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ANALYSIS OF THE EFFICIENCY OF MEASURES AND INSTRUMENTS OF BUDGET POLICY WITHIN THE FRAMEWORK OF PROGRAM-TARGET MECHANISMS FOR ENSURING THE BALANCE OF REGIONAL BUDGETS

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Abstract. *An analysis was made of the possible presence of a negative feedback between the share of market events in the expenditures of the consolidated budget (variable X1) and the share of gratuitous receipts in the income of its consolidated budget (vector variable Y1) of the RF-Udmurt Republic region, for the period from 2001 to 2020.*

The results of the analysis indicate the presence of a negative feedback between the share of market activities in the expenditures of the consolidated budget and the share of gratuitous receipts in the income of its consolidated budget of this region, which is most pronounced on a time scale of 1 to 2 years, and then gradually disappears.

Based on the example of the Udmurt Republic, the conclusion (Grebennikov and Magomedov, 2019) [5] is substantiated that financial relations between the federal center and the regions should follow the rule: the greater the potential for self-sufficiency of the regional budget - the smaller the share of gratuitous receipts in its consolidated budget.

Keywords: *program-targeted budgeting, budgetary self-sufficiency, inter-budgetary transfers, potential of budgetary self-sufficiency, correlation analysis.*

JEL classification: H77, C13, C82.

Introduction

The policy of distribution of interbudgetary transfers (IBT), in terms of subsidies, in the Russian Federation (RF) is implemented in a program-targeted form. In 1992-2013, the main instrument for implementing such a policy was federal target programs (FTP), which, in the course of two budget reforms, were marked by a transition to program-targeted budgeting (PTB), and were absorbed by the state programs of the Russian Federation ([1]; [2]). Distribution of subsidies from

the federal budget to the budgets of the constituent entities of the Russian Federation is carried out by co-financing the state programs of the constituent entities of the Russian Federation from the state programs of the Russian Federation. In turn, co-financing of municipal programs is carried out from the state programs of the subject of the Russian Federation ([3]; [4]).

Within the framework of state programs, a standard set of program measures is carried out - direct measures of state support, namely, budget investments in capital construction projects and various types of subsidies provided to business entities. At the same time, *social* and *commercial* projects are the objects of state program assistance ([5]; [6]; [7]).

The purpose of *social* projects implemented by the state is to supply the population with quality services in the field of social protection, healthcare, education, public safety, etc. Through these projects, governments carry out their main functions of "taking responsibility for the provision of goods and services to society as a whole or to individual households and financing the provision of these goods and services through tax revenues or other revenues; redistribute income and wealth through transfers; carry out non-market production".

At the same time, when the program event is aimed at ensuring the implementation of a *commercial* project initiated by a regional business entity - a market producer of goods, works and services. In this case, through program activities, the state directly participates in the construction, reconstruction, technical re-equipment of industrial, transport, road, and utility infrastructure facilities necessary for the implementation of a commercial project, and/or provides it with various types of subsidiary assistance.

Program expenditures to ensure the implementation of *social* and *commercial* projects have a different impact on the budgetary self-sufficiency of a constituent entity of the Russian Federation, by which we mean the ability of a constituent entity of the Russian Federation to fulfill the expenditure part of its consolidated budget at the expense of its own income.

It is quite obvious that the primary one-time program costs for ensuring the implementation of social projects give rise to secondary annually reproducible budgetary costs for maintaining social infrastructure and providing free public services.

In turn, program expenditures on commercial projects, subject to their successful implementation, lead to an increase in tax revenues to the budgets of the budget system of the Russian Federation, an increase in employment and GRP, contributing to an increase in the level of self-sufficiency of the budget of a constituent entity of the Russian Federation, i.e. its financial capabilities. The latter, as noted above, is precisely the goal of horizontal budget equalization.

The work (Grebennikov, Magomedov, 2019) [5] is devoted to identifying

the above effects from the implementation of social and commercial projects, in which the hypothesis of the presence of:

• negative feedback between the expenses of the consolidated budgets of NCFD subjects for the implementation of commercial projects and the share of gratuitous receipts[1] in the income of their consolidated budgets;

• positive feedback between the expenses of the consolidated budgets of NCFD subjects for the implementation of commercial projects and the share of taxes on economic activities in the income of their consolidated budgets.

Thus, the balance of program expenditures of the consolidated budget of a constituent entity of the Russian Federation for the implementation of *social* and *commercial* projects is one of the most important factors in increasing its budgetary self-sufficiency. Obviously, in order to increase the budgetary self-sufficiency of a constituent entity of the Russian Federation, it is necessary that the positive tax effects from the implementation of *commercial* projects overlap the regularly reproducible secondary costs generated by *social* projects.

As an important step in this direction, the work (Grebennikov, Magomedov, 2019) [5] proposes an approach to assessing the validity of the distribution of the actual volumes of gratuitous receipts[2] between the subjects of the Russian Federation that are part of a separate federal district (North Caucasian Federal District, NCFD). It is based on a natural assumption: the smaller the fiscal self-sufficiency potential (FSSP) of an entity, the greater the share of gratuitous receipts in its consolidated budget. Correlation analysis was chosen as a tool for checking the formulated assumption, in which the results of ranking the subjects of the federal district according to the two indicated indicators within a given period of time were used (Spearman's rank correlation coefficients were calculated).

In the work (Grebennikov and Magomedov, 2019) [5], budget expenditures on the social (non-productive) sphere are understood as the total expenditures of the consolidated budget of the region, reduced by a) the amount of budget investments in capital construction projects and b) subsidies to producers of goods, works and services in the following subsections of Section 04 "National Economy" of the classification of budget expenditures: 1) 0401 "General economic issues"; 2) 0402 "Fuel and energy complex"; 3) 0405 "Agriculture and fisheries"; 4) 0408 "Transport"; 5) 0409 "Road facilities (road funds)"; 0412 "Other issues in the field of national economy".

[1]In accordance with p. 3 of II (Classification of budget revenues) of the Instructions on the procedure for applying the budget classification of the Russian Federation (approved by Order of the Ministry of Finance of Russia dated 01.07.2013 № 65n), gratuitous receipts are an external source of income for the consolidated budgets of the budget system of the Russian Federation.

[2]In accordance with p. 3 of paragraph II (Classification of budget revenues) of the Instructions on the procedure for applying the budget classification of the Russian Federation (Approved by Order of the Ministry of Finance of Russia dated 01.07.2013 № 65n), gratuitous receipts are an external source of income for the consolidated budgets of the budget system of the Russian Federation.

The central idea of the study (Grebennikov and Magomedov, 2019) [5] is the thesis that only program activities aimed at ensuring the implementation of *commercial* investment projects for the production of goods, works and services increase the region's revenue base. It is assumed that in other cases, the positive effect of an increase in personal income tax and the number of state and municipal employees is eliminated by a corresponding increase in government spending on wages for social workers, subsidiary support, maintenance and overhaul of public buildings and structures. As a tool to substantiate this conclusion, we used a correlation analysis (Spearman's rank correlation coefficient) of the results of ranking NCFD entities in terms of the share of federal assistance in the income of their consolidated budgets (variable Y1), on the one hand, and the share of program activities for the development of the real sector in the expenditures of their consolidated budgets, namely, subsidies and capital construction (variable X1), on the other.

