen: «il préfère les labyrinthes de l'arithmétique aux labyrinthes de la logique.» Au sens figuré, il a comparé l'analyse économétrique à des puzzles pour enfants, dans lesquels il faut écrire notre âge " multiplier par quelque chose, ajouter encore quelque chose, déduire et finalement obtenir le nombre de la Bête de l'Apocalypse de Jean "[4]

Ainsi, Keynes a critiqué cette méthode de recherches, les reconnaissant comme inutiles et illogiques. En effet, à première vue, la multitude des calculs économétriques effectués pendant l'étude d'un phénomène avec un certain nombre des caractéristiques observées peut sembler une séquence incohérente des calculs, et le résultat obtenu à la fin n'est qu'une conséquence de ces actions, ne possédant aucune valeur significative. Néanmoins, le résultat dans plusieurs cas dépend du chercheur lui-même, qui choisit certains caractéristiques qui affectent le phénomène observé. Le critère de sélection n'est pas précisément défini, mais plutôt logique, il n'est pas donc certain que des autres facteurs soient négligé.

Mais Tinbergen a réfuté cette critique et a écrit que «les variables explicatives irrelevantes peuvent être interprétées comme des résidus aléatoires non corrélés systématiquement avec d'autres variables explicatives. Si la forme mathématique de la relation est donnée, il est possible de présenter certaines données sur les distributions probabilistes des résidus.» Il a également formulé que les facteurs explicatifs peuvent être mesurés et que l'indépendance des résidus peut être vérifiée ultérieurement lors de l'étude de leur autocorrélation. D'une manière ou d'une autre, le chercheur se souvient toujours des limites de la méthode et vérifie constamment la validité des données. [[5]. Il est impossible de ne pas accepter cette opinion, car il existe tout un système des méthodes prouvées pour vérifier l'étude en cours, ainsi que l'admissibilité de cette hypothèse. De plus, l'évaluation est effectuée de manière intégrée, c'est-à-dire de tous les côtés et à toutes les étapes. Les méthodes d'évaluation comprennent:

- coefficient de corrélation indiquant le degré de proximité des facteurs;
- coefficients de régression et d'élasticité - indicateurs de force de liaison;
- coefficient de détermination caractérisant la fraction de variance;
- évaluation de la signification des paramètres Fisher et Student.

En fait, cela ne concerne que la partie de la recherche elle-même, dont l'économiste est responsable. Mais il dépend fort des données initiales

obtenues auprès des personnes ou des organisations compétentes. Par exemple, les organismes de statistique qui recueillent et publient des informations quantitatives et qualitatives primaires.

Parfois, l'économiste suit aveuglément ces données, car il ne dispose pas des outils nécessaires pour la collecte de l'information nécessaire. C'est là l'un des dangers principaux de la recherche économétrique.

À ce jour, l'économétrie détermine en grande partie les directions du développement de certaines branches de l'économie. Les résultats économétriques constituent la base de la stratégie générale et ont donc une grande importance pour tout le développement, y compris dans le domaine de la gestion de la performance, tant au niveau de gouvernement qu'au niveau des entreprises. Le livre «Mobilité et stabilité sur le marché du travail russe» rapporte les résultats d'une étude utilisant la méthode des moindres carrés. Les auteurs ont conclu que dans le secteur privé, le salaire des travailleurs après 10 ans de travail continue pour le même employeur était à 20% plus que de ceux qui avaient moins d'un an de travail dans la même entreprise. Dans le secteur public, l'indicateur est encore plus élevé. [6]

Ça suggère la nécessité d'une politique compétente de l'état et des entreprises privées pour prévenir la haute fuite du personnel, car ce facteur affecte considérablement le développement des structures commerciales dans le pays et de l'état en général.

L'utilisation de diverses méthodes permet de résoudre les problèmes à noter:

- prévision;
- vérification des hypothèses;
- évaluation;
- prise de décisions;
- description des données (et leur homogénéisation);
- classification des objets et des caractéristiques;
- restauration des dépendances.

Des processus nombreux de l'économie se déroulent dans le temps, c'est pour cela une grande attention est accordée à l'analyse et à la prévision des séries chronologiques. Ceci est d'une importance considérable en raison de l'instabilité de la conjoncture du marché.[7]

Les méthodes économétriques c'est un outil efficace dans le travail du gestionnaire, dont la compétence consiste à résoudre certains problèmes dans le domaine de l'analyse des données statistiques et de la construction des modèles de processus économiques.

Par exemple, la réalisation d'un ensemble des modèles économétriques des processus dans le domaine de la production afin d'évaluer les résultats des impacts de gestion, qui comprend un système d'équations décrivant la dynamique des processus de production dans l'économie et l'influence de facteurs divers, y compris de la gestion, et un bloc d'évaluations d'experts.

Les méthodes économétriques sont utilisées fort dans l'analyse de la dynamique des prix et du niveau de vie. Ils sont appliqués à la fois au niveau macro et au niveau micro. Par exemple, dans le système d'analyse de la dynamique des prix les méthodes à noter sont appliquées:

- méthode des indicateurs spécifiques;
- méthode d'analyse de régression;
- méthode de score;
- méthode d'agrégation.

Grâce à elles, il est possible de prévoir le prix possible d'un produit particulier, la direction des mouvements des prix et l'évaluation des processus différents liés aux prix. Après la collecte des données appropriées, il est possible de prendre les décisions de gestion les plus efficaces.

Ce type des recherches permet non seulement de gérer d'une manière effective les processus économiques, mais aussi de stimuler le développement des sciences contigues.

«La science économique contemporaine se base sur les sciences qui composent la "pierre angulaire": la macroéconomie, la microéconomie et l'économétrie", d'après l'académicien Makarov.[8]

Cependant, ces possibilités de cette science sont loin d'être illimitées, malgré les tendances positives dans le développement de cette science et son effet bénéfique sur le système de gestion de la performance, il existe des problèmes qui faussent considérablement les résultats, qui affectent d'une manière significative la gestion de certains processus et ont donc un effet indéniable sur le développement de l'économie. Cependant, ils se trouvent dans le caractère spécifique des phénomènes économiques eux-mêmes. Certains d'eux sont difficiles à prévenir.

Les défis essentiels de la recherche économétrique et de la prise de décisions de gestion sont:

1) *Caractéristiques latentes*. L'économie souterraine est un exemple frappant d'activité latente, caractérisée par la dissimulation d'un certain nombre des données, qui représentent une grande partie du volume total, ce qui affecte de nombreux secteurs de la vie publique. Le résultat le plus évident est le sous-financement du budget, qui affecte les domaines de la sécurité sociale et du bien-être social. Mais le facteur le plus impor-

tant est le manque des connaissances de statistique, qui ne disposent pas d'information nécessaire pour la meilleure gestion possible. De plus, l'absence de contrôle des activités souterraines des organisations conduit aux changements inexplicables dans les indicateurs de l'activité des autres organisations, ce qui, à tort, peut être considéré comme l'effet des autres facteurs entravant le processus de sélection. L'ampleur de cette influence peut être jugée suite aux données récentes de Forbes: «l'économie souterraine en Russie représente près de 20% du PIB du pays, son volume en 2018 s'élevait à 20,7 billions de roubles». [9]. [Source électronique: <https://www.forbes.ru/biznes/372659-tenevaya-ekonomika-v-rossii-sostavila-20-vvp-strany> / date d'appel 18.04.2020.

2) *Facteur d'incertitude*. En économie, tous les processus sont interdépendants, mais ces liens ne peuvent être ni exacts ni sans ambiguïté. Ils comprennent une composante aléatoire, ce qui provoque un facteur d'incertitude.

3) *Science inexacte*. Comme vous le savez, l'économie est considérée comme une science "inexacte", car toute mesure comporte un part d'erreur, ce qui conduit parfois à des conclusions complètement illogiques, à la suite de l'influence d'un facteur non comptabilisé.

4) *Caractéristiques des objets socio-économiques*. La caractéristique essentielle des objets socio-économiques dans le cadre de la sphère à l'étude est la non-additivité et l'hétérogénéité de leurs caractéristiques. En effet, dans cet environnement, il est difficile de parler des normes uniques pour les objets d'observation et de la possibilité d'identifier les relations empiriques entre eux.

5) *Inexactitude des données statistiques et comptables*. Peut-être le seul problème qui est facile à prévenir, s'il se résume à des erreurs de calcul et d'enregistrement des processus économiques. Cependant, si le problème consiste une erreur des documents primaires, il convient de considérer que le danger se situe beaucoup plus profond.

Il s'agit peut-être d'une liste incomplète d'obstacles de la réalisation d'un travail d'analyse fiable, et notre objectif est de les éliminer, sinon incomplètement, du moins partiellement. La mise en œuvre de ces activités contribuera à renforcer les capacités tant des activités scientifiques que de la gestion, en particulier de la gestion de la performance.

Ainsi, nous avons fait des conclusions à noter:

- l'importance du rôle de l'économétrie dans le système scientifique moderne et le système de gestion;
- les valeurs des résultats de l'application des méthodes économétriques pour résoudre les problèmes de l'économie;

- la nécessité pour le chercheur de disposer d'information initiale fiable;
- l'existence des effets négatifs indirects de l'économie souterraine sur le développement des systèmes;

Il est particulièrement important de trouver des moyens d'encourager les systèmes économiques à la présentation de l'information réelle sur les processus en cours et leurs résultats, ce qui permet d'améliorer la mise en œuvre des programmes et projets publics et privés.

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## PROBLEMATIC ISSUES OF THE CORPORATE AGREEMENT

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*Legal rules governing corporate relations have appeared in the civil legislation of the Russian Federation since the adoption of Federal Law of May 5, 2014 № 99-ФЗ "On Amendments to Chapter 4 of Part One of the Civil Code of the Russian Federation and on the invalidation of certain provisions of legislative acts of the Russian Federation". The specified law included in the Civil Code of the Russian Federation (CC RF) the norms defining the concept of a corporate legal entity and their list (Art. 65.1 CC RF); information reflected in the decision on the voting results of the founders on the establishment of a corporate legal entity (Art. 50.1 CC RF); corporate reorganization procedure (Art. 60.2 CC RF); rights and obligations of participants in a corporation (Art. 65.2 CC RF); corporate governance (Art. 65.3 CC RF); requirements for a corporate agreement (an agreement on the exercise of the rights of participants in a limited liability company, a shareholder agreement) (Art. 67.2 CC RF), etc.*

*For a number of these legal institutes, a controversy has developed in the literature caused by inaccuracies made by the legislator in the regulation of relevant corporate relations, including with regard to the institution of a corporate contract. In the latter case, the discussion centered around the legal nature of the corporate contract, its legal force, subjects and object.*

*Regarding the legal nature of this agreement, a controversy is surrounding the question of whether the corporate agreement falls exclusively under civil law regulation or does not fall, and if it does not, then what branch of law does?*

*Disputes about the legal force of a corporate agreement are caused by the fact that corporate relations are regulated by the charter of a business company along with this agreement, and the current legislation does not give a clear answer to the question of which of these documents should determine the basic (main) rights and obligations of the corporation participants [ 2, p. 2-6], [3, p. 4-6].*

*To the subjects of the corporate agreement, a number of authors, in addition to the participants in a business company, consider it possible to include other persons, including the company itself, which causes objections of their opponents [5, p. 35], [20, p. 34-38], [16, p. 54].*

*The discussion is also being conducted regarding the subject of the corporate contract. Some authors insist that only those provisions (actions) that are listed in the law should be considered as such [10, p. 26], [14, p. 14], others are inclined to believe that the subject of a corporate agreement is not only the provisions reflected in laws, but also any other corporate governance issues that are not included in the charter [4, p. 71], [23, p. 7].*

*The authors of this article present their vision of the identified problematic issues and possible solutions, which may be of interest to researchers of corporate relations, business entities and the legislator.*

*Keywords: corporate agreement, charter, business company, subject of the corporate agreement, object of the corporate agreement.*

## **Introduction**

According to Par. 1 of Art. 67.2 CC RF, a corporate agreement recognizes an agreement of participants in a business company on the exercise of their corporate rights, in accordance with which they undertake to exercise these rights in a certain way or to refrain (refuse) from their exercise, including voting in a certain way at a general meeting of participants in a company, to co-ordinate other actions to manage the company, acquire or dispose of shares in its authorized capital (stock) at a certain price or when certain circumstances occur companies or to refrain from the alienation of shares (stocks) until the onset of certain circumstances.

To increase the level of legal regulation of a corporate contract, it is necessary to determine the accumulated problematic issues that arose in the process of its practical application, analyze the points of view of scientists on how to overcome them, court practice on resolving corporate disputes, and justify the position taken to improve the legislation in this sphere of public relations on this basis to formulate proposals acceptable to the legislator by its adjustment.

**Main part**

Before proceeding to the consideration of the declared topic, we note that in science there are two points of view on the branch of corporate relations. One group of scholars considers these relations a kind of civil law relations and, accordingly, corporate law - a sub-branch of civil law [1, p. 3], [21, p. 7], the other - that corporate relations, arising both within a corporation and outside it, are part of entrepreneurial law [9, p. 43], [13, p. 3].

The positions of scientists regarding the *industry affiliation of a corporate contract* are used in the argumentation of one or another point of view. The basis of the ongoing debate is the extremely blurred lines of demarcation between the traditional contractual institution and the corporate contract institution. But this, in a fair opinion of E. A. Sukhanov, is not the basis for their mixing, since we are talking about completely different agreements [22, p. 53]. In defense of the opinion of E. A. Sukhanov, one can draw an analogy with family law. The Family Code of the Russian Federation (FC RF) provides for the possibility of concluding a prenuptial agreement (Art. 40 FC RF) and an agreement on the payment of alimony (Art. 99 FC RF). The general provisions of the law of obligations apply to these types of transactions, but this, by no means, turns family legal relations into a form of contractual, and family law - into part of contractual law.

A. P. Sergeev taking a different view on the problem under consideration, believes that corporate relations can be regulated on the usual "contractual basis" and that a corporate agreement is one of the agreements of obligation law, and the resulting corporate relations are a kind of contractual relationship [21, p. 7]. The specified author, however, is forced to admit that "the freedom of shareholders in resolving issues of the company's activities on the basis of mutual agreements is not unlimited" [21, p. 10]. By agreement they can only regulate relations associated with participation in corporate organizations of a certain type (joint-stock companies and limited liability companies), as well as with their management (Art. 2 CC RF); the terms of a corporate agreement can only detail the provisions of the articles of association and the founding agreement.

We also pay attention to the following. Paragraph 3 Art. 307.1 CC RF states that the general provisions on obligations apply to corporate relations only if it is not otherwise established by the Civil Code of the Russian Federation, other laws or does not follow from the essence of these relations. The cited legislative disclaimer confirms the specific nature of corporate relations, which in some cases may not be regulated by general provisions on obligations. So, for example, obligations under a corpo-

rate agreement cannot be fulfilled by attracting any third party, here it is impossible to change the persons in the obligation, you cannot force a participant to fulfill an obligation under a corporate agreement after the termination of his corporate rights, succession does not arise in the corporate agreement [6]. These features of the corporate contract indicate a special, peculiar nature of the emerging relationship, which does not fully fit into the usual (traditional) contractual-legal relations of private law.

In our opinion, a corporate agreement, although it is an obligation, but a specific obligation, having a special object - the exercise of corporate rights outside the scope of the law of obligations, and a special method of regulation, consisting in the fact that participants in a business company, guided by the principle of freedom of contract, establish for themselves imperative requirements regarding their behavior in the event of pre-agreed cases (to vote in concert on certain issues submitted to the general collection, acquire or dispose of shares (stakes in the authorized capital) at a fixed price, to refrain from the alienation of securities (shares) to the occurrence of certain circumstances, etc.).

By implementing the obligations undertaken in practice, the parties to the corporate contract influence the formation of the will of the corporation, which is an independent subject of law, which is not typical for civil regulation and civil circulation, where independent entities operate and therefore participation in the formation of the will of the counterparty is excluded. It is the organizational and managerial aspect that makes it possible to distinguish corporate legal relations from the list of "purely" civil law relations based on self-sufficiency and independence of counterparties. This, however, does not mean a complete breakdown of the corporate contract with civil law regulation, since the parties concluded it not under duress, but voluntarily.

It should also be noted that the corporate contract aims not only to ensure the interests of the parties to the contract, but also the interests of third parties, for example, the creditors of the company, persons wishing to join the company, as well as the interests of the company itself, in the effective functioning of which the parties to the corporate contract are not interested less than all its other members. Accordingly, a corporate contract can be defined as a specific civil contract governing the exercise of corporate rights of participants in a business company in the interests of ensuring their property interests, property interests of third parties and society as a whole.

Being in its legal essence a specific civil law contract, a corporate contract can nevertheless be considered a business law contract, since the

latter as a complex industry includes the norms of civil, financial, labor, environmental, administrative, criminal and other branches of law. We can also say that the corporate contract is an institution of emerging corporate law as an independent complex branch of law, as evidenced by the extensive legislative framework governing the activities of corporate legal entities, and judicial practice for the consideration of corporate disputes [17, 18, 19].

Concerning the *legal force of the charter of a business company and a corporate contract*, the opinions of scientists also differ, which is facilitated by the wording of Par. 7 Art. 67.2 CC RF, establishing that the parties to a corporate contract are not entitled to invoke its invalidity in connection with its contradiction with the provisions of the charter of a business company. This norm can also be understood in such a way that provisions that contradict the charter can be included in a corporate agreement. At the same time, it will retain its force, and therefore the possibility of judicial protection, including in part that contradicts the charter.

In our opinion, it is necessary to proceed from the predominance of the charter before the corporate agreement. We find the relevant standards in the current legislation. So, in accordance with Art. 11 of the Federal Law of December 26, 1995 № 208-ФЗ "On Joint-Stock Companies" (as amended on 04.11.2019) (Law on JSC) and Art. 12 of the Federal Law of February 8, 1998 № 14-ФЗ "On Limited Liability Companies" (as amended on 04.11.2019) (Law on LLC), the charter is a constituent document of the company, the requirements of the charter are binding on all bodies of the company and its participants. The charter defines the rights and obligations of participants, the structure and competence of the company's management bodies, the procedure for making decisions and other issues, without the settlement of which neither the creation nor the subsequent activities of the company are possible.

We add to this that the charter has a public regulatory nature and is required to be presented upon registration of the company (Art. 12 of the Federal Law of August 8, 2001 № 129-ФЗ "On state registration of legal entities and individual entrepreneurs" (as amended by 12.11.2019). An interested person can receive a copy of the charter of any company at any time, for example, for a detailed study of his legal personality (Par. 4 Art. 11 of the Law on JSC and Par. 3 Art. 12 of the Law on LLC) Corporate agreements are confidential, the public domain receives only information about the fact of concluding such an agreement, but not about its internal content (Par. 4 Art. 67.2 CC RF).

It seems that the terms of the corporate agreement cannot contradict the provisions of the charter, otherwise they will be declared null and void by court order. And such a practice is known [17]. In this regard, it is necessary to eliminate the legal conflict caused by the wording of Art. 67.2 CC RF, since its preservation is fraught with serious consequences for the stability of a business company in the case when some of its members who are not parties to the corporate agreement will follow the requirements of the charter, while others that are parties to the corporate agreement will follow the requirements of the corporate agreement.

Let us turn to the problem of the subjects of a corporate contract. In most cases, the current participants in the corporation are recognized as such [11, p. 143-149], [15, p. nine]. However, in corporate legislation there is no prohibition on concluding a corporate agreement with future participants of the corporation, but in this case the corresponding agreement is unlikely to be considered corporate since within the meaning of Art. 62.7 CC RF The status of a member of a corporation to participate in a corporate contract is strictly mandatory.

In addition to members of the corporation, the trustee and the nominal holder of securities (shares) may also be the subject of a corporate agreement. Carrying out fiduciary management of property (stocks, shares in the authorized capital), the fiduciary is entitled to perform any legal and actual actions in relation to this property in accordance with the fiduciary agreement (Art. 1012 CC RF). Nominee holder of securities (in this case shares) in accordance with Par. 4 Art. 8.3 of the Federal Law of April 22, 1996 № 39-ФЗ "On the Securities Market" (as amended on 3.07.2019) has the right to take actions related to the exercise of rights to the relevant securities without a power of attorney, according to instructions received from the owner such securities. Consequently, both the trustee and the nominal holder, taking into account the specifics of the rights they acquired for securities (share), can be parties to a corporate agreement [12, p. 27], [8, p. 20]. This conclusion is confirmed in judicial practice [18], [19] and should be reflected in Art. 67.2 CC RF on a corporate contract.

Any other third parties, in addition to the above, cannot be parties to the corporate agreement. Such persons, for example, creditors of a company, according to Par. 9 Art. 67.2 CC RF, has the right to conclude another contract with participants in a business company, under which the latter, in order to ensure their protected interests, can undertake obligations to exercise their corporate rights in a certain way or to refrain from their implementation. At the same time, by virtue of a direct indication of the law, the rules on the corporate contract apply to this contract.

A certain interesting question arises as to whether a business company itself can be a subject of a corporate agreement? Some authors answer this question in the affirmative [5, p. 35], [20, p. 34-38], [16. p. 54].

In our opinion, a business company cannot be a subject of a corporate agreement. This conclusion follows from an analysis of Par. 1 Art. 67.2 CC RF, indicating that a corporate contract is concluded by its participants or some of them. If we allow the possibility of participation in the corporate agreement of a business company, then through its representative it will vote in accordance with the instructions of its bodies, determine their structure and competence, which contradicts the meaning of Par. 2 of the same article. Clause 4 Art. 67.2 CC RF requires notifying the company of the fact of concluding a corporate contract, but does not require disclosing its contents. Obviously, the presence of a company in the number of participants in a corporate agreement nullifies the value of this norm.

Thus, the subject of a corporate contract can only be participants in a business company, a trustee and a nominal holder of shares (shares).

Consider *the object of the corporate contract*, which also differs in certain specifics. It has already been indicated above that, according to Par. 1 Art. 67.2 CC RF, the contents of this agreement include the obligations of the parties to exercise their rights in a certain way or to refrain (refuse) from their implementation. These obligations are the subject of a corporate contract. The law specifically sets out obligations such as voting in a certain way at a general meeting; to co-ordinate other actions to manage the company; to acquire or dispose of shares in the authorized capital (shares) at a certain price or upon the occurrence of certain circumstances, or to refrain from the alienation of securities (shares) until the onset of certain circumstances.

Listing the obligations included in the object of the corporate agreement, the legislator uses the wording “including”, which makes it possible to supplement it with other obligations, which the special legislation does. So, Par. 3 Art. 8 of the LLC Act and Par. 1 Art. 32.1 of the Law on JSC speak of the right to carry out coordinated and other actions related to the creation, activities, reorganization and liquidation of a company.

In our opinion, the subject of a corporate contract can be any action if they do not violate the rights and legitimate interests of third parties, as well as the rights of the company itself. In this case, the object of the corporate agreement should be distinguished from additional rights that may be provided for in the charter of the company at its establishment [7, p. 22]. If such rights are spelled out in the charter, then there are no obstacles to detailing them in the corporate agreement. But this does not

apply to cases when additional rights are granted to specific participants by decision of the general meeting, since the main function of the corporate agreement is to coordinate the actions of the company participants in the optimal exercise of corporate rights together, while the institution of additional rights seeks to supplement (replenish) the rights stipulated by corporate law.

### **Conclusion**

The study allows us to draw the following conclusion: a corporate contract is a special, specific, type of civil law contract that differs from other private law contracts by its specific goals, subject, method of regulation and composition of participants. This gives grounds to consider the corporate contract one of the central institutions of emerging corporate law and at the same time one of the main sources of corporate regulation.

To strengthen the legal basis of the corporate contract, it is necessary to indicate in Art. 67.2 CC RF for mandatory compliance of a corporate agreement with the charter of a business company; to participate in it only members of the company, trustee and nominal holder of securities (shares); to reflect in it any actions relating to participation in the management of the company that do not violate the rights and legitimate interests of third parties, as well as the rights of the company itself.

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## TRUST SERVICES IN THE DIGITAL "KNOWLEDGE SPACE": LEGAL FUNCTIONS, RISKS AND RESPONSIBILITIES<sup>1</sup>

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*The paper deals with legal issues of establishment of trust between participants of electronic interaction in the "knowledge spaces" covering the sphere of education, research and innovation, in integration associations of States (the EU and the EAEU). The necessary condition for the development of the "knowledge space" in the digital environment - security and legal certainty of digital interaction - are highlighted. Legal recognition mechanisms related to identity management and trust services are analyzed. The necessity of creating a legal basis for a cross-border «environment of trust» in the form of an international agreement, as well as relevant national legislation, is indicated.*

*Key words: sustainable development, education, research, innovation, knowledge spaces, environment of trust, integration associations of States, trust services, identity management, regulatory and technical conditions of trust, legal basis for a transboundary environment of trust*

Over the past decades, there has been a process of promotion of universal access to knowledge in the digital space, including in the areas of education, research and innovation. In UNESCO recommendations digital space (or cyberspace) refers to the virtual world of digital or electronic communication associated with the global information infrastructure. Individuals and organizations are encouraged to have access to the information infrastructure (in particular, the Internet) and to the information and knowledge necessary for the development of society and the individual. The use of information and communication technologies to create new

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knowledge in all fields of science, to publish research results in digital format, and to modernize research management methods attracts the attention of the academic community, governments, civil society organizations, and private businesses.

In line with the goals of sustainable development, UN member States and international organizations are tasked with implementing information and communication technologies and global connectivity, and ultimately with bridging the digital divide and creating a knowledge-based society.

Special attention is paid to the facilitation of access to networks and services of public and educational institutions, schools, academic institutions, museums, archives and libraries. States are encouraged to improve systems for storing and digitizing information and knowledge in the public domain, thereby creating an educational and scientific environment that encourages creativity and audience growth.

In integration associations of States, such as the EU and the EAEU, the fundamental legal documents regulating the formation of "digital spaces" - digital agendas-have been approved. They apply universal, harmonized legal approaches to innovative digital development, which are followed by States within the framework of integration associations. A universal legal approach is to provide legislative support for research and innovation and create the best legal conditions for them. The use of information and communication technologies is considered by the legislators as the basis of modern innovative systems [5, c.163-167].

In 2009, the Eurasian Union adopted the "Concept of creating the Eurasian innovation system", which is a set of institutions that ensure the formation of infrastructure elements, norms and rules for regulating interstate relations in the field of innovation. The Eurasian innovation system is based on the basic principles of the state policy of the EAEU members: support and promotion of innovation; development of national innovation systems; coordination and cooperation in the development and implementation of interstate targeted programs and innovative projects [1, c.95-101]. The strategic document "Main directions of implementation of the digital agenda of the EAEU until 2025" defines the principles, tasks and mechanisms of cooperation between the member States on the digital agenda and the formation of a single digital space of the Union, which integrates information resources, as well as a set of digital infrastructures, digital processes and means of digital interaction.

In the European Union, the best conditions for research and innovation are formed starting from the process of designing policy decisions, strategies and regulations. When the European Commission develops new leg-

islative initiatives, their impact on innovation must be taken into account. The impact of new technologies on regulation in the EU is also subject to scrutiny at the early stages of the legislative process. Examples are artificial intelligence or blockchain, under the influence of which changes in legislation are planned. This practice allows Europe to have a favorable, "friendly" legislation for research and innovation ("Research and Innovation friendly regulation»).

This legal approach is used in the development of the Implementation Roadmap for the European Open Science Cloud (EOSC), adopted on 14 March 2018. The EOSC Strategic Implementation Plan (July 2019) presents the activities that will contribute to the implementation of the EOSC for the period 2019-2020. The European cloud initiative is based on the strategy of the digital single market and involves the formation of a trusted, open environment for the scientific community in order to obtain, exchange and reuse scientific results, create collective scientific knowledge and manage scientific research in the EU countries.

Creating the best legal conditions for the functioning of the digital "knowledge space" means that legal regulation should meet the public interest on a par with the level of technology development, and perform a legal function primarily to enhance the security and legal certainty of digital interaction. In this regard, at the global level, as well as within the framework of economic integration associations and in member States, the fundamental legal task is to develop legal mechanisms of trust in the digital environment. The legal mechanism of trust, along with the management of security and privacy risks, are key elements necessary for economic and social development in the context of digital transformation. The legal basis of the innovation strategy in both the EU and the EAEU includes regulation that supports the formation of a trusted environment for education, science and innovation. The UN Commission on international trade law (UNCITRAL) also emphasizes that by building trust in the online space, such a legal framework is a factor contributing to the achievement of sustainable development goals in the field of innovations.

To strengthen this factor, a uniform system of rules is required, starting with the terms and definitions. In this regard, the integration associations of States have developed and enshrined in legal documents such terms as: "trusted third party", "trust services", as well as the general concept of "environment of trust", which is designed to be both domestic and cross-border. In the Eurasian Union on the basis of the Treaty on the EAEU (Protocol on information and communication technologies and information interaction within the framework of the EAEU) provides for the formation

of a "cross-border environment of trust" in order to inform integration processes in all areas affecting the functioning of the Union. A cross-border " environment of trust "bis defined as" a set of legal, organizational and technical conditions agreed upon by member States in order to ensure confidence in the inter-state exchange of data and electronic documents". Recognition of foreign and international legal structures of trust services is facilitated by the existence of legal conditions for such recognition in the domestic law of States. For example, the Russian law "On Electronic Signatures" For example, the Russian law " On Electronic Signatures " provides rules for recognizing electronic signatures created in accordance with the law of a foreign state and international standards. In legal relations regulated by Russian law, such recognition is carried out in accordance with international agreements of the Russian Federation. Confirmation of compliance of electronic signatures with the requirements of international agreements can also be made by an accredited trusted third party authorized by an international agreement of the Russian Federation.

Cross-border recognition benefits from the existence of a domestic legal framework based on general principles or identical provisions. For these reasons, UNCITRAL is developing a legal framework for trust in the form of an international agreement, as well as model legislation.

The basic legal component of trust is the legal structure for identifying and authenticating participants in online digital interaction. "Electronic identification" refers to the procedure for using identification data in electronic form that uniquely represents a natural or legal person, or an individual representing a legal person. In turn, "authentication" means a process that allows the electronic identification of an individual or legal entity, or confirmation of the origin and integrity of data in electronic form.

The legal role of identification and authentication is recognized in both national and international law. The importance of identity is acknowledged in Sustainable Development Goal 16, target 9 of which calls for the provision of legal identity for all human beings. In the digital economy, this becomes the right to a digital identity.

Identification is required to perform various legal tasks in the electronic environment. Identification may be required for regulatory compliance, to establish the validity of a commercial document and to comply with contractual obligations. Russian Federal law of July 27, 2006 "On information, information technologies and information protection" regulates the use of information technologies for the purpose of identifying citizens of the Russian Federation. The law established the concept of the unified identification and authentication system (USIA), a Federal state information system

that provides authorized access to information contained in information systems. The procedure for registering a citizen of the Russian Federation in the unified identification and authentication system, including the composition of the information required for registration, the procedure and terms for verifying and updating information posted in the USIA using state information systems, are established by the Government of the Russian Federation. The Russian legislation on electronic signature stipulates the obligation of an accredited certification center to establish the identity of an individual who applied to it for a qualified electronic signature certificate, as well as to send information about the person who received a qualified certificate to the USIA .

Provisions governing electronic identification issues are contained in the Regulation (EU) No. 910/2014 of the European Parliament and of the Council of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market and repealing Directive 1999/93/EC (eIDAS regulation). One of the objectives of the Regulation is to remove existing barriers to the cross-border use of electronic identification means used in the Member States to authenticate, for at least public services. The aim of the Regulation is to ensure that for access to cross-border online services offered by Member States, secure electronic identification and authentication is possible. Assurance levels characterize the degree of confidence in electronic identification means in establishing the identity of a person, thus providing assurance that the person claiming a particular identity is in fact the person to which that identity was assigned. The assurance level depends on the degree of confidence that electronic identification means provides in claimed or asserted identity of a person taking into account processes (for example, identity proofing and verification, and authentication), management activities (for example, the entity issuing electronic identification means and the procedure to issue such means) and technical controls implemented.

Reliable identification is required for digital interaction in both the commercial and non-commercial sectors. In the European open science cloud, researchers can access network resources using a single set of login credentials provided and managed by their own institutions. For example, for libraries, this means that a researcher belonging to an institution can use the single sign-on (SSO) mechanism to access electronic resources that the library subscribes to. Users - once they have found the necessary electronic resource (magazine or article in the magazine) and have access to it with their identification data-do not need other identification data when switching to other resources [2]. They can access it from

anywhere and with any device. SSO is available in many universities and research institutes in Europe.

The Regulation will apply in relation to the European initiative on student cards. Every student card holder has the right to identify and register themselves electronically in higher education institutions in Europe when moving abroad for education. Electronic identification eliminates the mandatory on-site registration procedure and paper document flow. In addition, the card will allow students to access online courses and services provided at other higher education institutions. This initiative is considered by experts as an essential element of the digital European educational space.

International documents indicate technological and legal relationship between identity management and trust services. A list of trust services may include electronic signatures; electronic seals; electronic timestamps; electronic registered delivery; website authentication; electronic archiving; electronic escrow; and electronic proof of presence. For example, website authentication services allow a website visitor to verify that the website belongs to the correct person. Services related to electronic seals allow you to confirm that a document originates from a specific legal entity, thus providing proof of the origin and authenticity of the document. Services for long-term storage of electronic signatures and seals must guarantee the validity of electronic signatures and electronic seals for a long time and the possibility of their confirmation, regardless of technological changes in the future. Electronic delivery services with confirmation of receipt create a presumption of the integrity of electronic documents, sending such documents by an identified sender, receiving them by an identified recipient, confirming the date and time of sending and receiving.

The legislative acts of the Eurasian Union, including the "Concept of using services and legally binding electronic documents for interstate information interaction", provide for the use of authentication services (trusted services) within the framework of the EAEU.

A system of rules to ensure the security and legal certainty of relationships in the field of identity management and authentication services is fundamental to all electronic transactions. The importance of the appropriate regulatory framework, as well as methodological recommendations for reducing risks and building confidence in the authenticity of interacting parties is noted by both legal scholars and specialists in the field of information technology[3;4].

Relations in the field of identity management and identity services are not free from legal obstacles at both the international and national level. These include: the absence of legal provisions that give legal force

and legal certainty to such relationships; differences in laws and legal approaches to identity management; legal provisions based on specific technological requirements; and regulatory requirements for the submission of paper documents for legal interaction; lack of mechanisms for cross-border legal recognition of identification data and authentication services. Accordingly, it is necessary to develop a set of legal instruments that help overcome these obstacles and create favorable legal conditions for the provision of identity management and trust services. It is advisable to integrate these tools and structures into Russian law when updating information legislation (for example, when developing an information code or an electronic document law). At the international level, it is desirable to develop a legal mechanism for cooperation in ensuring the interoperability and security of identity management and trust services, in particular with regard to technical requirements and assurance levels. The development of international legal approaches and solutions will encourage cross-border interaction between identity management systems and trust services both for commercial and non-commercial uses.

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## FORMING OF SPIRITUAL CULTURE OF STUDENTS IS IN THE SYSTEM OF HIGHER EDUCATION OF KAZAKHSTAN

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*An address to the problem of forming of spiritual-moral values of personality is conditioned the requirements of society, necessity of increase of spiritual-moral potential in sociume, that is one of major terms of intercourse of people, their survival and progress in the modern world. In the article the features of forming of spiritual culture of students open up in the system of higher education of Kazakhstan. With the purpose of determination of the valued preferences of students in different aspects spiritually – moral culture, monitoring was conducted in two institutes of higher Nur-sultan the results of which are presented in this article.*

*Keywords: spirituality, culture, spiritual culture, moral education, common to all mankind values, spiritual values, higher education.*

### Introduction

In the modern world, education creates a mechanism not only for re-laying spiritual and moral culture, but also provides for the inclusion of a person in this process. That is why in many universities of Kazakhstan, concepts and education programs are created that substantiate the need for the priority development of spiritual and moral culture. The creation of a mechanism by which society can prepare young people for the perception of scientific ideas and ensure their implementation and wide dissemination is the prerogative of education, which as a factor in the development of science is a necessary prerequisite for the achievements of society. Modern scientific research on spiritual and moral values is extremely relevant and necessary. They should conceptually absorb all the essentials

about a person, enrich them spiritually, and contribute to the humanization of relations. A new pedagogical trend is being formed in the educational system, based on the idea of the value of the individual, its spirituality, and the priority of universal values. This fact necessitates highly qualified specialists with a rich inner spiritual world and personal qualities. According to the state program for the development of education in the Republic of Kazakhstan for 2016-2019, the main principle of the updated content of education is the creation of a humane educational environment that stimulates the development of moral and spiritual qualities of a person, namely self-knowledge, self-determination and self-realization [1]. It is necessary to achieve a high level of moral and spiritual culture in the system of higher education, in which students will be able to master the basics of the development of universal values.

### **Main part**

The methodological foundations of educating students' spiritual values in higher education are reflected in the works of G.N. Volkov, V. Andrushchenko, L. Gubersky, M. Evtukh, V. Kremen, K.K. Zhampeyisova, S.K. Kaliev, B.I. Mukanova, N.N. Khan and others. The problem of the spiritual development of the personality of the teacher as part of the pedagogical culture is one of the urgent in modern pedagogy and is reflected in the works of D.N. Kinitaeva, Omarova D.K., Masyrova R.R., Moldazhanova N.S., Baubekova G. D., Bekturganova A.S. and others.

Despite the growing interest in the educational process in higher education, which is associated with a change in the paradigm of modern education, the problem of the formation of students' value attitude to professional activities, especially the formation of spiritual culture, is still poorly studied. In the framework of theoretical analysis, it is advisable to consider the concepts of "spirituality", "culture" and "spiritual culture". In modern science, the concept of "spirituality" is more often considered as the result of a person's involvement in universal values and spiritual culture. Spirituality (from the Latin. *Spiritualitas*) - 1) the highest level of development and self-regulation of a mature personality, when the enduring human values become the main guidelines of its life; 2) the orientation of the person to action for the benefit of others, her search for moral absolutes [2]. Culture is the level, degree of development achieved in any branch of knowledge or activity (work culture, speech culture...) - the degree of social and mental development inherent in someone [3].

Spiritual culture is a combination of a person's moral experience in various areas of his activity - in everyday life and social production, labor and leisure, science and art, in the field of human relations with the

natural world, with God and himself. Spiritual culture is formed by the experience of all living and living generations of people. It is she who sets the semantic field of the whole culture in general, being the core of civilization [4].

The phenomenon of “spiritual and moral culture” in the scientific literature is considered in two ways: 1) as a social phenomenon, 2) as a quality of personality. From the structural point of view, the analyzed phenomenon includes three components: 1) spirituality; 2) morality; 3) culture.

Methodological components of the content of spiritual and moral culture are universal values (axiological component); substantial - national psychology (psychological component); applied - knowledge, skills, relationships necessary for life in society. We paid special attention to the study of the significance of the ideas of folk pedagogy, which determines the priority role of spiritual and moral culture in the system of youth education.

Thus, the structure of spiritual - morality includes: needs, knowledge, understanding, aspirations, behavior, that is, the ability to manifest volitional efforts in conditions when a person is faced with spiritual immorality.

The main criteria of spiritual morality are: 1) reason; 2) a responsible act; 3) creative, good-natured activity in the educational space [5, P. 118-119].

Monitoring conducted at S.Seifullin Kazakh Agro-Technical University, University «Turan-Astana», allowed us to determine students' value preferences in various aspects of spiritual and moral culture as an important part of professional culture.

Of the areas of upbringing, students consider to be the most important patriotic upbringing - 27.6%, moral - 23.8%, and legal - 20.4%. The last position is aesthetic education - 3.8%. Teachers have slightly different views. In the first position, they have civic education - 40%, in the second - spiritual and moral - 24%, in the third - patriotic - 22%, in the latter - family, aesthetic. From this we can conclude that both groups of respondents consider the highest priority to be patriotic, spiritual, moral, civil (teachers), legal (students).

The analysis of the questionnaires shows that the answers to the question “What do you think, who is responsible for the spiritual and moral education of the individual?” Are of interest. The opinions of teachers and students differ markedly. For teachers, the responsibility falls mainly on the family (70%), then rests with the person (20%), and then the state and the educational institution, and in equal proportions, 5% each. According to students, the responsibility is primarily borne by the person (41.6%),

then the state (32.8%) and then the family (14.4%), the educational institution (11.2%), respectively. It is noteworthy that every third student notes the positive impact of the state on the formation and development of the spiritual and moral culture of the individual. The value orientations of modern students can be judged by an analysis of the answers to the question "What do you see your purpose after graduation?" So 26.7%, that is, virtually every fourth graduate of the university sees his mission in serving Kazakhstan. 46.2% of respondents, that is, almost half of the respondents, intend to live in accordance with the spiritual and moral traditions of the country, republic, and family. At the same time, only a small number of respondents - 2.4% intend to serve people, the common good, even to the detriment of their interests. 10% seek to live in accordance with religious commandments, that is, every tenth graduate of a university. A significant number of those 13.6% (68 respondents) who want to live a full life without missing entertainment, pleasures, and not giving up the joys of life. An analysis of the results showed that the majority of students - 75% (250 people), the level of methodological knowledge on the development of spiritual and moral culture of the individual is at a high and medium levels. The data of the final questionnaire show that every fourth student is not sufficiently oriented in the theoretical and methodological aspects of the spiritual and moral culture of the individual.

In the course of experimental and pedagogical work, students were actively involved in cognitive and practical activities: they participated in press conferences of three universities (Eurasian National University named after L. Gumilyov, Agrotechnical University named after S. Seifullin, University «Turan-Astana»), round tables, performed creative group and individual work, etc. In the educational process, we used the following non-traditional technologies: - students were involved as co-rapporteurs during lectures, participated in discussions at problem lectures, seminars, participated in express polls, etc. In conducting seminars, emphasis was also placed on maximizing cognitive activation students' activities: discussion, dialogue, analytical, problematic working methods, protection of group projects, game forms (role and business game, telebridges between 3 universities), prospective analysis of pedagogical problems, etc.

The activity of students in the classroom was also ensured by the use of business, personality-oriented games, pedagogical imitation trainings, during the analysis and solution of pedagogical situations, individual-group research classes, etc. An important place in the system of extracurricular educational work with university students is held by pedagogical Olympiads, contests, KVN, etc.

The relatively low increase in the optimal level of the quality being studied is explained by the fact that the process of forming the spiritual and moral culture of a person is complex, multifactorial, and contradictory; it cannot be limited to the framework of only university training. Nevertheless, the obtained data indicate the effectiveness of the proposed methodology, therefore, we have reason to argue that a systematic, focused, consistent training of students, focused on the formation of his spiritual and moral culture, increases the efficiency of this process.

### **Conclusion**

The substantial and functional identification of the concepts of “spirituality” and “morality” and others, as well as the nature of their relationship, allows us to define morality as a way of practical orientation of behavior aimed at the conceptual, internal meaning of things, which is one of the dimensions and external manifestations of human spirituality. Spirituality as a way of human existence, directly related to human values, is the highest quality of the spiritual and moral culture of a person.

The educational space of the university is defined as a unique environment for the development of spiritual and moral culture among students under the following conditions:

- the formation of positive motivation among students for the spiritual and moral heritage of the people in the educational process;
- the active involvement of students in the meaning-creating activity;
- monitoring the study of the degree of influence of educational space on the development of the spiritual and moral culture of students in a multi-ethnic society;
- equal interaction with partners in the cultural and regional community, taking into account national psychology [6].

The results obtained during the experimental work allowed us to formulate the following conclusions:

1. The spiritual and moral culture of a student is formed effectively if the teaching of academic disciplines ensures the focus of their content on the formation of moral and spiritual values of the individual, positive motivation in the acquisition of professional knowledge, skills.

2. The content of basic education should be saturated with information about the spiritual essence of a person, his spiritual and moral ideals, values, guidelines, the need for spiritual and moral self-improvement of a person, the meaning and characteristics of his professional activity consist in constant work on himself.

3. Teachers should be actively involved in inter-university and inter-faculty interaction, ensuring the use of interdisciplinary connections, the in-

tegration of individual disciplines, which most stimulates the development of the spiritual sphere of studying young people, broadens their horizons, deepens theoretical and general cultural training, develops spiritual needs and the desire to meet them .

4. It is necessary to provide conditions for self-realization and creative development of students through the expansion of the field of practical activity: increasing the share of students' practical classes, the active inclusion of students in various forms of educational and extracurricular educational work during the period of practice, etc. This allows you to actualize the process of development of your spiritual world, moral qualities, the formation of the ability to moral reflection, the desire for self-realization in activity.

We see promise as a further study of the mechanisms of the university's relationship with educational partners, the development of conditions for the implementation of the model for the development of spiritual and moral culture of students in various didactic conditions. We believe that it will be of interest to study the problems of the formation of the moral and ecological culture of university students.

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## PLAYING METHOD: LEARNING NEW WORDS USING DICTIONARIES

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*In a foreign language lesson, a special place is occupied by the forms of classes that ensure active participation in the lesson of each learner, stimulate verbal communication, and contribute to the formation of interest and desire to learn a foreign language. These tasks can be solved with the help of playing methods. In the game, the abilities of any person, especially a child, are fully manifested. Being entertainment, relaxation, the game can develop into learning, into creativity, into a model of human relations, if students at the same time speak a foreign language using their vocabulary, the game opens up rich educational opportunities*

*Key words: playing method, lesson, dictionaries, memorize new vocabulary, grammatical skills, critical and creative thinking, worldview*

Enriching learners' vocabulary is a very challenging and actual theme nowadays. Children should learn new words and use them in practice. Therefore, one of the main goals of a teacher of a foreign language is to work on enriching learners' vocabulary: the more words a person knows, the most successful in communication he is. Knowing a lot of words makes possible to write essays, letters, and compositions properly and to talk to people easily without any difficulties.

The system of updated curriculum is oriented on developing four speaking skills: listening, reading, writing and speaking. To master all these skills well learners should have rich vocabulary and well-developed connected speech. In the era of informatization children have to learn to reflect, analyze, compare information, and draw conclusions independently. As a lot of information is in English learners need to know plenty of foreign words.

All unknown words we can find in a dictionary.

Dictionaries play an important role in human life. V.I. Goverdovsky believes that “a dictionary is one of the types of statements about a language in a language” [1].

Dictionaries are great helpers as they contain various and complete information about any language: lexical, phraseological, semantic, phonetic, pragmatic, stylistic. All these features facilitate the study of the English language and help choose the right meaning or translation of any word according to the context.

Dictionaries play an important role in the system of education (at the lesson of the English language), improving general and linguistic culture of people; develop learners' worldview, enriching and developing knowledge of the language.

As we have mentioned above dictionaries and, therefore, learning new words develop learners' worldview and they become educated, as every dictionary reflects the achievements of national culture based on historical experience of many generations. K. Kasares considers that a dictionary contributes to the implementation of the most important function, the function of active speech reproduction [2]. So they help develop monological and dialogical communication.

Dictionaries are not only a reference guide, but also a learning tool. One of the best ways to teach foreign language is to carry out vocabulary work constantly at all stages of a lesson and for learners of all ages.

To make a lesson interesting and to ensure active participation of each learner a teacher should use playing methods. These methods help form knowledge acquisition and desire of learning the English language; stimulate speech communication using topic vocabulary. Games and various activities require critical and creative thinking skills, so such lessons will not be boring at all.

Playing methods have rich educational and psychotherapeutic features. They contain different activities enriching learners' vocabulary, developing grammatical, speaking skills, logical and creative thinking skills. Learners feel comfortable doing these activities, they stop feeling stress when answer the teacher's questions, memorize new words more easily, and the lesson has positive psychological climate.

At each lesson, a teacher can find a place for game forms of learning. Playing methods techniques are very diverse. The main thing is that a game method should be appropriate for this or that lesson; it has to require learning and lesson objectives. Also playing methods should contain activities that are interesting for a particular age group of learners.

Due to the wide variety and communicative orientation playing methods can be held at any stage of learning unknown foreign words. When children get acquainted to new vocabulary, a teacher can prepare simple short exercises that make it easier to remember new words. When children repeat the learnt words, they can take part in role-playing games and game situations, which lead to the main aim of learning — communication between participants (learners).

We have worked out some sets of game activities. Children learn new words at the same time they develop their memory, grammatical and spelling skills, logical and critical thinking, and communication skills.

I. Exercises aimed at memorizing new words:

1) Translation: learners translate the words into Russian:

Antelope_____	Dragonfly_____
Beaver_____	Grasshopper_____
Calf_____	Peacock_____

2) Translation: learners translate the words into English:

Тюлень_____	крыло_____
Жужжать_____	обезьяна_____
Гавкать_____	ящерица_____

3) Anagrams – a teacher writes a very long word on the board, and learners make as many new words as possible.

Grasshopper: grass, hope, rash ...

4) Mix – on the board (or the card) there are a lot of mixed letters, learners find words putting these letters together.

E, a, b, e, v, r - \_\_\_\_\_ (beaver)

O, y, n, k, m, e - \_\_\_\_\_ (monkey)

Y, b, l, f, t, e, r, t, u - \_\_\_\_\_ (butterfly)

5) Letters – there are words with missing letters in them; learners fill in the gaps with the correct letter.

Z...bra, crocod...le, Liza...d, oct...pus, ostri..h

6) Sorting – the given words should be written (pronounced) in the alphabetical order.

Owl, Penguin, Squirrel, Crow, Canary, Oyster

7) Chameleon – learners find mistakes in the words.

Dear, girafe, lamp, oter, mause, pijeon, rinoceros

II. Exercises aimed at developing grammatical skills:

1) There are nouns and verbs in different forms, learners write (name) the initial form of these words.

Deer, mice, buzzed, wolves, kangaroos

2) A teacher writes nouns on the blackboard and asks learners to form plural form of these nouns.

Wolf, mouse, sheep, deer, octopus, panda, goose, fox

3) A teacher writes on the board words related to the topic «Animal world», learners make sentences using these words.

To buzz, to graze, a dog, to snort

III. Exercises aimed at forming logical thinking:

1) Learners name animals related to mammals, birds, reptiles, amphibians, insects, and shellfish

Giraffe, Hamster, Lizard, Hawk, Moth, Oyster, Peacock, Spider, Snake, Whale, Turtle, Worm, Crocodile, Dragonfly

2) Magic square. There is a table of cells with a written letter of the alphabet in each one. Among the letters are hidden the words on the topic «Animal world». Learners should find 10 words.

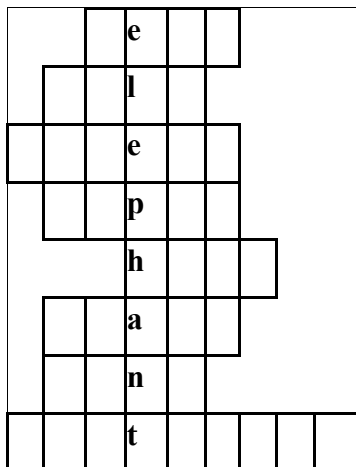
v	e	q	s	s	d	f	r	y
i	l	i	o	n	c	s	t	r
f	e	y	i	w	r	y	e	g
r	p	e	a	c	o	c	k	u
s	h	k	n	y	w	h	i	l
i	a	y	t	a	k	c	t	l
o	n	o	a	u	o	p	t	p
a	t	p	f	t	i	g	e	r
a	i	x	f	r	s	k	n	a
u	g	o	o	s	e	n	m	t

(Keys: elephant, gull, goose, peacock, kitten, crow, rat, tiger, lion, ant)

3) «Chain word»: a teacher writes a word on the board, then learners take turns in writing words, the first letter of which is the last letter of the previous word. Words in the chain are not repeated.

Elephant, tiger, rat, turkey, rhinoceros, seal...

4) Crossword puzzle. A teacher writes a long word vertically on the board, each letter of which can be included in one of the words of the crossword horizontally.



(Keys: seal, wolf, pigeon, puppy, hump, koala, mane, butterfly)

5) «Guess: who or what?» A teacher thinks of a word, and learners guess this word by asking only general questions that can be answered «yes» or «no».

For example: Is it big? Is it white? Is this a mammal? Is this a fish? Does it live in the forest? Does it eat meat? Does it have a tail?

6) Learners find and match suitable pairs.

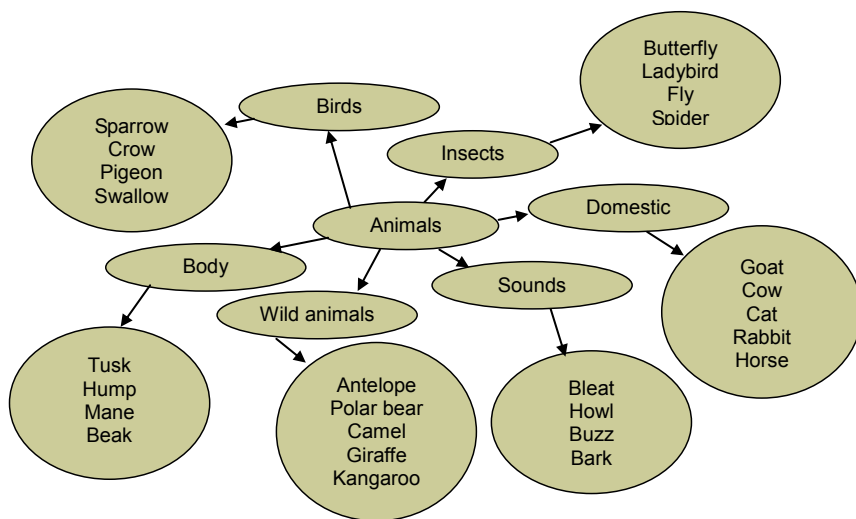
Domestic	monkey
Friendly	dog
Aggressive	parrot
Wild	ram
Clean	tiger
Quiet	dolphin
Indifferent	cat
Devoted	giraffe
Messy	fish
Noisy	puppy
Intelligent	rabbit
Unintelligent	hare

7) What animals can be seen in the zoo (in the park, in the forest, in the field)?

Calf, Beaver, Deer, Elephant, Donkey, Giraffe, Horse, Kangaroo, Lion

8) Tell and describe your pet?

9) Complete a memory map.



IV. Exercises aimed at developing general culture of learners and their worldview:

1) A teacher introduces proverbs and sayings about animals [3].

- A bird may be known by its song.

Видна птица по полету.

- A black hen lays a white egg.

От черной курочки, да белое яичко.

- A cat in gloves catches no mice.

Не замочив рук, не умоешься.

- A bird in the hand is worth two in the bush.

Синица в руках лучше соловья в лесу.

2) A teacher introduces idioms; learners guess the meaning of these phrases [4].

- monkey business (silly or dishonest behaviour)

- donkey's years (a very long time)

- to have butterflies in your stomach (to feel very nervous before doing something)

- bird's eye view (to see something perfectly clearly)

- cat and dog life (to argue)

- white elephant (something that costs far too much money to run)

3) Riddles. Learners guess the riddles.

- I'm a soft and furry pet.

I have four legs and a long tail.

I have sharp teeth and claws.

I like to chase mice.

I am a... (cat)

- I have wings but I'm not a bird

I am small and colorful.

I live in gardens and fields and forests.

I used to be a caterpillar.

I am a... (butterfly)

#### Conclusion

- dictionaries play a great role in learning new words and enriching learners' vocabulary developing speaking skills;

- playing methods activities and techniques are diverse and can be used at every stage of learning topic vocabulary;

- exercises for memorizing new words help to acquire spelling and writing skills, they develop translation techniques;

- grammar exercises are aimed at memorizing and reviewing grammatical forms of new words, making sentences with them;

- exercises aimed at forming logical thinking, promote the rapid search for new words when solving crosswords, guessing the meaning of proverbs and idioms, and their use in practice when composing riddles and short stories;

- exercises aimed at developing general culture of learners, contribute to expanding their worldview, the acquisition of knowledge about the country where the English language is spoken.

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## TO THE QUESTION OF STUDYING COLOR SYMBOLS IN MODERN LINGUIST

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*The article investigates lexemes, which nominate different colours and compose set expressions used to characterize a person and transfer information dealing with description of his/her appearance, age, character, inner state and interpersonal attitude. The author presents English, Uzbek and Karakalpak expressions with various colours and analyzes them from anthropocentric point of view.*

*Keywords: symbolic of colour, anthropocentric characteristics, human, age, appearance, interpersonal attitude, range of colours.*

Color has a certain stimulus that affects the mood and energy of a person. In this regard, not only physicists, but also psychologists are engaged in the properties of color. Goethe proved that color affects the emotional state of a person. In turn, this ability of color is associated with associations and objects related to a particular color. So, for example, green is considered to have a beneficial effect on the human nervous system, since it is the color of nature, greenery, trees.

Psychologists are interested in problems associated with color perception and color perception. The psychological aspect of color perception is closely related to socio-cultural and historical heritage. This means that psychology focuses on the symbolic nature of color and establishes a direct connection between color and brain perception, as well as associations arising from color perception.

There is a whole concept about the history of the development of color symbolism, in which the psychological effect of color on a person, factors and mechanisms of color preferences are studied. One of the important works in this direction is the work of B.A. Bazym's "Color and psyche" [2001].

According to Faber Birren, there are four types of associations associated with color perception: 1) general impression, 2) mental associations, 3) objective associations and 4) subjective associations. The last two types of associations are associated with the correlation of color with the object of the surrounding reality. Sometimes the same color can cause a wide variety of associations. For example, red color is associated with blood, life, energy, impulse, passion, love, anger, danger, war, idleness and vitality. Red color is always alarming and indicates the importance of any information or phenomenon.

Each color has a certain symbolism and is associated mainly with objects of the world. The sensations and emotions caused by any color are similar to the sensations associated with an object or phenomenon constantly painted in that color. So, the blue color, which is a symbol of harmony and tranquility, is associated with the color of a cloudless sky that does not predict rain or thunder. In the process of color perception, a person identifies certain signs, qualities, sides of different objects and phenomena.

As you know, the problem of color symbolism has become of interest to linguists since the 18th century. In this regard, in modern linguistics, the so-called coloristic vocabulary has been highlighted, demonstrating the features of colors in the linguistic picture of the world. Color vocabulary is unique for each language based on the uniqueness and national specificity of the languages of the world. So, if the white color in many nations is considered the color of happiness (for this reason, brides wear a white dress), in other nations (for example, Indians), the white color is considered a mourning color. Green is associated with American security and French crime. Consequently, colors are a means of reflecting the culture of a particular nation and are associated with its history, customs, traditions, folk traditions and beliefs. Therefore, the same color can be perceived differently in different language cultures. This suggests that the symbolism of color is also a sociocultural index indicating the emotions, images, experiences and psychological states of people.

Color has an ancient history and plays an important role in characterizing objects of the picture of the world. Color semantics, names of colors and their shades are included in the vocabulary of any language. Moreover, color semantics has rich resources for the formation of new color shades and related expressive-shaped values: *ripe cherry color* - the color of ripe cherries, *osmonrang* - sky blue color. Similar lexical color designations are easily perceived by the human brain and easily form associations associated with the color of the object being compared: ripe cherries in the first example and clear skies in the second example.

It should be noted that each people perceives the surrounding reality in different ways, so the number of tokens denoting colors varies in different languages. So, in Russian there is a strict border between blue and blue, and in Uzbek and English the same token is used to denote blue and blue: *blue* and *кўк*. The African tribes of Liberia have only two tokens for color designation: one is used for all warm tones, and the other for all cold tones.

American linguists B. Berlin and P. Kay were engaged in the number of tokens for designating colors on the material of about 100 different languages. According to their conclusion, in any developed language there are eleven basic color markers, including English: white, black, brown, gray, blue, purple, green, yellow, red, orange, pink. This theory was supported by the linguist U.L. Chafe, arguing that although different languages record a different number of color categories in their vocabulary, there is a universal set of eleven colors.

A.P. Vasilevich expresses the idea that the categorization of many names in a language is immanent to the speakers of that language. The members of a given linguistic community, when perceiving the color space, distinguish in it a certain number of meanings for which the language has a set of lexical means of expression [Vasilevich, 1987, p. 72]. This set and the number of color values included in it depends on the development of the social development of linguistic culture. Some linguists claim that in addition to the eleven primary colors, there are thousands of color shades.

Especially often used color notation in the texts of fiction, when they are used for expressive descriptions of objects of the world, as well as characterization of artistic characters.

A comprehensive analysis of color symbolism is a necessary task of modern linguistics, because it will allow you to deeply comprehend the linguistic picture of the world and the reality surrounding us, understand the effect of color on a person and his attitude, as well as describe human qualities with the help of color-denoting means of the language.

Color has a universal classification function and combines language designations of various objects and phenomena of reality, human nominations, social and social, religious and moral, emotional and interpersonal relationships, revealing a clear logic and a relatively strict system.

The symbolism of color acts as a means of reflecting the national culture of native speakers and has great cultural significance. Color tokens convey the deep meanings and interpretations embedded in them, the emotions and experiences of peoples (in our case, English, Uzbek and Karakalpak). Researchers call the symbolism of color the embodiment of cultural values and cultural realities, since the color vision of the world is interpreted dif-

ferently by each people. Color designations in each linguistic culture have their own history and national-cultural specificity. For example, the English have the expression yellow journal - tabloid magazine, *yellow magazine*. This is due to the year 1895, when a color photograph was placed in one of the issues of the New York World magazine, which was rare at the time. This was done in the expectation of sensation and attracting readers. The photograph depicted a child in yellow [A.V. Kunin, 1967, p. 1055].

The same color (yellow) is associated with coins in the Uzbek language: *сарик чақаси йўқ* - there is not a penny for the soul, there is not a penny in your pocket:

Битта-ю битта камчилиги – кассасида *сарик чақаси йўқ*, шипшийдამ эди (O. Yokubov).

In Karakalpak language, yellow, expressed by lexeme *сары* - yellow, blond, golden, is mainly used to describe the color of a person's hair: *сары жигит*- blond, *сары ҳаял* - blonde [Baskakov, 1958, p. 566].

Many colors are used primarily to describe the appearance of a person. Some phraseological units are unique because they simultaneously transmit several types of information. So, in Uzbek phraseology *сочиға оқ тушган (оқ оралаган)* has gray hair [M. Sadykova, 1989, p. 233] not only information about the appearance is transmitted, but also about the elderly age of a person when he has gray hair. The gray hair color in this expression is denoted by the Uzbek lexeme *оқ* - white. The same meaning is the English phraseology gray hairs - old age (live to gray hair) [A.V. Kunin, 1967, p. 413] with the token *gray*. The analysis shows that the same information (in this case, about an elderly person) is transmitted in different language cultures using different colors: white - in the Uzbek language and gray - in English.

Sometimes color symbolism may not match in different languages. For example, English phraseology *Judas hair* - red-haired [A.V. Kunin, 1967, p. 413] does not contain a token denoting color, but actualizes the meaning of "red-haired". Most likely, this is connected with the name of the person who had red hair color, which led to the replacement of the word *red-haired*, with *Judas* proper name. In this phraseology, one feels the national-cultural specificity associated with the history of the English people.

The English expression *lily white* - consisting only of whites, not having a single Negro in its composition, only of whites [A.V. Kunin, 1967, p. 1019] dropped out of everyday use and entered the list of archaisms. But in everyday speech, phraseology (as) *white as a sheet (as ashes or as death)* is often used. This expression is used either to describe the complexion of a person, or to characterize his reaction to any news, event or incident.

Often, phraseologism (as) *white as chalk (as driven snow, as milk, as snow or as wool)* is used to describe skin color [A.V. Kunin, 1967, p. 1019].

If the white color in English is mainly used to characterize the color of a person's skin, then in the Uzbek language the same color is used to express old age by describing gray hair: *соч-соқолига оқ кирди* - it turned gray (or turned gray); *соч-соқолига оқ оралади* - he turned gray, aged [M. Sadykova, 1989, p. 205]; *оқ тушган (соч-соқолига)* - gray-haired, with gray hair [M. Sadykova, 1989, p. 206]:

У қирқ бешларда, соқол-мўйловларига анчагина оқ тушган эди (Ойбек).

A healthy and flowering person, "blood with milk" is nominated by the Uzbek expression *оқи оқ, қизили қизил* [M. Sadykova, 1989, p. 206].

White color is used not only to describe the external characteristics of a person, but also his internal qualities, one of which is intelligibility in people: *оқ-қорани ажратмоқ (или танимоқ)* – sort out people [M. Sadykova, 1989, p. 206]:

Сиз, оқ-қорани таниган одамсиз, Абдушукур (Ойбек).

As can be seen from the examples, the symbolism of color is a unique means of transmitting information of a very diverse nature. So, the Uzbek expression *оқ подшо* – white king [M. Sadykova, 1989, p. 205] conveys historical information - it was used to designate the Russian tsar.

Paremiological unit has interesting semantics a *every white hath its black, and every sweet its sour* – there is no sweet without bitter (and there are spots in the sun) [A.V. Kunin, 1967, p. 1020]. Usually this proverb is used to emphasize that there is no ideal person, each has its own shortcomings.

In the Uzbek language there is an expression *оқ ичмоқ (или урмоқ)*, which means "drink to the bottom" [M. Sadykova, 1989, p. 205]:

Ўтирганларнинг ҳаммаси оқ ичишди (Мирмуҳсин). This phraseological unit reflects a model of human behavior in a particular situation, which means it conveys anthropocentric information.

Uzbek-friendly expression has national-cultural specificity *оқ ўл* – (etiquette, benevolent.) bon voyage [M. Sadykova, 1989, p. 205]. National phraseological expressions can be called Uzbek phraseological units *оқ ўл берсин* – so wish a woman in labor happiness; *оқ фотиҳа (бермоқ)* – blessing (give blessing) [M. Sadykova, 1989, p. 206]. These expressions have no English equivalents; they convey the high culture, kindness and benevolence of the Uzbek people. Typically, these expressions are pronounced by older people in relation to the younger ones, before traveling, getting married, having a baby, or just starting a business.

Among the Uzbek phraseological units with a purely national-cultural specificity, the following can be noted: *оқ сут берган (она)* – mother who was breastfeeding; *оқ сутимга розиман / рози эмасман* – words of the mother in relation to her children when she is happy or unhappy with their attitude towards her. The biggest curse in Uzbek linguistic culture is the expression *оқ қилмоқ* - to curse, reject a son or daughter.

Parental care for children is reflected in the Uzbek expression *оқ ювиб, оқ тарамоқ* [M. Sadykova, 1989, p. 206]. Let's try to translate it into English: *to take care*. At first glance, it seems that the English analogue of this Uzbek expression is selected, although without the presence of white symbols. In fact, it is impossible to reflect the fullness, sincere love and infinite parental care, which is reflected in the semantics of expression *оқ ювиб, оқ тарамоқ*.

White color can indicate a person's social status: *white-collar job* – work in an institution, *white-collar worker* – employee. “White” work is metaphorically transmitted using the combination of white collar, that is, one who wears a white shirt and works in an office or office.

In English, red color is expressed mainly by the *red* token, in the Uzbek language the lexeme *қизил* (*қип-қизил*), and in Karakalpak language, the lexeme is *қызыл*. In English, various shades of red are also conveyed by tokens: *scarlet, crimson, ruby, cherry, cherry, bloody-red, fire-red*. In the Uzbek language, there are similar shades of red that are conveyed by tokens: *алвон* - scarlet, crimson, bright red, *scarlet, қирмизи* - red, scarlet, *пушти* - pink, *олов ранг* - fiery, *оч қизил* - light red, *тўқ қизил* - dark red, burgundy. These shades are widely used to describe mainly the external characteristics of a person: *cherry cheeks* - red cheeks, *олов рангли соч* - red-red hair, *пушти ранг лаблар* - pink lips.

It should be noted that the symbolism of red is positive in English. So, in addition to the above notations, this color also symbolizes a healthy looking face: *(as) red as cherry* - ruddy, with a blush all over the cheek, blood with milk [Kunin, 1967, p. 748]. This refers to the natural complexion. In the Uzbek language, the expressions *қип-қизил мағиздек* - with a blush on his face, *оқи-оқ, қизили-қизил* - blood and milk are used in the same meaning. In the dictionary of M. Sadykova, additional information is attached to these revolutions: “қизил юз соғлом одам ҳақида” - about a healthy red-cheeked person [M. Sadykova, 1989, p. 38].

If the color of the human face becomes red from any news, strong unrest or feelings of shame, the British use the expressions *(as) red as a lobster* - red as a cancer and *(as) red as a turkey-cock* - red as a turkey [Kunin, 1967, p. 748]. Expressions appearing in the Karakalpak language empha-

size the connection of red color with a sense of shame: *бет қызарып кетти* - cheeks are burning, *уялғаннан қызар* - burn with shame [Baskakov, 1958, p. 420].

Despite the positive energy, red color can be used to describe the negative characteristics of a person. So, the expression see red (or scarlet) describes the psychological state of a person and is used in relation to a person who has become enraged, infuriated [Kunin, 1967, p. 803]. It is believed that the red color increases blood pressure, pulse rate, activates the emotional state. It follows that rage and anger are described with a red color designation and this is apparently connected with the reddened complexion of a person who has become enraged. In the Uzbek language, such a person is called *қизиқ қон одам* - a hot, hot-tempered person [Sadykova, 1989, p. 308]. In the Karakalpak language, the tokens and expressions are used to indicate the fury and anger of a person: *қызаралма* - blush, boil, get excited, get angry; *қызарыс* - to redden, get excited, disappear; *қызарт* - anger, make blush [Baskakov, 1958, p. 420].

It is very interesting that the red color (as well as other colors) can mean professional employment of a person: *red coat* - an English soldier; *the red-coated gentry* - British soldiers; *red tab* - (military jarg.) staff officer [Nasrullaeva, 2018, p. 92].

Thus, the symbolism of color in the description of a person and objects-phenomena of the surrounding reality has both similarities and differences in different linguistic cultures and this is due to the moral-religious, ethno-specific, socio-historical background of peoples and native speakers. Each of the languages studied has a unique meaning, symbolism and specificity of use. This specificity is especially evident in the description of a person, his age, appearance, social status, professional employment, personal characteristics and psychological conditions. Colors most vividly and expressively create vivid and unique images, sometimes metaphorical and hyperbolic, introducing a "twist" and "falling into a point" in the description of anthropocentric characteristics.

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## PRAGMATIC MARKERS IN THE SENTENCES FROM RENAISSANCE ARTWORKS

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*Based on the material of the texts of plays written in the period of 1485-1650, an analysis is made of the variety of predicative and non-predicative pragmatic markers in sentences that make up the lines of characters. The discussion includes appeal, exclamation, modal-predicative and non-predicative structures, related questions. The author's approach to their placement in the sentence is discussed.*

*Keywords: epistemic stance adverbials, pragmatic markers, tag questions, spoken interaction, authorial styles.*

As is known, discursive markers are a wide class of linguistic units, represented by words, phrases, sounds that have no real lexical meaning, and attracted by the speaker to form the conversational structure. The diversity and functioning of colloquial speech of different languages at the present stage of their development is being paid close attention by researchers (works [1-4] and many others). Whereas their functioning in other historical periods is given less attention.

Studying colloquial speech in diachrony, a researcher often has to deal with the imitation of "live" speech, performed by the author of a literary work when building the lines of characters.

So, modern authors introduce various pragmatic markers into sentences of speech of actors. Moreover, the localization and the number of markers in the sentence may be different. There are examples with the placement in the sentence of one or more (usually from 2 to 4) markers. In the passage *She's in the house – I think. I mean, I can't be sure any more, can I?* (2016, Khoury R., "The end game") the predicative marker forms the end of the first sentence, and subsequently forms the initial and final parts (after the cited example, hereinafter in parentheses we indicate the year of writing or the first publication of the

work, its author, title). Attached question and token of the type *I think, I mean, I guess* are often embedded in a sentence, as in the examples *Mother understood – **did she not?** – that all this peace and solitude, this haven if tranquility, must be paid for somehow?* (2018, Ley R., “Her Mother’s Secret”) and *Like most people, **I guess**, I had assumed both were synonymous, but he explained how they aren’t at all the same thing.* (2016, Khoury R., “The end game”). A similar position in the sentence is also characteristic of non-predicative markers - the location between the main and subordinate clauses *Small wonder, **then**, that Elodie and Jacques turned more and more to one another.* (2018, Ley R., “Her Mother’s Secret”), concentration at the end of the structure *Hurts good, **though, huh?*** (1996, Robbins H., “The Stallion”). In addition, predicative and non-predicative markers can be combined with each other, forming various variations, such as, for example, being at the beginning and end of a sentence one at a time – ***Anyway**, we were only friends, **weren’t we?*** (2008, Challis C., “The Beautiful Game”, p. 221) or form a kind of “blocks” of two structures – ***But, of course**, you were away **then, weren’t you?*** (2001, Collier C., “Swansea Girls”).

In this paper, we consider how the authors of the Renaissance period (1485-1650) use pragmatic markers of various kinds in sentences that make up dialogs.

Given the diversity of pragmatic markers, we restrict ourselves to considering only some of them - noun-appeal, interjection or exclamation, adverb, adjoining question, modal-predicative combinations of the type *I think*.

In a sentence that has a single pragmatic marker, it is possible to place this marker at the beginning and end of the sentence if it accompanies the entire prediction, as well as in the middle if the purpose of the marker is to highlight a particular syntagma or even a single word. The location of the marker depends on its type. So, for example, for predictive markers like *I mean, I think, I believe* placement in the end is typical *He will steal to heaven, unknowing to God, **I think**.* (1553, Udall N., “Ralph Roister Doister”), after syntagma *I should not be rid of him, **I think**, till doom’s day.* (ibid), at the beginning of the structure ***I know** you are of her bosom.* (1606, Shakespeare W., “King Lear”).

The same placement - at the beginning of a sentence, its end or middle - is also characteristic of an adverbial word, which is clearly seen in the example of an adverb ***then**: My brother Iohn is gone **then?**, **Then** you have married her?* (1631 Dekker Th., “Match mee in London”) and *What shall we **then** do with her?* (1553, Udall N., “Ralph Roister Doister”). An

appeal may also be placed – *Weep no more, **lady**, ye shall be well received.* (1553, Udall N., “Ralph Roister Doister”) and *Go to it, **sirs**, lustily!* (ibid); *Be merry, **woman**;* (ibid); ***Petruchio**, go thy ways, the field is won.* (1594, Shakespeare W., “The Taming of the Shrew”)

Interjection or exclamation is most often placed at the beginning of a sentence: ***Tut!** thou are deceived.* (1553, Udall N., “Ralph Roister Doister”). There are also cases of its placement in the end with the formation of the interrogative attached part *You said it was a Toledo, **ha?*** (1598, Jonson B., “Every Man in his Humour”). Very uncharacteristic is the placement of interjections in the middle of the receiving sentence *Run, run, **O** run!* (1605, Shakespeare W., “King Lear”).

In contrast to the markers listed above, the attached question in the texts of the studied period is characterized by the placement mainly in the end of the structure, regardless of how long the supporting sentence is. So, for example, in the work of W. Shakespeare we came across a sentence in which the attached question is related to more than 20 words from the determining part of the sentence: ***You could** for a need study a speech of some dozen lines or sixteen lines, which I would set down and insert in’t, **could you not?*** (1601, Shakespeare W., “Hamlet”).

If the sentence contains several predicative markers, then their placement is as follows.

Two markers in one sentence can be placed together at the beginning, as an appeal and predicative combinations in the examples ***I hope, sir**, your good worship will be my bail?* (1604, Jonson B., “Measure for Measure”) and ***Sir, I pray you**, what lord or great gentleman is this?* (1553, Udall N., “Ralph Roister Doister”).

It is not uncommon for a marker to be combined with a preposition, which, while not being considered in this paper, can also be classified as a pragmatic marker, acting as a means of correlating the current sentence with the previous one. An example is the combination of the prepositions *and* and *but* with the non-predicative marker adverb *surely* and the predicative combination *I fear*: ***And surely** for thy sake she shall speed.* (1553, Udall N., “Ralph Roister Doister”) and ***But I fear** it will end with a mock for pittance.* (ibid).

We also encountered “blocks” containing the first interjection/exclamation and the noun-appeal or adverb, as in the examples ***Ah, sir!** Be good to her;* (1553, Udall N., “Ralph Roister Doister”); ***Tush, fool!** thou art deceived, this is not she.* (ibid); ***Why, then**, unsaid again!* (ibid). Thus, by placing markers at the beginning of a sentence, the authors select markers from different types.

Combinations of two markers can also be located in the final design. As part of such “blocks”, we came across markers of various types, such as the *now*, *sure* adverbs and the predicative combinations *I presume*, *are you* in the examples *You come from court, now, I presume?* (1635, Shirley J., “Lady of Pleasure”) and *Gracious with the dutchess! sure, you said so?* (1632, Massinger Ph., “The Maid of Honour”), or appeal and affiliate question, as in the sentence *You are not pageant poet to the city of Milan, sir, are you?* (1609, Jonson B., “The Case is Altered”).

For placement in the end of the structure, the author can pick up two markers of the same type, among such designs we came across examples with two successively related questions: *You’ll shed his blood, you’ll say: will you so?* (1623, Fletcher J., Rowley W., “The Maid in the Mill”).