The calculations and results of the work (Grebennikov and Magomedov, 2019) [5] showed a negative feedback between the considered values X1 and Y1, which varies over the years of the period 2001-2017. Simultaneously with this result, a central point was demonstrated that explains this negative relationship, namely, a positive (with few exceptions) relationship between taxes on economic activities as an internal source of regional revenues (variable X2) and the share of budget expenditures on the real sector of the economy (variable Y2).

Subsequently, based on the approach and results of work for the subjects of one federal district, in the next work (Grebennikov et al., 2021)[6], test indicators were calculated to determine to what extent the annual dynamics of the actual distribution of volumes of interbudgetary transfers between the subjects of the Russian Federation for each of the eight federal districts for the period 2000–2018 meets the *criterion* proposed in (Grebennikov and Magomedov, 2019) [5] — the negative value of the Spearman ordinal correlation coefficient between the variables "share of gratuitous receipts" and "budgetary self-sufficiency potential". In addition, in this work, an attempt was made to establish a correlation between the calculated values of these indicators and the socio-economic characteristics of the federal districts, and the conclusion was drawn, that for a correct assessment of the impact of program-targeted management on regional development, it is necessary to take into account the parameters of programs at all levels of the budgetary system of the Russian Federation in the context of a separate territory - a subject of the Russian Federation or their group.

Thus, as follows from the results and conclusions of the works (Grebennikov and Magomedov, 2019)[5]; Grebennikov et al., 2021)[6]), financial relations between the federal center and the regions should follow the rule: the greater the potential for self-sufficiency of the regional budget, the smaller the share of gratu-

itous receipts in its consolidated budget.

Main idea and research direction

Based on the approach (Grebennikov and Magomedov, 2019) [5], which assumes the presence of:

— negative feedback between the share of market activities in the expenditures of the consolidated budget (variable X1) and the share of gratuitous receipts in the income of its consolidated budget (vector variable Y1) of the region;

— positive feedback between the share of market activities in the expenses of the consolidated budget of the region (variable X1) and the share of taxes on economic activities in the income of its consolidated budget (variable Y2),

in this paper, these hypotheses will be tested by conducting an extended correlation analysis between the indicated variables for the case of individual regions from different federal districts, when the correlation is determined not on the basis of information for a time period of one year, for a group of regions (in this case, as in the work (Grebennikov and Magomedov, 2019) [5], for the group of NCFD regions), but based on annual information on selected variables {X1; Y1; Y2} for a particular region over a period of time (2001-2020), comparing the results obtained with the results of work (Grebennikov and Magomedov, 2019) [5].

Methodology and data

To identify possible presence:

— negative feedback between the share of market activities in the expenditures of the consolidated budget (variable X1) and the share of gratuitous receipts in the income of its consolidated budget (vector variable Y1) of the region;

— positive feedback between the share of market activities in the expenses of the consolidated budget of the region (variable X1) and the share of taxes on economic activities in the income of its consolidated budget (variable Y2), the region of the Russian Federation - the **Udmurt Republic** was chosen in the work.

For the selected region of the Russian Federation, annual data from 2001 to 2020 are used for the following indicators:

✓share of federal assistance in the income of the consolidated budget of the region (variable Y1);

✓share of program activities for the development of the real sector in the expenditures of the consolidated budget of the regions, namely, subsidies and capital construction (variable X1);

✓share of budget expenditures on the real sector of the economy (variable Y2).

The initial data of variables for analysis were taken from the database of the Federal Treasury of the Russian Federation [8].

The paper analyzes the correlations between variables X1 and Y1 and X1 and Y2 on different time scales, using the method of cross wavelet correlations, in which the correlation coefficient ρ between two time series: $\{X_j(t)\}$; $\{Y_j(t)\}$, for

each scale λ_j, with a lag τ, is calculated in in accordance with the approach considered in [9]:

$$\rho_{\tau,XY}(\lambda_j) \equiv \frac{Cov\{\bar{W}_{j,t}^{(X)}, \bar{W}_{j,t+\tau}^{(Y)}\}}{(Var\{\bar{W}_{j,t}^{(X)}\} Var\{\bar{W}_{j,t+\tau}^{(Y)}\})^{1/2}},$$

where: $\left\{\bar{W}_{j,t}^{(X)}\right\}$ – wavelet decomposition coefficients of the time series $\{X_t\}$ on the scale λ_j; $\left\{\bar{W}_{j,t}^{(Y)}\right\}$ - wavelet decomposition coefficients of the time series $\{Y_t\}$ on the scale λ_j; $-1 \le \rho_\tau \le 1$, for all τ and j.

Results

Figure 1 shows the values of the correlation coefficient between variables X1 and Y1 on different time scales.

From the analysis of the numerical values of the cross-wavelet correlation coefficient, for the period from 2001 to 2020, the share of federal assistance in the income of the consolidated budget of the region of the Udmurt Republic (variable Y1) and the share of program activities for the development of the real sector in the expenditures of the consolidated budget of the region of the Udmurt Republic (variable X1),

$$\rho_l = \{0.189325, -0.80444, -0.299655, 0.0847759\}$$

it follows, that:

at the first, smallest scale level, associated with fluctuations of X1 and Y1 variables at the level from 6 months to 1 year, the correlation of X1 and Y1 variables is positive, but relatively insignificant (0.189325), that is, an increase in the share of program activities for the development of the real sector in the expenditures of the consolidated budget of the regions (variable X1) does not lead to a decrease in the share of federal assistance in the income of the consolidated budget of the region of the Udmurt Republic (variable Y1);

at the second scale level, associated with fluctuations in variables X1 and Y1 from 1 to 2 years, the correlation of variables X1 and Y1 is negative and significant (- 0.80444), that is, an increase in the share of program activities for the development of the real sector in the expenditures of the consolidated regional budget (variable X1) leads to a significant decrease in the share of federal assistance in the income of the consolidated budget of the region of the Udmurt Republic (variable Y1);

at the third scale level, associated with fluctuations in variables X1 and Y1 from 2 to 4 years, the correlation of variables X1 and Y1 is negative, but not as significant as at the 2nd scale level (- 0.299655), that is, an increase in the share of program activities for the development of the real sector in the expenditures of the consolidated budget of the regions (variable X1) leads to a decrease in the share

of federal assistance in the income of the consolidated budget of the region of the Udmurt Republic (variable Y1);

at the fourth scale level, associated with fluctuations in variables X1 and Y1 from 4 to 8 years, the correlation of variables X1 and Y1, although positive, but not significant, is practically absent (0.0847759), that is, an increase in the share of program activities for the development of the real sector in expenditures of the consolidated budget of the regions (variable X1) does not affect the decrease in the share of federal assistance in the income of the consolidated budget of the region of the Udmurt Republic (variable Y1).