The author can also use a marker at the beginning and end of the structure, in which case markers of different types are usually selected. We came across examples with a similar placement in one sentence of non-predicative and predicative markers - *indeed* adverb and modal-predicative combinations *I confess: Indeed, he dwelleth hence a good start, I confess.* (1553, Udall N., “Ralph Roister Doister”); combination of words representing appeal *My Lord of Arundel*, and affiliate question *have you not?: My Lord of Arundel, you have the note, have you not?* (1593, Marlowe Ch., “Edward II”); exclamation *why* and *O* and affiliate question: *Why, ye drunken whoresons, will it not be?* (1533 Heywood J., “The Play of the Weather”) and *O, you haue made him a swecte beagle, ha’ y not?* (1606, Chapman G., “The Gentleman Vsher”); two predicative markers of different types - combination *I think* and affiliate question *will you not?: I think you’ll take his part, will you not?* (1607, Beaumont Fr., “The Knight of the Burning Pestle”).

Speaking about the placement of two markers in the sentence, we note the least common options. As such, we see the embedding of the “block”, consisting of the appeal and the modal-predicative structure, in the middle of the receiving sentence, as in the example *Up before day, sirs, I charge you, an hour or twain.* (1553, Udall N., “Ralph Roister Doister”), as well as setting one marker as an attached question *will you?* or *throw ye?*, to the end of the structure, and of another, non-predicative, like *then* or predicative, like *I hope*, – after certain words or combinations: *I ha’ sworn I’ll ha’t, and I hope you will not let my oaths be cracked in the ring, will you?* (1604, Dekker Th., “The Honest Whore”); *Who shall then know our Tib Talkapace, throw ye?* (1553, Udall N., “Ralph Roister Doister”).

More rarely found is the placement of three markers on offer. In this case, the nature of their arrangement in the structure is the same as in the

case of placing two - concentration at the beginning or end of the structure or placement at the beginning and in the end.

If there are three markers, they are usually of a different type. The concentration of all three markers at the beginning of the sentence can be observed in the structure **Why, then, I pray**, *keep the quantity of your wit from the quality of my maidenhead, and you shall find my maidenhead more than your wit.* (1622, Rouley W., "A Match at Midnight"). We also encountered structures with the placement of one marker, represented by the attached question, in the end, and in the beginning - two markers, one of which is interjection or exclamation *Ha, Why*, and the second is an appeal *my good Lords*, adverb *then*, predicative structure *I hope*, respectively: **Ha my good Lords**, *that every one of you now Had but a Lady of that youth and beauty To bless your selves this night with, would ye not?* (1624, Fletcher J., "A Wife for a Moneth"); **Why, then** *you took my chain along with you to prolong my days, did you?* (1604, Middleton Th., "A Mad World"); **Why I hope** *I am no spirit, am I?* (1609, Jonson B., "The Case is Altered"). Another marker distribution can be seen in the structure **Oh**, *that was the story of Jone and the wall, was it not, George?* (1607, Beaumont Fr., "The Knight of the Burning Pestle") - interjection is put at the beginning of a sentence, and in the end - an attached question and a noun-appeal.

Sometimes an author places three markers in a sentence, two of which are of the same type. An example of such a concentration of two related questions in the end, together with the exclamation placed at the beginning of the sentence *O* is visible in the structure **O t's a wittie hearing, ist not thinke you?** (1606, Chapman G., "The Gentleman Vsher").

The most rare option is to embed one of the three markers in the receiving sentence. A similar arrangement can be observed in the adverb *perhaps*, located on the border of syntagmas - *And I too harsh, perhaps, in my reproof: was I not, Clarinda?* (1632, Massinger Ph., "The Maid of Honour"), the other two markers, the attached question and the appeal, form the end of the structure.

Thus, speaking of the placement by the authors of literary texts of the studied period of pragmatic markers of various kinds in the sentence, the following can be noted. Building the sentences that make up the lines of the characters, trying to make the speech of the characters of the work as "lively" as possible, close to real, the authors saturate the structures with the attached question with pragmatic markers characteristic of the speech of contemporaries.

Their choice and composition depends on objective and subjective factors. We attribute to objective existence at the stage of writing a work of structures that are in the everyday speech of people for whom the work is intended. Also objective factors include the composition of structures, their structure. Subjective factors include the author's decision to include or not include the marker in the sentence, the choice of the type of marker and its location in the design.

If the author places only one marker in the sentence, then for some structures the general tendency of the placement features is not visible. Words of an adverbial character, constructions like *I think, I hope*, as well as appeals are located at the beginning or end of a sentence, and also are built in, usually delimiting the syntagma. Interjection is most often placed by the authors at the beginning of the structure. Less commonly found is its placement in the end or in the middle of the sentence receiving marker. The joined question in the overwhelming majority of the sentences we have studied (from more than 120 works) is located in the end of the structure.

When combining several markers in one sentence, the picture changes in some way. Ready-made blocks consisting of two or three markers, predicative or non-predicative, the composition of which varies, are located around the sentence receiving marker. They make up the boundaries of the structure, for the most part without being built in. Such compositions form the initial or final parts of the structure. Thus, the pragmatic markers under consideration - the structures that form the phatic part - are located outside and form a kind of frame for the informative part of the sentence. However, a number of authors locate the phatic components within the sentence, highlighting a certain syntagma. Such placement in the study period is quite rare and represents the individual choice of the creator of the text.

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## LANGUAGE OF GERMAN AND RUSSIAN FAIRY TALES: METHODS AND TECHNIQUES OF WORD FORMATION

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*The object of the study of the article is German and Russian fairy tales. The author considers the uniqueness of German and Russian fairy tales, their heterogeneity in content and form. The article analyzes the most typical ways and techniques of word formation for the language of German and Russian fairy tales, the peculiarities of their use make up the difference between their language and the language of written works of art.*

*Keywords: fairy tale, linguocultural community, system of related elements, hyphenated way of forming complex words, connecting vowels, emotional coloring.*

Currently, the issues of the relationship of language and culture, language and folklore receive quite a lot of attention in linguistic research. The explanation for such a wide interest in them is due to the fact that it is in folklore and mythology that the oldest ideas about the world are recorded, which have the most direct impact on the formation and reflection of mentality. Moreover, a fairy tale these days has ceased to be regarded as something frivolous, low, but is already perceived as an explication of the spirit of an individual people. At the same time, it should be noted that in modern linguistics a lot of work has been done in studying the fairy tale. It is possible to note a number of scientific works, which have widely considered such features as genesis, history, poetics, stylistic and linguistic features of this genre. Indeed, it is a fairy tale that has the most distinct structural organization and the ability to obey certain specific laws. Nevertheless, the question of its study in linguistics is still open. And the difficulty lies in the fact that it is a fairy tale, originating from the primitive

communal system, in each era to adapt to the requirements of the present and be filled with new content. Since this genre of oral folk art, although outwardly simple and uncomplicated, still has a rather deep latent content and is capable of truthfully and intelligibly reflecting the social organization of an ancient society of a certain era, its beliefs and customs. All this hidden potential allows us to trace in a rather detailed way the formation and development of ethnic groups in the process of scientific research, because most peoples have much in common, which makes their life quite similar.

"Literary Encyclopedic Dictionary" defines the concept of a *fairy tale* as one of the main genres of oral folk poetry, an epic, mainly prose, artwork of a magical, adventurous or everyday nature directed towards fiction [2]. In a fairy tale, we observe the presence of a special world, whose life proceeds according to its internal magical laws. For example, its world is replete with characters who are absent in reality: *Baba Yaga*, *Koschey Besmertnyy*, *Zmey Gorynych*, *Nussknacker*, *Fee* (fairy), *Drache* (dragon), *Zwerg Nase* (Little Longnose). Their appearance - is a consequence of various, sometimes unrealistic transformations, manipulations and tricks. This can be confirmed by such examples as *Trick*, *Hexerei* (magic), *Zauberei* (witchcraft), *Wunder* (miracle), «оборотился он волком», «в правое ухо зашел – умылся, в левое – снарядился и стал еще красивее прежнего», «превратилась она в лягушку», for example:

*In den alten Zeiten, wo das Wünschen noch geholfen hat, lebte ein König, dessen Töchter waren alle schön, aber die jüngste war so schön, dass die Sonne selber, die doch so vieles gesehen hat, sich wunderte so oft sie ihr ins Gesicht schien* [Der Froschkönig oder der eiserne Heinrich].

*В старые годы, когда стоило лишь пожелать чего-нибудь и желание исполнялось, жил-был на свете король; все дочери его были одна краше другой, а уж младшая королева была так прекрасна, что даже само солнышко, так много выдавшее всяких чудес, и то дивилось, озяря ее личико* [Transl. P. Polevoy].

It should be noted that the majority of nations have a lot in common, that they are united and make their way of life similar. After all, the bulk of both peoples are ordinary people, busy with daily work, they build their homes, love, raise children, pass on their knowledge to them, enjoy the beautiful and laugh at obvious stupidity. Nevertheless, one cannot fail to notice that a fairy tale is also a way of imagination and fantasy, which markedly distinguishes a German fairy tale from a Russian one. Nevertheless, the German and Russian fairy tales, being a kind of way of imagination and fantasy, are also characterized by very noticeable differences.

At its core, a fairy tale - is a special epic genre, presented in the form of oral or written folk art, the implementation of which is carried out mainly in a narrative form. Its content is presented, as a rule, in the form of text in which signs or images, deployed in time, have a compact sequence and reproducibility. The explanation for this can apparently be the fact that a person's understanding of narrative texts is at the same time an understanding of himself in the surrounding reality. It is also noteworthy that the fairy tale has its own special language, or metalanguage, which allows us to describe the entire areal space [1]. This language is a system of related elements that allow you to realize its plot and realities.

The language of this genre of folk art is characterized by cases of both prefixal and suffix word formation, in particular, the use of diminutive suffixes *-chen* and *-lein*.

For example, in the tales of the Brothers Grimm, we note the presence of expressions with diminutive suffixes:

*Schneewittchen* (Snow White), *Töchterchen* (daughter), *Schneeweißchen*, *Rosenrot*, (Snow-White, Rose-Red), *Mütterchen* (mother) fairy tale "Golden Goose", for example:

*Sie wünschte sich ein Töchterchen so weiß wie Schnee mit roten Wangen und schwarzem Haar* (B. Grimm. Schneeweißchen und Rosenrot).

*Она хотела доченьку, белую, как снег, с красными щеками и черными волосами* [Snow-White and Rose-Red. Transl. A. Soloviev].

These suffixes add an additional positive touch to the characterization of the hero's appearance.

*Es war aber ein kleines Gärtchen an dem verwünschten Häuschen, darin standen zwölf Lilienblumen...* [Die zwölf Brüder].

*А позади заколдованного домика был небольшой садик, и в том садике росли двенадцать лилий* [Transl. P. Polevoy].

Examples of the presence of diminutive suffixes (*-очк*, *-ок*, *-к*, *-ица*, *-ец*, *-оньк*, *-еньк*, *-ушк*), we also note in the language of Russian fairy tales - this is a characteristic way of word formation of nouns, for example:

*Тятенька, Иванушка, Аленушка, игрище, домишко, шкурка, уточка, старичок, лебедушка, солнышко, птичка, кустик, кожанка, козленочек, снегурочка, лошадка, мамушка, лягушонка в коробченке, прялочка, лошадка, горноста́й-чернохвостик, соко́лок, дедушка, грамотка, коровушка, дитя́тко, бу́ренушка, сторо́нушка, го́ренка, ушко, брата́ец, сестри́ца, води́ца, бере́жок* etc., for example:

*Это моя лягушонка в коробчонке приехала!* [The Frog Princess].

*Сбрызнули деток живящую водой – они вострепнулись, сбрызнули говорящую – они заговорили* [White duck].

It should be noted that prefixal and suffixal formations occupy a significant place in the language of a fairy tale. Prefixes such as: *ver-*, *miss-*, *ab-*, *auf-*, *un-*: *achten* – *verachten* (уважать – презирать), *vertrauen* – *misstrauen* (доверять – не доверять), *beschuldigen* – *entschuldigen* (обвинять – оправдываться), *Sinn* – *Unsinn* (смысл – чушь), for example:

*Der König aber war auf die Königin böse und beschuldigte sie: «Du bist eine schlechte Mutter. Du hast auf das Kind nicht aufgepasst!»* [Die Rosenprinzessin]

Король рассердился на королеву и обвинил ее:

– Ты плохая мать! Ты не обращаешь внимания на ребенка! [Transl. A. Fedorov]

A considerable role is also given to affixes.: *-los*, *-voll*: *erfolgreich* – *erfolglos* (успешный – безуспешный), *sorgenfrei* – *sorgenvoll* (заботливый – беззаботный) and others, for example:

*Vor vielen, vielen Jahren lebte in einem kleinen Häuschen eine alte Frau mit ihrem Enkel. Der Junge war lieb und sorgenvoll* [Das Geschenk der Waldfee].

Много-много лет жила старуха в маленьком домике со своим внуком. Мальчик был любящим и заботливым [Transl. Fedorov].

The presence of these components makes it possible to form in the newly formed words an anonymous, mostly negative value (cf. in Russian *не-* (счастье – несчастье), *без-/бес-* (честный – бесчестный, обидный – безобидный). In the translation language of German, as well as in Russian fairy tales, we also note the use of word formation of colloquial vocabulary, for example: *за-*, *вы-*, *о-*, *по-*, *из-*, *раз-*, *при-*: *погоняли* (horses), *прискочил*, *изломал*, *принуждают*, *сотворили*, *помыкаешься*, *отбивать*, *свертывается*, for example:

*Приезжает Василиса Премудрая,хватила – нет лягушачьей кожи, **приуныла, запечалилась** и говорит...* [The Frog Princess].

*Иван-царевич **поблагодарствовал** старику и пошел за клубочком...* [The Frog Princess].

*Иван-царевич пожалел и пошел дальше – к синему морю, видит – на песке лежит, **издыхает** щука-рыба* [The Frog Princess].

*Вот старшие братья явились на смотр со свои женами, **разодетыми, разубранными*** [The Frog Princess].

***Поплакали** дед с бабой да ничего не **выплакали*** [Burenushka].

*Так всю кашу через плечо и **выбросала*** [Burenushka].

*Взял по ступы и ударил ей. И она **обернулась** женщиной* [Burenushka].

From the above syntheses and examples, it is clear that examples of prefixal word formation give a special flavor to the content, setting the reader in the right way, which is why they are so widely used in the language of German and Russian fairy tales.

Linguistic analysis of German and Russian fairy tales also reveals a significant amount of the formation of new words by adding their foundations (Zusammensetzung), as well as cases of hyphenation: *Waldfee* (wood fairy), *Menschengesicht* (human face), *Mondlicht* (moonlight), *Großmutter* (grandmother), *Holzfäller* (lumberjack), for example:

*Der Junge sollte nur die Zauberworte rufen: «Waldfee mit dem Menschengesicht, komm hervor ins Mondlicht!»* [Das Geschenk der Waldfee].

*Мальчик должен был произнести заклинание: «Лесная фея, явись из лунного света в человеческом облики»* [Transl. A. Fedorov].

*Er kam nicht mehr wie früher zu seiner Großmutter, um ihre Märchen zu hören* [Das Geschenk der Waldfee].

*Он больше не приходил к его бабушке, чтобы как раньше слушать ее сказки* [Transl. A. Fedorov].

*Einmal sah er im Wald drei Holzfäller* [Das Geschenk der Waldfee].

*Однажды он увидел в лесу трех лесорубов* [Transl. A. Fedorov].

A linguistic analysis of the texts of fairy tales allows us to note also the fact that in a Russian fairy tale, unlike a German one, a hyphenated formation of complex words is very often present: *дерево-золотые маковки*, *хлеб-соль*, *спать-опочивать*, *плита-камень*, *отец-родитель*, *терем-избушка*, *погодушка-несчастье*, *буря-непогода*, *гуси-лебеди*, *гусли-самогуды*, *бабушка-старушка*, *скатерка-хлебосолка*, *отец-матери*, *пойдешь-поедешь*, *кручинен-печален*, *обуздал-оседлал*, *бабушка-задворенка*, *узидид-гулял*, *стар-матёр* (human), *бить-ломать*, *плетка-живулька*, *девица-поленица*, *ветер-полоса*, *по-добру-поздорову*, *солнышко-батюшка*, *жар-птица*, *рять-сила* and others, for example:

*Вдруг выбежала девица:*

*– Душечка, я выйду, тебя из седла выну; со мной **хлеба-соли** кушать и **спать-ночевать!*** [Ivan Tsarevich and the Sineglazka bogatyr]

***Обуздал-обседлал** себе коня **добрый**, пошел **солнышку-батюшку** падать во резвые ноги, просить благословленьица* [Ivan Tsarevich and the Sineglazka bogatyr].

*И жар-птица своим волшебством опять устроила ему икры* [Ivan Tsarevich and the Sineglazka bogatyr].

The hyphenated method of forming complex words with its certain melody, which is characteristic mainly for folklore, allows the reader to perceive the text of the fairy tale in a special way. The basis for this meth-

od of word formation in Russian is different parts of speech: *noun*, short/full *adjective*, *adverb*, *verb*.

At the same time, obtained as a result of the addition of words, it appears as a sort of folded statement, the task of which is to clarify the reality of the fairy tale plot or to reveal the essence of the character of the fairy tale.

Our observations allow us to note in Russian translations of German fairy tales, as well as directly in Russian fairy tales, such methods of phrasing as *morphological* and *lexical syntactic*.

The morphological method of compounding allows you to form a new word by combining significant parts, i.e. stems and a significant word with the help of connecting vowels: *o* after stems on a solid consonant *e* after strings on a soft consonant, hissing *ц*, for example: зме[й]-**е**-лов, душ-**е**-губ, солнц-**е**-пек.

In some examples, the formation of a compound word also requires the presence of a suffix (compound suffix method), for example: полк-о-вод-ец, рук-о-дел-и-е, (the whole word does not work without a suffix: полк-о-вод-, рук-о-дел-).

The lexico-syntactic method allows you to merge stable combinations without connecting vowels in the form in which they are usually used in speech, for example: полцарства, вечнозеленый, for example:

Не пойдет **трехглавый душегуб** на Русь-Матушку [The tale of Zmey Gorynych].

Этому **дармоеду** еще и **полцарства** в придачу? [The tale of Zmey Gorynych].

Выходит на **солнцеpek** **вертихвостка** и давай представляться... [The tale of Zmey Gorynych].

In German, the formation of new words through substantiation is quite widespread: *krank* – *der Kranke*, *alt* – *Die Alte*, for example:

*Er kam ins Schloss, um den Kranke zu heilen* [B. Grimm. Schneewit-  
tehen].

Он прибыл в замок, чтобы вылечить больного [Transl. A. Fedorov].

Thus, the results of our observations allow us to conclude that in the language of both German and Russian fairy tales, various methods and techniques of word formation are found. Prefix, suffix, and hyphen word formation methods occupy a significant place among others, since they have a wide range of semantic shades and allow us to present a more colorful characterization of characters and realities of fairy tale space.

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## PRECEDENT PHENOMENA AS A MEANS OF REFLECTION OF NATIONAL-CULTURAL SPECIFICITY OF LINGUISTIC WORLD IMAGE

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*The aim of the article is to represent the linguo-cultural potential of a precedent phenomenon as a means to reproduce, store and structure the knowledge. It is noted that a precedent phenomenon represents a certain imagery and association-based complex which is meaningful for the members of a language community and is regularly referred to in their speech production. The aim of the article is to represent the specific ways of precedent phenomena usage to condense the cultural experience of a language community user. With reference to the interpretation approach applied to the semantic components of precedent phenomena meaning, there are contextually relevant for the XXI century text meanings established on the basis of the dictionary definition.*

*Keywords: dialogism, intertextual links, precedence, precedent phenomenon, precedent text, precedent name, linguo-cultural artefact.*

The view of culture as reflected in the language form is nowadays perceived as one of the cornerstones of linguoculturology as a branch of linguistics dealing with representation, reflection and fixation of cultural phenomena in language and discourse. As it is stated in recent research, one of the most typical ways to represent modern communicative practices is with the help of the term “text dialogue” [3, p. 172]. Dialogism as a concept, first coined by M. Bakhtin, introduces the status of a word as a minimal structural element, which incorporates text into the life of society and history, which are treated as texts in their own turns; reflecting and “reading” them, the text creator links to them by their multi-usage [8, p. 427]. Two or more interconnected texts co-activate knowledge of the outer world and refer to world image in general or to a peculiar complex-structured fragment of it [3, p. 176 – 177]. Whether the text – and, in particular, the one which is characterized by dialogism – is perceived

correctly, depends not only on language and graphic means and media, but also on the common pool of knowledge, which serves as a basis for text formation and its subsequent decoding [2, p. 9]. Language as a complex multi-level system accumulates meanings of nominative units in the form of encyclopedic, conceptual content of a language sign or as a set of associations with functional or mental frames. The ability of language sign communication between representatives of a language community is based on deciphered verbal artefacts, when the interlocutors can associate identical mental substances with language signs of the same form [7, p. 12-13]. In other words, to serve as an information transfer means, language is able to manifest itself through the process of decoding which is based on dialogue nature of the word and presupposes the use of special instruments to interpret the unit of meaning.

Apart from the textual links, which predominantly serve to create textuality, text dialogue directs the evolving text along the patterns of semantic and syntactic text organization, which are conventional for the prior language culture [3, p. 76]. The links appearing between the preceding and the emerging text as a result of such direction are called inter-textual. This approach follows into the idea that intertextual links that are based on precedent phenomena can co-activate a considerable stratum of heterogenous data, not immediately connected to the information verbalized in a certain textual stretch [3, p. 179]. The notion of linguistic precedence, introduced by Yu. N. Karaulov, also demonstrates the link to wider cultural context, because the term “precedent” refers to texts both meaningful to a language user cognitively and emotionally and having hyper-personal character which means that wide range of language users is able to identify them, including the individual’s predecessors and contemporaries [4, p. 216]. The system of precedent phenomena is one of the instruments of cultural memory transmission and a means of nation’s unification around its cultural values and moral ideals. Precedent phenomena act as moral standards of a nation reflecting its assessment of reality [10, p. 12]. Thus such text inclusions as precedent phenomena may serve from the language perspective to enrich the text with the background information known to a great number of language community representatives and are able to bring out the aspects of meaning specific to a certain context.

The evaluation of such phenomena and their precise connotations may be based in the text on the author’s commentary which helps reach unambiguity: *«События шли в рваном, ускоряющемся темпе сна, в котором, однако, надо жить и действовать – большинство наших ошибок от того, что мы не проживаем сны, а надо отбыть их с открытыми*

глазами, как Раскольников отбывает острог, – чтобы перемениться» (Д. Быков «Остромов, или Ученик чародея»). – *“The action followed in a ragged, accelerated pace of a dream, which nevertheless required living and acting – most part of our mistakes happens because we are not living through them, but need to wait them out open-eyed, like Rascolnikov who waits for the prison-term to end” (Dmitry Bykov “Ostromov, or The Magician’s Apprentice”, translation by T. Anikeyeva).*

Precedent phenomenon has the ability to enrich the text with additional connotations, as it is linked to value orientations relevant to the collective subject and co-activates a considerable component of world image in the sum of propositions [3, p. 181]. A special role in the establishment of intertextual links is played by the precedent name as a vital part of national culture in its historic development. Moreover, it is understood as a means to relate the text to a wider historical context. Describing his earlier life in the letter to one of his acquaintances, D. Bykov’s character resorts to the following use of a precedent text: «Желая себе польстить, я сказал бы, что всю жизнь пытался самоопределился относительно самых тонких, неформулируемых вещей – а других видно, скажем, потому, что для них действительно что-то значил выбор: Гучков или Милюков, синее надеть или розовое... Скажем проще: я прожил вроде того Левши, который умел ковать блоху, но ведь невооруженным глазом этого не видно» (Д. Быков «Остромов, или Ученик чародея»). – *“In the wish to flatter myself I would like to say that I wanted to identify myself all my life against most subtle, nameless things – others are visible, let’s say, because choice mattered to them: Guchkov or Milukov, blue or pink to wear. To put it in simple words, I’ve lived my life like Levsha, who knew how to shoe a flea, but it’s not visible to the unaided eye” (Dmitry Bykov “Ostromov, or The Magician’s Apprentice”, translation by T. Anikeyeva).* In this case precedent text as a specific nominative means lends itself to be recognized by the recipient due to the use of the precedent name *Levsha*, which corresponds to the V. G. Kostomarov’s principle of first-element cultural experience recognition [5, p. 76]. Despite the actualization of a verbalized invariant of a precedent text which enters, according to D. B. Gudkov, the cognitive base of Russian-speaking cultural community (*Levsha* is a Tula gunsmith who shoed a flea which was crafted by English handymen), there is some co-activation of less explicit text attributes, which are based on the well-known “Skaz” by N. S. Leskov (squint-eyed *Levsha* is perceived by Russian-speaking people as a symbol of man-of-the-people talent [9], somebody who can surprise the observer by his expertise). As the knowledge base in the mind of each person depends

on the volume of cultural signs conferred, the reader who is well-aware of the work of N. S. Leskov, can widen the group of attributes explicated on the basis of the source text. The perception invariant promotes the understanding of the precedent name *Levsha* as a person of outstanding professional skill; a good reader can enrich the interpretation potential of this name by taking into consideration the sum of its attributes (*Levsha* may be represented as someone who due to some circumstances is not able to apply his knowledge to the benefit of others: leaving himself aside, he strives to help Russia but coming to his homeland he cannot get an audience with the sovereign which leads him to great disappointment and subsequent death in the poor people's hospital [9]).

The modern stage of language development presupposes the use of not only precedent phenomena which refer the reader to the classic texts of Russian literature, but also the linguo-cultural artefacts that are described as nationally-marked and meaningful representations (objects) of the secondary reference [6, p. 157]. There are usually mythological or fairy-tale phenomena serving as typical artefacts, such as *water of life and death*, *the apples of youth*. Nevertheless, the wider understanding of the term "culture" can manifest itself through the language reference to the group of nationally-marked mental facts of cultural or daily character, especially the ones which used to be typical of a nation historically; they may be represented in the text in an unchanged or a modified way. This way we observe the cultural reference to an annual Soviet New Year TV show as a relic of bygone days in A. Gelasimov's novel "Rachel": «Мои старички притулились на какой-то скамейке, а рядом целая орава завязывает коньки. Профессор дождался, пока они отвалили на лед, и говорит – а помните, Алла Альбертовна, какие здесь были катания в начале шестидесятых годов? Помните, тогда в моде были такие толстые свитера? Я думаю – ну все. Началась программа «Голубой огонек». Уважаемые телезрители, сейчас по вашим многочисленным просьбам выступит певец Иосиф Кобзон и вся его шайка» (А. Геласимов «Рахиль») – "My elds made themselves comfortable on a bench, and nearby a whole gang of youngsters were tying the skates laces. Professor waits till they back off to the ice rink and says – do you remember, Alla Albertovna, what fine skating people had here in the beginning of the sixties? Remember the thick woolen sweaters that were in back then? I think – that's right. Here's when "Golyboy Ogonek" begins. Dear ladies and gentlemen, now by popular demand we welcome Joseph Kobzon and his gang» (A. Gelasimov "Rachel", translation by T. Anikeyeva). The obvious knowledge of the concept "Golyboy Ogonek" typical for the

Russian-speaking community manifests itself through the enhancement of a comic effect created by the usage of a precedent utterance-quote, which was widespread among the TV presenters to introduce a performer. The decoding of such cultural facts is carried out with the help of the cultural code, which facilitates accumulation, translation and the following interpretation of such insertion.

In much the same way as artefacts, precedent names are able to accumulate not only the denotative, but also the evaluative characteristics in the nomination process. In the novel "The Grey House" by M. Petrosyan there is a conversation touching upon the problem of proper nouns evaluation: – *Но еще Седой говорил: слова, которые сказаны, что-то означают, даже если ты ничего не имел в виду. Он смеется, выуживая из пачки новую сигарету. – Не знаю, кто такой этот Седой, но раз он что-то такое говорил, я, пожалуй, утешусь. Если вдуматься, «Седой» звучит не хуже, чем «Аристотель»* (М. Петросян «Дом, в котором...»). – *"But it was Sedoy who said that the words expressed do mean something even if you don't mean anything. He smiles, fishing for another cigarette from the pack. – I don't know this Sedoy, but it's consoling if he said something like that. If you think about it, Sedoy sounds no worse than Aristotle"* (M. Petrosyan "The Grey House", translated by T. Anikeyeva). Precedent names, and Aristotle in particular, are defined by some researchers as epistemological prototypes or communicative precedents, which are considered to serve as a model to follow in order to serve a nominative purpose during communication. The structure of this precedent name refers the recipient to the core features of a precedent name Aristotle which already contains the evaluation inherent to the context (Aristotle is one of the greatest philosophers of Greece – "один из величайших философов Греции", the creator of the most united and comprehensive system of the Greek science – "творец самой законченной и всеобъемлющей системы греческой науки" [1]), which helps create an association link assisting the situational choice of this name from the range of others.

The material analyzed helps to establish the use of a precedent name as a cultural link which unites separate cultural layers and epochs between the development stages of national culture. Precedent phenomena can be regarded as signs of appealing to the fundamental value core and the links to a certain historical epoch. Despite the individual ways of cultural phenomena treatment, the perception of such phenomena as precedent texts in the XXI-century text is based on the minimized perception invariant of its recognition in the mind of a certain language user. Though the reference to the minimized perception invariant makes it considerably easy to

perceive and interpret the precedent phenomenon, an experienced reader is able to re-interpret the text fragment containing it with the help of an extended set of its features. Apart from the precedent phenomena which serve as cultural memory containers, one can single out linguo-cultural artefacts, which are able to reflect the link to the historically preceding cultural values set and point out to the wide spectrum of phenomena of national and cultural character.

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## THE DEVELOPMENT OF SUBJECTIVITY IN THE PROCESS OF IMPLEMENTING A TRAINING PROGRAM BASED ON A HOLODYNAMIC APPROACH

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*The article is devoted to the consideration of the features of training, implemented on the basis of the holodynamic approach. aimed at developing the subjectivity of its participants. The group and individual technologies used in the training process provide work with the personal history of the participants by working out deep feelings and images, make it possible to transform destructive images into positive ones and integrate already mature forms into the life of the subject, increasing his self-attitude and self-acceptance. The use of Student's criterion for comparing the results obtained using the indicated methods showed statistically significant changes on the scales of the KAMBOX and "Self-actualization test" methods (on scales: self-support; value of self-actualization; flexibility of behavior; spontaneity; self-esteem; self-acceptance) that occurred in the structure of subjectivity of participants trainings when comparing the results obtained before and six months after its completion.*

*Keywords: subject, subjectivity, development, training, holodyne, holodynamic approach, student criterion.*

The problem of the development of personality subjectivity is currently one of the urgent in modern psychology. Interest in this problem is due to a number of reasons, such as changes in the social situation of develop-

ment, unstable economic conditions, ideological crisis, modernization of education, etc., where it is necessary to quickly make decisions, adapt to new social conditions that require flexibility in thinking and behavior. Subjectivity in modern psychology is defined as the systemic quality of personality associated with actively transforming properties and the ability to make changes in the world and in oneself (K.A. Abulkhanova [2011], I.V. Vachkov [2007], V.I. Slobodchikov [1998], V.V. Selivanov [2002], E.A. Sergienko [2012], etc.). The problem of the development of personality subjectivity is a problem of mental resources [Ilyushchyna, 2017], a person's ability to control his fate. The process of development of subjectivity is a combination of different processes: self-knowledge, self-determination, self-improvement, self-actualization through the search for personal semantic foundations and the construction of ways to implement the found meanings and is always associated with mastery of one's own behavior, internal states, reactions, goal setting and designing the course of development of one's own abilities.

At the same time, the requests of real people experiencing difficulties of self-realization, overcoming difficult situations, identified the need for the development of a practice-oriented psychology that helps and accompanies the development of the subjectivity of a modern person, providing assistance in solving his life problems and difficulties. Over the past decades, various psychotherapeutic approaches have been affirmed: psychoanalytic, gestalt-psychological, cognitive-behavioral, therapeutic, fairy-tale therapeutic, etc. One of the approaches that came to Russian practice-oriented psychology is the holodynamic approach, founded by V. Woolf [1990], whose active follower is one of the authors of this article, whose personal psychological practice initially as a client, and in the last 15 years as a practicing psychologist, has proved the effectiveness of this approach [Kirichkova, 2006].

Holodynamic tools allow you to access the primary self-organizing information structures of the human psyche (holodynes) in order to solve the problem, "track", transform destructive forms into positive ones and integrate already mature forms into the life of the subject. When considering a person as a subject of activity, cognition and communication through the images of the whole (holodynes) in this approach, one can trace the formation, promote the actualization of his subjectivity, which finds itself in the main ability of a person to turn his own life activity into an object of practical transformation, which allows him to be (become) an active subject, author, owner, manager of his own life, aware and managing his own resources.

The concept of holodyne (image), introduced by V. Woolf, is characterized by him as a unit of consciousness and as a universal toolbox in solving psychological problems. The scientist postulated the sources of the formation of the holodynes of the subject: genetically transmitted information; subjective life experience, which is captured in the form of feelings, sensations and experiences; images of the desired future (imagination) and the collective unconscious, containing images of the previous phylogenetic experience of mankind, and also formulated the basic principles of the holodynamic approach in psychological counseling [V.Vernon Woolf, 1990]. According to V. Woolf, "I" or "I-potential" is the main manager of each person's holodyne. "I" - individually and universally. In general, it can be stated that the provisions of the holodynamic concept are to some extent correlated with the postulates that have developed in Russian psychology about the role of the imaginative sphere, self-awareness, and sources of development of the human psyche ([A.N. Leontyev, 2000], [A.A. Gostev, 1992 ] et al.)

We conduct psychotherapeutic work with clients on the development of subjectivity within the framework of the holodynamic approach, following the algorithms laid down by its founder, taking into account the individual characteristics and problems of the client, we use both group and individual forms of practice. The experience gained by us was embodied in the training program "Image Transformation of I or the training to create a personal success story." In the framework of this article, we briefly present its substantial characteristics, and also show the results of evaluating its effectiveness.

The training "Image Transformation of I or training on creating a personal success story" provides opportunities for transitive living events when dealing with the problems of clients of different age groups (adults in our study) during group classes held once a week for 8 hours. The total duration of the training was 24 hours. (If necessary, individual clients have the opportunity to continue working with the trainer individually).

The main objective of the training process is to assist its participants in the transition from a state of observer of the events of their own life to a state of active and responsible co-author in the process of creating their own destiny. Training participants get acquainted with the concept of holodynamic approach, its basic provisions. An important aspect of the training work is the awareness of Personal History (PH) - work with a person's ideas about his role in the world and the expectations corresponding to these ideas, reflected in subconscious life scenarios.

Important for therapeutic work is the development by the training participants of the role and mechanisms of PH formation, which is recorded in the human subconscious as a combination of visual images (holodynes), sounds, inner speech and kinesthetic sensations, i.e. in the form of various internal states, the set of which creates the emotional background of our life. A person reacts in the usual way in similar life situations, the memory of which is stored in the “library of states” of the subconscious mind, from which the state that best suits the particular situation (according to the principle of similarity) is selected. We experience, live through, feel what we focus on. When we call what we are experiencing, words evoke a corresponding representation. Describing our experiences in words, we have the ability to change the content of the experience. Linguistic or semantic patterns are a familiar set of words and metaphors that we use to “attribute” the meanings of the events of our lives.

In the process of training, work is done on the problem or problems of the participants. Each participant in the training indicates the problem that he needs to solve. The image (holodyne) of the problem is worked out on a level-by-level basis: a picture is created, a story is written using all holodynes as characters in a given sequence. In the analysis of the story, relatively complete actions between several characters are traditionally distinguished - leading to wins, dividends: moral, material and psychological. In the following, a general conclusion is drawn as a result of a comparison of the facts identified in the story with specific facts and events in the family tree or personal history. This work is carried out in several stages in accordance with the ideology of holodynamics, it allows us to work out and transform the psychological problems repressed by the subject into the unconscious, contributing to their understanding, transformation [Kirichkova, 2019]. In the process of group work with holodynes, group resonances are achieved to help identify the basic complex, i.e. to compose a holographic portrait of an underlying problem that is common to all members of the group, a transition is made from linear plan thinking to thinking involving “holographic vision” and knowledge of the leading principle of holodynamics - all are parts of a single whole and provisions on hidden order. Scenario stories composed of holodynes allow us to reveal in each case the hidden orders of the problem, the absurd, heterogeneous areas of the individual and archetypal levels of the unconscious, to understand and objectify them.

Training allows you to get over traumatic experiences, to work out and harmonize your personal history, etc. The training participants learn to think holistically-dynamically (stream thinking), come to a state of sincerity

- a necessary condition for the synchronism of the figurative and verbal-logical spheres. Holodynamic analysis (introspection) leads to deeper layers of awareness of the experience.

To assess the effectiveness of the development of subjectivity of the training participants, we conducted a study that included psychological diagnostics at the stage of formation of the training group and at the end of its work. In total, 65 subjects - adults of various professions took part in the study on the evaluation of the effectiveness of the training "Image Transformation of I or the training for creating a personal success story". In a re-cut performed after 6 months, 61 people participated (four dropped out for various reasons).

The KAMBOX methodology (constructs, analysis, interpersonal perception, Khokhlova) was used as a tool for assessing changes in the subjectivity of clients - participants of the training. This is the author's version of the method of personality constructs developed by L.P. Khokhlova based on the method of personality constructs by D. Kelly [Kozlova, 1975], [Khokhlova, 1980], where not only semantic, but also emotional, evaluative, and substantive characteristics of constructs and the methodology for the study of personal maturity "Self-actualization test - SAT" by E. Shostrom were evaluated, in Russian the full adaptation of M. Krozom, carried out under the direction of L.Ya. Gozman, in which the key category - personal maturity - is revealed by a diagnostic assessment of a number of personality characteristics of the subject, such as time competence, value orientations, behavior flexibility, sensitivity, self-esteem, self-acceptance, creativity, etc., considered as characteristics of personal maturity and aimed at identifying various attitudes and relationships of a person to the world, other people, to himself [SAT].

Working with the CAMBOX method, the clients in this study - the subjects - characterized themselves in terms of life categories (life, death, happiness, unhappiness, development, survival, villain, victim, rescuer, crisis (shock), fear, anxiety, money (material prosperity), health, family, love, hobbies (entertainment), children, work). Identification of the subject's ability / inability to differentiate at the deep psychological level the semantic constructs of the listed objects was carried out using indicators of "homogeneity-heterogeneity" with respect to functionally different areas of activity (SA: C1-sphere of business activity and functions (roles); C2-sphere expressing the characteristic of communication, moral and ethical constructs; C3-sphere of a person's individuality) of the objects being evaluated., i.e. the nature of the joint activity was taken into account. The indicators of positivity-negativity of perception of life events

were also evaluated, which were determined by calculating the percentage of constructs rated by subjects as positive (with a “+” sign) in relation to the total number of constructs.