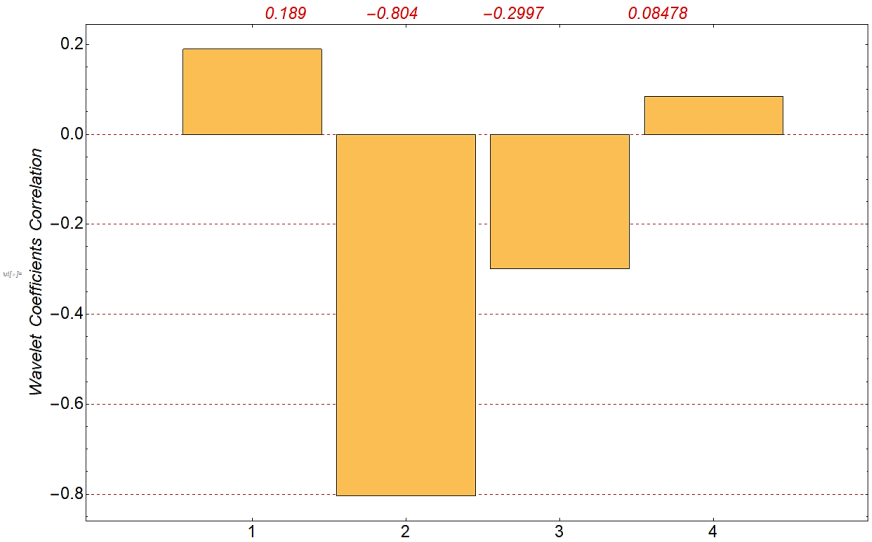

Figure 1. *Correlation between wavelet coefficients after decomposition of time series {X1; Y1} based on the discrete wavelet transform DaubechiesWavelet [8]*

Conclusion

Thus, the results obtained in this work for the region of the Russian Federation - the Udmurt Republic, for the period from 2001 to 2020, confirm the Grebennikov-Magomedov hypothesis and indicate the presence of a *negative feedback* between the share of market events in the expenditures of the consolidated budget (variable X1) and the share of gratuitous receipts in the income of its consolidated budget (vector variable Y1) of this region, which is most pronounced on a time scale from 1 to 2 years, and then gradually disappears.

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LEVELS AND CATEGORIES OF DEVELOPMENT OF INFORMATION COMPETENCIES WITHIN THE FRAMEWORK OF THE STRUCTURAL COMPONENT OF THE INTELLECTUAL POTENTIAL OF INDUSTRIAL ENTERPRISES

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Abstract. *The relevance of this study is predetermined by the intensification of the introduction of information technologies in all areas of industrial production. The statement of the research problem consists in identifying the factors that ensure the adaptation of information technologies to the industry specifics of production. The purpose of this article is to determine the structure and composition of information competencies, as well as their detailing by category to control the level of training of specialists and employees of enterprises. As a result of the study, the structure and composition of information competencies were determined in the context of three categories: basic, professional and complementary. It is concluded that the specification of information competencies in the context of these categories will help to unify approaches to assessing the level of training of specialists and employees of industrial enterprises.*

Keywords: *branch industrial enterprises, information technologies, information competencies, composition, structure.*

Introduction

The level of development of intellectual potential largely determines the successful operation of industrial enterprises in modern economic conditions. This comprehensive criterion assumes that the employees of the enterprise have the

required managerial and professional competencies. On their basis, efficient work of personnel, purposeful improvement of production processes, organization of interaction with contractors, optimization of administrative and economic activities are ensured. An important tool for the practical implementation of these and other components of the activities of industrial enterprises has become modern information technologies (IT) and products of the digital economy, as well as information and analytical management systems (CIAMS) formed using them. The combination of managerial and professional competencies, modern IT and CIAMS serves as the basis for the sustainable development of industrial enterprises and their gaining competitive advantages in the struggle for sales markets.

Materials and methods

As source materials, assessments of factors hindering the development of modern IT and the use of digital economy products in the activities of industrial enterprises were used. As a methodological justification in this study, the methods of system analysis, processing and generalization of information were used.

This article uses the following definition of modern IT - it is a set of methods and software and technological tools that allow you to manage production and technological processes by collecting, storing, processing and presenting various kinds of information [5].

The use of modern IT in the activities of industrial enterprises makes it possible to reduce the labor intensity of production through the efficient use of information resources. The main goal of introducing modern IT into the production sector is to create favorable conditions for the development of industrial enterprises. The determining condition for its implementation is that the majority of specialists (managers of all levels of management) and employees (professional workers) of enterprises have the required level of information competencies necessary to use modern IT, digital economy products and CIAMS in production activities.

Results and discussion

As a result of a comprehensive study, factors hindering the introduction of modern IT and the development of digitalization at enterprises in the manufacturing sector were identified [2]. The most significant deterrents include the incompatibility of modern IT with existing equipment (56%) and lack of funding (54%). Slightly less significant deterrents were problems with personnel, including: a lack of qualified personnel (33%) and a lack of motivation among senior managers (29%) (see fig. 1) [2]. It seems obvious that the problems with personnel are caused by the insufficient level of their professional and managerial competencies, primarily related to the presence or absence of information competencies. This circumstance directly affects the development of the intellectual capital of industrial enterprises within its informational structural component.

With the development of modern IT and the digitalization of all spheres of the

economy, there is an urgent need to develop "information competencies" among the majority of employees of industrial enterprises [4]. That is why the main direction of our research will be to determine the composition of professional and managerial competencies within the information structural component of the intellectual potential of industrial enterprises. In relation to this direction, it seems appropriate to use the following definition of the concept of "information competence" - this is a set of necessary knowledge, skills and practical skills in the use of modern IT in production activities, which a specialist must have in order to effectively perform job duties (management competencies) or qualification requirements (professional competencies) [3].

The expansion of the practice of using modern IT in the production activities of industrial enterprises causes an increased demand for employees with information competencies at the following levels.

The first level is associated with the need to expand the range of professions, within which specialists must acquire general information competencies in terms of using modern IT at their workplaces to solve current production problems.

The second level is associated with the obvious need for professional information competencies for the production of products and services within the framework of modern IT, namely: software, various web resources, e-commerce tools, cloud computing, the Internet of things, processing large data arrays. Not so long ago, these information competencies were limited to IT professionals. However, the use of modern IT in the production activities of industrial enterprises and its digitalization have led to a revision of the previous practice and the inclusion of professional information competencies in the competencies of a fairly large part of other professions.

The third level is associated with a change in the way work is done and the use of complementary skills for this, designed to support the solution of new tasks using modern IT in the workplace [6]. Such competencies include the use of information communications in the internal and external spheres of activity of enterprises, the promotion of products on e-commerce platforms, the analysis and processing of large data sets, etc.

Within the framework of the information structural component of the intellectual potential of industrial enterprises, each of the levels described above can be assigned its own composition of information competencies in categories: basic, professional and complementary. Detailed knowledge and work skills that specialists of industrial enterprises should have to solve the widest range of production tasks in the context of these categories of information competencies are given below.

The basic category of information competencies is characterized by the following set of knowledge and skills.

Knowledge: software used in production activities; opportunities and features of using modern IT, digital economy products and CIAMS; general approaches to ensuring information security.

Work skills: with internal and external devices of the computer; with information networks, operating systems and databases; with text editors and spreadsheets; with various products of the digital economy; on the construction of graphs and the preparation of electronic presentations.

The professional category of information competencies is characterized by the following set of knowledge and skills.

Knowledge: legal framework for the use of modern IT, products of the digital economy and CIAMS; program documents for the implementation of state policy that regulate the development and use of modern IT in the activities of industrial enterprises; software used in production activities; opportunities and features of using modern IT, digital economy products and CIAMS; general approaches to ensuring information security; methodological foundations of project management.

Work skills: on strategic planning and management of production activities of industrial enterprises; with internal and external devices of the computer; with information networks, operating systems and databases; with text editors and spreadsheets; with various products of the digital economy; with management systems for the implementation of projects and production activities of industrial enterprises.

The complementary category of information competencies is characterized by the following set of knowledge and skills.

Knowledge: computer-aided design systems; systems of engineering calculations, analysis and simulation modeling of production processes; systems of automated technological preparation of production; enterprise resource planning systems; production process control systems; product data management systems; management systems for regulatory and reference information; systems for collecting, processing, storing and analyzing information; enterprise information content management systems.

Skills in working with information systems: engineering calculations, analysis and simulation of production processes; automated design; automated technological preparation of production; enterprise resource planning; management of production processes and data on manufactured products; management of regulatory and reference information; collection, processing, storage and analysis of information; enterprise information content management.

As a rule, the structure and composition of information competencies are determined in competency passports and qualification requirements for the areas of training specialists (managers of all levels of management) and employees (pro-

fessional workers) of enterprises. Today, in many industrial enterprises, the practice of forming information competency profiles in relation to job and professional instructions, taking into account the industry specifics of their production activities, has become widespread. The development of this practice is largely due to the expansion of the requirements of industrial enterprises acting as employers to the structure and composition of information competencies that specialists and employees should have [1]. Through the formation of profiles of information competencies, the industry specifics of production are adapted to the conditions and requirements associated with the implementation of various IT solutions.

The above specification of the knowledge and work skills that specialists of industrial enterprises should have in the context of the proposed categories of information competencies can be used as the basis for the formation of a unified approach to the selection of specialists and employees for employment, as well as the development of advanced training systems for enterprise personnel.

Conclusion

The results obtained in the course of the studies made it possible to form the following conclusions.

1. In modern economic conditions, the successful production activity of industrial enterprises is largely determined by the level of development of intellectual potential and its key component of human capital. It is reflected in the availability of the required managerial and professional competencies of the personnel of industrial enterprises.

2. However, the introduction of modern IT in the activities of industrial enterprises in Russia is constrained by a number of factors. Among them, the so-called personnel problems are of no small importance. They can be explained by the insufficient level of his professional, managerial and informational competencies. This circumstance is reflected in the informational structural component of the intellectual potential of industrial enterprises.

3. Today, any specialist or employee of an enterprise must have certain information competencies necessary to use modern IT in the production process.

4. The structure and composition of information competencies are presented in the context of three categories: basic, professional and complementary. Detailing information competencies in the context of the proposed categories will help to unify approaches to the selection of specialists and employees when they are hired, as well as to the development of personnel development systems.

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WAYS TO SOLVE ECONOMIC PROBLEMS USING OPTIMIZATION METHODS

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Abstract. *In the process of doing business, there is a need to make managerial decisions and choose the right strategy. The possibilities of non-mathematical methods do not always allow the formation of a final conclusion that will have sufficient optimality and accuracy. This article discusses the implementation of optimization methods in the process of solving real economic situations. The use of mathematical methods in economic practice from a historical point of view is given. The application of these methods is one of the main tools used by an entrepreneur in the process of organizing and running a business. The article builds a logical order of the stages of making the optimal decision and describes their content. On the basis of a model example, we consider the search for an optimal strategy for selling a company's products in conditions of limited resources, the ultimate goal of which is to maximize profits. To determine the result, one of the linear programming methods is used, namely the simplex method. A step-by-step solution is described with the derivation of recommendations for organizing a product sales system. In conclusion, the possibilities are given that open up in the process of using mathematical science in economic reality.*

Keywords: *optimization methods, economic and mathematical methods, optimal solution.*

An integral part of the existence of any society is the economic system. Its improvement reflects the development and complication of the processes of relationships between people, contributes to the improvement of the quality of life and the emergence of innovations. The efficiency of the economy depends on making the right management decisions at the micro and macro levels. However, in the process of activity, it is difficult for economic entities to evaluate the effectiveness of some decisions without the use of additional tools offered by other scientific fields.

Thus, as a result of the interaction of mathematical analysis and economics, some methods have been formed that can help entrepreneurs consider the prospects of making a particular decision in terms of financial results. [4]

One of the first authors who used mathematical methods in economic practice was Francois Quesnay. He studied medicine, studied economics, and later became the founder of the physiocratic school. In the 18th century, Quesnay published a scientific work that contained a mathematical model that, in tabular form, showed the distribution of the product created in the economy between economic agents. Another author who made a huge contribution to the development of entrepreneurship tools was Antoine Cournot. He was the first to define the demand function and its schedule, applied differential calculus in economic theory, and also became the author of the scientific work "Studies on the mathematical foundations of the theory of wealth." Of great importance for the development of economic and mathematical methods were the ideas of Nobel laureates and leading economists D. Keynes, G. Kuhn, V. Leontiev, G. Odum, E. Odum, I. Prigozhin, K. Sims and others. [2]

The use of optimization methods in economics makes it possible to evaluate all available information, taking into account the existing benefits and risks, structure it and choose the best solution for a given situation. Consequently, such a tool becomes the basis for the entrepreneur in the process of doing business. [4]

To determine the optimal solution to an economic problem in mathematics, mathematical programming is used, namely:

- linear programming;
- nonlinear programming

These sections of mathematical programming are used to solve economic problems. In reality, most dependencies are non-linear, so when solving linear problems, reality is simplified. It cannot be said that the results of applying linear programming give unrealistic values, on the contrary, in most standard situations, this section is effectively used. With the help of linear programming, questions are solved regarding the selection of the most profitable program for the production of goods, the transportation of products, as well as planning the composition of products. In certain situations occurring in the economy and production, it is necessary to take into account the time factor that affects the process itself and the optimality criterion. In such cases, dynamic programming is used. A complex problem with a large number of variables will be reduced with the help of this section of mathematical programming to several problems with fewer variables. [3]

Linear programming methods include: graphical, simplex method, artificial basis method, Jordan-Gauss method and others.

Nonlinear programming methods include: gradient methods, Monte Carlo method, convex programming methods, Lagrange multiplier method, dynamic programming methods.

The optimal decision is made in several stages.

First, the problem itself is formulated, taking into account the fact that it cannot be solved by non-mathematical methods. After posing the problem, it becomes possible to select a finished model or build a new model that reflects all the essential aspects of the problem.