The results of the diagnostic showed that before the training, the subjects described themselves in comparison with life categories more instrumental, rationally. After the training, its participants increased the volume and positivity of perceived qualities in themselves and in life categories. The indicators of positivity-negativity indicate an increase in the level of acceptance by clients of training certain qualities of a person depending on the sphere of their manifestation (total percentage of constructs with a rating of “+”, P1-characterizes the style of business communication, P2-loyalty in relationships, P3-level of individuality )

When analyzing the values of the indicator of acceptance of individuality (acceptance of individuality is described using the above indicators C1, C2, C3, P1, P2, P3 and their ratio), it was found that before the training, the individual was emotionally rejected by the subjects or had a low rate. After the training, personal acceptance indicators increased significantly. If, in order to interpret these results, we refer to the categories of E. Berne regarding Ego states: Parent, Child, Adult, then we can say that after the training the Adult's Ego state has significantly increased and the Child's Ego state will unfold, and it, as is known, answers for creativity, needs, desires [Bern, 2018].

Mathematical data processing was carried out using factor analysis methods (the “principal components” method with varimax rotation) and cluster analysis in the "SPSS. 23 For Windows." Using the Student criterion to compare the results obtained using the indicated methods showed statistically significant changes on the scales of the KAMBOX and the “Self-actualization test” (on the scales: self-support; value of self-actualization; flexibility of behavior; spontaneity; self-esteem; self-acceptance) that occurred in the subjectivity structure of participants trainings when comparing the results obtained before and six months after its completion.

Thus, the study showed the effectiveness of the training we developed based on the holodynamic approach. The actualization and development of the subjectivity of clients is facilitated by the independent living of transpersive events, and not just retro and perspective ones, or events of the present, a deep level of awareness of the experience lived, their living in the process of training traumatic experiences, the elaboration of personal history and its harmonization in the process of training we developed “Image Transformation I or training on creating a personal suc-

cess story ", implemented on the basis of a holodynamic approach. As a result of the study, it was found that the volume of constructs related to the manifestation of subjectivity is statistically significantly increased, self-attitude has changed from anxious-stressed to confident and optimistic.

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## THE EFFECT OF INFUSION THERAPY ON CHANGES IN OXYGEN SATURATION DURING TOXEMIA DURING THERMAL BURNS IN INFANTS

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*Despite the relatively more pronounced losses through the damaged skin surface, intoxication, and the severity of burn shock, the authors established the feasibility of limiting the water load in children aged 5 months to 3 years with a burn area of  $32.7 \pm 4.9\%$ : 2-3A degree  $26 \pm 7 \pm 2.2\%$ , 3B degree  $6 \pm 2.7\%$ , IF -  $71.3 \pm 8.4$  units. The critical days of the highest risk of acute cardiac decompensation were the second, fifth, sixth, and seventh days. Limiting the total daily water load in the 3rd group of children, as well as intravenous infusion within 60-100 ml / kg / day in the 1st group, 48-110 ml / kg / day in the 2nd group, 67-110 ml / kg / day in 3 the group with the necessary drug support of heart function increased the effectiveness of timely correction of acute heart failure without compromising kidney function, external respiration, and thermoregulation. A confirmation of the increased risk of acute cardiac decompensation on day 5.6 was a tendency to an increase in respiratory rate in children of group 3.*

*Keywords: burn, infusion therapy, infancy, toxemia, oxygen saturation*

### Relevance

At an early age (up to 3 years), protective reactions, hypersympathotonia prevail, which leads to the appearance of a more severe symptom complex of shock, a period of toxemia, septic toxemia and burn exhaustion. With imperfection of the subcortical parts of the brain, a higher me-

tabolism is noted, a high water content in the brain tissues provokes frequent convulsive reactions, impaired respiration, cardiovascular and excretory systems. The immaturity of the autonomic nervous system leads to inconsistency of autonomic reactions, instability of respiration and pulse with the development of complications. The cardiovascular system in young children has great compensatory capabilities, which leads to persistent circulatory disorders, a state of decompensation of the contractile function of the heart develops due to its increased contractility. Due to the high risk of complications and mortality, the problem of developing the effectiveness of timely corrective measures, especially during toxemia, remains relevant [2,3].

### **Purpose**

To study the effect of infusion therapy on changes in oxygen saturation during toxemia during thermal burns in infants.

### **Material and research methods**

In total, research data from the age of 5 months to 3 years was studied in 29 children who received thermal burns. Patients were considered depending on age, duration of treatment in ICU conditions. So the number of children in ICU up to 10 days was 18 (1 subgroup), 11-20 days - 6 children (2 subgroups), more than 21 days (21-40 days – 5 babies). Along with hourly thermometry, monitoring of respiration rate, oxygen saturation, hemodynamics, monitoring was carried out of the fluid's fluid balance (parenteral, enteral fluid, volume of urine output). A detailed analysis of reliably significant deviations, intergroup differences of the studied indicators was carried out. The results were obtained by monitoring with hourly recording of the studied parameters.

Assessment of the severity of the burn was carried out by calculating the surface area of the damaged skin and using the Frank index. The prognosis is favorable if the IF is less than 30 units. The prognosis is relatively favorable if  $IF = 31-60$  units. The forecast is doubtful if  $IF 61 - 90$  units. The prognosis is unfavorable if the IF is more than 90 units [3,4]. The research data were processed by the method of variation statistics using the Excel program by calculating arithmetic mean values (M) and mean errors (m). To assess the significance of differences between the two values, Student's parametric criterion (t) was used. The relationship between the dynamics of the studied parameters was determined by the method of pair correlations. The critical level of significance was taken equal to 0.05.

Intensive therapy from the moment of admission was aimed at elimi-

nating from burn shock, simultaneous anesthesia and intravenous administration of crystalloids, volemic solutions under the control of hemodynamics, volume of diuresis. Regular, every 8-12 hours, the introduction of painkillers, cardiogenic, desensitizing, stress-limiting agents, vitamins, etiotropic antibacterial therapy. According to indications, hormones and blood substitutes were used. Inhaled oxygen was inhaled. For all children, vitamins C and group B were used, antipyretic and hypersensitizing agents, as well as drugs against stressful damage to the gastrointestinal tract, septicotemia and toxemia.

### Results and discussion

As shown in table 1, significant differences in anthropometric data, the area of the burn surface, the lesion area of 2-3A degree in the groups of patients was not detected. However, a significantly significant age difference was found. So, children of group 3 were younger than patients of group 1 by an average of 9 months ( $p < 0.05$ ). The area of 3B degree lesion reliably prevailed by 5.9% ( $p < 0.05$ ), IF was more than twice as large ( $p < 0.05$ ), which accordingly led to an increase in the duration of intensive therapy in ICUs by 20 days ( $p < 0.05$ ) and treatment in a hospital for 34 days ( $p < 0.05$ ) due to the severity of the condition.

**Table 1**  
**Characterization of patients under the age of 3 years in groups**

Groups	Age, in months	Height, cm	Weight, kg	S, %	2-3 A, %	3 B, %	IF, units	C/d in stats	C/d in ICU
1	19,3±6,2	81,6±8,8	10,9±2,2	32,7±9,8	32,7±9,8	0,1±0,03	33,4±10,1	15,4±3,5	6,8±1,8
2	14,2±4,6	79,7±5,7	10,1±1,9	33,6±7,6	24,8±7,4	9±2,8	48,4±11,28	41,6±10,2	12,8±1,3
3	10,1±2,1*	71±2,5	9,9±0,8	32,7±4,9	26,7±2,2	6±2,7*	71,3±8,4*	49,3±3,8*	26,3±2,4*

\* reliably relative to data in 1 group

Thus, the main factors affecting the severity of the condition of children with thermal burns of infancy turned out to be age (the younger the child, the more severe the condition), the area of skin surface damage of grade 3B, and IF. Thus, age, IF indicator, and area of thermal damage of 3B degree turned out to be objective indicators of the severity of thermal burn and can predict the duration of intensive care in ICU and inpatient treatment, making it possible to objectively assess future economic costs.

**Table 2**  
**Toxemia infusion therapy**

Day	The total daily volume, ml/kg per day			Intravenously, ml/kg per day			The volume of daily urine output, ml/kg/hour		
	1 group	2 group	3 group	1 group	2 group	3 group	1 group	2 group	3 group
1	128±28	111±32	113±23	82±23	67±14	91±24	3±1	3±1	1,5±0,5
2	185±30	176±28*	111±13	86±15	82±20	78±17	4±1	4±1	3,4±1,1
3	198±43	195±35*	154±14*	88±27	91±22	84±11	5±1	4±1	4,1±0,7
4	199±49	181±38	155±22	85±22	86±16	89±15	5±1	5±1	5,0±1,5
5	192±46	171±24*	118±15**	84±23	79±17	86±13	5±1	4±1	5,1±0,7
6	201±31*	184±35*	118±8**	82±20	87±13	80±17	5±1	4±1	4,5±0,7
7	199±33*	195±32*	139±20**	83±15	81±19	78±11	5±1	5±2	4,2±0,6
8	191±21*	170±17*	149±44	81±14	82±11	82±16	5±1	4±1	4,1±1,9
9	231±64*	169±20*	148±22	87±22	67±18	75±18	5±0,1	4±0,1	4,0±0,7
10		161±10*	154±16*		61±13	81±12		6±1	3,6±1,1

\* significantly relative to the indicator in the first day

\*\* significantly relative to the indicator in group 2

As can be seen from the data presented in table 2, the daily volume of injected fluid on the first day of treatment in the ICU was the closest to the volume of daily physiological needs in all patients. So in the 1st group, the daily volume was  $128 \pm 28$  ml / kg per day, in the second -  $111 \pm 32$ , in the third -  $113 \pm 23$  ml / kg / day. However, on the second day in the 1st group, an increase of 44% was found (57 ml / kg / day, the difference is not significant due to the wide variation in the indicators), in the second, the fluid administration was significantly increased by 58% (65 ml / kg / day) and in in the third group, the daily volume of injected water did not differ from age requirements and amounted to  $-111 \pm 13$  ml / kg / day. The absence of an increase in the daily water load in the 3rd group of children was due to the high risk of developing acute heart failure in the most severe patients.

On day 3, the volume of injected fluid was greater than the amount on day 1 in 54% (70 ml / kg / day) in group 1, 75% (84 ml / kg / day) in group 2,  $p < 0.05$  in 3 - by 36% (41 ml / kg / day,  $p < 0.05$ ). Moreover, in the 3 group of children, 44 and 41 ml / kg / day was administered less than in the first and second groups. The need to limit the water load is explained by the appearance of signs of acute heart failure, despite the ongoing corrective therapy (cardiotonic, vasodilating, diuretics, metabolite drugs) The volume of water load throughout the entire period of the toxicogenic phase of a burn disease remained at a level that did not significantly differ from the amount of daily load for 3 days. So, in the 1st group of children the infusion volume on the 4.5th day was about 199 ml / kg / day, and in the next 6,7,8,9 days it significantly exceeded the 1-day indicator by 57% (by 73 ml / kgsut,  $p < 0.05$ ), 55% (71 ml / kg / day,  $p < 0.05$ ), 48% (63 ml / kg / day,  $p < 0.05$ ), 80% (103 ml / kg / day ,  $p < 0.05$ ), respectively.

The water load in children of the 2nd group practically did not differ from the volume of injected fluid in the 1st group and was 5,6,7,8,9,10 days significantly more than in the 1st day by 54%, 65%, 73%, 60% , 50%, 45%, respectively. It is noteworthy that in the 3rd group of children, the daily volume of infusion on day 10 only became significantly greater than on day 1 by 30% (41 ml / kg / day). Moreover, over 5.6.7 days, it was necessary to administer significantly significantly less than on the corresponding days in children of the 2nd group 53, 66, 62 ml / kg / day ( $p < 0.05$ , respectively). Thus, in children of the 3rd group, despite the relatively more pronounced loss of damaged skin surface, intoxication, and the severity of burn shock, the need to limit the water load was found.

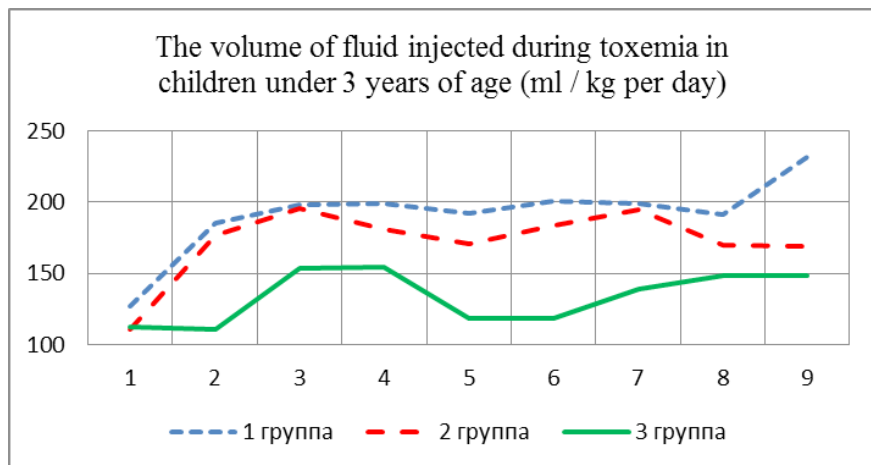
The critical days of the highest risk of acute cardiac decompensation were the second, fifth, sixth, and seventh days. The volume of parenteral administration was calculated so as to prevent overload of the pulmonary

**Table 3**  
**Indicators of body temperature, respiratory rate and oxygen saturation in the first decade of burn disease in children under 3 years old**

Day	T °C			Respiratory rate per minute			Oxygen saturation, %		
	1 group	2 group	3 group	1 group	2 group	3 group	1 group	2 group	3 group
1	36,7±0,1	36,5±0,2	36,6±0,2	30,6±1,4	31,5±2,1	32,2±3,5	98,0±0,3	97,9±0,2	93,3±6,2
2	36,8±0,1	36,9±0,1	36,5±0,3	30,0±1,6	30,8±0,4	32,6±1,3	97,9±0,2	97,9±0,4	97,2±1,1
3	36,9±0,1	37,0±0,2	36,5±0,1	30,4±1,5	31,3±1,8	31,8±2,6	97,9±0,2	97,7±0,6	97,8±0,4
4	36,9±0,2	37,0±0,2	36,6±0,1	30,0±1,6	31,5±1,7	35,6±0,2	98,0±0,3	97,9±0,3	97,7±0,5
5	37,0±0,1	37,1±0,1	36,7±0,1	30,1±1,3	31,3±0,8	34,2±1,0	97,9±0,3	98,1±0,2	97,7±0,5
6	37,0±0,2	37,0±0,1	36,8±0,1	30,2±1,2	31,8±1,1	33,8±0,6	97,9±0,3	97,4±0,1	97,6±0,3
7	37,1±0,2	37,1±0,2	36,9±0,05	30,5±0,8	31,7±1,3	33,1±0,43	98,0±0,3	97,7±0,1	97,9±0,35
8	37,1±0,2	37,0±0,1	36,9±0,1	29,5±1,3	30,8±1,3	33,9±1,1	97,7±0,2	98,0±,3	97,7±0,1
9	36,9±0,1	37,0±0,1	36,9±0,1	28,9±2,0	30,2±1,5	33,2±0,9	97,7±0,3	97,7±0,2	97,9±0,1
10		37,0±0,2	36,9±0,2		29,8±1,1	32,5±0,5		98,0±0,2	97,4±0,3

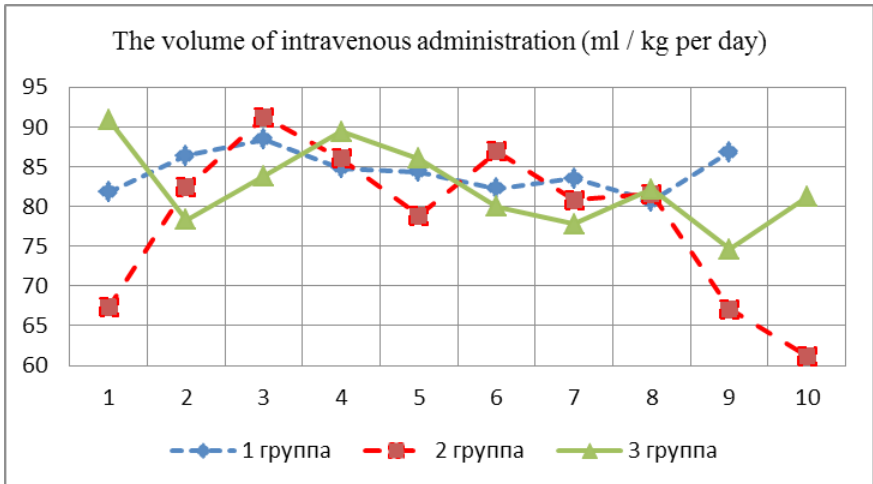
circulation, which was expressed in the restriction of intravenous infusion (hemo-, plasma-, albuminotransfusion, inclusive) within 60-100 ml / kg / day in group 1, 48-110 ml / kg / day in group 2, 67-110 ml / kg / day in group 3. Renal dysfunction was not observed, the volume of diuresis corresponded to moderate polyuria in all children, allowing to maintain a fairly effective detoxification regimen. The effectiveness of the correction of water balance deviations during the period of toxemia is confirmed by stable data of central and peripheral hemodynamics, temperature, respiratory rate and oxygen saturation index, are shown in table 3 [1].

Of certain interest is a comparative assessment of the studied parameters according to the severity of the condition of burnt children in groups up to 3 years. A relatively smaller volume of infusion therapy in children of group 3 over the entire period of toxemia (Fig. 3) is noteworthy, which was due to a higher risk of acute heart failure than in the first and second groups.



**Fig.1**

Confirmation is the limitation of water load by 5.6 days to age-related physiological needs (120 ml / kg / day). Thus, during the period of burn toxemia with a total area of skin lesion of  $32.7 \pm 4.9\%$ , grade 3B  $6 \pm 2.7\%$ , IF  $71.3 \pm 8.4$  units, the need was found to limit the total water load to the physiological daily needs for 5-6 days.

**Fig.2**

As can be seen from the table. 2 and fig. 2 data, the volume of parenteral administration in three groups of children did not differ significantly except for the first and tenth days, when the severity of shock in group 3 required intravenous infusion 25 ml / kg more than in the second. On the 10th day, the improvement in the condition of children of the 2nd group allowed limiting the volume of intravenous infusion therapy to 60 ml / kg / day (with a total volume of administration of 161 ml / kg / day on average), while the indications for the most severe children of the 3rd group were for parenteral administration in a volume of 80 ml / kg / day (with a total volume of administration of 154 ml / kg / day). Thus, the area of the skin surface lesion  $32.7 \pm 4.9\%$ , grade 3B  $6 \pm 2.7\%$ , IF  $71.3 \pm 8.4$  units, necessitated a more extensive parenteral infusion therapy as early as 1 day after a burn injury.

Confirmation of an increase in the risk of acute cardiac decompensation by 5.6 days is a tendency to an increase in respiratory rate in children of group 3 (Fig. 3) with the highest rates by 4.5.6 days, which explained the need to limit water load on these days.

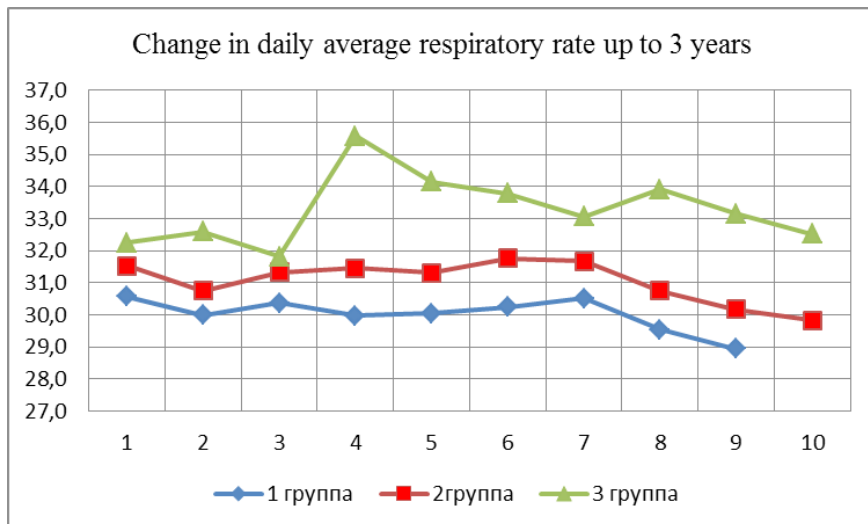


Fig.3

### Conclusions

The feasibility of limiting the water load in children of group 3, despite the most pronounced loss of damaged skin surface, intoxication, and the severity of burn shock was due to the high risk of acute heart failure. The critical days were the second, fifth, sixth, seventh day. Limitation of the total daily water load in the 3rd group of children, as well as intravenous infusion within 60-100 ml / kg / day in the 1st group, 48-110 ml / kg / day in the 2nd group, 67-110 ml / kg / day in 3 the group with medical support for cardiac function increased the effectiveness of timely correction of acute heart failure. A confirmation of the increased risk of acute cardiac decompensation on day 5.6 was a tendency to an increase in respiratory rate in children of group 3.

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## THE MAIN PREDICTORS OF REMOTE RESULTS IN TREATMENT OF THYROTOXICOSIS BY RADIOIODOTHERAPY

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*The study included 96 patients with toxic goiter, among whom 57 were diagnosed with Graves' disease, and 39 - functional autonomy of the thyroid gland, represented by multinodular toxic goiter. All patients received  $^{131}\text{I}$  therapy, after which they were observed dynamically. It was shown that the appointment of standard activity of  $^{131}\text{I}$  (400 MBq) is associated with a high risk of thyrotoxicosis recurrence (40.3%) in Graves' disease. The main predictors of the long-term results of radioiodine therapy are thyroid volume and the level of antibodies to the thyroid stimulating hormone receptor in thyrotoxicosis of autoimmune origin caused by Graves' disease.*

*Keywords: Graves' disease, multinodular toxic goiter, thyrotoxicosis,  $^{131}\text{I}$  therapy, antibodies to the thyroid stimulating hormone receptor.*

Thyrotoxic forms of goiter, due to both diffuse toxic goiter and nodular forms, occupy a leading place in the structure of thyroid pathology. In young people, the main cause of thyrotoxicosis is diffuse toxic goiter of autoimmune origin, while in people over 60 years of age living in regions of iodine deficiency, the most common cause of thyrotoxicosis is the development of functional autonomy (FA) against the background of a long-term multinodular euthyroid goiter.

Currently, three main methods of treating thyrotoxicosis are used: pharmacotherapy (thyrostatic drugs), a surgical method, and radioactive iodine therapy. The main disadvantage of thyrostatic therapy is a rather high risk of developing thyrotoxicosis relapse after its cessation and, accordingly, a relatively low probability of persistent remission [1]. Surgical treatment due to the high cost and risk of complications (paresis of the recurrent nerve, hypoparathyroidism) is used less and less in the world. The most promising treatment for hyperthyroidism syndrome is radioiodine therapy (RIT) [4].

**Purpose of the study** – to evaluate the significance of some clinical and laboratory parameters as predictors of long-term results of  $^{131}\text{I}$  treatment and to optimize the RIT method for outpatient conditions.

### **Materials and methods**

The study included 96 patients with two main pathogenetic forms of toxic goiter: 57 patients with Graves' disease (GD), 39 patients with multinodular toxic goiter (MNTG). The average age of patients with GD was  $42 \pm 0.64$  years, patients with MNTG -  $59.89 \pm 0.72$  years; duration of thyrotoxicosis - 18 [10; 52] months.

When conducting RIT, an isotonic aqueous solution of sodium iodide taken per os was used. A fixed activity of  $^{131}\text{I}$  was assigned - 200 MBq, twice, with an interval of 2 months (total activity 400 MBq). In the absence of euthyroidism, upon reaching 6 months, a third course of RIT was performed.

Prior to RIT, all patients underwent drug euthyroidism and underwent standard research, including thyroid function (TR) function assessment: thyroid stimulating hormone (TSH), free thyroxine ( $\text{fT}_4$ ), antibodies to thyroid stimulating hormone receptor (AB r-TSH); assessment of TR size by ultrasound. A second study of these indicators was carried out 6 months after RIT.

Statistical analysis was performed using the STATISTICA 6.0 program and the application software package. The data obtained in the tables and in the text are presented as relative values - (%), as well as ( $M \pm m$ ), where M is the arithmetic mean value, m is the standard error of the mean. The significance of differences was determined using Student's t-test for paired variables. Differences were considered significant at  $p < 0.05$ . To assess the relationships between the studied phenomena, we used a correlation analysis (the square method) with an assessment of the reliability of the obtained correlation coefficients.

### **Results and discussion**

Analyzing the outcome of treatment, it should be noted that the overall RIT efficiency indicator was 66.7%. In GD, positive results (hypothyroidism, euthyroidism) were observed in 59.7% of cases: hypothyroidism occurred in 27 patients (47.4%), euthyroid state was observed in 7 patients (12.3%). The persistence of thyrotoxicosis after two courses of RIT was determined in 23 patients with GD (40.3%). The rather high frequency of the absence of the effect of RIT in GD can be explained by the more severe course of thyrotoxicosis due to the autoimmune nature of this disease and the diffuse nature of the TR lesion [2,3].

In the group with MNTG, persistent euthyroid state was observed in 17 patients (43.6%), hypothyroidism was achieved in 13 patients (33.3%), i.e. favorable treatment outcomes with this pathogenetic variant of thyrotoxicosis were noted in 76.9%. In the group of patients with MNTG 6 months after RIT, thyrotoxicosis persisted only in 9 patients (23.1%).

The thyrotoxicosis persisting 6 months after RIT in some patients indicated insufficient  $^{131}\text{I}$  activity and required re-administration of the radio-pharmaceutical, resulting in a total  $^{131}\text{I}$  activity of 600 MBq in this group. The overall treatment results are presented in table 1.

**Table 1. RIT results by a two-stage course depending on the genesis of thyrotoxicosis after 6 months**

Disease	Number of patients	Hypothyroidism		Euthyroidism		Relapse		Overall performance indicator
		abs.	%	abs.	%	abs.	%	%
<b>GD</b>	57	27	47,4	7	12,3*	23	40,3*	59,7
<b>MNTG</b>	39	13	33,3	17	43,6*	9	23,1*	76,9
<b>Total</b>	96	40	41,7	24	25,0	32	33,3	66,7

**Note:** significance of differences in outcomes in two pathogenetic variants - \* $p < 0,05$

A clear link between the initial TR volume and the RIT results should be noted. According to our observations, a large volume of TR in GD was a risk factor for the recurrence of thyrotoxicosis after  $^{131}\text{I}$  therapy, which is consistent with the literature [5,6]. In patients with favorable RIT outcomes (hypothyroidism and euthyroidism), the initial volume of TR was significantly lower than among patients in whom thyrotoxicosis continued ( $21.71 \pm 0.62 \text{ cm}_3$  and  $38.13 \pm 1.32 \text{ cm}_3$ , respectively) ( $p < 0.05$ ). A similar pattern was found for patients with MNTG.

The main marker of thyrotoxicosis of autoimmune genesis is an increase in the titer of p-TSH antibodies [1]. According to the results of the study, in the group of patients with favorable RIT outcomes (hypothyroidism and euthyroidism) ( $n = 34$ ), the p-TSH AB titer in 100% was within the reference values ( $< 11 \text{ U/L}$ ), which indicates immunological remission of GD and may be seen as a predictor of a favorable outcome for RIT. In the group of patients with relapse of thyrotoxicosis ( $n = 23$ ), in contrast, in 93% of cases, a significant increase in the titer of p-TSH AB was detected ( $> 11 \text{ U/L}$ ), which indicated the absence of immunological remission and

was a risk factor for the relapse of thyrotoxicosis after RIT.

During the study, a correlation analysis was performed between the initial volume of TR and the level of TSH 6 months after RIT, which established the presence of a reliable correlation negative weak link  $r = -0.36$  ( $p < 0.05$ ). In addition, a correlation analysis was performed between indicators of thyroid status (TSH level 6 months after RIT) and titer AT of p-TSH in the group of patients with GD, which established the presence of a reliable negative mean connection  $r = -0.64$  ( $p < 0, 05$ ).

Thus, the absence of immunological remission was a risk factor for the development of thyrotoxicosis recurrence during RIT in the group of patients with GD. The results of the study suggest that the increase in the level of p-TSH AB is an independent marker of long-term RIT results.

### Conclusions

1) The autoimmune variant of thyrotoxicosis due to Graves' disease requires the appointment of higher  $^{131}\text{I}$  activities in comparison with functional autonomy against the background of MNTG.

2) The main predictors of long-term RIT results are the TR volume for both thyrotoxicosis variants and the level of antibodies to the thyroid stimulating hormone receptor in thyrotoxicosis of autoimmune origin caused by Graves' disease.

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## **GENERAL INHALATION SEVOFLURANE ANESTHESIA EFFECT ON THE INFLAMMATORY AND BRAIN DAMAGE BIOMARKERS BLOOD SERUM LEVELS IN THE PAEDIATRIC PATIENTS WITH CRANIOSYNOSTOSIS DURING MRI INVESTIGATION: A COHORT STUDY**

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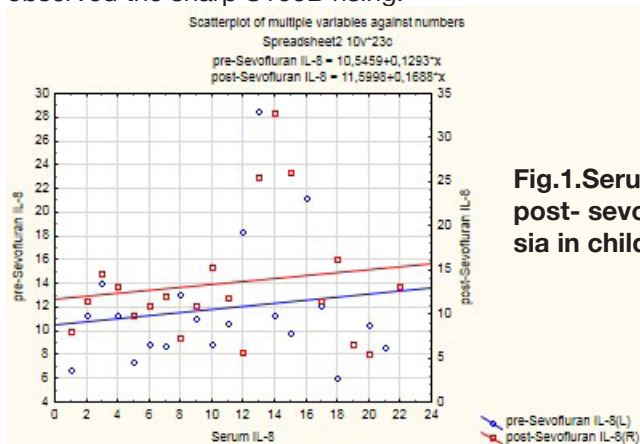
*The effect of inhalation anesthesia in pediatric practice is a widely extensively discussed problem. Despite the large accumulated experience of domestic and foreign colleagues, the search for optimization of the application and reduction of the negative impact, including minimization of neurotoxicity, the development of cognitive dysfunctions, as well as studying the modulation mechanisms of the systemic inflammatory response (SIRS) of inhalational anesthetics, in particular sevoflurane in pediatric anesthesiology especially in children with a premorbid background remain an important research area.*

**Keywords:** *pediatrics, anesthesia, sevoflurane, systemic inflammatory response, neuroinflammation, craniostenosis*

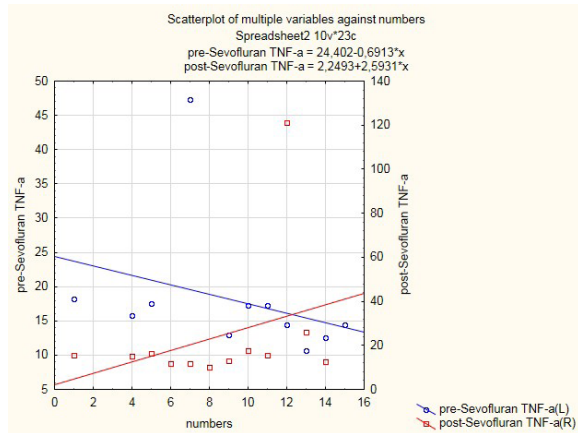
**Background:** The purpose of investigation was to determine the correlation between the neuroinflammation and brain damage biomarkers in paediatric patients with craniosynostosis under condition of general sevoflurane anesthesia without neurosurgery.

**Methods:** The prospective cohort clinical investigation included 23 II-III ASA paediatric patients with non-syndromal forms of craniosynostosis aged from 1-18 months. Head MRI scanning was performed under the condition of general inhalation sevoflurane anesthesia before any reconstructive operation. Anesthesia duration was  $29.11 \pm 5.6$  min. All paediatrics had good general condition without any infection disease before 2 weeks of MRI date investigation. Blood samples were taken twice: before the sevoflurane exposure and after examination ending. Serum samples were frozen by  $-36^{\circ}\text{C}$ . We defined IL-6, IL-8, IL-10, TNF- $\alpha$  ("Cobas Integra 400 Plus", Roche Diagnostics), protein S100B (S100A1B+S100BB; the sensitivity of the method is 90 ng/ml, Manufacturer Fujirebio Diagnostics (Sweden)). The analysis was performed on a Personal Lab analyzer from Adaltis (Italy).

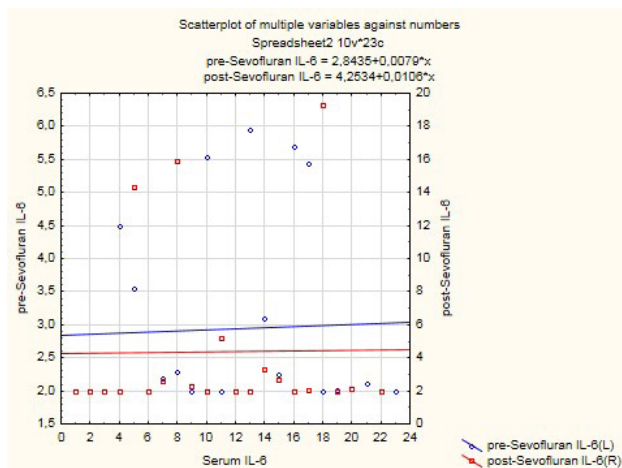
**Results:** After sevoflurane exposure we received the serum IL-8 rising ( $p < 0,045524$ ) (Fig.1); serum TNF- $\alpha$  significant decrease ( $p < 0,000002$ ) (Fig.2). In the 1 patient, we observed the serum IL-8 decrease but with the sharp serum TNF- $\alpha$  increase; statistical non-essential serum IL-6 increase (Fig.3); insignificant difference between serum IL-10 pre- and post-anesthesia levels ( $p < 0,000015$ ) (Fig.4). We received the serum protein S100B decrease ( $p < 0,000018$ ) (Fig.5), but only in 3 patient's blood samples we observed the sharp S100B rising.



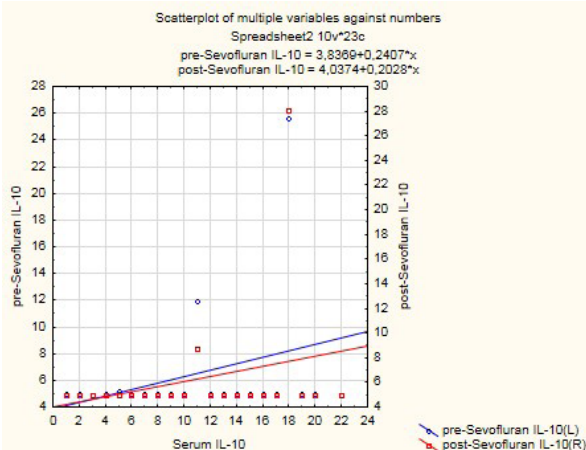
**Fig.1.** Serum IL-8 pre- and post- sevoflurane anesthesia in children.



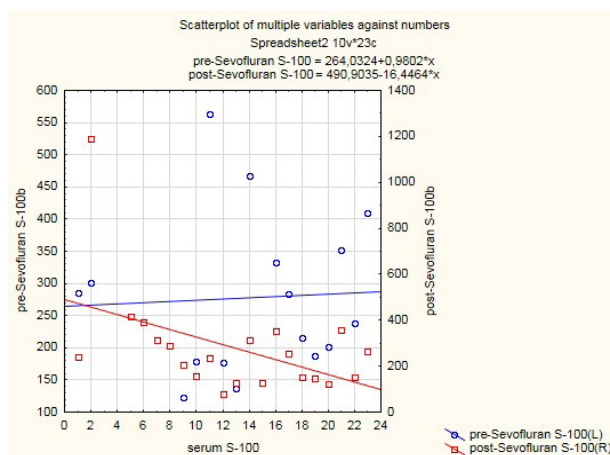
**Fig.2.Serum TNF-α pre- and post- sevoflurane anesthesia in children.**



**Fig.3. Serum IL-6 pre- and post- sevoflurane anesthesia in children.**



**Fig.4. Serum IL-10 pre- and post- sevoflurane anesthesia in children.**



**Fig.5. Serum S100B pre- and post- sevoflurane anesthesia in children.**

**Conclusion:** with a brief exposure to sevoflurane, a disturbance in the cytokine pool balance with a selective increase in the pro-inflammatory cytokine IL-8 and some decrease in TNF- $\alpha$  is already observed, which can probably be assumed to form a systemic inflammatory response as a compensatory response of the body when anesthetized. The absence

of a significant difference in the study of IL-6, IL-10 probably indicates that due to the short duration of the anesthetic in our study, we could not see the expanded picture of SVO, but here we can judge the allowable time of use of sevoflurane. In almost all the examples, we received a decrease in the neurospecific protein S-100B, which according to known scientific data indicates the formation of neuro-autoregulation processes and brain protection under conditions of a damaging factor — with a brief anesthetic effect, which is a positive prediction, and we can assume the protective effect of sevoflurane on the brain and, accordingly, we consider it appropriate to use sevoflurane in children with craniosynostosis.

**Competing interests:** the authors declare that they have no competing interests.

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## **ASSESSMENT OF THE FORMATION OF THE NECESSARY COMPETENCIES IN THE COURSE OF EMERGENCY CARE FOR STUDENTS OF A MEDICAL UNIVERSITY**

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*Our article provides statistical information that allows us to assess the level of training of medical Students at different stages of studying to provide emergency care in various situations. On the basis of the Department of traumatology, orthopedics and neurosurgery our scientific group has developed a unique questionnaire that includes the most complete list of emergency situations to which medical students should be able to respond correctly at the end of their training. As a confirmation of the work done, the article presents: a table with a summary of results, analysis graphs and results in the form of conclusions.*

*Keywords: Medical universities, questionnaires, analysis, first aid, emergency situations, serious condition, bleeding.*

### **Introduction**

This year, on the basis of the Krasnoyarsk State Medical University, the All-Russian Contest «Neotlozhka» («Urgency») was held, where the best students of medical universities competed in the ability to provide assistance in extreme situations. We became interested in how much an average medical student's level of professional competencies

is formed. Together with the teachers of the Department of Traumatology, as well as specialists in the field of resuscitation and intensive care, obstetrics and gynecology, author's questionnaire was developed. It includes questions on the rules of assistance in standard and often encountered extreme situations. An interesting dependence of the questionnaire results on the student faculty and the year of study was built after analyzing the work.

### **Purpose**

To assess the students' readiness for professional activities in extreme situations in the dynamics of the occupational genesis. To make a forecast of ways to solve the problems associated with the preparation of graduates of medical universities.

### **Material and methods**

We have developed an author's questionnaire. Its first part includes five situational tasks with a free answer, the maximum score is 9. The second part contains three questions with several possible answers and the third – two tasks for building a sequencing, each answer is estimated at 1 point. The maximum possible score is 14.

The first part included tasks about first aid for burns, arterial and upper digestive tract bleeding, suicide attempt, as well as the priority issue in choosing between surgery for acute appendicitis and for small intestine obstruction. The second part – questions about the action in case of: myocardial infarction, frostbite, as well as the identification of signs of the onset of labor. The third – questions about triple intake of Safar and a major epileptic seizure sequencing.

664 people took part in the survey: 124 from the 2nd year, 136 from the 4th year and 144 from the 6th year of Medical Care Faculty. 60 people from the 2nd year, 64 from the 4th year and 56 from the 6th year of the Pediatric Faculty. 24 works from the 2nd year, 26 from the 4th year and 24 from the 5th year of the Faculty of Dentistry. We examined the sixth years at the Medical and Pediatric Faculties and the fifth at the Dental, inasmuch as in Russians medical universities, the Medical and Pediatric Faculties include six years of studying, while the Dental Faculty includes only five.

Summary and grouping of the statistical survey results, analysis and interpretation of data.

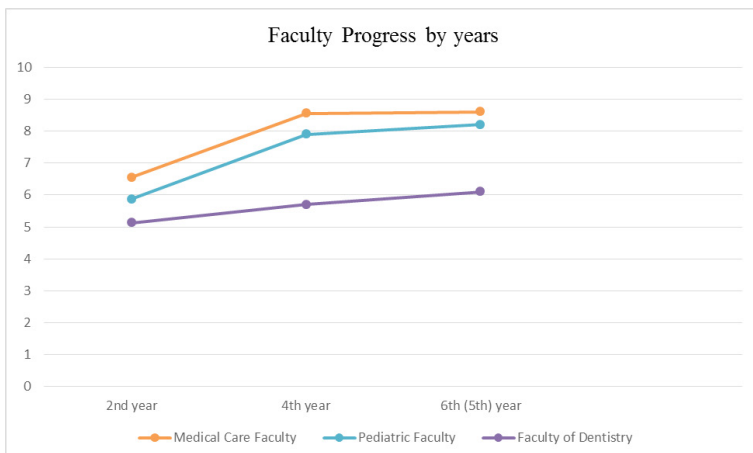
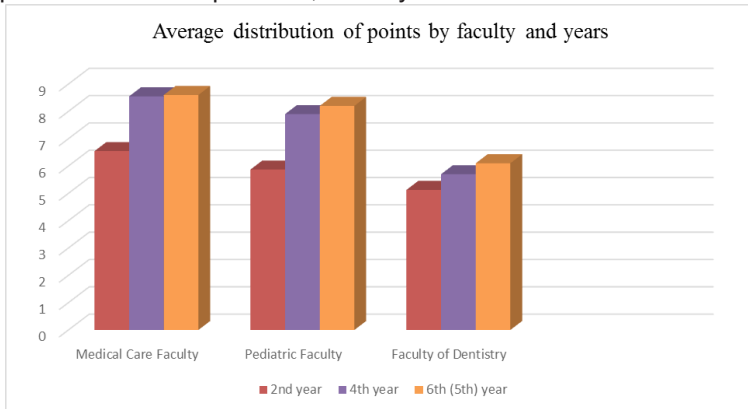
Based on a summary and grouping of the survey results, we compiled the present table, which indicates the average scores of each stream (table No. 1).

Table number 1

Year \ Faculty	Medical Care		Pediatrics	Dentistry
	First stream	Second stream		
2	6.45	6.64	5.87	5.125
4	8.6	8.5	7.9	5,7
6 (5 for Dentistry)	9	8.2	8.2	6.1

The distribution of the survey results is presented below:

In the process of counting and checking questionnaires, our scientific group identified some patterns, namely:



1) Students of all years and faculties do an excellent job of helping people with burns, arterial bleeding and frostbites;

2) Students of all years and faculties poorly differentiate signs of the onset of labor and incorrectly prioritize the choice between surgery for acute appendicitis and for the small intestine obstruction;

3) The greatest increase in knowledge in the field of emergency and emergency care is noted between the 2nd and 4th year students, while between the 4th and 6th year students (5th in Dentistry) the increase in knowledge is moderate;

4) 2nd year students of all faculties have difficulty completing tasks aimed at providing first aid in attempted suicide, as well as tasks with triple intake of Safar and a major epileptic seizure sequencing;

5) 4th year students (mainly specialties in Medical Care and Pediatrics) are able to provide assistance to patients with epilepsy and myocardial infarction, but still find it difficult to correctly answer the question about the sequence of actions for taking Safar;

6) Most students of the 6th year of medical care and pediatrics know the sequence of actions when taking Safar and with the help of a patient with epilepsy.

### **Conclusions**

According to the results of the work, it is clearly seen that the level of formation of professional competencies of medical university students is growing each year. The most noticeable is the progress of students in the faculties of Medicine and Pediatrics, which level of preparation at the 4th and 6th years is sufficient to provide urgent or emergency care. At the same time, it should be noted that we rated the training level of all faculties 2nd year students as unsatisfactory. Throughout all years the level of training of the Dentistry Faculty students is insufficient although growth is noticeable. Our scientific group is convinced that a student of a medical university of any year and faculty should be ready to provide full urgent or emergency assistance, which at the moment, unfortunately, is not this way. It is necessary to conduct training sessions with simulation of an emergency, individual tests after the trainings, test control with complication of input data to improve the formation of professional competencies of a medical university student.

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**PROGRESSION DE L'INSUFFISANCE VEINEUSE DES MEMBRES  
INFÉRIEURS SELON DES DÉLAIS DE L'APPLICATION DE LA  
SUTURE VASCULAIRE SUR UNE GRANDE VEINE SAPHÈNE  
TRAUMATISÉE LORS D'OPÉRATIONS AUX MALLÉOLES  
DEVELOPMENT OF VENOUS INSUFFICIENCY OF THE LOWER  
EXTREMITIES DEPENDING ON THE TIMING OF APPLYING  
A VASCULAR SUTURE TO A LARGE SUBCUTANEOUS VEIN  
DAMAGED DURING ANKLE OPERATIONS**

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**Objectif de l'étude:** déterminer la fréquence de la progression de l'insuffisance veineuse des membres inférieurs selon des délais de l'application d'une suture vasculaire sur une grande veine saphène traumatisée lors d'opérations aux malléoles.

**Matériaux et méthodes:** on a examiné 18 patients, opérés en raison des fractures fermées des malléoles, qui ont subi, lors de l'opération, une lésion iatrogène de la grande veine saphène, à l'endroit où elle passe près de la malléole interne. Initialement, tous les patients inclus dans l'étude n'avaient aucun signe d'insuffisance veineuse des membres inférieurs.

Les patients dont la grande veine saphène avait un trauma primaire n'ont pas été inclus dans les groupes d'étude. 3 groupes de patients ont été observés. Les patients du premier groupe (8 personnes), dont la suture vasculaire a été réalisée au cours de l'opération primaire – après la réalisation de l'ostéosynthèse des malléoles. Dans le deuxième groupe (4 personnes), une réparation de la continuité de la veine a été effectuée dans le délai de 8 et 12 jours après l'opération primaire. Dans le troisième groupe (6 personnes), la suture vasculaire a été appliquée un an plus tard, lors de la deuxième opération – en raison d'enlever les implants métalliques. Pendant la période postopératoire, une évaluation comparative des plaintes des patients et des données d'une étude objective caractérisant la progression de l'insuffisance veineuse des membres inférieurs a été réalisée.

**Résultats de l'étude:** les patients qui ont subi une réparation du flux du vaisseau par le traitement chirurgical lors de l'opération primaire, avaient le flux sanguin dans les veines sans changement, et aucun signe de l'insuffisance veineuse n'a été identifié. Les patients qui ont eu une réparation du flux du vaisseau par le traitement chirurgical lors de l'élimination des implants métalliques, pendant la période précédante à l'élimination des implants métalliques, avaient une progression des signes de l'insuffisance veineuse dans 92%.

**Conclusion:** en cas de la réparation précoce du vaisseau traumatisé (au moment de l'opération primaire), aucun signe de l'insuffisance veineuse n'est observé, contrairement aux patients dont la réparation du vaisseau a lieu au moment de l'opération de l'élimination des implants métalliques.

**Mots - clés:** insuffisance veineuse, suture vasculaire, grande veine saphène du pied, fracture de la malléole interne, traumatologie.

**Introduction.** Après environ 2 années d'étude de ce problème, constatant que les patients, dont la grande veine saphène est traumatisée lors de la période peropératoire, ont le premier signe d'insuffisance veineuse des membres inférieurs, nous avons commencé à envisager des solutions. On a envisagé une possibilité d'application d'une suture vasculaire sur la zone traumatisée d'une grande veine saphène au point de la malléole interne aux moments différents [1-4]

**Objectif de l'étude.** Déterminer la fréquence de la progression de l'insuffisance veineuse des membres inférieurs selon le moment de l'application de la suture vasculaire sur une grande veine saphène traumatisée lors de l'opération aux malléoles.

**Matériaux et méthodes:** on a examiné 18 patients, dont la grande veine saphène est traumatisée lors de la période peropératoire, à l'endroit où elle passe près de la malléole interne, hospitalisés dans la division de traumatologie n ° 2 de l'Hôpital clinique n ° 6 G. A. Zakharine, Penza.

Tous les patients ont été divisés en 3 groupes:

1. Un groupe de patients (8 personnes), la suture vasculaire a été réalisée au cours de l'opération primaire – après la réalisation de l'ostéosynthèse des malléoles.

2. Groupe de patients (4 personnes), une réparation de la continuité de la veine a été effectuée dans le délai de 8 et 12 jours après l'opération primaire.

3. Groupe de patients (6 personnes) la suture vasculaire a été appliquée un an plus tard, lors de la deuxième opération – en raison d'enlever les implants métalliques.

Les critères de sélection étaient:

1. Trauma fermé à la malléole interne (dans le cas des traumas ouverts, des lésions vasculaires saphènes se sont produites aux niveaux différents au moment du trauma et les données n'étaient pas objectives) [5-6].

2. Trauma iatrogène peropératoire de la grande veine saphène lors de l'accès à la malléole interne [7-8].

3. L'absence initiale des signes de l'insuffisance veineuse des membres inférieurs (exclu au stade de la préparation préopératoire lors de l'échographie vasculaire et par suite, tels patients ne participaient dans l'étude) [9].

La suture vasculaire a été réalisée indépendamment des délais du trauma, en cas d'intersection transversale ou complète d'une grande veine saphène lors de l'opération dans le cas d'une fracture de la malléole interne. Dans ces cas, une suture vasculaire est appliquée à l'aide d'un microscope (Img.1) et des instruments microchirurgicaux, le flux du sang veineux à travers le vaisseau a été reconstruit.



**Img.1 Le microscope pour l'application des sutures vasculaires.**

Pour l'application des sutures vasculaires, on utilisait le matériel de suture Prémilene 6/0 ou 7/0. (Img. 2).



Img. 2. Le material de suture.

**Résultats.** Pendant leur séjour à l'hôpital tous les jours, ainsi que lors d'examens de contrôle (8 semaines après, 6 mois, 1 an, après l'élimination des implants métalliques, 15 mois après le trauma), nous avons examiné tous les patients, indépendamment du fait s'il y ait eu un trauma veineux peropératoire ou pas. Les plaintes ont été recueillies, les antécédents de travail ont été pris en compte, l'UZDG a été effectué, le mesurage de la circonférence de la malléole, du pied a été effectué.

Le tableau ci-dessous représente la fréquence des complications, y compris l'insuffisance veineuse des membres inférieurs et d'autres. (Tabl.1)

**Tableau 1. La fréquence des complications selon les délais de l'application de la suture vasculaire.**

	Progression des complications	
	insuffisance veineuse	autres
1 groupe de patients	0	0
2 groupe de patients	Délais précoces de l'obtention des données objectives.	75% (1 cas de l'invalidité d'anastomose, 2 cas des processus inflammatoires)
3 groupe de patients	92%	16,7% (l'invalidité d'anastomose)

D'après les données ci-dessus, il vient que les patients qui ont subi un trauma iatrogène peropératoire d'une grande veine saphène, mais après l'ostéosynthèse, une suture vasculaire a été réalisée, n'ont aucun signe de l'insuffisance veineuse (données objectives, données échographiques, plaintes des patients).

Dans le deuxième groupe de patients, où la suture vasculaire a été réalisée dans les délais de 8 à 12 jours, il n'était pas possible d'évaluer objectivement les signes de l'insuffisance veineuse. En plus, un grand risque de complications a été identifié, dans 75% des cas, ce qui est lié à une intervention chirurgicale répétée dans les délais précoces. La probabilité de complications purulentes-inflammatoires a considérablement augmenté. Par conséquent, l'application d'une suture vasculaire dans ces délais a été renoncée et les patients ne participaient plus à l'examen.

Dans le troisième groupe de patients, où la réparation de la continuité du vaisseau se produisait aux délais plus retardés de la première opération, c'est-à-dire lors de l'élimination des implants métalliques, des signes de l'insuffisance veineuse ont été observés dans 92% des cas (plaintes prises en compte, échographie régulière, mesurage de la circonférence du pied et de la malléole), mais pendant une échographie 3 mois après l'élimination des implants métalliques (c'est-à-dire, 1 an et 3 mois après le moment de l'opération), il a été révélé que le flux sanguin dans les veines était normalisé, il y avait une diminution du diamètre de la grande veine saphène presque aux indicateurs sur le pied sain. En plus, les patients ont noté une diminution considérable des plaintes.

### **Discussion:**

Lors des opérations traumatologiques, une grande attention est accordée au repositionnement des fragments osseux, souvent sans prêter attention à la composante vasculaire [10].

Il est très important d'attirer l'attention des chirurgiens-traumatologues à la nécessité de préserver la grande veine saphène, et dans le cas de son trauma en peropératoire, sa réparation est obligatoire, ce qui évite la progression des signes de l'insuffisance veineuse en cas de la réparation lors de la première opération et l'amélioration de la condition des patients lors de la réparation du vaisseau pendant l'élimination des implants métalliques des malléoles [11].

**Conclusion:** en cas de la réparation simultanée de la continuité du vaisseau, c'est-à-dire pendant une opération - ostéosynthèse des malléoles et la réalisation d'anastomose vasculaire, les signes de la progression de l'insuffisance veineuse peuvent être évités dans 100% des cas. S'il est impossible de la réaliser l'anastomose en cas du trauma peropératoire de la grande veine saphène (difficultés techniques, l'absence de la maîtrise, caractère compliqué de la fracture, une période longue où le patient se trouve sur la table d'opération, etc.), alors selon nos données l'insuffisance veineuse des membres inférieurs se développe dans 92 % des cas, mais même lors de la réparation du flux du sang dans la veine après un an, les signes de l'insuffisance veineuse diminuent.

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**EVALUATION OF DYNAMICS OF METALLOPROTEINASE ACTIVITY  
AND INDICATORS OF OXIDATIVE STRESS IN THE TREATMENT  
OF BURNS WITH A NEW DERIVATIVE OF N-ACETYL-6-  
AMINOHEXANOIC ACID**

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*The aim of the study was to examine in a rat experiment the effectiveness of using a new derivative of N-acetyl-6-aminohexanoic acid in healing burn skin wounds, assessing the dynamics of metalloproteinase activity and indicators of oxidative stress in the blood at the stages of the wound process. The results showed that the use of a new derivative of N-acetyl-6-aminohexanoic acid demonstrated its regenerative properties, which was manifested in accelerating the healing of experimental thermal burns against the background of restoration of balance in the system of matrix proteinases and their tissue inhibitors and a decrease in the activity of free radical processes, which are one from pathogenetic factors of the wound process.*

*Keywords: burn wound, derivative of N-acetyl-6-aminohexanoic acid, oxidative stress, planimetry.*

## **Introduction**

Among skin lesions, thermal burns account for a significant proportion and their treatment remains relevant from a medical and socio-economic point of view, since it involves significant costs for the treatment and rehabilitation of victims [1, 2]. Currently, in the healing of skin wounds, a large number of dosage forms for local exposure are used [3, 4], however, their mechanisms of action are not justified. At the same time, preparations based on N-acetyl-6-aminohexanoic acid and its derivatives are one of the promising wound healing substances [5]. The prevention of acute experimental defects of the gastric mucosa of various origins and duodenal ulcers in rats with zinc acexamate was experimentally established [6]. The synthesized new derivatives of acexamamic acid are characterized not only by reparative properties, but also have a high safety potential [7]. In this regard, it is very important to evaluate the biochemical mechanisms that underlie the stimulation of the regeneration of thermal burns of the skin, followed by the justification of the selection of the dose of the drug, the method of its administration and the selection of the correct tactics for treating the wound depending on its stage to exclude possible complications.

## **Purpose**

To study the effectiveness of using a new derivative of N-acetyl-6-aminohexanoic acid in healing burn skin wounds in an experiment on rats, to evaluate the dynamics of metalloproteinase activity and indicators of oxidative stress in the blood at the stages of the wound process.

## **Material and research methods**

The model objects were 45 white non-inbred female rats weighing 180-200 g. Before the experiment, the animals were quarantined for 14 days. The skin surface was depilated, and then, under conditions of general inhalation anesthesia with ether vapors [8], a thermal burn of 225 mm<sup>2</sup> was performed using a steel stencil in the interscapular region. At an incandescent temperature of 240 °C and an exposure of 8 seconds, a burn of the III degree was formed on the skin. All manipulations with animals were carried out in accordance with the "European Convention for the Protection of Vertebrate Animals Used for Experiments or for Other Scientific Purposes" (Directive 2010/63/EU).

We studied the wound healing properties of a new derivative of N-acetyl-6-aminohexanoic acid (LHT 2-18), synthesized at JSC "VSC BAV" (Staraya Kupavna), using it locally in the form of a 2% ointment based on polyethylene glycol.

The animals were divided into groups that differ in their effect on the defect area: rats of group № 1 were applied with an ointment base (polyethylene glycol), group № 2 with LHT 2-18 in the form of 2% ointment. To the rats of the control group, preparations were not applied; a spontaneous course of the wound process occurred. Local applications of substances were performed once daily after measuring the area of wounds, starting from the second day of the study, until the time of scab rejection.

Burn regeneration was monitored to reduce the area of thermal defect by the planimetric method. Starting from the second day of the experiment, the contours of each defect were daily transferred onto a transparent film and its area was calculated using graph paper.

To determine the biochemical parameters in animals, blood was taken from the femoral vein in the amount of three milliliters on the 7th, 14th and 21st day of the study. In animal blood serum samples, enzyme-linked immunosorbent assay determined levels of type 9 metalloproteinase (MMP-9) and tissue inhibitor of type 1 metalloproteinases (TIMP-1) using the Rat Total MMP-9 test from R&D Systems, Inc. (USA) and Rat TIMP-1 manufactured by Cloud-Clone Corp. (USA). By the photometric method using the test systems "Total Oxidative status/capacity PerOx (TOS) Kit" and "Total Antioxidative status/capacity PerOx (TAS) Kit" manufactured by Immundiagnostik AG (Germany), the indicators of oxidative stress (OS) - the total oxidative (TOS) and total antioxidant (TAS) activity of serum. The oxidative stress index (OSI) was defined as the ratio of TOS to TAS.

Statistical analysis of data was performed using the IBM® SPSS® Statistics 23.0 software program "IBM Corporation" (USA). Quantitative data are presented as arithmetic mean and standard error of the mean. To assess the statistical significance of the difference in means in the two groups, Student and Mann-Whitney criteria were used, in three groups - Kruskal-Wallis. The differences between the indices in the groups were considered statistically significant at  $p < 0.05$ , and there was a trend of differences at  $p < 0.1$ .

### **Research results and discussion**

As a result of thermal exposure, experimental animals developed a burn of the III B degree with damage to all skin layers, accounting for 4-5% of the total body surface area.

On the first day after the burn, animals of all groups were inactive, listlessly, in small quantities, took food. On the third day after the injury, motor activity and appetite were fully restored in animals of groups № 1 and № 2, while in animals of the control group there were signs of physiological discomfort. The defect area in rats of the control group decreased slowly

and on the 7th day of the study was  $215.5 \pm 3.74 \text{ mm}^2$ , on the 14th day -  $126.1 \pm 3.50 \text{ mm}^2$ , on the 21st day -  $43.3 \pm 5.49 \text{ mm}^2$ . A similar dynamics of thermal burn healing was also observed in animals of group № 1. The area of wound defects was  $209.8 \pm 2.37 \text{ mm}^2$ ,  $120.6 \pm 2.37 \text{ mm}^2$  and  $38.1 \pm 5.01 \text{ mm}^2$ , respectively, at 7, 14 and 21 days of research. However, in rats of group № 2 on the 7th day of the study, the area of the wounds was  $176.0 \pm 12.62 \text{ mm}^2$ , on the 14th day -  $48.5 \pm 6.71 \text{ mm}^2$ , and on the 21st day complete scarring of the wounds was noted. The wound areas in animals of group № 2 at all control points of the study were statistically significantly less ( $p < 0.05$ ) than in rats of the control group and group № 1.

By the seventh day of the experiment, in animals of groups 1 and 2, the burn area decreased on average by 18% and 20%, respectively, while in the control - by 16%. On the 14th day of the experiment, the areas of wound defects decreased in the control group of rats by 44%, in groups № 1 and № 2 - by 47 and 78%, respectively. On the 17th day of the experiment, group 2 rejected scab fragments, under which the connective tissue scar was visualized. On the 21st day of the study, the burn wound in animals of group № 2 was completely healed, while in the control group the wound area was 19%, and in group № 1 it was 17% of the initial area of the applied defect. In the control group and rat group № 1, complete epithelization was observed only on the 23rd day. The results obtained in this study indicate the pro-regenerative properties of the new derivative of N-acetyl-6-aminohexanoic acid, applied topically as 2% ointment.

Assessment of the state of the system of matrix metalloproteinases and their tissue inhibitors when modeling a thermal burn revealed the dynamics of both enzymes and their inhibitors, as well as a change in their balance in the blood depending on the stage of the wound process. On the 7th, 14th and 21st day of the experiment in the control group of animals, the concentration of MMP-9 was  $12.1 \pm 0.98 \text{ ng/ml}$ ,  $15.7 \pm 1.18 \text{ ng/ml}$  and  $9.32 \pm 0.90 \text{ ng/ml}$ , respectively; in group № 1 -  $11.97 \pm 2.01 \text{ ng/ml}$ ,  $14.7 \pm 1.02 \text{ ng/ml}$  and  $8.40 \pm 0.88 \text{ ng/ml}$ ; in group № 2 -  $6.75 \pm 0.58 \text{ ng/ml}$ ,  $8.86 \pm 0.82 \text{ ng/ml}$  and  $5.34 \pm 0.39 \text{ ng/ml}$ . The levels of TIMP-1 at the same time of observation were in the control group of rats -  $3.23 \pm 0.39 \text{ ng/ml}$ ,  $4.06 \pm 0.44 \text{ ng/ml}$  and  $4.55 \pm 0.49 \text{ ng/ml}$ ; in group № 1 -  $3.95 \pm 0.62 \text{ ng/ml}$ ,  $4.25 \pm 0.44 \text{ ng/ml}$  and  $4.68 \pm 0.44 \text{ ng/ml}$ ; in group № 2,  $3.43 \pm 0.37 \text{ ng/ml}$ ,  $4.91 \pm 0.44 \text{ ng/ml}$  and  $6.49 \pm 0.50 \text{ ng/ml}$ . Thus, it was found that in the blood serum of all rat groups, an increase in the level of MMP-9 on the 7th and 14th day of the experiment and a decrease by 21 days are clearly observed, and the concentration of TIMP-1 increases at all periods of the experiment, which, in general, leads to a decrease the level of proteinases

compared with the content of their inhibitors. Considering the fact that for the adequate course of tissue remodeling processes during the regeneration process, it is not the absolute content of MMP and/or TIMP that matters, but their ratio, i.e. balance, for further evaluation, we compared the values of the MMP-9/TIMP-1 ratio.

The results of the study indicate that for all groups of animals the indicators of MMP-9/TIMP-1 in the blood on the 7th, 14th and 21st days of the repair of thermal burns of the skin decreased as the defect healed. In the control group of animals, this indicator was  $4.32 \pm 0.49$ ,  $4.16 \pm 0.30$  and  $2.15 \pm 0.12$ , in group № 1 -  $3.36 \pm 0.30$ ,  $4.41 \pm 0.81$  and  $1.89 \pm 0.18$ , respectively, days of observation. As follows from the above results, the differences between the values of MMP-9/TIMP-1 at all stages of the experiment in the control group and group № 1 were statistically unreliable, therefore, the use of the ointment base does not have a regenerating effect. Moreover, in the blood of rats of group № 2, the values of MMP-9/TIMP-1 were  $2.25 \pm 0.28$ ,  $1.85 \pm 0.19$  and  $0.88 \pm 0.08$  (all  $p < 0.05$ ) by 7, 14 and 21 days, respectively. We calculated the ratio of MMP-9/TIMP-1 in the blood of 10 intact rats, which averaged 0.7. Thus, the results of the study indicate that only in the group of animals that received treatment for burn wounds with a new derivative of N-acetyl-6-aminoheptanoic acid (group № 2), proteolytic activity was lower at all stages of the wound process and by 21 days of the study almost close to normal.

OS analysis showed that the activity of oxidative processes and antioxidant protection in blood serum depends on the stage of the wound process. The dynamics of the TOS and TAS values consisted of their increase in the first two weeks of observations and a decrease in the third week of the experiment. So, on the 7th, 14th and 21st day of the experiment in the control group of animals, the TOS concentrations were  $17.6 \pm 1.48 \mu\text{mol/l}$ ,  $156.3 \pm 43.4 \mu\text{mol/l}$  and  $144.1 \pm 24.38 \mu\text{mol/l}$ , respectively; in group № 1,  $57.2 \pm 10.84 \mu\text{mol/l}$ ,  $159.4 \pm 46.9 \mu\text{mol/l}$  and  $135.0 \pm 26.12 \mu\text{mol/l}$ ; in group № 2,  $58.0 \pm 10.84 \mu\text{mol/l}$ ,  $125.3 \pm 20.43 \mu\text{mol/l}$  and  $58.3 \pm 9.54 \mu\text{mol/l}$ . TAS levels at the same observation time were in the control group of rats -  $4.82 \pm 0.54 \mu\text{mol/l}$ ,  $63.8 \pm 10.9 \mu\text{mol/l}$  and  $142.1 \pm 7.06 \mu\text{mol/l}$ ; in group № 1 -  $19.9 \pm 4.96 \mu\text{mol/l}$ ,  $75.4 \pm 12.98 \mu\text{mol/l}$  and  $146.86 \pm 8.66 \mu\text{mol/l}$ ; in group № 2,  $21.2 \pm 4.93 \mu\text{mol/l}$ ,  $80.4 \pm 10.8 \mu\text{mol/l}$  and  $126.3 \pm 8.66 \mu\text{mol/l}$ .

The degree of revealed changes in TOS and TAS was expressed differently, therefore, for the subsequent assessment of the activity of the course of free radical processes, not absolute values of the indicators were used, but their ratio, called OSI, characterizing the balance between

oxidative and antioxidant processes. The results of the study indicate that for all groups of animals, OSI in the blood on the 7th, 14th and 21st day of treatment for thermal burns of the skin decreased as the defect healed. At the same time, there were no significant differences in the indicators characterizing the OS between the control groups and № 1 at all stages of observation. OSI indicators at three time points of the experiment amounted to  $3.78 \pm 0.62$  units,  $1.57 \pm 0.20$  units and  $0.50 \pm 0.08$ , respectively, while the statistical analysis revealed the presence of significant differences between these indicators. So, on the 7th day of the study, rats of group № 2 showed a tendency toward a decrease in OS activity relative to indicators in animals of the control group and group № 1. Moreover, the OSI value in animals of group № 2 compared with rats of the control groups and № 1 was 84.9% and 91.1%, respectively ( $p < 0.1$ ). The revealed tendency of differences in the studied groups intensified with the continuation of the experiment, and on days 14 and 21 the decrease in OSI in group № 2 became statistically significant compared with the control groups and № 1. On day 14, OSI in animals of group № 2 compared with rats of control groups and № 1 was 50.5% and 56.9%, and on day 21 it was 51.0% and 58.1%, respectively (all  $p < 0.05$ ). Therefore, the results of the study indicate a statistically significant decrease in the activity of oxidative stress during the repair of thermal burns in rats when they are treated with a new derivative of N-acetyl-6-aminoheptanoic acid.

**Conclusion.** Thus, the results of the study showed that the use of a new derivative of N-acetyl-6-aminoheptanoic acid demonstrated its regenerative properties, which was manifested in accelerating the healing of experimental thermal burns against the background of restoration of balance in the system of matrix proteinases and their tissue inhibitors and a decrease in the activity of free radical processes, which are one of the pathogenetic factors of the wound process.

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## TO THE QUESTION OF MEANS OF OPTIMIZING THE MECHANISMS OF HEART RHYTHM REGULATION

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*The influence of the biological product "Simbiol" on the work of heart rhythm control mechanisms was studied. According to the mathematical analysis of heart rhythm after the course of taking "Simbiol", the activity of the autonomous mechanism of regulation of the heart rhythm in highly qualified weight lifters increases. A decrease in the activity of the central regulation mechanism contributes to the expansion of the adaptive potential of the body of athletes in response to physical activity of large volume and intensity. As shown by the study of the component composition of the body by bioimpedansometry, a three-week intake of a biological product changes the component composition of the body. The volume of active muscle mass increases with a decrease in the fat component.*

*Keywords: "Simbiol" bio-product, athletes, heart rate, regulatory mechanisms, body composition.*

### **Relevance**

The peculiarity of modern sport is that the extreme physical exertion experienced by elite athletes previously applies to mass sports, including children's [1, 9]. Work in the so-called "emergency" mode for an organ-

ism with insufficient adaptive potential often carries the opposite effect. In place of the growth of sportsmanship, based on adequate functional capabilities, due to the high "price" for adaptation, functional exhaustion is formed, often turning into a pre-pathological and pathological state. Increasing the functional reserve of pharmaceuticals has its own limitations on the time and dose of administration. Safe in structural, physiological and biochemical nature is the use of so-called physiological "doping" in the form of adaptogens, actoprotectors, immunomodulators, etc., obtained from raw materials of plant and animal origin [3, 4, 5]. One of them is the "Simbiol" bio-product obtained from whey.

The purpose of the study was to assess the effect of "Simbiol" on the central and autonomous mechanisms that regulate the functioning of the heart muscle.

### **Research methods and organization**

36 weightlifting athletes aged 17-23 years were examined. The level of sportsmanship from 1 category to the master of sports. The examined were divided into two groups: the control group (CG) of 20 young men and the main group (MG) of 16 people. MG athletes used "Simbiol" (NPO Probio LLC, Bryansk, Russia) for 21 days. CG athletes received the equivalent dose of placebo in the same manner. The test product obtained by the method of microbiological processing of whey (cheese, curd, casein) using industrial cultures of lactic acid microorganisms and subsequent low-temperature thickening contains hydrolyzed whey protein, oligopeptides and free amino acids, glucose, galactose, lactates, nucleic acids, E, B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, PP, beta-carotene, ergosterol, folic acid, endosomal enzymes of lactic acid bacteria, micro and macro elements, polysaccharides. Evaluation of body composition was carried out according to standard methods using the apparatus "Tanita BC-601" ("Tanita Corporation", Japan). To assess the state of the regulatory mechanisms of the cardiovascular system, variational pulsometry was used according to the method of M.R. Baevsky [2]. Heart rate was recorded using the "Varicard 2.51" hardware-software complex ("Ramena", RF). The heart rate was recorded for 5 minutes at rest before starting to take the product and 21 days after completion of the course. Assessment of heart rate variability (HRV) was performed according to generally accepted time (Mx-Mn, RMSSD, SDNN, pNN50%, AMo, SI) and spectral (TP, HF, LF, VLF) characteristics. These indicators allow us to identify the contribution of both the autonomous and central contours of regulation, and the ratio of parasympathetic and sympathetic regulation to the adaptive reactions of the body. The results are presented as mean values and standard error of the mean

( $M \pm m$ ). Assessment of the reliability of differences in average values was carried out using t-student test. The significance level was considered relevant at  $p < 0.05$ .

### Results and discussion

The results of the work performed showed that for CG athletes, three-week training loads mainly suppress cholinergic regulation of the heart (table). In particular, the rate of Mx-Mn ( $p > 0.05$ ) is unreliably reduced by 30%, HF - by 84% ( $p < 0.05$ ), SDNN - by 32% ( $p < 0.05$ ), RMSSD - by 58% ( $p < 0.05$ ), pNN50% - by 19% ( $p > 0.05$ ). Against this background, adrenergic effects on the heart increase with an increase of 37% in the AMo index ( $p < 0.05$ ).

**Table**

**Dynamics of heart rate variability indicators after a course intake of a biological product ( $M \pm m$ )**

HRV index	Main group			Control group		
	Before taking Simbiol	After taking Simbiol	$p < 0,05$	Before taking a placebo	After taking a placebo	$p < 0,05$
Mx-Mn, ms	320 $\pm$ 29,38	428 $\pm$ 34,65	$p < 0,05$	329,0 $\pm$ 30,1	252,8 $\pm$ 32,71	$p > 0,05$
RMSSD, ms	42,7 $\pm$ 4,21	72,7 $\pm$ 6,12	$p < 0,05$	45,2 $\pm$ 4,86	28,6 $\pm$ 2,37	$p < 0,05$
SDNN, ms	62,0 $\pm$ 6,78	69,3 $\pm$ 4,09	$p > 0,05$	71,0 $\pm$ 7,02	53,8 $\pm$ 5,06	$p < 0,05$
pNN50, %	33,5 $\pm$ 3,71	46,9 $\pm$ 4,54	$p < 0,05$	29,1 $\pm$ 3,63	24,4 $\pm$ 3,01	$p > 0,05$
AMo, %	35,0 $\pm$ 3,09	23,1 $\pm$ 2,08	$p < 0,05$	32,9 $\pm$ 3,60	45,1 $\pm$ 5,95	$p < 0,05$
SI, cu.	93,1 $\pm$ 6,17	70,6 $\pm$ 4,51	$p < 0,05$	88,3 $\pm$ 5,52	125,0 $\pm$ 8,48	$p < 0,05$
TP, ms <sup>2</sup>	3531 $\pm$ 404	5003 $\pm$ 521	$p < 0,05$	3488 $\pm$ 435	2695 $\pm$ 313	$p > 0,05$
HF, ms	1003 $\pm$ 146	1598 $\pm$ 203	$p < 0,05$	1197 $\pm$ 157	651 $\pm$ 102	$p < 0,05$
LF, ms	1234 $\pm$ 236	1091 $\pm$ 207	$p > 0,05$	1255 $\pm$ 229	1578 $\pm$ 250	$p > 0,05$
VLF, ms	349 $\pm$ 62	522 $\pm$ 80	$p > 0,05$	325 $\pm$ 51	363 $\pm$ 59	$p > 0,05$

According to spectral analysis, the total spectral activity (TP) decreases by 29% ( $p > 0.05$ ), the activity of the vasomotor center (LF) increases by 26% ( $p > 0.05$ ) and by 12% ( $p > 0.05$ ) activity of the cortical-humoral heart rate control circuit. A significant increase in the regulatory system tension in CG athletes upon completion of the training mesocycle is indicated by a significant increase of 42% ( $p < 0.05$ ) in the stress index (SI). According to a number of authors [7, 8], such a reac-

tion indicates the formation of a dysregulatory type of regulation caused by physical exertion. The pronounced predominance of cholinergic regulation among individual CG athletes deserves a close analysis, which, apparently, indicates a relatively low level of fitness, not excluding the transition to a state of overtraining. For this part of the athletes, paradoxically high indices of mainly spectral characteristics of HRV are recorded. In particular, in the subject N. The number of Mx-Mn was higher than 700 ms, TP - above 21393 ms<sup>2</sup>, LF - above 12217 ms, VLF - above 2799 ms, with a decrease in SI to a minimum value of 8 cu. According to cardiologists, autonomic dysfunction is often a predictor of heart damage and this should be taken into account by trainers and educators when building the training process. The course application of "Simbiol" by MG athletes with the same physical exertion improves the body's functional capabilities, expanding its adaptive potential. The basis of the expansion of the functional reserve is the strengthening of cholinergic effects on the heart muscle, which, as is known, perform trophotropic function [6]. After the course intake of the biological product, an increase in the average values of the following indicators is noted: Mx-Mn by 34% ( $p < 0.05$ ), RMSSD - by 70% ( $p < 0.05$ ), pNN50% - by 40% ( $p < 0.05$ ), SDNN - by 12% ( $p > 0.05$ ). From the spectral characteristics of MG athletes, the total power of the TP spectrum increases by 42% ( $p < 0.05$ ); HF - by 59% ( $p < 0.05$ ), VLF - by 50% ( $p > 0.05$ ). The integral indicator of the tension of SI regulatory systems is reduced by 32% ( $p < 0.05$ ). A favorable factor is the absence among MG weightlifters of athletes with extreme values of the studied parameters, both in the direction of uncontrolled growth of adrenergic and cholinergic effects. We consider this condition as confirmation of the balance of regulatory systems for controlling heart rhythm. As a result of the studies, the positive effect of the "Simbiol" drug on the functional status of weightlifters during training loads was shown for the first time. After a three-week use of the bio-product, the autonomic regulation of the heart improves. An increase in the ergotropic function of regulatory systems directly during training and an increase in trophotropic activity in a state of relative dormancy are shown. The results obtained are one of the proofs of the expansion of adaptive capabilities during physical exertion and an increase in the efficiency of work in a state of relative rest. Taken together, the revealed changes in the work of the body at the level of regulation of the heart rhythm provide an increase in the physical performance of weightlifters and increase resistance to physical stress. When studying the component composition of the body, it was shown that the course

application of "Simbiol" is accompanied by an increase in muscle mass amid a decrease in the fat component of the body composition.