The second stage is the construction of a mathematical model. By means of transformation the formulated problem is translated into mathematical language. If the resulting model corresponds to existing models, then the solution is built according to already known algorithms. If the model has a complex structure, then it is either divided into simpler ones or combined methods are applied to it.

The next stage is directly the solution of the constructed model. At this stage, mathematical theory is used, thanks to which it is precisely defined and easy to implement. It is important to pay attention to the level of stability of the obtained solution, which is calculated by changing the variables.

The fourth stage is the comparison of the constructed model and the real initial situation. The model is verified by comparison with the solutions previously obtained in practice or the behavior of the real system.

The final stage is the preparation of recommendations for implementing the results of the solution in practice. [1]

Consider the solution of an economic problem on a model example using optimization methods.

A commercial enterprise sells products: A, B, C. For their implementation, resources of the 1st type are used in the amount of: 16 units, 8 units, 9 units; resources of 2 types: 7 units, 7 units, 2 units; third type: 9 units, 2 units, 1 unit. according to product types. The total resources of the first type are 520, the second - 140, the third - 810. Profit from the sale of products A - 8 thousand rubles, profit from the sale of products B - 6 thousand rubles, and from the sale of products C - 4 thousand rubles for 1 thousand rubles. turnover.

It is necessary to determine at what volume of trade the maximum profit will be.

The turnover of each type of product will be denoted by x_1, x_2, x_3, which, based on the meaning of the problem, will take values greater than and equal to zero. Therefore, the function reflecting the profit received from the sale of products will take the form:

$$maxf = 8x1 + 6x2 + 4x3$$

Resource constraints need to be taken into account:

$$\begin{cases} 16x_1 + 18x_2 + 9x_3 \leq 520 \\ 7x_1 + 7x_2 + 2x_3 \leq 140 \\ 9x_1 + 2x_2 + x_3 \leq 810 \end{cases}$$

$$x_j \geq 0, \qquad j = \overline{1,3}$$

It is necessary to bring the problem to the canonical form. We transform inequalities into equalities using additional variables.

$$maxf = 8x1 + 6x2 + 4x3 + 0x4 + 0x5 + 0x6$$

$$\begin{cases} 16x_1 + 18x_2 + 9x_3 + x_4 = 520 \\ 7x_1 + 7x_2 + 2x_3 + x_5 = 140 \\ 9x_1 + 2x_2 + x_3 + x_6 = 810 \end{cases}$$

$$x_j \geq 0, \qquad j = \overline{1,6}$$

The next step is to populate the simplex table:

Basis	C_j	B_i	X1	X2	X3	X4	X5	X6
			8	**6**	**4**	**0**	**0**	**0**
X4	0	520	16	18	9	1	0	0
X5	0	140	7	7	2	0	1	0
X6	0	810	9	2	1	0	0	1
f_j-c_j		0	-8	-6	-4	0	0	0

The goal of the problem is to maximize the profit from the sale, therefore, when negative numbers appear in the table in the index line, it indicates that the optimal solution has not been found and the solution should be continued.

Leading column corresponds to X1.

In order to determine the key string, it is necessary to calculate the ratio of free members and members of the leading column. The minimum value of the relation defines the key string. At the intersection of the leading column and the key row is 7. Enter X5 instead of X1. In place of the allowing element, we write 1 and, according to the rectangle rule, fill in the remaining elements.

Basis	C_j	B_i	X1	X2	X3	X4	X5	X6
			8	**6**	**4**	**0**	**0**	**0**
X4	0	200	0	2	31/7	1	-16/7	0
X1	8	20	1	1	2/7	0	1/7	0

X6	0	630	0	-7	-11/7	0	-9/7	1
f_j-c_j		160	0	2	-12/7	0	8/7	0

The key column is X3. The key line is where the element is 1400/31, hence the enabling element is 31/7.

Basis	C_j	B_i	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**
			8	**6**	**4**	**0**	**0**	**0**
X4	4	1400/31	0	14/31	7/31	7/31	-16/31	0
X5	8	220/31	1	27/31	-2/31	-2/31	9/31	0
X6	0	21730/31	0	-195/31	11/31	11/31	-65/31	1
f_j-c_j		7360/31	0	86/31	12/31	12/31	8/31	0

In the index row, all values are non-negative, therefore, the solution is optimal. Having calculated the values from the column of free terms, we get a ready-made economic solution.

In order to get the maximum profit in the amount of 237.4 thousand rubles, it is necessary to sell 7.1 thousand rubles. products of type A and 45.2 thousand rubles. products of type C, products of type B are unprofitable to sell.

Using the simplex method of linear programming, recommendations on the implementation plan were obtained using an example. This example is a small part of what mathematics allows you to do in economic practice.

Making a decision is a rather complex process. In order to minimize the possibility of making a mistake, which can bring enormous losses, there are methods in mathematical science [6]. Optimization methods can help with inventory management, resource allocation, traffic scheduling, network planning, and others. The use of these methods has become an indispensable tool for analyzing economic reality.

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END-TO-END TECHNOLOGIES AS A MARKER OF THE DIGITAL TRANSFORMATION OF THE REGIONAL ECONOMY

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Abstract. *The article uses the concepts of end-to-end technologies as markers for the development of the regional economy. The possibility of using these technologies in all spheres of the economy without changes is the determining factor by which it is possible to determine the level of digital transformation of the economy. The shortcomings in the implementation and dissemination of end-to-end technologies in the field of digital transformation of business processes and social interactions of Krasnoyarsk Krai are investigated. An assessment of the impact of technological restrictions on the process of digital transformation in the regional economy of Krasnoyarsk Krai is given.*

Keywords: *digital economy, digital transformation, end-to-end technologies.*

Introduction

The digital transformation of the economy is the widespread use of digital technologies that provide a deep reorganization of business processes and a significant improvement in their characteristics (reduction of resources spent on the execution of processes, reduction of execution time, reduction of intermediate sub-processes), as well as the emergence of fundamentally new properties and qualities [1].

The strategic goals and objectives of the development of the digital economy in Russia are fixed in the national project "Digital Economy" and its federal projects [2]. It is planned to create a unified mechanism for regulating the digital components of industries, uniting everyone in one document, allowing to fix the general concept of development in the period 2022-2024. The implementation of digital transformation is associated with the availability of end-to-end information technologies.

End-to-end digital technologies are a complex set of multidisciplinary knowl-

edge, advanced science-intensive technologies and a system of intellectual know-how formed on the basis of the results of fundamental and applied scientific research, cross-industry transfer and integration of advanced science-intensive technologies, subtechnologies [3].