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**THE NATURE OF THE INFLUENCE OF THE SPECIALIZED FOOD  
PRODUCT "MDX MULTICOMPLEX" ON THE TYPOLOGICAL  
FEATURES OF THE AUTONOMIC REGULATION OF HEART  
RHYTHM IN HIGHLY QUALIFIED ATHLETES IN CERTAIN TYPES OF  
ATHLETICS**

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*The effect of the "MDX Multicomplex" food product on the functioning of the autonomous and central mechanisms of heart rate regulation in 44 highly qualified middle-distance athletes, sprinters and throwers at the pre-competitive stage of the annual training cycle was studied. The state of the mechanisms of autonomic regulation of the heart rhythm was carried out by the method of mathematical analysis using the hardware-software complex "Varicard 2.51". The increased activity of the autonomous mechanism of regulation of the heart rhythm after a course of "MDX Multicomplex" is shown. A positive moment should be considered the change in some athletes of the central control of the heart rhythm to autonomous, which helps to expand the adaptive capabilities of the body during training and competitive activities.*

*Keywords: athletes, heart rate, autonomic regulation, bioproduct.*

**Relevance**

Nowadays, products of natural origin increasingly often appear on the sports nutrition market, the distinguishing feature of which is safety for the health of athletes, a "soft" growing effect on the organs and systems of the body, which is based on increasing physical performance, improving

the functional state of the body, enhancing immunity and acceleration of recovery after training and competitive loads [4, 7, 8, 9]. This group also includes products derived from whey with a long history of use [1]. In recent years, NPO "Probio" LLC (Bryansk, Russia) has developed a modern technology for producing a specialized food product for sports nutrition called "MDX Multicomplex".

**Purpose of the study** - assessment and biomedical grounding for the use of sports nutrition bioproduct "MDX Multicomplex" to increase the adaptive capabilities of athletes of certain types of athletics.

### **Research methods and organization**

The study involved 26 middle-distance athletes, 12 sprinters and 6 hammer throwers (average age  $22.5 \pm 1.7$  years) at the pre-competition stage of the annual training cycle. The dynamics of the cellular composition of the blood, providing oxygen-transporting functions of the blood and the state of the immune status, were evaluated. Within 21 days, athletes took a specialized product according to the recommended regimen. Measurement of indicators was carried out twice: at the beginning and at the end of admission. Heart rate was recorded on a "Varikard 2.51" hardware-software complex ("Ramena", RF). Cardiointervograms were recorded for 5 minutes at rest twice: before starting to take the product and 21 days after completion of the course. Assessment of heart rate variability (HRV) was performed according to the most important time and spectral (MxDMn, AMo, SI, TP) characteristics. The division into types of autonomic regulation depending on the dominance of a central or autonomous regulation mechanism was carried out according to the classification of Shlyk N.I. [5]. The results are presented as mean values at standard error of the mean ( $M \pm m$ ). Assessment of the reliability of differences in average values was carried out using t-student test. The significance level was considered relevant at  $p < 0.05$ .

### **The results of the study**

In sports physiology, the concept that the cardiovascular system is an indicator of the adaptive reactions of the whole organism has gained wide acceptance [5]. The optimal management of the training process largely depends on the state of the cardiovascular system. How successful the participation of the cardiovascular system in maintaining homeostasis will be, so the athlete's work in micro-, meso- and macrocycles of training activity will be productive. To assess the functional state of the body, the method of mathematical analysis of heart rate variability is used. The works of recent years [2, 6, etc.] established individual typological features of vegetative regulation, according to which cen-

tral or autonomous regulation mechanisms dominate in management. Physical performance is largely determined by the type of regulation. Most researchers adhere to the concept that a person is dominated by one of the genetically determined types of autonomic regulation. Namely: moderate (type I) or pronounced (type II) dominance of the central regulation mechanism and moderate (type III) or pronounced (type IV) dominance of the autonomous regulation loop [5]. The optimal platform for deploying the athlete's functionality is a moderate autonomous type of regulation. Studies on athletes of various sports have shown the predominance of representatives with type III regulation [3, 6]. They are characterized by a high functional reserve and expanded adaptive capabilities of the body, since with the dominance of the parasympathetic division of the ANS, the body economically consumes plastic and energy resources. Accordingly, when performing muscular work, the working increase will be greater. Athletes with type IV regulation form extreme variants of the autonomous regulation mechanism. On the one hand, the presence of this type indicates the athlete's hypersensitive state and his high willingness to work with maximum manifestations of functional capabilities, and on the other hand, such a state may reflect a failure of adaptive mechanisms and the development of a pre-pathological state [6]. Athletes with moderate dominance of the central regulation mechanism are characterized by high functional readiness, however, its prolonged state leads to the depletion of primarily energy reserves, which reduces the adaptive potential of the body during a long training process. The second type of regulation is considered to be the least favorable, in which there is a rapid depletion of the body with a transition to a premorbid state, and, with continued training and competitive activity, overwork develops with pathological disorders in the organs and systems of the athlete's body. Our studies have shown that prior to the use of "MDX Multicomplex" in the middle school group 75% had type I and 25% had type III regulation. In the group of sprinters as a whole, the tension of regulatory systems is growing, as evidenced by the appearance of type II regulation in 50% of athletes, and 50% have type III regulation. Among throwers, 50% are of type III, 25% of type II, and adaptation failure is found in 25%. In a comparative analysis of HRV indicators with type III regulation in athletes of different types of athletics, certain differences are noted due to the characteristics of the sport. So, the AMo50% indicator characterizing the activity of the sympathetic ANS in throwers is significantly higher by 26% compared to middle distance runners and by 17% compared to sprinters ( $p < 0.05$ ) (table 1).

**Table 1**

**Comparative characteristics of heart rate variability in athletes of different types of athletics before using the "MDX Multicomplex" food product**

indicators	middle distance runners		sprinters		hammer throwers	
	I	III	II	III	III	II
HR, beats/m	78,3±2,96	62,54±1,80	77,25±2,91	55,0±1,15	68,0±3,04	79,61±3,06
MxDMn, ms	217±21,38	3993±37,83	205±19,75	446±49,57	360±25,94	233±24,05
AMo50%	52,2±3,97	27,27±1,08	54,41±4,49	28,72±1,42	34,0±2,10	58,09±5,60
SI, cu	164±29,2	37±2,56	178±31,37	31±3,40	59±13,51	185±28,81
TP, ms	2426±498	9033±1525	1274±390	5391±805	7519±1261	1400±528

At the same time, the value of the MxDMn indicator, as a reflection of the activity of the parasympathetic division of the ANS, is maximum for sprinters ( $446.67 \pm 45.51$  ms), which is 12% insignificantly higher than that of the middle peasants and 24% statistically significantly higher compared to throwers ( $p < 0.05$ ). Hence the maximum value of the stress index for throwers ( $59.50 \pm 13.51$  cu.). The stress index is 84% higher compared to sprinters and 62% compared to average workers ( $p < 0.05$ ). In throwers, the level of tension of regulatory systems is increased due to the high psychoemotional component in the total load. The integrative indicator of homeostasis, which is the heart rate as high as possible for athletes with type I and type II regulation, which indicates a decrease in homeostatic stability of the body under systematic physical exertion. On the contrary, athletes with type III regulation have a statistically reliable decrease in heart rate, which characterizes the athlete's condition as stable with less plastic and energy resources. After a course intake of a sports nutrition product, the following results were obtained. In the group of middle-athletes, the number of athletes with type III regulation increased by 25%, thereby reflecting an increase in the body's functional capabilities after taking the biological product. Accordingly, the number of athletes with increased tension of regulatory mechanisms decreased. In the group of sprinters, the number of athletes with type III remained (50%), but in the remaining 50%, instead of type II regulation with a pronounced predominance of the central regulation mechanism, a moderate central regulation mechanism is recorded, which indicates an increase in functional capabilities and an expansion of adaptive potential. In the group of throwers, 50% of athletes with the III type of regulation are also quantitatively preserved, while the rest are

retained in the II type of regulation.

**Table 2**

**Comparative characteristics of heart rate variability indicators  
in athletes of different types of athletics after applying the "MDX  
Multicomplex" sports nutrition food product**

indicators	middle distance runners		sprinters		hammer throwers	
	I	III	I	III	III	II
HR, beats/m	73,1±1,83	66,5±7,50	75,4±2,00	57,7±1,20	64,2±1,04	86,7±3,44
MxDMn, ms	244±30,33	320±25,01	219±21,58	435±49,42	497±84,53	155±24,03
AMo%	43,7±5,10	35,6±5,72	50,5±7,35	23,1±2,60	21,6±1,90	64,6±8,02
SI, cu	126±26,73	61±20,63	149±41,11	26±6,57	24±5,41	301±89,02
TP, ms	2353±377	2979±648	1823±510	7236±1944	9544±2772	10742±4062

At the same time, after taking the bioproduct, the throwers lost their athletes with signs of maladaptation. For throwers and sprinters with type III regulation, after taking a sports nutrition product, indicators characterizing the level of tension of regulatory systems are reduced. So, the integral indicator of tension - the stress index for sprinters is reduced by 19% from  $31.74 \pm 3.40$  cu. up to  $26.60 \pm 6.57$  cu., and for throwers reliably by 141% ( $p < 0.05$ ) (table 2). We were interested in the question of how, against the background of taking the multicomplex, the indicators of heart rate variability in athletes change depending on the size of the training load. To this end, we analyzed the dynamics of indicators in middle school students with type III regulation after switching from two workouts a day to one-time during the microcycle. According to the study, a decrease in physical activity was accompanied by an increase in the activity of the parasympathetic link and a decrease in the contribution of the sympathetic link of the autonomic nervous system. As a result, MxDMn increased by 7%, and AMo50% decreased by 75%. After reducing physical activity, the total activity index of regulatory systems (TP) increased by 200%, and the stress index (SI) decreased by 205%. In the transition from one-time training to two-time training for sprinters with type III regulation, the activity of the parasympathetic department in terms of MxDMn decreases by 21%, with an increase in the activity of the sympathetic link (AMo50%) - by 61%. As a result, the integral value of the voltage index (SI) is increased by 202%. Consequently, monitoring the characteristics of heart rate variability allows an objective assessment of training loads and dosing muscle

work within the functional capabilities of the athlete's body. Based on the results obtained, it seems reasonable to conclude that the III type of regulation, as the most balanced, remains steadily predominant throughout the study period, while the changes affect the "extreme" (I and IV) types of regulation. The discovered pattern confirms the statement of Shlyk N.I. [6] that the III type of regulation represents a ready-made physiological "platform" for playing sports.

### **Conclusions.**

1. It is shown that the course application of "MDX Multicomplex" increases the functional reserve of the athlete's body by increasing the activity of the autonomous regulation loop, which performs an energy-saving function in relation to energy and plastic resources.

2. It is shown that the body of athletes with type III regulation is the most resistant to physical exertion, regardless of the sport in athletics.

3. It was found that increasing physical activity in the microcycle reduces the activity of the autonomous mechanism and enhances the influence of the central mechanisms of heart rate regulation.

4. The method of mathematical analysis of heart rhythm is objective, accessible and valid in assessing the functional state of the body of athletes.

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## **DEVELOPMENT OF A CELL PROLIFERATIVE ACTIVITY CRITERION FOR EVALUATING THE QUALITY OF CYTOLOGICAL PREPARATIONS IN CONVENTIONAL CYTOGENETIC RESEARCH**

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*Conventional cytogenetic study (CCS) is an important stage in the examination of hemoblastosis patients, however, the identification of chromosomal abnormalities and the reliability of karyotyping results largely depend on the number of metaphase plates available for analysis. A study was conducted, the purpose of which was to develop a criterion for the proliferative activity of cultured in vitro cells and assess the possibility of its use for taxing the quality of cytological preparations in CCS. It was found that the  $MPP/S_{287}$  indicator, based on the calculation of metaphase plates per unit area of the chromosome preparation, is an objective criterion and an effective tool for assessing the proliferative activity of in vitro cultured cells and the number of metaphase plates.*

*Keywords: hemoblastoses, cytogenetics, metaphase plates, proliferative activity.*

Conventional cytogenetic study (CCS) is one of the mandatory stages of the examination of patients with leukemia and basic genetic analysis for hematologic pathologies, since it allows you to evaluate the state of the entire karyotype and identify not only marker and recurrent, but also variant and additional chromosome changes. Standard karyotyping data makes it possible to verify the diagnosis, stratify patients into risk groups and predict the course of the disease [Krishna Chandran R., Geetha N., 2019; Morales-Chacón K., Bourlon C., 2019]. However, in some cases, CCS may be difficult or impossible due to the insufficient number of metaphase plates on the chromosome preparation or the poor quality of metaphase chromosomes due to the lack of a clearly defined morphological structure and banding, which does not allow them to be identified in accordance with the International Cytogenome System nomenclature ISCN.

Currently, there are no criteria for an objective assessment of the quality of chromosome preparations in CCS. There are some references in the scientific literature to the requirements for the quality of metaphase plates that are descriptive, and their practical use is associated with a large share of subjectivity [Snigireva GP, Bogomazova AN, 2007; Polityko A.D., Naumchik I.V., 2008; Hovsepyan V.A., Sarpova M.V., 2017]. In this regard, there is a need to develop criteria to objectify and standardize the assessment of the quality of chromosomal preparations in CCS.

**The purpose** of this study is to develop a criterion for the proliferative activity of *in vitro* cultured cells and to evaluate the possibility of its use for taxing the quality of cytological preparations in a conventional cytogenetic study.

### Materials and methods

The biological material for the study was bone marrow (BM) and peripheral blood of patients with chronic myeloproliferative diseases CMD ( $n = 47$ ), as well as peripheral blood (PB) of relatively healthy individuals ( $n = 20$ ). The object of the study was the cytological preparations of metaphase chromosomes prepared according to the standard technique of conventional cytogenetic research (GTG-banding). Cultivation of biological material (patients with CMD - 24 hours, conditionally healthy - 72 hours) was carried out at a temperature of 37 °C in a nutrient medium containing RPMI-1640 with glutamine and 20% calf fetal serum ("PanEco", Russia). When cultivating PB of conditionally healthy individuals, a growth stimulator of T-lymphocytes, mitogen phytohemagglutinin (25 µl) was added to the nutrient medium. Stoppage of cell division BM and PB of patients with CMD was carried out with a solution of colchicine (0.05%), added to the nutrient medium in an amount of 6 µl simultaneously with the introduction of biomaterial. Stoppage of cell division PB conditionally healthy individuals was carried out with a solution of colchicine (0.05%), added to the nutrient medium in an amount of 40 µl 30 minutes before the end of cultivation.

Metaphase plates were counted using an Axio Scope.A1 light microscope (Carl Zeiss, Germany) at a magnification of  $\times 200$ . Evaluation of the proliferative activity of cultured *in vitro* cells was carried out on the basis of counting the number of metaphase plates (MPP) on the area of the chromosome preparation (S) equal to 287.5 mm<sup>2</sup>, which was calculated by the formula:

$$S = W \cdot D_{FV} \cdot n,$$

where W – glass slide width (25 mm),  $D_{FV}$  – diameter of the field of view of the microscope, n – number of transverse scans of a glass slide (10).

The diameter of the field of view of the microscope was determined by the standard formula [Abramowitz M., Spring K.R., 2002]:

$$D_{FV} = \frac{FN}{M_o \cdot M_T} ,$$

where FN – eyepiece diameter (23 mm),  $M_o$  – objective lens magnification ( $\times 20$ ),  $M_T$  – tube lens magnification ( $\times 1$ ).

Statistical processing of the results of the study was performed using the "Medical Statistics" program and the spreadsheet editor Microsoft Excel 2019. Quantitative data are presented in the form of arithmetic mean, median, standard error of the mean, and extensive indicators. The scatter of MPP values at  $S = 28.75 \text{ mm}^2$  was estimated by calculating the standard deviation. The reliability of the differences in the indices in the comparison groups was assessed using parametric (Student t-test) and non-parametric (Mann-Whitney U-test) methods. The difference was considered significant at  $p < 0.05$ .

### Results

Criteria that allow an objective and standardized assessment of the quality of chromosomal preparations during conventional cytogenetic studies should be based on well-known and clearly defined cytological and cytogenetic characteristics. Our own experience with CCS has shown that *in vitro* growth and division of leukemia cells obtained both in patients with different types of hemoblastoses and in patients with the same nosological form of proliferative diseases of the hematopoiesis system vary widely. These variations cause a different number of dividing cells in the metaphase stage used to evaluate the karyotype. To find out whether the proliferation rate of cultured *in vitro* leukemia cells can be a criterion for the quality of chromosome preparations, we evaluated the variability of the number of metaphase plates on chromosome preparations in various patients.

In studies, we refused to evaluate the proliferative activity of cells using the mitotic index (MI, %) [Aguñiga-Sánchez I., Cadena-Íñiguez J., 2017; Bezhdugova S.A., Gidova E.M., 2018; Oney-Birol S., 2019] due to the bias of the obtained indicators: the number of cells (1000) required for MI calculation on the chromosome preparation of a patient with leukemia can range from one to several tens of fields of view of the microscope ( $\times 200$ ), while suitable for chromosomal analysis metaphase plates may be unevenly scattered over a larger area of the preparation. We evaluated the proliferative activity of cultured *in vitro* leukemic cells of patients on the basis of counting the number of metaphase plates (MPP) on the area of the chromosome preparation (S) equal to the visual field of ten transverse

scans of a standard microscope slide 25 mm wide with a magnification of  $\times 200$ , which is  $287.5 \text{ mm}^2$ . Preliminary studies showed that for one patient the number of MPPs on an area of  $28.75 \text{ mm}^2$ , corresponding to the visual field of one transverse scanning of a glass slide, did not have a reliable spread of the magnitude values relative to the mathematical expectation (Table 1). However, in order to minimize errors for further research, MPP counting was performed on 10 cross-scan fields ( $\times 200$ ) of each chromosome preparation.

**Table 1**  
**The amount of MPP in the area of one ( $S_n$ ) and ten ( $MPP/S_{287}$ ) visual fields of the chromosome preparation. Microscope magnification  $\times 200$ .**

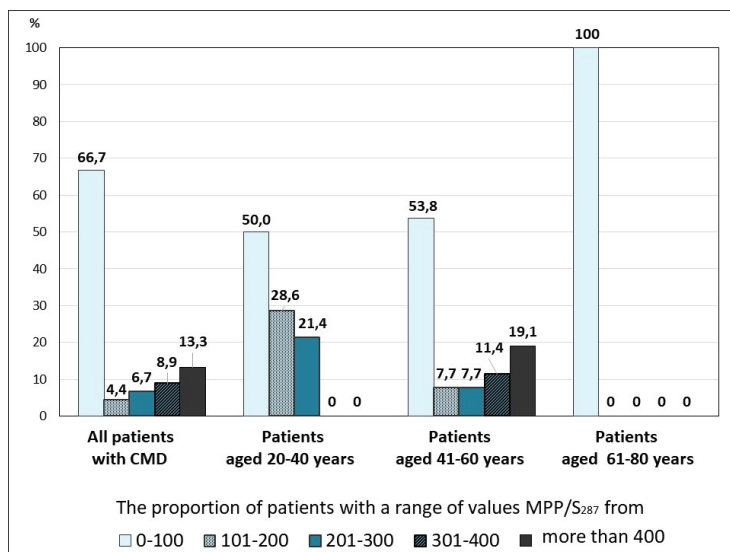
CMD patients (n=10)	MPP ( $S=28,75\text{mm}^2$ )											MPP ( $S=287,5 \text{ mm}^2$ )
	$S_1$	$S_2$	$S_3$	$S_4$	$S_5$	$S_6$	$S_7$	$S_8$	$S_9$	$S_{10}$	$M \pm m$ (n=10)	
1) S.H. (1995)	113	136	144	148	107	147	117	102	97	116	$122 \pm 6.45$ $\sigma=19.35$	1227
2) S.O. (1976)	17	10	6	15	9	12	8	10	5	8	$10.0 \pm 1.26$ $\sigma=3.37$	100
3) K.S. (1961)	1	0	0	0	0	0	0	0	0	0	$0.10 \pm 0.11$ $\sigma=0.32$	1
4) H.A. (1974)	28	18	16	23	20	38	21	20	16	17	$21.70 \pm 2.26$ $\sigma=6.78$	217
5) H.K. (1995)	5	6	3	1	2	5	3	5	5	5	$4.0 \pm 0.54$ $\sigma=1.63$	40
6) H.A. (1975)	2	2	1	1	0	0	1	0	2	1	$0.90 \pm 0.29$ $\sigma=0.88$	10
7) H.M. (1979)	25	30	31	22	19	37	39	37	31	24	$29.50 \pm 2.29$ $\sigma=6.87$	295
8) Y.H. (1993)	71	60	78	83	99	81	58	82	55	69	$73.60 \pm 4.55$ $\sigma=13.66$	736
9) N.H. (1975)	2	0	0	0	0	0	0	0	0	0	$0.20 \pm 0.21$ $\sigma=0.63$	2
10) H.E. (1962)	1	0	0	0	0	1	0	0	0	0	$0.20 \pm 0.14$ $\sigma=0.42$	2

Thus, using an indicator of the number of metaphase plates on the chromosome preparation area equal to  $287.5 \text{ mm}^2$  ( $MPP/S_{287}$  indicator), we evaluated the proliferative activity of *in vitro* leukemia cells of bone marrow (BM) and peripheral blood (PB) of patients with chronic myelopro-

liferative diseases (CMD) when performing the initial conventional cytogenetic analysis.

The study showed that the spread of  $MPP/S_{287}$  was from 0 to 372 ( $M = 115.47 \pm 12.98$ ;  $Me = 109$ ), if PB was used as biological material, and from 0 to 1278 ( $M = 186.47 \pm 44.10$ ;  $Me = 53$ ), if BM was used as biological material. In the control group (conditionally healthy), the spread of  $MPP/S_{287}$  values was: min - 31, max - 315 ( $M = 164.55 \pm 16.97$ ;  $Me = 166$ ).

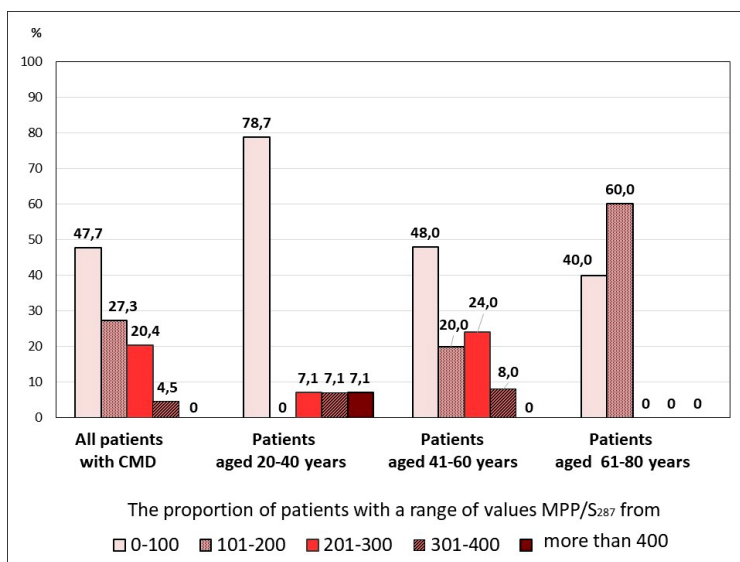
An analysis of the variability of the number of metaphase plates on chromosome preparations showed that  $MPP/S_{287}$  values in the range from 0 to 100 were most common: the proportion of CMD patients with these  $MPP/S_{287}$  indices on preparations prepared from BM was 66.7% and on preparations prepared from PB, - 47.7%. Indicators of proliferative activity corresponding to 101-200, 201-300, 301-400 and more than 400  $MPP/S_{287}$  had, respectively, 4.4%, 6.7%, 8.9%, 13.3% of patients in whom BM was used as biological material, and 27.7%, 20.4%, 4.5%, 0% of patients in whom PB was used as biological material (Fig. 1, 2).



**Fig. 1. The number of patients with CMD with different levels of  $MPP/S_{287}$  on preparations derived from bone marrow**

The study of the variability of the number of metaphase plates on chromosome preparations depending on the gender of patients did not reveal any peculiarities in the distribution of the frequency of occurrence of the

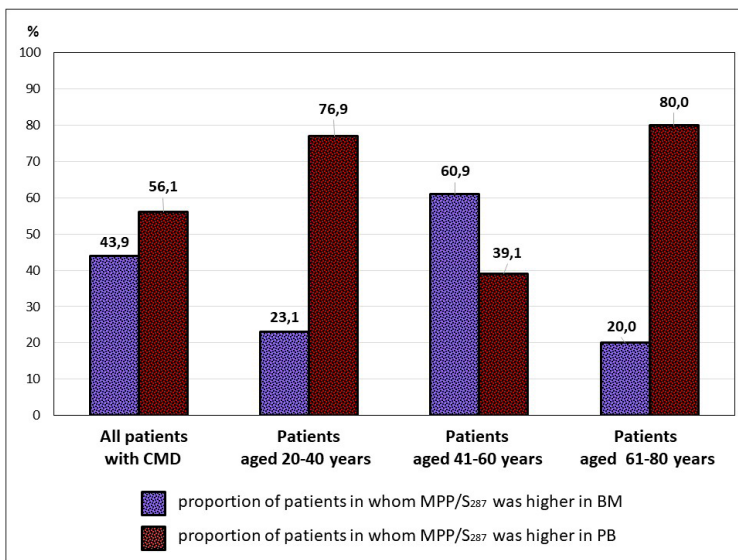
indicated  $MPP/S_{287}$  ranges. However, the division of patients into three age subgroups with an interval of 20 years (A: patients aged 20-40 years ( $n = 14$ ), B: 41-60 years ( $n = 28$ ) and C: 61-80 years ( $n = 5$ )) showed a change in the proportion of patients with different levels of  $MPP/S_{287}$ . So, on chromosome preparations prepared from BM (Fig. 1),  $MPP/S_{287}$  with a range of values from 0 to 100 was observed in 50.0% and 53.8% of patients of subgroups A and B, and in 100% of cases in patients subgroups B (A/B:  $p < 0.05$ ; B/C:  $p < 0.05$ ). On chromosome preparations prepared from PB (Fig. 2), the highest frequency of occurrence of  $MPP/S_{287}$  with a range of values from 0 to 100 was observed in patients of subgroup A (78.7%), while with age it decreased to reach 48.0% in subgroup B (A/B:  $p < 0.05$ ) and 40.0% in subgroup B (A/B:  $p > 0.05$ ). At the same time, in older age subgroups, an increase in the proportion of patients with  $MPP/S_{287}$  in the range of 101-200 was observed: up to 20.0% in subgroup B (A/B:  $p < 0.05$ ) and up to 60.0% in the subgroup B (A/B:  $p < 0.05$ ).



**Fig. 2. The number of CMD patients with different levels of  $MPP/S_{287}$  on preparations obtained from peripheral blood**

A comparative assessment of the proliferative activity of leukemia cells from various biological material showed that in the general group of CMD patients  $MPP/S_{287}$  was higher on preparations obtained from peripheral blood. Moreover, the proportion of patients in whom  $MPP/S_{287}$  was higher

in PB was 56.1%, and in BM– 43.9% ( $p > 0.05$ ). In the subgroups of patients under the age of 40 and over 60, division activity was also higher in blast cells from peripheral blood (the proportion of patients, respectively, 76.9% and 80.0%) compared with bone marrow cells (proportion of patients, respectively, 23.1% and 20%) (subgroup A - BM/PB:  $p < 0.05$ ; subgroup B - BM/PB:  $p < 0.05$ ). Among patients aged 41-60 years, the growth activity was slightly higher in BM cells compared with PB cells - the proportion of patients with higher MPP/S<sub>287</sub> in preparations obtained from BM was 60.9%, and from PB - 39.1 % ( $p > 0.05$ ).



**Fig. 3. Comparative level of proliferative activity in vitro of bone marrow and peripheral blood leukemia cells**

### Discussion

Reliable CCS information can only be obtained by analyzing a sufficient number of metaphase plates with identifiable chromosomes. Otherwise, the results of the analysis require re-testing by repeated CCS or using other technologies of cytogenetic research.

Despite the standard methodology, taking into account the protocols for individual nosological groups, the number of metaphase plates suitable for assessing the state of the karyotype of leukemic cells in patients with hemoblastosis may be different. This is partly due to the lack of a stimulatory effect of mitogens artificially added to the culture medium

(phytohemagglutinin, lipopolysaccharide, etc.), as occurs during cytogenetic analysis to identify the hereditary pathology of chromosomes. Since the mitogens currently used for cytogenetic studies exclusively affect lymphocytes, they cannot be used to stimulate *in vitro* growth of leukemia cells of other differentiation lines. Meanwhile, pathogenetic mutations that have diagnostic and prognostic significance are detected only in that neoplastic cell clone that determines the line of leukemia differentiation. In this regard, in the cultivation of blast cells for their cytogenetic analysis in most cases, one has to rely on the proliferative potential that this clone of tumor cells possesses.

It is known that leukemia cells are less prone to division in culture than normal hematopoietic cells [Nilsson T., Lenhoff S., 2004]. Our own experience with CCS has shown that leukemia cells of hemoblastosis patients cultured *in vitro* under the same conditions have different proliferative potential, which determines the quantitative variability of dividing cells in the metaphase stage. Despite the uniform culturing conditions in nutrient media and the standard method for preparing chromosome preparations, the number of metaphase plates has significant differences both in patients with different types of hemoblastoses and in patients with the same nosological form of the disease.

Evaluation of proliferative activity, as an additional stage of the study with standard karyotyping, should be carried out by an affordable and fast method. For this reason, most of the cytological markers of cell proliferation, currently known [Shmarov D.A., Pogorelov V.M., 2013] cannot be used in routine practice when performing conventional cytogenetic analysis. Our study showed that the mitotic index and its modification, the metaphase index, also cannot be used, due to the bias of the obtained indicators, due to the relative rarity and randomness of the scatter of metaphase plates suitable for chromosome analysis on a glass slide.

To evaluate the proliferative activity of *in vitro* cultured cells, we used the metaphase platelet index (MPP) on the chromosome preparation area equal to the visual field of ten transverse scans of a standard slide with a microscope magnification  $\times 200$  ( $S = 287.5 \text{ mm}^2$ ). A comparative assessment of the number of MPPs in ten visual cross-sectional fields of each chromosome preparation confirmed that this indicator can be used as an objective criterion for the proliferative activity of cells cultured in CCS.

Our assessment of the number of  $\text{MPP}/S_{287}$  on chromosome preparations prepared from BM and PB of CMD patients showed a significant scatter of values, more pronounced in relation to bone marrow cells. Chromosomal preparations with a high  $\text{MPP}/S_{287}$  score are of greater val-

ue for cytogenetic analysis, since they increase the possibility of choosing the situationally necessary number of metaphase plates with chromosomes identified in accordance with ISCN and a reliable assessment of the karyotype.

Analysis of the variability of the number of metaphase plates on chromosome preparations showed that in most patients the  $MPP/S_{287}$  values ranged from 0 to 100, while in conditionally healthy individuals in the control group, most  $MPP/S_{287}$  values exceeded the threshold of this range. Significant differences in  $MPP/S_{287}$  were also revealed by us when stratifying CMD patients into age subgroups. It was found that with increasing age, there is a significant increase in the proportion of patients who have  $MFP/S_{287}$  in the range of 0 to 100 on drugs obtained from BM, as well as the proportion of patients who have  $MFP/S_{287}$  in the range of 101-200 on drugs obtained from PB.

Thus, index  $MPP/S_{287}$  is an objective criterion and an effective tool for assessing the number of metaphase plates on a chromosome preparation. Clarification of the reasons for the difference in proliferative activity of leukemia cells cultured *in vitro* requires additional studies.

### **Conclusion**

The data obtained as a result of the study prove the possibility of using the  $MPP/S_{287}$  indicator as a criterion for the proliferative activity of cells cultured in CCS. However, the presence of a sufficient number of metaphase plates cannot ensure the identification of a number of chromosomal abnormalities with an unsatisfactory morphological structure of the chromosomes and the absence of banding. In this regard, the creation of an objective system for assessing the quality of chromosome preparations during conventional cytogenetic studies requires supplementing the proliferative activity criterion of cells with quality criteria for metaphase plates and chromosomes, which allow them to be identified in accordance with ISCN.

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**FOLK SONATA FOR FOLK INSTRUMENT  
(TO THE 70TH ANNIVERSARY OF THE URAL COMPOSER ANATOLY  
KRIVOSHEY)**

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*The article will focus on the work of the composer of the Southern Urals Anatoly Krivoshey. Anatoly Krivoshey made a huge contribution to the development of domestic culture, the music he wrote for Russian folk instruments is in demand and is performed not only in the Urals, but also in other regions of the country. The article talks about the preservation of folk traditions, the folklore sources of the musical culture of the region. Style features, the philosophical concept of images, folklore present in Krivoshey's sonata for domra and piano will be considered.*

*Keywords: composer, creativity, art, traditions, sonata, domra, folklore.*

It's hard to imagine our life without musical art. Art is necessary for man to develop an individual perception of life, the formation of feelings and needs of the individual. Listening to a musical work, we can assume the factors affecting the composer's personality, conditions, events, because the work is capable of transmitting the dynamics of various processes in our life. The personality of the composer, as the creator of a musical work, is manifested through his work especially clearly. Individuality is emphasized by work, author's signature.

The ability to create, to compose - is the most important thing for the composer. The ability to think about your composition constantly, modify, change, improve it - this is a creative process that requires interest, love,

respect and devotion from its creator, that is, a gifted person. The thinking process of such a person is in constant motion and cannot stop. For an ordinary person who does not create great works, the whole process of writing remains an incomprehensible mystery, and only a spiritually developed person who is able to think faster and deeper than others will be understood.

“The ability of a person to create himself and the world of other people, to choose the image of the future world, is, from the point of view of existentialism, a consequence of the fundamental characteristic of human existence - its freedom. Man is freedom. Existentialists emphasize that a person is completely free, regardless of the real possibilities for the existence of his goals. Human freedom is preserved in any situation and is expressed in the ability to choose, make a choice. It is not about choosing the possibilities for action, but expressing one's attitude to a given situation. Thus, freedom in existentialism is, first of all, the freedom of consciousness, the freedom to choose the spiritual and moral position of the individual” [6, p. 228].

Of course, spiritual freedom is above all for the composer. Only a spiritually free person is capable of writing and enjoying it, who knows how to protect himself from everything that bothers him, small and insignificant, and, surrounding himself with what matters to him at the moment. The composer chooses the freedom of creativity, he realizes himself as a person, he realizes himself as a gifted person, who is entrusted with a special mission by nature. Even N. Dobrolyubov (Russian critic, publicist) asserted: “Consciousness of one's personality already necessarily implies a consciousness of its integrity and its rights” [9, p. 181].

**Composer Anatoly Krivoshey** was born on June 27, 1950 in Che-lyabinsk. He was a graduate of the Ural State Conservatory named after M.P. Mussorgsky (1977 - musicology), graduated from the Ufa State Institute of Arts (1983), the composition class of the People's Artist of the USSR, State Prize laureate, Professor Z. Ismagilov, candidate of art E. Zemtsova. In 1992, A. Krivoshey entered the graduate school of the Ural State Conservatory named after M.P. Mussorgsky to the composition class of the People's Artist of the Russian Federation, Professor V. Biber-gan and Honored Artist of the Russian Federation, Professor A. Nimensky.

Anatoly Krivoshey - Honored Artist of Russia, laureate of International and All-Russian Competitions, Presidential Fellows in the nomination “Prominent figures of culture and arts” (2001, 2002, 2010), member of the Union of Russian Composers, member of the Union of Theater Workers of Russia, Professor, Head of the Department of History, Theory of Music

and Composition of the South Ural State Institute of Arts named after P.I. Tchaikovsky.

The creative activity of A. D. Krivoshey is inscribed in the musical culture of the region in several directions. His authority as a teacher, the creator of his own composer school, is widely known. He - is one of the brightest composers of the Southern Urals.

**Among his students:**

composer **V. Averbach**, laureate of the international competition named after I. Stravinsky, twice laureate of the international charity program "New Names", laureate of the All-Union Competition for Young Composers named after P.I. Tchaikovsky, lives in the USA;

composer **D. Broda**, laureate of the international competition named after A. Berg, lives in Germany;

composer **O. Korolenko** - Laureate of the First Prize of the VII All-Russian Youth Festival "I Will Be Appreciated in the XXI Century" (Moscow);

laureates of the Moscow international competition "Rowan Dreams" **P. Kornienko** and **M. Maximova** (Chelyabinsk);

Laureates of the International Competition for Young Composers named after S. S. Prokofiev **S. Sabirov** (Kazakhstan), **U. Zhuravleva** (Chelyabinsk), **K. Paleolog** (USA) and others;

composer **S. Banturov**, music editor of ChGIK (Chelyabinsk);

members of the Union of Composers of Russia Professor **T. Shkerbina**, Professor **A. Kuz-min** (Chelyabinsk), Candidate of Pedagogical Sciences **P. Sergienko** (Chelyabinsk), Laureate of the Golden Mask Theater Prize **E. Karmazin** (Ekaterinburg), T Buzina (St. Petersburg), **E. and L. Seleznev** (Moscow) and others.

Among the works of A. Krivoshey are the ballet Mephistopheles, the symphony Christmas, the symphony Angel Post, a concert for two pianos and an orchestra, the cantata Wind Song (lyrics by K. Sandberg), the cantata Ural Songs (folk lyrics), the cantata "Immortal Regiment" (poems by front-line soldiers Sergey Narovchatov, Sergey Orlov, Leonid Pivert), the cantata "Andrei Ivanovich does not return home" (verses by Faina Grimbarg), the cantata "Cossack Circle" (folk lyrics) for the Cossack choir and chamber orchestra, "Golden Tube" music for alto saxophone, symphony orchestra and the Cossack choir (folk lyrics), "Requiem" for soloists and a symphony orchestra to verses by A. Akhmatova, String Quartet № 1, String Quartet № 2, "Farewell to Tbilisi" and "Walk with Mozart in Prague" for a string quartet, choir suites "Hogwarts", "Blue Bird" (lyrics by N. Shilov), "Antre" for button accordion, accordion and vibraphone, Sonata for flute and piano and others

The musical culture of Russia cannot be imagined without Russian folk instruments, because they are known and popular not only in our country, but throughout the world. Performing art on folk instruments is a complex and multifaceted phenomenon. The history of performance on folk instruments dates back more than one century. Instruments and performance in the process of historical evolution underwent various changes, like the whole musical culture. The formation and development of folk instrumental performance, of course, was accompanied by all sorts of difficulties, and one of them is the problem with the repertoire.

Indeed, in connection with the emergence of a musical educational system and the development of professionalism, folk instrument performers were increasingly short of original compositions: concerts, symphonies, sonatas, suites, miniatures, etc. Despite the many difficulties that arise, the level of the folk instrumental genre at the present stage is quite high, and the performance of folk instruments continues to develop thanks to composers, musicians, teachers, their love of folk music gives confidence that the improvement of instruments will continue, and musical works by composers will be composed.