The following areas of end-to-end technologies are distinguished:

Neurotechnologies and artificial intelligence:

- Computer vision
- Natural language processing
- Speech recognition and synthesis
- Decision support systems
- Promising AI methods and technologies
- Neuroprosthetics and neurointerfaces

Technologies of virtual and augmented reality:

- Content and user experience
- Platform solutions for users
- Capture technologies
- Feedback interfaces
- Graphical output
- Data optimization technologies

Distributed ledger technologies:

- Data organization and synchronization technologies
- Consensus technologies
- Application and smart contract technologies

Quantum technology:

- Quantum computing
- Quantum communications
- Quantum sensors and metrology

New manufacturing technologies:

- Digital design and management of the life cycle of a product
- Technologies of "smart" production
- Manipulation technologies

Robotics components and sensors:

- Human-machine interaction
- Technologies of sensory-motor coordination
- Sensors and sensory information processing

Wireless technologies:

- WAN
- LPWAN
- WLAN
- PAN

• Satellite communication technologies

As part of the Krasnoyarsk Krai [4] strategy in the field of digital transformation of the sectors of the economy, social sphere and public administration, it is planned to introduce artificial intelligence technologies, virtual and augmented realities, and wireless communication technology. From this the purpose of the study is formulated.

*Purpose of the study***:** using the mechanisms of classical strategic planning, analyze the impact of restrictions on the export of end-to-end technologies on digital transformation on the regional economy and assess the prospects for its development in the period 2022-2024.

Main results

Having identified the main end-to-end technologies used in the region, we will assess their use and impact on the regional economy.

Artificial intelligence technologies are used in large and medium-sized regional companies and the public sector. These technologies are most widely used in the processing of speech information.

Consider the following examples of speech recognition. In Russian, free order is compensated by developed morphology, function words and punctuation marks, but in most cases this presents an additional problem for a computer. Neologisms can be found in speech, for example, the verb "Fifty ruble" - that is, send 50 rubles. The system should be able to distinguish such cases from typos and understand them correctly. The correct understanding of homonyms is another problem. In speech recognition, among others, the problem of phonetic homonyms arises. In the phrase "A gray wolf met a red fox in a deep forest", the highlighted words are heard the same way, and without knowing who is deaf and who is red, one cannot do (besides the fact that the fox can be red and the forest can be deaf, the forest can also be red (characteristic, in this case denoting the predominant color of the foliage in the forest), while the fox can be deaf, which creates an additional problem arising from the previous one, although it is partly compensated by morphology - the adjectives in this sentence have a clearly different gender) [5].

Theoretical solutions to this problem were developed in 2015-2017. Chatbots and voice assistants became the first stage in 2017-2019 and helped in the development and testing of user-oriented interfaces [6]. The leading experts in this area are "Yandex" and "Sber". The offers available on the market fully cover the existing needs in the regional segment.

The situation with virtual and augmented reality technologies is similar. The only difficulty in using this technology is the limitations in the distribution of equipment. The main supplies of equipment in the region were carried out by Huawei. The limited supply of equipment affects the introduction of this technology in the region [7].

Wireless technologies - are a subclass of information technologies that are used to transfer information between two or more points at a distance without requiring a wired connection [8]. Wireless communication technologies are used in all sectors of the economy. The cost and time to set up a wireless network may be less than to deploy a cable network. For example, older buildings often contain hazardous materials, such as old production mines, which contain negligible amounts of chlorine from ducts and asbestos. Due to the geographical features of Krasnoyarsk Krai, building classical communication networks is a costly and inefficient undertaking.

As part of the federal project Eliminating the Digital Divide, PJSC Rostelecom, a telecom operator, provided settlements with 250-500 inhabitants with Internet access points. For 7 years (2015-2021), 280 Wi-Fi access points have been installed. According to the Federal Law of the Russian Federation "On Amendments to the Federal Law "On Communications" dated 07.04.2020 № 110-FZ, in settlements with a population of 100-500 people, the federal project "Elimination of the Digital Divide" is being implemented, within the framework of which communication facilities are being installed to provide services cellular communication and mobile Internet. This project is planned to be implemented until 2030 inclusive[9]. Thus, wireless network technologies are widespread and have been used in Krasnoyarsk Krai for a long time.

Conclusion

One of the important aspects of the transition to a digital economy is the process of introducing end-to-end technologies. These technologies make it possible to apply a unified approach and develop all areas of the regional economy. Three out of seven technologies are represented in Krasnoyarsk Krai. At the same time, two of them are largely dependent on the supply of equipment. The decline in supplies from Asian countries and the cessation of supplies from European countries will lead to a slowdown in the rate of adoption of technologies in addition to the reality. Wireless networking and artificial intelligence technologies are less dependent on the supply of equipment, but the restriction on the spread of technologies slows down their development. Geopolitical changes throughout 2022 will lead to a complete overhaul of end-to-end technology adoption strategies.

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THE POSSIBILITY OF SECURING ARTIFICIAL INTELLIGENCE IN CONSTITUTIONAL AND LABOR LAW

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Abstract. *The author of the article considers the problems of fixing artificial intelligence in national legislation, specifically in constitutional and labor law. The experience of foreign countries on the legal regulation of artificial intelligence is also analyzed. The processes of introduction of robotics into the labor activity are touched upon. The author presents his assumptions regarding the consolidation of artificial intelligence in Russian legislation.*

Keywords: *artificial intelligence, national legislation, legal problems, constitutional law, labor law, robotization.*

The Constitution of each State, as a normative act with the highest legal force, fixes the foundations of the social system and public administration. If the digitalization of a society changes its production sphere, communication system, organization of work of government agencies, then the structure of society as a whole changes. Since the constitution is a reflection of the social and state structure, a change in this structure due to digitalization should entail a corresponding change in the constitution and other normative legal acts included in the sources of constitutional law.

In support of this, we can refer to the fact that in some countries the process of amending constitutional legislation has already begun. Digital rights of the individual are beginning to be included in the number of constitutional rights. An example of a law regulating relations in the context of digitalization of society is the French Law "On the Digital Republic" of 2016. This law provides for open access to public data and protection of rights in a digital society. In 2018-2019, a public discussion of transformations related to digital transformation, including constitutional reform, began in France. In January 2020, Deputy Pierre Rafan submitted a proposal to the French National Assembly to adopt the "Charter of Artificial Intelligence and Algorithms" [1]. After registration, the draft was submitted for consideration to the Parliamentary Committee on Constitutional Legislation.

The authors of the draft propose to include in the preamble of the French con-

stitution a reference to the new constitutional law – the Charter mentioned above - and to fix a number of fundamental issues in the law itself, for example, actions for regular audit of artificial intelligence systems and assessment of their evolution, restrictions to prevent malicious manipulation of artificial intelligence systems, and so on. Thus, in the conditions of digitalization, the process of forming a new law regulating relations begins, taking into account the developing artificial intelligence.

Some researchers, for example, the judge of the Constitutional Court of the Russian Federation Gadis Hajiyev, insist that the constitution should not have any sections on artificial intelligence in the foreseeable future. According to other experts, it is time to regulate issues related to artificial intelligence by constitutional law, at least because the spread of artificial intelligence technologies greatly affects human rights. For example, face and speech recognition technologies in practice significantly detract from the right to privacy, that is, the more technologies are used, the more acute the question arises about the need to formulate guarantees of rights and freedoms at the constitutional level so that these constitutional guarantees allow effective protection of human rights in a digital society.

The fundamental principle enshrined in most constitutions is the recognition of a person, his rights and freedoms as the highest value. In order for this principle to be implemented in practice in the future, it is necessary to prescribe the basics of the status of artificial intelligence at the level of the constitution.

What questions are put to constitutional law in relation to the regulation of relations in which artificial intelligence is present?

The first issue is human rights and their protection. For example, the constitutional right to privacy, to personal inviolability. Artificial intelligence systems receive information about the outside world from numerous sensors and sensors. Taking into account the projected "sensory revolution" until 2025, the number and possibilities of observation are increasing many times. We will live in a world where almost every step we take is visible and recorded by recording devices:

- at home (due to the use of personal electronic assistants, through "smart watches", "smart" home appliances);
- at work – through various sensors;
- on the street and so on.

Specific guarantees for the protection of the right to privacy can be prescribed in the law, but at least the initial provisions from which the law will be based should be fixed in the text of the constitution.

The inadmissibility of discrimination is the second question that needs to be answered. As already existing experience shows, artificial intelligence systems after training can discriminate against certain categories of citizens, and sometimes these categories belong to socially unprotected groups, including in the workplace.

That is, the use of artificial intelligence can exacerbate the problem of inequality in the possibilities of access to artificial intelligence and the benefits associated with it, which leads to further stratification of society and its polarization.

The next question is the transparency of the work of artificial intelligence. Artificial intelligence makes decisions based on complex algorithms, so people are afraid of artificial intelligence, not trusting its work, because they cannot understand the process. The principle of openness of algorithms for the purpose of transparency of work will be enshrined in the constitution as one of the basic principles of the functioning of artificial intelligence. Its consolidation in the constitution will be aimed at ensuring new human rights, which will need to be prescribed in law:

- the right to know about the reasons for the decision made by artificial intelligence;
- the right to know about the artificial or natural nature of the subject with whom you communicate;
- the right to a decision based not only on automated processing.

Otherwise, artificial intelligence for many will not be a blessing, but a threat. The importance of these issues is such that consolidation at the constitutional level is quite a likely solution.

The previous question is related to another one of fundamental importance – restrictions on the use of artificial intelligence. The question of restrictions concerns not only the right of a person to know with whom he is currently communicating – with a person or with an artificial intelligence system, but also more complex issues that sooner or later will be put before the constitutional legislator. Artificial intelligence can exist almost forever, accumulating resources, developing its abilities and "changing" the physical part of the cyber-physical system as it wears out. Is it possible to allow artificial intelligence to exist forever?

Artificial intelligence, developing, will have an increasing impact on society, reaching new heights in scientific activity, being used in public administration, can get almost limitless opportunities, including in power. In this regard, some authors propose to fix in the constitution provisions on restrictions for artificial intelligence, for example, to establish the maximum possible life cycle of the system, if possible, being only in one physical shell, and so on. But if artificial intelligence is able to exist forever, then the establishment of such restrictions will include the "right to destruction", which is ethically very ambiguous.

Arising from the previous ones is the question of the status of artificial intelligence, this question is one of the key issues of a general theoretical nature.

Moreover, Benjamin Herrick, a lawyer from Michigan, in the article "Paradigms of evolution and Constitutional Rights: the imminent danger of artificial intelligence" [2] expresses an opinion supported in one form or another by a num-

ber of researchers. He draws attention to the fact that the biological man initiated his own evolution, as a result of which by 2050 he will become one with the machine, after which the "renewed" man will understand that the organic parts are holding him back and the biological component will gradually disappear from the machine.

There are no ready-made solutions to the above questions. The prevailing opinion so far is that modern artificial intelligence systems do not have characteristics similar enough to humans to create a moral obligation to recognize them as subjects of law. But there is a need for constitutional and legal regulation of artificial intelligence in order to ensure human rights in a changing society. In addition, even if artificial intelligence remains an object of law, its features require regulation at the level of the constitution or constitutional law, which will establish restrictions on the use of artificial intelligence and so on.

If most researchers disagree with the recognition of artificial intelligence as a subject of law, then many researchers respond positively to the question of using the capabilities of artificial intelligence to improve legislation and the legislative process. The introduction of machine learning and the use of artificial intelligence in lawmaking is already taking place in a number of countries. For example, in Italy, within the framework of the Datafication project, the legislative process is being "digitized": artificial intelligence systems are already being used for automated analysis of the frequency of use of regulatory legal acts and so on.

New technologies are changing production, displacing some workers from their jobs: robots and complex computer programs are taking on more and more functions that were previously performed by employees, and the scale is expanding every year. According to economists, more than a third of workers may lose their jobs in the next one and a half to two decades, in addition, entire groups of professions will disappear. Artificial intelligence, controlling production processes, actually manages workers. Algorithmization of management due to the use of artificial intelligence systems affects the processes of recruitment, labor rationing, control over the performance of labor duties by employees, regulation of wages, and so on.

Robo-recruiter programs are increasingly being used for recruitment. They reduce the employer's costs for finding a potential employee and allow the selection of candidates for a position based on a digital profile. The profile is formed from information in the resume, information from open databases, interviews with a robot recruiter, and so on. The intelligent analysis of the available data allows the program with elements of artificial intelligence to predict how successful the candidate's work will be in a particular position. It can be noted that American courts are already considering lawsuits about possible discrimination in hiring based on the results of intelligent information analysis by a robot recruiter.

The introduction of artificial intelligence into production and service provokes the rejection of part of intellectual labor and a significant share of physical labor of people – this entails a change in the labor duties of employees, as well as working conditions. Workers begin to work by directly contacting robotics – this requires new skills from them, changes the content of work. The changes will increase, because the employee needs rest, gets tired of routine operations, and this causes the employer to replace him with a robot devoid of such "human" shortcomings. In fact, there is a displacement of people from production and the "embedding" of artificial intelligence systems into previously existing jobs. The further away, the more these systems, in particular, robots will compete with workers.

If the Fourth Industrial Revolution means the transition to fully automated production, controlled by artificial intelligence systems, with the prospect of integration into a global industrial network of things and services, then this transition will dramatically reduce the dependence of industry on human labor. The same can be said not only about production, but also about professional service and agriculture.

Labor legislation has been formed in an industrial society and takes into account a set of risks inherent in an industrial, but not a digital society. Intelligent automation of production requires the reaction of labor law, for example, through the restriction of labor that can be performed by robots (and the formulation of a list of works carried out only by humans, for example, work with children, nurses for elderly people, etc.), through the creation of rules for the interaction of human and robot workers for work where their work will be joint, through the establishment of "protective" quotas for jobs occupied by people and so on.

The level of development of robotics allows us to conclude that by 2025 – 2030, a new generation of robots will be employed by employers in many workplaces where people work today. That is why measures of social support for people are being actively discussed, first of all, the introduction of an unconditional basic income, guarantees for retraining, and so on.

The recognition of robots as subjects of labor law in the case of their recognition as subjects of civil law is a matter of time, and the allocation of a special subject of labor law – an employee with a neuroprosthesis, a question that has already been voiced by some legal scholars.