The South Ural composer Anatoly Krivoshey made a huge contribution to Russian culture, the music he wrote for Russian folk instruments is in demand and is performed not only in the Urals, but also in other regions of the country. The art of hearing life, the reality surrounding us, nature, and in it special sounds, the ability to think in musical phrases and themes, transferring what you hear to the musical staff - this is not given to everyone. The sequential mastering by the composer A. Krivoshey of the Ural theme is interesting: the folklore sources of the musical culture of the region, poetry, and traditions. For folk instruments he wrote the Ural Overture (1982), Faust Suite (1993), Round dance for the orchestra of Russian folk instruments (1995), Concertino for two button accordions and the orchestra of Russian folk instruments (1985), the Palekh suite for button accordion (1982) chamber-instrumental and chamber-vocal music.

Naturally, Anatoly Krivoshey when writing his works based it on the acquired experience of composers of previous eras. But the composer always decides for himself what kind of music he will compose, he knows what it will be about because he has been carrying it in his heart and soul, perhaps for many years. His path is difficult, starting to compose, he will no longer be able to turn off this road and will give everything to the end, giving his strength and talent so that the music is performed and heard. The composer's task is to maintain a high level of culture in society, to raise public interest in Russian folk instruments, because "the level and

state of culture can be understood only on the basis of the development of cultural history; in this sense, they speak of a primitive and high culture; the degeneration of culture creates either lack of culture, or a "refined culture" "(purified from the understanding of many people, sophisticated) [7, p. 229].

Any folk instrument is part of the history of an ethnic group. Instruments are able to reveal the mores and customs of this or that people, to tell about its culture. Russian folk instruments reveal the wealth of the broad Russian soul, its bright, colorful creative character. Confirmation of this is the melodic nature of Russian music, its polyphony. "The purpose of the revival of [ancient] instruments is to give the people a musical instrument that corresponds to their character, nature and at the same time as much as possible satisfies the requirements of modern musical culture. Yes, and not only "people", since in their present form ancient Russian musical instruments are equally suitable for everyone, especially for those who did not have the opportunity to devote themselves specifically to music. Having improved the instruments to which there was so little trust, first of all, it was necessary to show their musical ability in sound and technical terms "[1, p. 55].

One of the most striking Russian folk instruments is domra. Domra has become a recognized instrument; it, along with all other instruments, helps to shape aesthetic views and bring up a musical, artistic taste, and contributes to the comprehensive development of the personality. Domra's concert repertoire is huge and includes a variety of genres, among which the sonata genre is most interesting. This genre is attractive with a wide variety of dramatic and compositional solutions. In the twentieth century, it is embodied in music for folk instruments. The variety of samples of the genre, as well as the specifics of their decisions, allow us to talk about a certain role of this direction in the evolution of the sonata. The identity and special timbre of the domra becomes attractive for the composer A. Krivoshey.

The sonata for balalaika and piano was written by him in 1996, in 3 parts. According to the author, a sonata is "... a person's spiritual state, a singing thought of self-expression of his nature. The dizzying pace of life's phenomena is reflected in the truth of art, and in accordance with the requirements of the time, the means of artistic expression are renewed, changed. The author concentrated the expressive impulses of phonic sound combinations, enhancing their role as means of artistic expression and, giving them a conditionally independent value as a sphere of generalized figurative expression. The methods of playing the balalaika

and domra are identical, they have a quart system. So, the sonata will sound good on the domra. Since I am a musician performer, soloist of the orchestra, and my domra instrument, I was interested in the opportunity to make a performing version of the sonata for the 3-stringed domra of Krivoshey (2020).

Sonata - is a chamber genre that maximizes the possibilities of domra, and as an academic instrument. The individual properties of the composer's creative thinking reveal an artistic image, the sincerity of the soul, penetrate into the subtlest spheres of the human inner world. The musical language of A. Krivoshey sonata for domra and piano continues to follow the best traditions of Russian music, opens up new possibilities for the development of the artist's creative imagination and enriches the folk art with a new repertoire. Such a wide distribution of the genre allows us to talk about the sonata for folk instruments as an independent direction as a whole. Possessing specific features and a highly artistic look, the sonata should take its rightful place in the history of the development of the genre in the XX century.

If we talk about the stylistic features of the sonata for A. Krivoshey domra, then we can note the philosophical concept of images, artistic and aesthetic thinking, vibrant folklore. Folklore is one of the important components in musical composer creativity. The composer applies modern compositional solutions, a syncopated rhythm that gives elasticity, plasticity and characteristic expressiveness, the image is emphasized by accents, the inventive interaction of intonated, timbre-colored sound types. In their movement you can catch certain patterns that are both purely musical and overheard in life itself. The sonata's dramaturgy is based on the epic principle of musical narrative, which is born in following thematic episodes.

**First part.** A short introduction sets the momentum that determines the nature of the sonata. Rhythm as a music engine and form builder. Rhythm is intimately connected with natural breathing (sound lives on the basis of breathing, and consequently, on rhythm) together they give life to the work. The introduction sounds like a posed question. It is about the fate of man. The main party answers the question of entry, the dialogue begins, in the soul of a person there is a tense struggle (willpower? Or weakness?). The lyrical and psychological tone of the statements, the reception of improvisational fantasy music increases the level of tension. The elements and structure of the development of the topic increase its aspiration and weight, which develop and culminate in the quick finale. The composer applies non-square periods and sentences (5 + 7). For the

first time L. Beethoven applied such non-square periods in his sonatas (extended and shortened periods). L. Beethoven Sonata № 3, II part (4 + 6), L. Beethoven Sonata № 7 (5 + 4).

**Second part.** Man and nature merge together. The legato bar gives softness to the attack of sound at domra, each rounded sound is in contact with the previous one. Tremolo - the main method of extracting long-lasting sound on domra. "By performing the tremolo motif, you create a certain dynamic form and thereby introduce a certain meaning into its sound. A phrase is a complete melodic revolution consisting of several motifs. The execution of a phrase and a motive are largely similar, but the phrase is not built from individual sounds, but from motives. Each motive should be determined by its place in the general construction of the phrase, depending on the logic of its development" [8, p. 18]. A complex combination of different structural principles based on contrast-variant deployment is growing. The leading principle is the dynamics of variant transformations with a gradual reduction to a common denominator.

**Third part.** The emotional center of the sonata, which requires a huge and internal concentration from the performer, the ability to convey complex mental states. Man must be strong, strong-willed. The atmosphere of a creative surge. A very important area in modern sounding is the "textural-timbre equivalent". "Textural-timbre equivalent" is the term of A. Veprik. He believed: "The artist must find the necessary means to carry out his plan. The problem of "textural-timbre equivalent" is as acute for every composer as the problem of the unity of musical material and the type of its development" [5, p. 61]. The dynamic shades available in the text are closely related to the figurative structure of the composition, enhancing expression. At the end of the third part we will hear an element of folklore, a small tune that will show us the nationality of domra, and complete this part.

All parts of the sonata are interconnected. There is no strong contrast between them, except for the tempo; each subsequent musical material supplements the previous one.

The music of A. D. Krivoshey evokes a lively direct response from listeners due to the vivid figurative structure, lyrical immediacy, and democratic musical language. "Composer - the name of is people influences the whole many-sided world of music in all its versatility, either directly in composer observations and quotes, or through a network of mediating intonations, or in genres of various kinds of processing, or by educating in especially gifted composers a sense of folk music language to the great, capitalistic generalizations of folk musical practice in higher forms of mu-

sic. Then the individual composer's mind organically refracts musical intonation, like thought – mind and soul of the people" [2, p. 22].

However, the world is changing, and so is our life. "There is an intensive search for the national idea of Russia. According to what moral and ethical laws the state needs to develop in order to become, as before, a mighty power, the interests of which would be reckoned with throughout the world. All these questions are very serious and deep on the one hand, but on the other, their solution lies only in one plane: a return to understanding of their genetic roots and spiritual origins is necessary. The leading thread on this path is an understanding of the foundations of traditional Russian folk culture, which even at the dawn of its inception was inconceivable without folk musical instruments" [3, p. 106].

If our life is rapidly changing, then culture, music, and poetry are changing ... People become different, but long-standing traditions are preserved. Of course, folklore will never miss the opportunity to grow in options, but the seed of thought, the essence itself, will remain a strong core. "Folk traditions in the musical art have tendencies not only for sustainability, but also for development in accordance with historically changing social paradigms. Hence, folk traditions in the broad sense of the word are constantly evolving phenomena and ways of functioning of a socially significant, ethnosocially unique and highly artistic spiritual, and material culture of the people" [4, p. 149].

We must not forget about human qualities in the musical space, because every composer, musician, performer, conductor brings his art, discoveries and finds to the world stream of music. Bertold Auerbach, a XIX century German writer, believed: "Music alone is the world language and does not need translation, for it speaks to the soul" [9, p. 213].

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## SMART URBAN PLANNING GROWTH FOR POST-WAR CITIES

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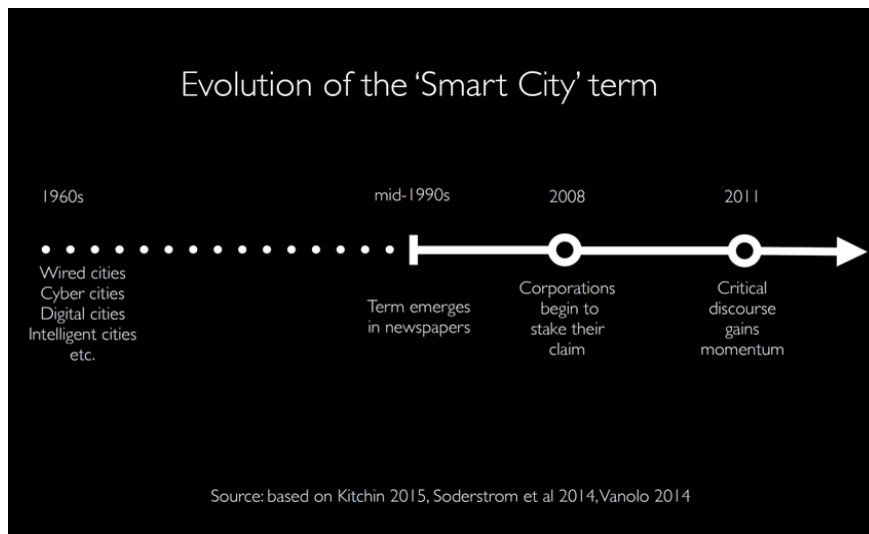
*The purpose of the paper is to determine the interrelationship between urban planning and smart cities in the stages of construction and expansion and their applicability to Syrian cities after the war. According to a UN report, more than half of the world's population live in urban areas. The report predicts that the world will see a surge in urbanization and that the city's population Will exceed six Billion by 2045. Cities based on integrated technological systems can respond to rapidly changing needs by providing pre-built facilities within the city's infrastructure environment in the areas of transportation, communications, information exchange, security, environmental quality and other vital needs, as well as a flexible planning structure. Smart cities are not limited to those that are established from the beginning by new technology, but also existent cities could turn into smart cities by introducing modern technology to its infrastructure and modifying its plans to ensure the intelligent expansion of its urban architecture in the future. Cities that are emerging from war situations and significantly damaged in their structure are a great opportunity to dynamically work on "from the bottom up" in urban planning and implementing smart city strategies as in the Syrian cities.*

*Key words : Urban planning- Smart cities - Cities after the war - Modern technology - Architecture in the future - Smart city strategies .*

### **1. Introduction**

The approach of Smart Cities is an emerging trend among policy makers around the world. The majority of the population of today's world lives in cities. For this reason, assimilating and applying smart city concepts is essential to guarantee a distinct level of living for the population. Creative thinking and cooperation among all stakeholders and scientific ideas can achieve the desired benefits of cities, to absorb the large and efficient population boom, promote economic growth and improve the well-being of the city's population.

However, there is no uniform definition of Smart City. Smart city projects are usually part of a general urban modernization program that includes urban planning, the environment and information technology.



**Fig. 1: Evolution of the 'Smart City' term [1].**

The term Smart City appeared at the European Digital Conference in 1994, and in 1996 the Europeans launched the digital city project in a number of cities (Fig1) . The European authorities adopted the city of Amsterdam as a digital city followed by Helsinki. [2]

According to the terms of urban planning, smart cities go far beyond what most people might realize. "Rick Robinson, executive architect of smart cities, IBM Europe, says the smart city systematically seeks to create and promote innovations in city systems available by Technology, leading to a change in the relationship between the creation of economic and social value on the one hand and the consumption of resources on the one hand, and thus contribute in a coherent manner to achieve the clear vision and objectives supported by consensus among the shareholders in the city.[3]

At the First Annual International Summit about Smart Cities in North Africa, held at Al Akhawayn University in July 2014, the organizers developed a scientific definition of smart cities through covering four axes: urbanization, digital containment, public administration, and transporta-

tion. [4]

Smart cities have emerged as a way of structuring the urban context and have evolved rapidly since then. Today, it promotes digital content and services in urban areas, integrating mainstream computing and environmental challenges.

Urban restructuring, rehabilitation and development of real estate projects, such as the redevelopment or rehabilitation of parts of the city, such as former port areas, industrial buildings, dilapidated buildings or war- and conflict-affected areas, could be great opportunities to apply the smart city-based approaches and solutions.[5]

The success of the Smart City Master Plan depends to a large extent on the design of a strong strategy based on a clear vision for the city's future. Improve the quality of life for all people to develop plans to solve the real needs of society.

The Smart City concept, therefore, could be a tool that forms a part of urban planning and helps to address sustainable development strategies and long-term technological innovation to improve the quality of life of the population. Especially in regions and cities that have a harsh climate. Smart city technologies - whether through building interventions or restructuring of city plans - play a large role in adapting to climatic factors.

## **2. Background**

Smart city strategies usually share the attributes and purpose set by the vision of the city government. While this task is usually important, short, ambitious and general, but it also represents the local government of the city, and policy-makers move towards strategic thinking to develop the city and transform it into a smart city.

Despite the consensus on the outline of the Smart City strategy, the nature of the city, the current situation and its different sectors (such as economy, culture, natural resources, etc.) necessitates the alignment of the strategic outlines with strategic thinking specific to each particular case. This trend has been adopted by European cities, especially Vienna, Stockholm, Manchester and others. The adoption of the general strategic guidelines, with a focus on the relevant and desirable characteristics and sectors concerned, makes these cities known as environmentally smart cities or artificially intelligent cities. Areas of focus are already identified by policy makers at the highest levels of the city government, in coordination with those responsible for developing the national development plans of the state. This alignment is essential and must be carried out from the outset before committing to any development strategy to transform into

a smart city. [6]

For example, if the strategy is needed to develop a smart city with a focus on the environment and smart living as a priority, the strategy is expected to recommend a good urban governance first, which in turn requires public sector support, especially for open public data, and reduce the digital divide within society.

And if the focus is on energy and infrastructure, building smart cities (in partnership with the private sector) focuses on the provision of goods and buildings free of hazardous materials, emphasizing the use of sustainable energy and sustainable use of land and water, including waste treatment with minimal environmental impacts.

### **2.1. Smart growth**

Smart growth, a trend that seeks to control the growth of the city in a smart way, through a set of principles for land use and development aimed at improving the quality of life and preserve the natural environment, and save money over time. The principles of smart growth emphasize financial, environmental growth and social responsibility, and recognize that interdependence between development and quality of life. [7]

Intelligent growth enhances and complements communities by prioritizing urban dictation, regeneration, and urban intensification strategies.

The trend began after the United States Environmental Protection Agency (EPA) set out in 1996 a general set of principles for intelligent growth: [8]

1. Adoption of mixed land uses: Traditional development often divides cities into residential areas and commercial areas, keeping homes and businesses separate. Smart growth aims to keep homes, jobs and shops close together. This makes it practical for people to wander through walking, cycling and public transportation rather than driving private cars. It also helps to keep money within the local economy.

2. Benefit from compact construction design: it takes up a lot more space to build 500 single-family homes than it does to build one apartment building with 500 units. That leaves much more space available for nature. It's also cheaper to provide services for people if they live in one building rather than 300.

3. Create a range of opportunities and housing options: There are different types of families that need different types of housing. To meet the needs of all its residents, the city must offer a variety of options, including small apartments, large houses, condominiums, some homes for rent and some for ownership, with prices suited to a wide range of budgets.

- 4 - Construction of residential neighbourhoods dependent on pedes-

trian traffic: Smart growth aims to place houses where people live, working places and shop close to each other. There are houses, companies, schools, libraries, and places of worship close by, connected to safe streets and sidewalks.

5. Promote excellence, attractive communities, and sense of place : Every community has something that makes it unique, like a waterfront, a beautiful old library, or ethnic neighbourhood. These are the things that give the city its distinctive shape and feel, making it different from any other city. Intelligent growth aims to protect these special features - preserving old buildings, respecting natural features and man-made monuments, and designing a new development that fits smoothly around them.

6. Keep open spaces, agricultural land, natural beauty, critical environmental areas: Smart growth is not only about development but also about leaving some open spaces unfinished. By maintaining the size of development, intelligent growth helps to preserve agricultural land and waterways. Important natural areas, open space protects air and water quality by filtering rainwater, absorbing surplus, preventing erosion, and helping to keep wind and heat under control.

7. Promote and directly develop existing communities: Instead of expanding cities into new, sprawling suburbs, smart growth aims to steer new development towards existing communities. This helps keep open spaces by placing new buildings in areas that have already been built, rather than overcrowding new "green lands".

8. Provide a variety of transportation options: residents should not head to their own cars every time they need to go somewhere. Building walkable neighbourhoods is a good start, but people also need public transportation options to keep them connected to the rest of the world. Smart growth works to give residents as many transportation ways as possible, including safe roads, reliable public transportation, sidewalks, and bicycle paths for bike commuting.

9. Make development decisions predictable, fair, and cost-effective: Smart growth, depends on builders – who want their projects to be cost-efficient. If towns that aim to encourage smart growth, they need to make it easy for developers to build this way. For instance, a developer who wants to convert an old facility to a new one shouldn't have to fill out more forms and pay more in fees than one who wants to knock the building down and build a new one. So, towns need to examine their zoning laws and building codes, removing all unnecessary barriers for smart-growth projects.

10. Encourage community cooperation and cooperation with stakeholders in development decisions: Every town is different, and growth

that's smart in one place doesn't always make sense in another. And the best way to find out what the community truly needs is to make the people who live there a part of decision making to take part in the planning process and guide it to fit their needs.

The most important urban concepts that smart growth meets are: new urbanization, growth management, new community design, sustainable development, urban land conservation, urbanization prevention, place creation, best practice development, sustainable development and sustainable transport.

This concept is not limited to existing cities, but extends to the development of future studies for the reconstruction and development of cities destroyed by natural disasters or emerging from conflict and war, as is the case in cities in the Syrian Arab Republic.

## **2.2. Planning for tomorrow**

Despite the ongoing conflict on the ground, smart technologies from satellite imagery and social media analysis can help plan for the reconstruction of Syria after the war. A World Bank initiative, the SIRI, has prepared a schematic diagram of the destruction of six major cities in Syria - and the locations of these damage - facilities and services that are still operating and those that have stopped working. The Information and Research Initiative for Syria can help estimate the cost of repairing damages. [9]

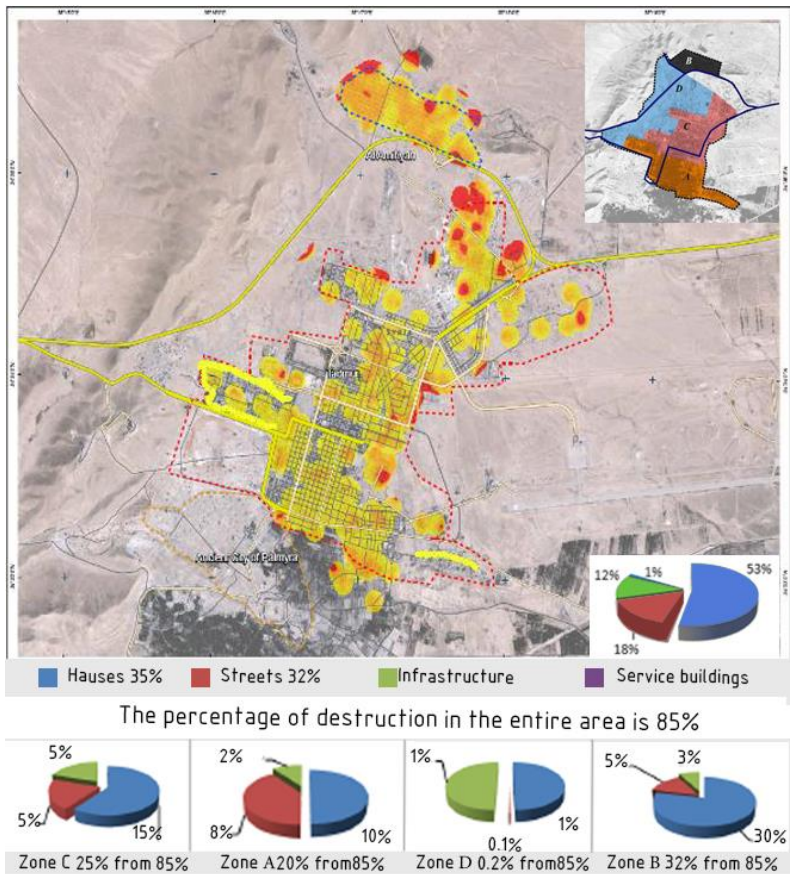
"The Bank is using the latest technology and methods that have been tested in advance to be ready to start working in Syria in time when the conflict eases," said Fred Belhadj, Regional Director, Middle East, World Bank. Technology can also allow us to develop realistic and viable plans in Syria before the war ends and in a way we have never been able to do before. "

Data collection techniques for natural disasters, which have been tested for decades, are being adapted to collect data when human-induced disasters occur. On this,

Raja Rehan Arshad, chief disaster risk specialist at the World Bank Group says "There is a growing demand to start looking at what will happen tomorrow, but from the perspective of the previous day." This is supposed to complement, rather than substitute, estimates on the ground as soon as possible.

## **3 Analysis**

The city of Palmyra is considered one of the most important pillars of development in Syria. It possesses all the elements of development and its potential for advancement. It is the richest and most polarized spatial memory, making it the most important kingdom in the east and the most



**Fig2. Destruction caused by the conflict in Palmyra [author and 12]**

important commercial port and transit road. [10]

Since Palmyra's existence, it had spatial sanctity. It was found to remain, and its current steadfastness after the destruction it has suffered through the ages and in the face of the conflicts in Syria, which is a message of its sustainability. [11]

Therefore, it is important to identify methods for the reconstruction of the affected urban areas, based on preserving the old and respecting its privacy and carrying out restoration interventions, and on the other hand to create new smart urban structures while preserving the urban identity of the area, and meets the needs of future expansion of the city which is

compatible with the development plans of the region.

In the time of the crisis, the organization Da'esh (ISIS) took control of Palmyra twice, the first time was in 2015, and the organization destroyed many of the ancient monuments and valuable historical monuments during the two periods that dominated Palmyra. The Syrian army liberated the city of Palmyra from the organization in March 2016.

After the restoration of the city, several authorities evaluated the damage in the city of Palmyra and analysed its current situation, and relied on aerial imagery (UNITAR) as shown in Figure (2) and reached the following results:

- Area A: is the old residential area of Palmyra, where population density is increasing and the city's services are concentrated. The damage is medium and distributed. The area has great importance and priority in rehabilitation in preparation for the return of the fleeing population from the city.

- Area B: is the area of illegal residential buildings and slum districts in Al-Amiriya district, where there is a lot of damage and unfit for habitation, but there is a need for emergency rehabilitation because of the expectation of a large number of residents returning there.

- Area C: a residential area with moderate and severe damages with relatively few services.

- Area D: The non-implementation part of the organizational chart, and must be built according to a new plan that meets the real requirements of the population on the basis of modern principles.

As a result, the process of reconstruction in the city of Palmyra after the war is an opportunity to apply the principles of smart cities at the planning and architectural level to ensure the city's future growth and development.

#### **4 Results**

Through the previous analysis of the urban planning of the Palmyra city, we find that there are fundamental considerations must be taken in account when developing the new master plan of the city, the most important is its integration with the surrounding environment from natural and social terms and the ability to grow in a smart way without harming them, in addition to other principles can be summarized by the following points.

- The main pillar of the development of the planning study for the city of Palmyra in the next phase is to rely on the basic urban network (of the archaeological city) and link it to the future urban extensions and rely on it in the structure of the green network, which maintains the ecosystem and restore the city's natural balance and improve the standard of life and



**Fig3. The proposed urban and green grid in Palmyra [author and [13]**

health. (Fig3)

- The study suggests changing the character of the Northwest Region of the master plan which located at the foot of the mountain. To be transformed into an interactive western park that preserves the natural identity of the mountain and thus preserves the natural landscape of the residential and archaeological city on the mountain.

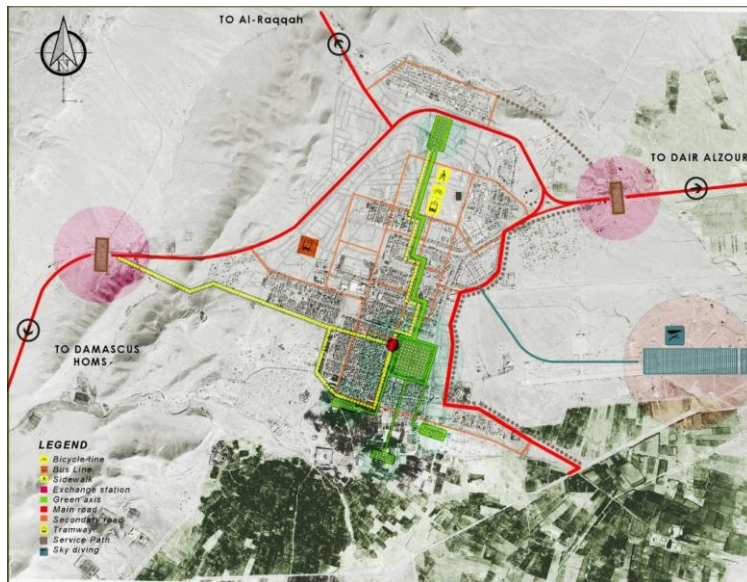
- The urban spaces are special spaces of coexistence between the residential blocks, which will be aimed to enhance the interaction and communication with nature and reducing the pollution and noise, and will be linked to the public spaces of the city, which are areas that create an environment suitable for social interaction and will provide spaces for renewable physical activities and opportunities for cultural activities, which would generate opportunities to promote tourism. (Fig2)

- The study of the transport network in Palmyra was based on the principle of integrated transport. The study divided the networks in the city into three levels, starting with an external network which aims to control and secure the connection of the city to its surroundings and extends to a service network within the city.[14]

- In order to improve the level of transport in the city by integrating the work of these networks at different levels according to an environmental perspective and a sustainable vision. (Fig4)

- Linking the city to important regional axes, thus enhancing its effective role in the region (through an advanced transport network of high-

ways and railways), which will increase the city's advantage of the re-



**Fig4. The proposed transport network in Palmyra [author]**

gion's capabilities and not only the spatial capacity within the narrow area around the city.

- The e-heritage city proposal: Through the use of virtual reality to achieve the closest simulation of reality in all its forms (environmental - urban - social - economic). This model represents the current reality of the city and provides concepts and alternatives for conservation projects of the regions after forming a virtual model of the city by applications and electronic technologies to build an electronic heritage city and solve many of its problems such as: [15]

- Problems of transportation through intelligent transport systems, where the database can be used to provide all the data related to transport networks and traffic within the city and provide technical support for development.

- Control the urban growth of the city by updating the database and linking it to the outputs of the strategic plan prepared for the city

- Construction management: where special applications can be made for building permits within the city and follow-up of urban projects in terms of implementation to provide support in the decision-making related to the development of the city.

## **5 Discussion**

The previous analysis of the smart urban growth towards a smart city to the post war cities, demonstrates that it is a multi-level regional innovation system that combines knowledge-based activities, problem-solving institutions, digital communication infrastructure and tools to increase capacity to solve Problems.

Also, the creation of smart cities requires a combination of technical components. These components are related to the city type, varying between new smart cities and transforming existing cities into smart cities.

Smart cities are a complex and interconnected system, and need thorough and informed studies of all its components before starting to build new smart cities or transforming existing cities into smart cities. This study includes a general strategy and guidelines in the framework of smart city planning and expansion. The real question is, if smart urban growth is such a great deal for the community, why is not it more common? Part of the answer is simply inertia. Towns that have always directed new development to the suburbs to build new cities do not see any need to change and extend their cities in new and efficient way.

The other problem holding back smart growth is ignorance about this new way of living. To some people who do not know a lot about smart growth, it could be understood as a way of keeping their cities from growing and extending. Other may think that smart growth is much more expensive than traditional development.

In addition, the lack of expansion in the adoption of smart city applications in the present is due to many other reasons, including the lack of the appropriate legal and legislative environment, the lack of adequate sources of funding, in addition to the lack of skills and capabilities.

## **6 Conclusions**

The study concludes the necessity of following new developmental approaches to develop an existing city to formulate sustainable and smart urban communities to the post war cities in Syrian, that achieve containment, independence and self-sufficiency without disturbing the ecological system. And that the smart city is not only an urban gathering, but also includes its relationship with the rest of the other communities, which in its entirety constitute its immediate regions.

The transformation of existing cities into smart cities depends on their existing infrastructure. Therefore, ready-made templates for smart cities should not be applied, and appropriate studies should be conducted to make smart cities compatible with local reality.

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## COMPOSITION NATIONALE DE LA POPULATION RURALE DU SUD DE LA RÉGION DE TIOUMEN: DYNAMIQUE ET DIFFÉRENCES RÉGIONNELLES.

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*L'article examine la composition national de la population rurale des districts du sud de la region de Tioumen, transformée pendant la période entre recensements de 2002-2010. D'après les résultats de l'étude, il a été constaté que la colonne vertébrale de la population rurale est composée des russes, suivis par les tatars avec un grand détachement et la troisième place des leaders est occupées par les kazakhs. En même temps, si le nombre des russes augmente, celui des tatars et des kazakhs diminue. En même temps, il est noté que dans les territoires ruraux, il y avait des peuples qui n'y vivaient pas auparavant ou qui se trouvaient en un nombre dit singulier. Un autre aspect particulier du recensement de 2010 est l'augmentation du nombre des citoyens qui n'ont pas déclaré leur nationalité.*

*Mots-clés: région de Tioumen, population rurale, composition nationale, langue maternelle.*

La région de Tioumen est la plus grande région de la Fédération de Russie. Sa superficie est de 1 435,2 mille km<sup>2</sup>, soit 8,4% de la superficie du pays. Parmi les sujets de la Fédération de Russie par la superficie, elle est inférieure à la République de Sakha (Yakoutie) et au territoire du Kraï de Krasnoïarsk. Seuls 19 États du monde de 193 membres de l'ONU dépassent son territoire. Par exemple, en Europe, il n'y a pas de tels États.

La ville de Tioumen est le centre administratif. Géographiquement, la région est située dans la Sibérie occidentale, et occupe une partie majeure de celle-ci, s'étend des côtes de l'océan Arctique jusqu'au territoire des steppes forestières. Elle s'étend du nord au sud sur 2 100 km et de l'ouest à l'est sur 1 400 km.

Sur le territoire de la région de Tioumen, en tant que sujet de la Fédération de Russie, se trouvent les districts autonomes des Khantys-Mansis — Iougra (KHMAO—Iougra) et de la République des Nénets (YANAO), qui ont reçu le statut des sujets autonomes de la Fédération de Russie en 1993, mais font officiellement partie de la région de Tioumen.

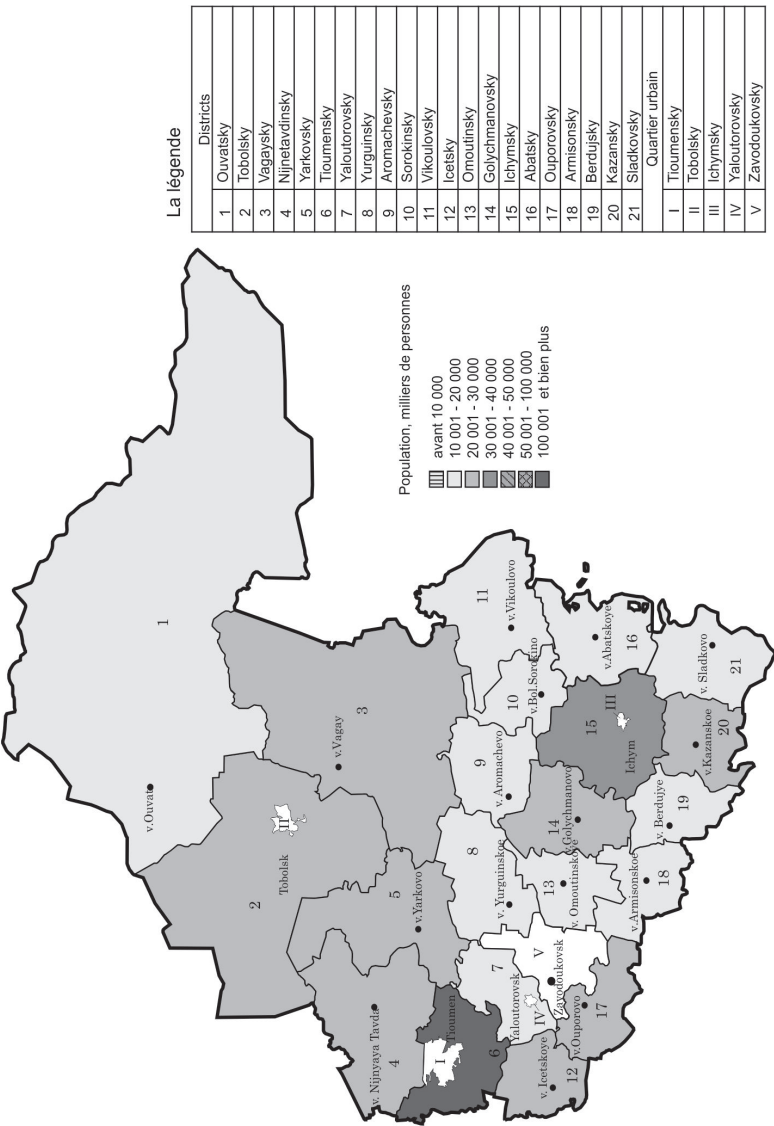
La superficie de la partie de sud de la région de Tioumen fait de 159,5 mille km<sup>2</sup>, se compose de 20 districts municipaux et 6 districts urbains [1]. Au 01.01.2019, selon le Service fédéral des statistiques d'état (Rosstat) [2] la population totale comptait 1,5 million de personnes, y compris la population rurale - 500,5 mille personnes, soit 32,9 %. La population rurale habite 20 municipalités et 4 districts urbains.

La composition nationale de la population rurale du sud de la région de Tioumen est assez variée. Des représentants de plus de 100 nationalités habitent son territoire, dans les territoires ruraux fort moins que ça. En même temps, un peu plus de 80% sont russes (428,9 mille personnes.) (table. 1). Ils sont dispersés dans le sud de la région, font majorité dans toutes les territoires municipaux et dans la plupart des localités. La proportion la plus haute des russes est dans les districts Vikoulovsky (95,18 %) et Yurginsky (93,62%), la plus basse dans le district Vagaisky (51,2%) (tabl. 2, img. 1).

**Tableau 1. Composition nationale de la population du sud de la région de Tioumen (à la date du recensement de 2010)**

Nationalité	2002		2010	
	pers.	%	pers.	%
Population totale,	523 635	100,0	531 624	100,0
y compris :				
Azerbaïdjanais	1 153	0,22	1 179	0,22
Arméniens	1 367	0,26	1 427	0,27
Bachkirs	716	0,14	684	0,13
Biélorusses	2 398	0,46	1 640	0,31
Géorgiens	244	0,05	183	0,03
Ingouches	723	0,14	944	0,18
Kazakhs	9 537	1,82	9 255	1,74
Komis	709	0,13	506	0,10
Komi-perméniens	266	0,05	209	0,04
Lesghiens	128	0,02	98	0,02
Maris	104	0,02	78	0,01
Moldave	648	0,12	535	0,10
Mordves	579	0,11	496	0,09
Allemands	9 237	1,76	7 229	1,36
Polonais	302	0,06	263	0,05
Russes	420 460	80,30	428 858	80,67
Tadjiks	503	0,10	782	0,15
Tatars	55 120	10,53	52 763	9,93
Oudmourtes	905	0,17	680	0,13
Ouzbeks	468	0,09	685	0,13
Ukrainiens	6 680	1,28	5 154	0,97
Khantes	337	0,06	261	0,05
Tchéutchènes	420	0,08	385	0,07
Tchouvaches	7 153	1,37	5 451	1,03
Autres	2 818	0,53	2 286	0,42
Sans indications	660	0,13	9 593	1,80

Source: établi à partir de : [3].



Img. 1. Répartition des russes dans le sud de la region de Tioumen, %.

Source: établi par les auteurs suite au recensement 2010.

**Tableau 2. Répartition des principales nationalités par territoires municipaux, % (à la date du recensement de 2010)**

Districts	Total	Y compris					
		russe	tatars	khazaks	allemands	ukrainiens	autres
1	2	3	4	5	6	7	8
Abatsky	100,0	92,37	0,21	2,1	1,71	0,5	3,11
Armisonsky	100,0	91,2	0,2	3,18	1,4	0,76	3,26
Aromachevsky	100,0	83,48	9,37	0,49	1,09	0,70	4,87
Berdujsky	100,0	91,74	0,24	4,1	1,17	0,74	2,01
Vagaysky	100,0	51,2	39,7	0,04	0,37	0,56	8,13
Vikoulovsky	100,0	95,18	0,60	0,41	0,79	0,51	2,51
Golychmanovsky	100,0	90,17	0,46	3,26	0,97	0,65	4,49
Icetsky	100,0	86,79	3,38	1,53	1,38	1,59	5,33
Ichymsky	100,0	88,70	0,44	4,86	1,81	0,88	2,55
Kazansky	100,0	88,44	0,26	5,73	2,33	0,73	2,51
Nijnetavdinsky	100,0	74,91	13,67	0,37	0,87	1,03	9,15
Omoutinsky	100,0	89,8	0,39	3,12	1,6	0,64	4,35
Sladkovsky	100,0	89,42	0,26	6,70	1,44	0,44	1,74
Sorokinsky	100,0	89,09	0,56	2,87	1,90	0,66	4,92
Tobolsky	100,0	61,38	34,11	0,04	0,61	1,10	2,76
Tioumensky	100,0	77,76	13,16	0,56	1,28	1,22	6,02
Ouvatsky	100,0	87,30	4,96	0,06	0,61	1,92	5,15
Ouporovsky	100,0	84,36	0,59	2,52	3,08	0,75	8,7
Yurginsky	100,0	93,62	0,54	1,09	1,04	0,61	3,1
Yaloutorovsky	100,0	67,57	24,15	1,32	1,13	1,20	4,63
Yarkovsky	100,0	57,34	32,51	0,06	0,50	0,79	8,8

Source: établi à partir de [3].

Les tatars font la deuxième nation la plus nombreuse (52, 8 mille de pers.). Ils représentent près de 10% de la population. La population tatare habite tous les districts du sud de la région. La proportion la plus élevée de tatars est présentée dans les districts Yaloutorovsky (24,1 %), Yarkovsky (32,5), Tobolsky (34,1) et Vagaisky (39,7%) (l'ouest et le nord du sud de la région). Dans ces districts, ainsi que dans plusieurs autres, il y a des localités où la population tatare est majoritaire. Au total, les tatars

occupent la deuxième place dans neuf districts et la 3ème dans un district (tabl. 3).

Les kazakhs sont les troisièmes par le nombre de population. Ils sont près de 9,3 mille personnes, soit 1,74% de la population. La plupart des kazakhs se trouvent dans les districts frontiers à la République du Kazakhstan ou à une certaine distance de celle-ci. Dans la moitié de nord du sud de la région, les kazakhs sont fort moins nombreux. Une ou deux familles kazakhes se trouvent dans des nombreuses localités du sud de la région. Dans certains districts, ils habitent en petites colonies – les auls et les cordons. Par le nombre de population, les kazakhs occupent la deuxième place dans les douze districts du sud de la région.

La part des deux autres peuples dépasse 1%. Ce sont les allemands (1,36 %) et les tchouvaches (1,03%). La population allemande se trouve principalement dans les districts les plus méridionaux de la région, les tchouvaches au long des rivières Tavde, Tobolu et Vagaï. Dans deux districts de la région (Vikoulovsky et Ouporovsky), les allemands occupent la deuxième place par le nombre de la population, la troisième dans les dix, les tchouvaches occupant la troisième place dans trois districts, les ukrainiens – la troisième dans cinq districts (tabl. 3).

Selon les données du recensement de 2010, 9,6 mille de personnes (1,8 %) ne pouvaient pas indiquer leur nationalité (en 2002, il n'y en avait que 660 pers., soit 0,08 %).

Entre les recensements de 2002 et 2010, la population rurale totale (y compris les districts urbains) dans le sud de la région a grandi. La population des peuples majoritairement a augmenté. En même temps, le nombre des géorgiens et des tchouvaches a considérablement diminué (de 1,3 fois), de même des komis (de 1,4 fois), et al. 99,5% des habitants ont la nationalité russe.

**Tableau 3. Répartition des nationalités essentielles dans les régions du Sud de la région de Tioumen**

Nationalité	Nombre des districts	Districts
<b>Les russes</b> 1ère place	21	Abatsky, Armisonsky, Aromachevsky, Berdujsky, Vagaysky, Vikoulovsky, Golychmanovsky, Icetsky, Ichymsky, Kazansky, Nijnetavdinsky, Omoutinsky, Sladkovsky, Sorokinsky, Tobolsky, Tioumensky, Ouvatsky, Ouporovsky, Yurginsky, Yaloutorovsky, Yarkovsky

Tableau 3 (fin).

Nationalité	Nombre des districts	Districts
2ème place	0	—
3ème place	0	—
<b>Les tatars</b>		
1ère place	0	—
2ème place	9	Aromachevsky, Vagaysky, Icetsky, Nijnetavdinsky, Tobolsky, Tioumensky, Ouvatsky, Yaloutorovsky, Yarkovsky
3ème place	1	Vikoulovsky
<b>Les khazakhs</b>		
1ère place	0	—
2ème place	12	Abatsky, Abatsky, Berdujsky, Golychmanovsky, Ichymsky, Kazansky, Omoutinsky, Yurginsky, Yaloutorovsky, Sladkovsky, Sorokinsky, Ouporovsky,
3ème place	0	—
<b>Les allemands</b>		
1ère place	0	—
2ème place	2	Vikoulovsky, Ouporovsky,
3ème place	10	Abatsky, Abatsky, Berdujsky, Golychmanovsky, Ichymsky, Kazansky, Omoutinsky, Sladkovsky, Sorokinsky, Yurginsky
<b>Les tchouvaches</b>		
1ère place	0	—
2ème place	0	—
3ème place	3	Aromachevsky, Nijnetavdinsky, Yarkovsky
<b>Les ukrainiens</b>		
1ère place	0	—
2ème place	0	—
3ème place	5	Vagaysky, Icetsky, Tobolsky, Tioumensky, Ouvatsky

Source: établi à partir de: [3].

Parmi les grands peuples, ce sont généralement les femmes qui sont plus nombreuses, parmi les petits peuples - les hommes. Ainsi, les hommes sont plus nombreux parmi les peuples caucasiens (azébaïdjanais, arméniens, géorgiens, ingouches, etc.) et asiatiques (kirghizes, tadjiks, ouzbeks).

En considération de la majorité de la population russe au sud de la région, le russe est la langue la plus répandue (82,6 %). Sauf des russes, les polonais, les allemands, les biélorusses, et al., ont appelé le russe sa langue maternelle. En total, 13 peuples (plus de 50% de chaque peuple parle russe). La deuxième langue la plus répandue et parlée est la langue tatare. À l'exception des tatars, les bachkirs et, d'une manière beaucoup plus limitée, d'autres peuples parlent le tatar. La troisième langue la plus répandue est l'ukrainien. 34,5% des ukrainiens, 4,5% des polonais et un certain nombre d'autres le considèrent comme la langue maternelle. 20 peuples ont nommé la langue maternelle celle qui leur a été donnée à la naissance (tabl. 4).

**Tableau 4. Répartition de la population rurale des nationalités les plus nombreuses, ayant indiqué leur langue maternelle, % (à la date du recensement de 2010)**

Nationalité	Langue maternelle	Y compris			
		Le russe	Le tatar	L'ukrainien	autre
Population total, y compris	100,0	82,6	7,2	0,7	9,5
Avariens	100,0	14,5			85,5
Azerbaïdjanais	100,0	14,6	0,1		85,3
Arméniens	100,0	16,6	0,1		83,2
Bachkirs	100,0	31,7	7,5		60,7
Biélorusses	100,0	80,8	0,1	0,3	18,7
Bulgares	100,0	52,6		0,9	46,5
Géorgiens	100,0	41,1			58,9
Darguiniens	100,0	20,8	0,4		78,8
Ingouches	100,0	12,6			87,4
Kazakhs	100,0	18,7	0,1		81,2
Kirghizs	100,0	10,2	0,4		89,4
Komis	100,0	50,7			49,3
Komi-perméniens	100,0	64,9			35,1
Koumyks	100,0	6,1			93,9
Lesghiens	100,0	12,2	0,2		87,6

Tableau 4 (fin).

Nationalité	Langue maternelle	Y compris			
		Le russe	Le tatar	L'ukrainien	autre
Mansis	100,0	76,1			23,9
Maris	100,0	48,5	0,3		51,2
Moldaves	100,0	44,9	0,1		55,0
Mordves	100,0	60,1			39,9
Allemands	100,0	86,6			13,4
Nénètses	100,0	8,9			91,1
Nogaïs	100,0	6,5	0,5		93,0
Polonais	100,0	89,1	0,3	4,5	6,1
Russes	100,0	99,9	0,0	0,0	0,0
Selkoupes	100,0	28,6			71,4
Tadjiks	100,0	10,3			89,7
Tatars	100,0	15,0	84,9		0,1
Oudmourtes	100,0	66,0	0,3		33,7
Ouzbeks	100,0	13,7	0,4		86,9
Ukrainiens	100,0	65,0	0,1	34,8	0,1
Khantes	100,0	50,8	0,0		49,2
Tchétychènes	100,0	11,5	0,1		88,3
Tchouvaches	100,0	55,5	0,1		44,4
Autres	100,0	40,1	0,2	0,1	59,5

Source: établi à partir de: [3].

### Conclusions essentielles:

1. La composition nationale de la population du sud de la région de Tioumen a subi certains changements pendant la période entre recensements 2002-2010. Dans la population totale le part du plus grand peuple – les russes - a augmenté, y compris grâce à la croissance de la population russe. En même temps, les parts de deux autres peuples dans le trio des plus nombreux se sont réduits, dû à leur diminution et à la croissance du nombre des autres peuples.

2. La population russe est majeure dans toutes les territoires municipaux de la région. Sa part varie de 51,2% dans les districts Vagaysky à 93,62% dans le district de Yurginsky.

3. La deuxième nationalité la plus nombreuse – les tatars – occupe la 2ème place dans 9 districts et la 3ème place dans un district. Les troisièmes par le nombre – les Kazakhs - occupent la 3ème place dans 12 districts de la région.

4. Le russe est une langue la plus répandue dans les territoires ruraux (plus de 82 %). Sauf les russes, 13 peuples ont nommé le russe comme leur langue maternelle. En général, presque tous les habitants des territoires ruraux parlent russe.

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## DECISION RULE FOR RECOGNIZING SMALL OBJECTS BASED ON SUBBAND PROCESSING OF RADAR SIGNALS

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*The article discusses the problems that arise during radar sensing of small sized aircraft. The features of reflections in the X and UHF ranges of radio waves and the technical characteristics of radar systems are determined. Decision rules for the recognition of small-sized objects have been developed with subband presentation of radar information and the resonant nature of reflections. The features of decision rules due to the singularity of spectral covariance matrices are considered.*

*Keywords. Recognition, decision rules, subband processing, coherence, criterion, covariance matrix, frequency.*

### **Relevance**

The recognition of small objects using radar information has recently become increasingly important. This is due to the fact that in recent years various unmanned aerial vehicles (UAVs), both aircraft type and copter type, have been widely used. The range of applications of these UAVs is constantly expanding. Starting from entertainment goals, ending with a combat application. All this determines the need for their detection and recognition, to prevent threats posed by such objects [1]. Moreover, the linear dimensions of these objects are quite small and can be as little as two dozen centimeters, and composite materials are used in the structural

elements to reduce radar visibility. The use of optical and infrared means does not always provide the desired result. This is determined by their dependence on weather conditions, time of day, as well as very weak thermal contrast [2].

**Problems in the detection and recognition of small UAVs in the quasi-optical frequency range.**

When using radar to detect and recognize such objects, a number of problems arise. To date, the technology of centimeter wave radars, including small ones is quite well-developed. These tools operate in the "quasi-optical" frequency range (when the wavelength is significantly less than the linear dimensions of the objects). The main feature when reflecting radio waves from UAVs is that the radar cross-section (RCS) of these objects is very small (amounts to about  $0.001 - 0.05 \text{ m}^2$ ) [2]. This is determined by both the small size of the objects and the materials of manufacture. Therefore, the detection range of small-sized UAVs is limited by the power (energy) characteristics of radar equipment and today does not exceed several kilometers (and even then in almost ideal conditions). In this case, methods based on the Doppler effect are mainly used (manifested in the presence of the radial velocity of the object due to a change in the signal frequency during reflection). However, most of the small-sized UAVs are low-speed, or in general can be practically motionless (hover). In addition, the flight altitude of such objects is small, as a rule, does not exceed several tens of meters. Under these conditions, detection and recognition must be carried out against the background of the underlying surface. At the same time, in the resolved volume of the radar, reflections arise not only from the object itself, but also from the underlying surface (earth) and possibly from other extraneous objects. The specific RCS of the underlying surface, in this range of radio waves, can reach  $0.1 \text{ m}^2$ . In this case, the earth is a passive noise, and the signal-to-noise ratio in the reflected signal can reach up to minus 10 - 15 dB in power (even for locators with good resolution) [2].

To solve the above problems, new approaches and methods for processing radar information are required, as well as the use of other ranges of radio waves where reflections from small UAVs will be more informative.

**Features of reflections from small UAVs and technical requirements for radar systems.**

Modern radar technology allows you to create tools that operate in virtually any range of radio waves. The methods for the formation and processing of ultra-wideband signals (UWB), including spectral processing, are quite well developed. These achievements can significantly expand the capabilities of radars in the detection and recognition of small UAVs.

To detect and recognize small UAVs, it is necessary to use a range of radio waves in which the reflective properties of such objects are most fully manifested and where reflections from passive interference are much less pronounced, in this case reflections from the underlying surface. The most acceptable is the UHF range of radio waves. This is explained by the fact that in this range “resonant” properties are manifested when signals are reflected. Separate structural elements of small UAVs are capable of forming responses to electromagnetic effects [3]. This is especially evident in cases where the wavelength is comparable to or a multiple of the linear dimensions of the structural elements of such objects. The dimensions of reaction-capable structural elements are not known a priori. Therefore, it is impossible to determine in advance the frequency of the probing effect. As a way out of this situation, it is natural to use multi-frequency wide-band sounding [4]. For this, it is possible to use linearly frequency-modulated (LFM) signals with a wide band or ultrashort smooth pulses. The impact of the LFM of broadband signals is equivalent to the use of short radio pulses of a certain frequency. Synthesizing such signals is possible using digital methods [5].

To ensure broadband, the LFM signal samples must be sufficiently short in duration. However, a short-term exposure not always give rise to a resonant response, therefore, the resulting reaction corresponds to the concept of the impulse response of a certain system. The duration of the reaction depends on the bandwidth of the response filter, which must be evaluated in order to make sufficient use of the energy properties of the reflections [3].

The relatively low UAV mobility allows the use of coherent signal properties [5], that is, the accumulation of signals reflected from objects. This can provide the necessary energy characteristics of signals for detection at long ranges and recognition of objects with acceptable quality indicators.

All of the above features arising from the formation, emission and reflection from small UAV signals, as well as the technical features of radar systems, suggest the improvement of processing methods of received signals in order to make the most complete use of the information contained in the reflected signals. To do this, it is possible to use methods of subband analysis and signal synthesis, quite well developed by a team of scientists of the Belgorod State National Research University under the leadership of Zhilyakov EG [7]. These methods suggest analyzing the properties of the received signals from the standpoint of dividing the frequency band into subbands [8].

### Subband presentation of signals when receiving and processing information

The received and digitized broadband signal (time-sampled) can be represented in vector form [7]

$$\vec{x} = (x_1, \dots, x_Q). \quad (1)$$

In this case, the components of the vector are the signal values (functions of time) that correspond to the value of the argument  $q\Delta t$

$$x_q = x(q\Delta t), q = 1, \dots, Q, \quad (2)$$

where:  $\Delta t$  - time sampling interval;  $Q$  - number of signal samples;  $q$  - reference number.

When processing signals, it is necessary to take into account the fact that the energies of the signal components are concentrated in a small number of rather narrow intervals of the spectral definition region. This approach, when the data are analyzed from the standpoint of some dividing the frequency axis into a series of frequency intervals, is usually called subband [7].

$$\Delta\omega = 4\pi/(Q-1). \quad (3)$$

In accordance with relation (3), the following partition of the frequency axis into frequency intervals  $k$  of the following form is proposed [7]

$$\Omega_k = [-\Omega_{1k}, -\Omega_{2k}) \cup [\Omega_{1k}, \Omega_{2k}), k = 0, \dots, K, \quad (4)$$

$$\Omega_{10} = 0; \Omega_{20} = 2\pi/(M-1); \Omega_{1k} = \Omega_{2,k-1}; \Omega_{2k} - \Omega_{1k} = 4\pi/(Q-1), \quad (5)$$

where:  $K$  - number of frequency intervals;  $k$  - frequency slot number.

It is advisable to use the concept of a part of the signal energy falling within a given frequency interval [8] as the basis of subband analysis

$$P_k(x) = \int_{\omega \in \Omega_k} |X(\omega)|^2 d\omega / 2\pi. \quad (6)$$

Substitution of the following definitions here

$$X(\omega) = \sum_{q=1}^Q x(q) \exp(-j\omega(q-1)), \quad (7)$$

after a series of transformations allows you to get a representation directly in the field of originals in the form of a quadratic form [7]

$$U_k(\vec{x}) = \vec{x}' A_k \vec{x}, \quad (8)$$

where:  $A_k = \{a_{\gamma\xi}^k\}$ ,  $\gamma, \xi = 1, \dots, Q$  - subband matrix with elements

$$a_{\gamma\xi}^k = \begin{cases} \frac{\sin[\Omega_{2k}(\gamma-\xi)] - \sin[\Omega_{1k}(\gamma-\xi)]}{\pi(\gamma-\xi)}, & \gamma \neq \xi \\ \frac{\Omega_{2k} - \Omega_{1k}}{\pi}, & \gamma = \xi \end{cases} \quad (9)$$

For each frequency interval, a subband matrix is calculated. After the transformation (8), the sample (1) is actually converted into a vector of dimension  $k$ , which can be called a spectral vector (SV) and can be written as [9]

$$\vec{U}_{(k)} = \begin{pmatrix} U_{(1)} \\ U_{(2)} \\ \dots \\ U_{(k)} \end{pmatrix} = (U_{(1)} \quad U_{(2)} \quad \dots \quad U_{(k)})^T, \quad (10)$$

where:  $U$  – fraction (part) of signal energy in the frequency interval;  $k$  – frequency slot number;  $T$  – transpose sign.

If the locator performs several soundings (packets) on the same object and the requirements for the coherence of the reflected signals are fulfilled (parameters of the reflected signals are unchanged during the coherence time) [6], then the received packet of signals can be represented as a sample  $n$  of vectors

$$\vec{U}_{n(k)} = \begin{pmatrix} U_{1(1)} & U_{2(1)} & \dots & U_{n(1)} \\ U_{1(2)} & U_{2(2)} & \dots & U_{n(2)} \\ \dots & \dots & \dots & \dots \\ U_{1(k)} & U_{2(k)} & \dots & U_{n(k)} \end{pmatrix}, \quad (11)$$

where:  $n$  – the number of pulses in a pack; current probe number  $i = 1, \dots, n$ ; the dimension of the vectors in the sample is  $k$ .

In the general case, sample (11) is a random measurement (it is a multidimensional random variable), since the measurements are subject to random disturbances, the probabilistic nature of which affects all stages. These are errors of the meter itself, inaccuracies in registration and noise in the channels when transmitting measurement data, rounding errors in the calculations, and a number of other parameters. Therefore, it is possible to determine the multidimensional probability distribution of the measurement data and evaluate its moments. In the case of the assumption of Gaussianity (normality) of random measurements, the probabilistic distribution of the sample can be characterized by two moments - the first initial (mathematical expectation) and the second central (covariance matrix) [10]. The elements of the covariance matrix (CM) reflect the degree of statistical relationship between the elements of the initial vector of fixed parameters among themselves. The vector of mathematical expectation (ME) can be written in the form [10]

$$\bar{\mathbf{m}}_{(k)} = \begin{pmatrix} m_{(1)} \\ m_{(2)} \\ \dots \\ m_{(k)} \end{pmatrix} = (m_{(1)} \quad m_{(2)} \quad \dots \quad m_{(k)})^T, \quad (12)$$

where the elements of the vector, for each frequency interval, are calculated in accordance with the expressions

$$m_{(1)} = \frac{1}{n} \sum_{i=1}^n U_{i(1)}, \quad m_{(2)} = \frac{1}{n} \sum_{i=1}^n U_{i(2)}, \quad \dots, \quad m_{(k)} = \frac{1}{n} \sum_{i=1}^n U_{i(k)}, \quad i=1, \dots, n \quad (13)$$

The covariance matrix can be written as an expression [10]

$$\mathbf{M}_{(k \times k)} = \frac{1}{n-1} \sum_{i=1}^n (\bar{\mathbf{U}}_{i(k)} - \bar{\mathbf{m}}_{(k)}) (\bar{\mathbf{U}}_{i(k)} - \bar{\mathbf{m}}_{(k)})^T. \quad (14)$$

This matrix, in the General case, can be considered the spectral covariance matrix (SCM) of the object, having the dimension  $k \times k$ .

With a Gaussian distribution of the sample, the probability density of the  $i$ -th sample vector can be written as an expression [10,13]

$$P(\bar{\mathbf{U}}_{i(k)}) = \frac{1}{(2\pi)^n (\det \mathbf{M}_{(k \times k)})^n} \exp \left[ -\frac{1}{2} (\bar{\mathbf{U}}_{i(k)} - \bar{\mathbf{m}}_{(k)})^T \mathbf{M}_{(k \times k)}^{-1} (\bar{\mathbf{U}}_{i(k)} - \bar{\mathbf{m}}_{(k)}) \right] \quad (15)$$

Thus, the subband representation of signals in the processing of information allows you to apply a statistical approach and describe the measurement data in the form of a Gaussian distribution with the spectral covariance matrix of the object.

### **Decision rules for the recognition of small UAVs and the features of their formation.**

The property of normality of features greatly simplifies the form of the decision function, since the decision function turns out to be a linear combination of observations, and its distribution will again be normal. All types of decision rules are based on the formation of a likelihood relationship and its comparison with a certain threshold, the value of which is determined by the selected quality criterion [10,14].

In the case of statistical detection and recognition of the probability density, the distribution of attributes is a priori unknown, so the decision rules are not substituted for the probability densities themselves, but their estimates obtained in the learning process. Accordingly, the decision rule compares the threshold not with the likelihood ratio itself, but with its assessment obtained in the course of training [10].

In this case, the task of parametric training will be to evaluate the parameters (vector of means and SCM) of normal probability densities used in the decision rule. Therefore, in the future we will operate not with the moments of distribution, but with their estimates.

The original vector has dimension  $k$ , which actually determines the number of frequency intervals (or subbands). When a small-sized object is irradiated with signals with a fairly wide band (such signals include ultra-wideband LFM signals), the received signal will manifest energy in those subbands that are determined by the "resonant" properties of the reflections. This will depend on the design of the object. In some subbands, the signal energy may be practically absent. This will make SCM degenerate (singular). To overcome the SCM singularity, it is possible to use a fairly well-developed method for the analysis of principal components, which consists in choosing a basis in which the covariance matrix is not singular [11].

To do this, we choose as the  $\tau$  - dimensional basis  $E(\mathbf{U})$  all  $\tau$  normalized eigenvectors  $\bar{\mathbf{b}}_i^0 (i = \overline{1, \tau})$ , corresponding to nonzero eigenvalues  $\lambda_i$  SCM  $\mathbf{M}$  ( $\text{rg}\mathbf{M} = \tau$ ). In the general case, conditions  $\tau \leq k$  must be satisfied. Then the transition matrix  $\mathbf{B}$  of size  $k \times \tau$  will consist of vectors  $\bar{\mathbf{b}}_i^0$ , arranged in columns [11]. The matrix  $\mathbf{B}$  must satisfy condition  $\mathbf{B}^T \mathbf{B} = \mathbf{I}$ , where  $\mathbf{I}$  - is the identity matrix of dimension  $\tau \times \tau$ . We can write expressions for recalculating the original vector and estimates of distribution moments in the form [12]

$$\bar{\mathbf{Y}}_{(\tau)} = \mathbf{B}_{(k \times \tau)} \bar{\mathbf{U}}_{(k)}, \bar{\boldsymbol{\mu}}_{(\tau)} = \mathbf{B}_{(k \times \tau)} \bar{\mathbf{m}}_{(k)}, \mathbf{T}_{(\tau \times \tau)} = \mathbf{B}_{(\tau \times k)}^T \mathbf{M}_{(k \times k)} \mathbf{B}_{(k \times \tau)}, \quad (16)$$

where:  $\bar{\mathbf{Y}}_{(\tau)}$  - vector with dimension  $\tau$ , obtained from the original, by recalculation;  $\bar{\boldsymbol{\mu}}_{(\tau)}$  and  $\mathbf{T}_{(\tau \times \tau)}$  - recalculated estimates of distribution moments with dimension  $\tau$ .

The probability density (15), in a new basis, can be written as [13

$$P(\bar{\mathbf{Y}}_{i(\tau)}) = \frac{1}{(2\pi)^n (\det \mathbf{T}_{(\tau \times \tau)})^n} \exp \left[ -\frac{1}{2} (\bar{\mathbf{Y}}_{i(\tau)} - \bar{\boldsymbol{\Gamma}}_{(\tau)})^T \mathbf{T}_{(\tau \times \tau)}^{-1} (\bar{\mathbf{Y}}_{i(\tau)} - \bar{\boldsymbol{\Gamma}}_{(\tau)}) \right] \quad (17)$$

In this case, the correct reversal of SCM  $\mathbf{T}_{(\tau \times \tau)}$ , recalculated into a new basis, is possible, since in this basis the matrix is not degenerate (not singular).

We will consider the construction of decision rules using the example of recognition of small-sized UAVs against the background of the underlying surface (earth). We formulate hypotheses.

In the scope of the radar resolution, reflections occur only from the underlying surface – hypothesis  $H_0$ . In the scope of the radar resolution there is a small UAV, and reflections occur from the object and the underlying surface – hypothesis  $H_1$ . At the same time, as a training sample, it is necessary to use a sample obtained a priori for the object, without taking into account reflections from the earth. The translation matrix  $\mathbf{B}$  must be obtained a priori using the SCM of the object. When recalculated, this matrix will select only those spectral components that are inherent in the object. For the remaining spectral components, it will act as a filter. In this case, the degeneracy of SCM is eliminated. The decisive rule is to form the logarithm of the likelihood ratio and compare it with the threshold  $C$  [10,13]. As a control sample, the sample obtained during the current sounding of the allowed radar volume was used. In this case, recognition is two-alternative. This makes it possible to use fairly well-known criteria. For example, the threshold can be determined in accordance with the Neumann-Pearson criterion [10,13], setting the probability of an error of the first kind  $\alpha$  (false alarm). The smaller the given  $\alpha$ , the greater the threshold. The decision rule can be written as [14]

$$L = \frac{n}{2} \ln \left| \frac{\mathbf{T}_{(\tau \times \tau)}^{(1)}}{\mathbf{T}_{(\tau \times \tau)}^{(0)}} \right| + \frac{1}{2} \cdot \sum_{i=1}^n \left( (\vec{\mathbf{Y}}_{i(\tau)} - \vec{\mu}_{(\tau)}^{(1)})^T \cdot (\mathbf{T}_{(\tau \times \tau)}^{(1)})^{-1} \cdot (\vec{\mathbf{Y}}_{i(\tau)} - \vec{\mu}_{(\tau)}^{(1)}) - \right. \\ \left. - (\vec{\mathbf{Y}}_{i(\tau)} - \vec{\mu}_{(\tau)}^{(0)})^T \cdot (\mathbf{T}_{(\tau \times \tau)}^{(0)})^{-1} \cdot (\vec{\mathbf{Y}}_{i(\tau)} - \vec{\mu}_{(\tau)}^{(0)}) \right) > \ln C, \quad (18)$$

where: superscripts in estimates  $\mu$  and  $\mathbf{T}$  denote the hypothesis (1 corresponds to hypothesis  $H_1$ , 0 to hypothesis  $H_0$ ); subscripts define the dimension.

This decision rule allows you to recognize a specific object (small UAV) on which training was conducted.

### Conclusions

Forming decision rules is possible with subband processing of received signals. In this case, the requirements for the coherence of the received signals at a certain period of accumulation time must be fulfilled.

Using the approach described above, various options for forming decision rules are possible when recognizing small UAVs. For example, assuming that the underlying surface is homogeneous in the vicinity of the resolvable volume, it is possible to forming a decision rule (two-alternative) for recognizing inhomogeneities that appear in the resolvable volume.

When recognizing some types of UAVs from others, it is necessary to use multi-alternative solutions using a different criterion. For example, Bayes, in which the probabilities of the appearance of classes are a priori unknown.

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## **DETERMINATION OF THE GEOLOGICAL STRENGTH INDEX GSI FOR THE CONDITIONS OF THE AKZHAL DEPOSIT**

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*The article presents the results of geotechnological research in accordance with rating classifications in the conditions of the Akzhal deposit. An example of determining the geological strength index GSI to get a qualitative characteristic of the studied rock mass is considered. The geological index of rock strength allows obtaining a correct transition from the strength of a rock sample to the strength of an array, and makes it possible to get reliable strength characteristics of rocks necessary for numerical modeling of geomechanical processes.*

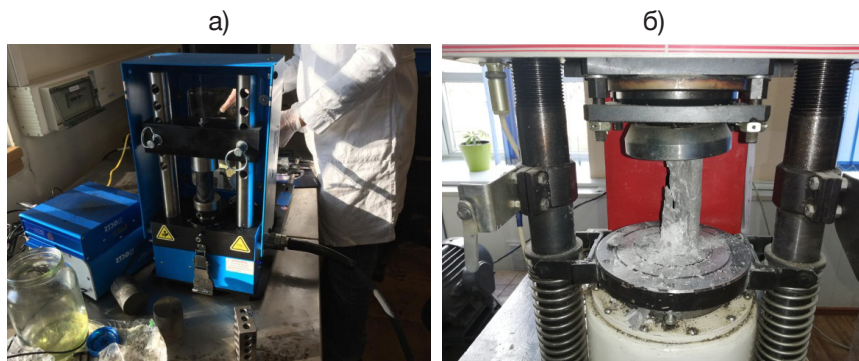
*Keywords: rock mass strength, rating classifications, stress-strain state, geological strength index GSI.*

In the world practice, when designing underground structures, rating systems of rock mass classification are widely used. Engineers prefer numerical values to qualitative descriptions, and therefore rating classifications are useful in designing mining operations.

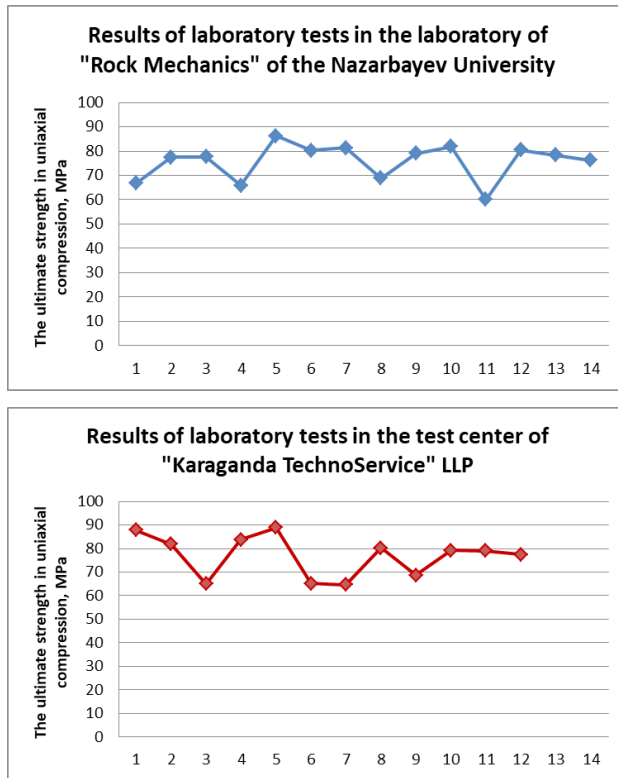
At present, the Akzhal mine is working out reserves of lead-zinc ores by open and underground methods with a system of sub-storey collapse. In the future, according to the project of industrial development of the Akzhal deposit [1], a complete transition to underground mining of reserves to a depth of 630 m is planned, so the problems related to ensuring the stability of preparatory and capital workings during the development of sub-barrier and instrument reserves are of great scientific and practical interest. The ability to predict changes in the stress-strain state of rock masses in the vicinity of the mine can reduce the probability of failure of the mine and increase their reliability. In this regard, there is a need to conduct geotechnological studies of determining the parameters of stability of the mine workings of the Akzhal mine.

For predictive assessment of the stress-strain state of a rock mass, numerical modeling methods are widely used, which allow a reasonable approach to solving geotechnological problems. The reliability of modeling results often depends on the accuracy of the input source data. Important components of the initial data are the strength of rocks for uniaxial compression ( $\sigma_{cj}$ ), and the indicator of the geological strength index GSI (Geological Strength Index) [2].

In order to determine the strength limit under uniaxial compression ( $\sigma_{cj}$ ), laboratory tests of rock samples of the Akzhal deposit were conducted in the laboratory of "Rock Mechanics" of the Nazarbayev University (Fig. 1A), and in the test center of "Karaganda TechnoService" LLP (Fig. 1B). As a result of laboratory tests, the average value of the compressive strength is determined, which is 76.24 MPa [3] (figure 2 a, b).



**Figure 1 – Laboratory tests of rock samples**  
**a - in the laboratory of Nazarbayev University;**  
**b - in the test center of "Karaganda TechnoService" LLP**



**Figure 2 – Results of laboratory tests of rock samples from the Akzhal deposit**

Today, in the world practice of designing underground structures, the Hoek-Brown strength criteria, the basis of which is the geological strength Index (GSI), are most widely used. The method for determining the strength of a rock mass is based on an assessment of the blockiness of the array and the state of the violation surfaces (cracks).

The classification is constantly being improved depending on the requests arising from the design practice. So, in one of the latest studies by Hoek and Brown [4], it is proposed to define the GSI index as follows:

$$GSI = 1.5 * JCond_{89} + RQD/2 \quad (1)$$

where  $JCond_{89}$  is a parameter of the rating classification of rock fracturing in accordance with the methodology of the International Society for Rock Mechanics (ISRM),

*RQD* - an indicator of the quality of rock.

$$JCond_{89} = JA4 = JA41 + JA42 + JA43 + JA44 + JA45 \quad (2)$$

As a result of mine research at the Akzhal mine, the rating indicators composing *JCond*<sub>89</sub> (*JA4*) were determined according to the methodology of the International Society for Rock mechanics (ISRM) [5], the indicators in points are shown in table 1.

**Table 1 – Determination of the rating assessment of the geological characteristic of fracturing JA4**

Parameter	Interval of values				
A4. Characterization of cracks ( <i>JCond</i> 89)					
A4.1. The roughness of the cracks	Very rough	Rough	<i>Slightly rough</i>	Smooth surface	Traces of slip
Rating JA41	6	5	3	1	0
A4.2. The length of the cracks	< 1 m	1-3 m	<b>3-10 m</b>	10-20 m	> 20 m
Rating JA42	6	4	2	1	0
A.4.3. Crack detection	No	< 0,1 mm	<b>0,1-1,0 mm</b>	1-5 mm	> 5 mm
Rating JA43	6	5	4	1	0
A4.4. Crack filler	No	Solid filler < 5 mm	Solid filler > 5 mm	Soft filler < 5 mm	Soft filler > 5 mm
Rating JA44	6	4	2	2	0
A4.5. Weathering of crack walls	No	<i>Slightly weathered</i>	Medium weathered	Highly weathered	Split
Rating JA45	6	5	3	1	0
<b><math>JCond89 = J_{A4} = J_{A41} + J_{A42} + J_{A43} + J_{A44} + J_{A45} = 3+2+4+2+5 = 16</math></b>					

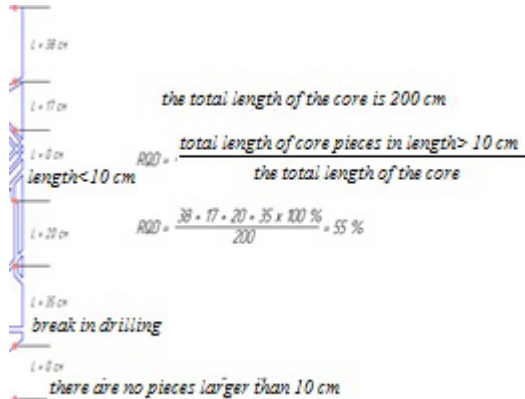
In 1967, D. Deere [6] introduced the "rock quality index" *RQD* as an indicator of quantitative assessment of the quality of a rock mass according to core drilling data. The indicator is defined as the ratio of the total length of core pieces (longer than 10 cm) to its total length:

$$RQD = \frac{\sum l_{(>10cm)}}{l_{core}} \quad (3)$$

where *RQD* is an indicator that is directly proportional to the number of cracks.

The RQD indicator for the conditions of the Akzhal deposit was determined according to the method [5]. The total length of the core was 150 cm, and the core diameter was 54 cm. The procedure for determining the RQD value was performed according to figure 3. The Results of determining the RQD at the Akzhal underground mine are shown in table 2.

a)



б)



**Figure 3 – Defining the RQD indicator**  
 a - the procedure for measuring and calculating RQD;  
 б - determination of the RQD index of the Akzhal deposit rock.

Table 2 – Results of determination of RQD

Intervals of a borehole, m	Value of RQD	Rock quality
30,8-38,3	92,6	Very strong
20,3-30,8	84,4	Strong
9,7-20,3	80	Strong
6,7-9,7	61	Average
<b>Average value</b>	<b>80,7</b>	<b>Strong</b>

$$GSI = 1,5 * JCond_{89} + 0,5RQD = 1,5*16 + 0,5*80 = 64$$

Thus, as a result of the research, the value of the geological strength index GSI for the conditions of the Akzhal deposit was established, which is 64 (Fig. 4).

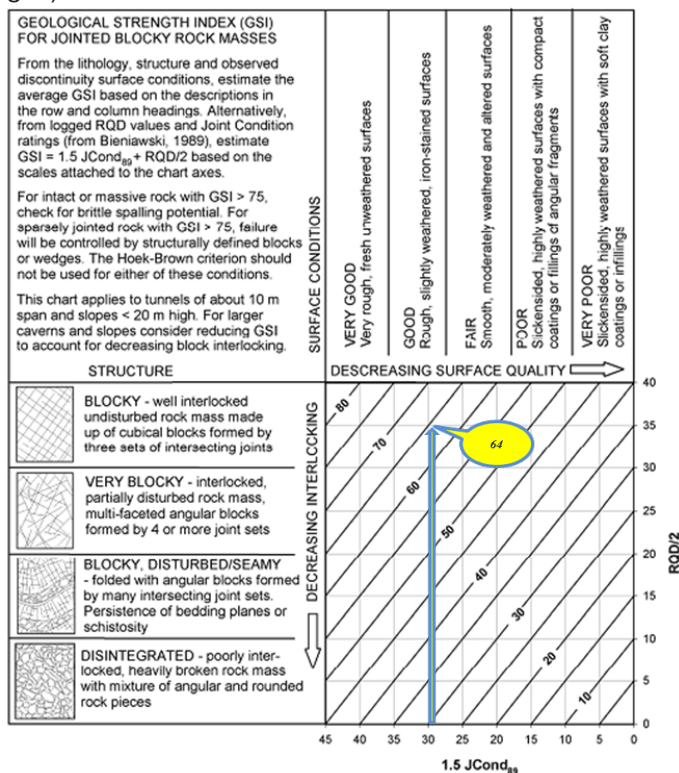


Figure 4 – GSI indicator definition diagram

*Conclusions.* Conducting geotechnological studies based on rating classifications allows obtaining reliable strength characteristics of rocks necessary for numerical modeling of geomechanical processes. The geological index of rock strength allows making a correct transition from the strength of a rock sample to the strength of a rock mass.

In this work, an example of using the geological strength index GSI to obtain a qualitative characteristic of the studied rock mass was considered. The results of calculations showed that the rocks of the Akzhal deposit are characterized by high stability and belong to the category "Block" in structure, that is, a well-linked rock mass consisting of blocks of cubic shape with mutually intersecting systems of cracks.

The obtained value of the geological strength index GSI is one of the main source data for numerical modeling.

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