The success of neuroprosthetics makes it possible to combine a person and an artificial intelligence system into a single whole – a neuroimplant in the form of an artificial limb, an artificial organ or a chip. Neuroimplants are able to eliminate some of the problems of people with disabilities, other people who do not have medical indications will simply want to increase their abilities, for example, by implanting a chip that increases memory capacity and reaction speed. As a result, there is a need to create occupational safety standards with the participation of employees with neuroprostheses. Such workers will have a number of abilities that

are not inherent in the rest. For example, neuroprostheses will allow you to come into direct contact with robotics. But this increases the risks of collaboration for other employees, due to the threat of "hacking" the artificial intelligence system of neuroprosthesis, due to problems with maintaining the confidentiality of information, because sensors of such systems can automatically record information from the environment.

In connection with all the transformations taking place in the sphere of labor in the coming years, it is very likely that changes will be made to a number of labor law institutions. For example, in the institutions of working time and rest time, labor protection, guarantees and compensation, and a number of others. Additional protection of workers from overloads will be required, since the robot does not need breaks for sleep, rest and nutrition, and the employee, whose functions include monitoring the automated production process, is forced to monitor the situation even without being physically at the workplace. With regard to labor protection, new risks for workers appear, for example, the risk of a malfunction or unpredictable behavior of a robot after machine learning are physical risks, and there are also psychosocial risks, such as the need for a person to work at the pace of a robot, stress from contact with a robot, and so on.

A sufficient number of conclusions can be drawn from the above, one general conclusion can be recognized that in the era of digitalization of society, the legal regulation of artificial intelligence is not an urgent issue that requires a quick solution. However, before answering it there are a lot of obstacles, as already described above, legal, ethical, social. Opinions of different jurists differ: someone suggests that artificial intelligence is not the problem that needs to be brought to the fore, but those who adhere to the so-called "soft law", those who believe that artificial intelligence is the future of man, and in order for society to this has not turned into a threat, its legal regulation is necessary.

As you know, society is anthropocentric, accordingly, the law will meet the needs of a person, not a robot. The legal consolidation of the status of artificial intelligence, as well as its regulation, is just a matter of time.

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THE USE OF HISTORICAL MATERIALS IN THE EDUCATIONAL PROCESS OF HIGHER EDUCATIONAL INSTITUTIONS

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Abstract. *The article reveals ideas about a proper, balanced diet, concentrated in the holistic teaching of the East thinkers-encyclopedists (completely unexplored), and also proposes separate recommendations for using the educational potential of pedagogical thought of famous scientists of encyclopedists in the formation of a healthy lifestyle. In the process of preparing the article, the poorly studied works of the East thinkers on folk medicine, as well as their previously unknown recommendations on preserving human health, were used.*

The authors believe that without a deep study of the pedagogical heritage, which has accumulated centuries of experience in a healthy lifestyle, without assimilating the pedagogical values of the past, it is impossible to successfully learn the patterns of development of the spiritual and moral formation of the person.

Keywords: *ideas of scientists-encyclopedists, healthy lifestyle, history of development of teachings, ethical virtues, moral postulates.*

The national tradition of preserving life in Kazakhstan from ancient times relied on the practice of fire worship, Islam, customs and mentality. All this together has compiled a set of certain rules and requirements for the preservation of human health. This arsenal of rules and requirements evolved evolutionarily and was transformed with living conditions, national traditions and the experience of daily life. Each historical era made its own adjustments to it. Thus, rooted in centuries, the ideas of a healthy lifestyle have reached our days as works, ideas of scientists of the past, experience of traditional medicine.

Currently, in the education system of Kazakhstan and other republics, great attention is paid to the revival of the views of thinkers on the problems of preserving a healthy lifestyle, healing through nutrition, flora, hygiene, and physical development.

Works of theoretical and applied content are essential for thorough coverage of the historical and pedagogical aspects of the problem of the formation of a healthy lifestyle. Our historical and systematic, retrospective analysis in this direction shows that starting from the deep sources represented by Avesta, the activities of the famous thinkers al-Farabi, Ibn Sino, Yusuf Balasaguni, Mahmud Kashgari, Kaikavus, Yassaui, etc., educational and pedagogical thought in the person of steppe philosophers, healers and doctors, specifically carries out continuity

The study of the works of the great thinkers of the past makes it possible to state that their works focus on a huge methodological arsenal for the formation of a healthy lifestyle, as well as systematized the conceptual views of famous European scientists, and proposed effective ways to promote the health of the younger generation. Addressing the origins of the problem of the formation of a healthy lifestyle testifies to the historical, ethnocultural and national wealth of the Kazakh (or any other) people.

The purpose of the study: scientific justification of the content of ideas on the formation of a healthy lifestyle, concentrated in the holistic teaching of the East thinkers-encyclopedists, as well as the development of recommendations on the use of the educational potential of the works of famous enlighteners in the formation of a healthy lifestyle.

Tasks: to identify the prevailing specific didactic ways to form a healthy lifestyle in the creative heritage of the great thinkers of the past; to reveal in the teachings of the East thinkers-encyclopedists the features and trends in the development of ideas for the formation of a healthy lifestyle, to determine positive ideas that are of scientific value for the modern practice of educating the younger generation.

Research methods: analysis and study of philosophical, historical, pedagogical, psychological and pedagogical literature; methods of historical-comparative, retrospective and historical-systemic analyses; studying the pedagogical experience of individual university teachers on healthy lifestyle issues.

At different stages of the historical and civilizational development of society, ideas about health were formed, in which, under the influence of socio-cultural conditions, specific types of worldviews were formed. The understanding of the concept of "healthy lifestyle" is reflected in many religious doctrines, its aspects have been studied for centuries by representatives of various scientific fields. A certain scientific value is represented by the activities of the famous healer Oteboydak Tleukabyluly (1388-1478), who left his descendants with the richest knowledge on the formation of a healthy lifestyle for the younger generation. The

pedagogical views of the thinker are revealed in the studies of T. Alsatov, Zh. Abiev [1]. Domestic and foreign scientists N. A. Amosov, I. I. Brekhman, A. S. Imangaliev, M. Ya. Vilensky, P. I. Kalyu, G. I. Kutsenko, V.P. Kaznacheev, L. G. Tatarnikova, A.V. Akhaev, G. D. Alimzhanova, E.V. Weiner, V.V. Kolbanov, Kh. K. Satpaeva, Zh. Zh. Zhatkanbaev, G. S. Akieva, I. Yu. Mordvintseva, A. M. Oshelekalieva, T.K. Boleev and others are intensively developing its various directions.

Important in the development of historical and pedagogical aspects of the problem under study are the works of K. Kunantaeva, A. Kubesov, A. N. Ilyasova, K. Zharikbaev, S. Kaliev, S. Gabbasov and others. The issues of scientific support and promotion of a healthy lifestyle in the aspect of physical education of children and adolescents are thoroughly considered by scientists K.I. Adambekov, S.V. Evstratov and others.

Despite a large number of works in various areas of the formation of a healthy lifestyle, in which attention is paid to the historical aspects of the problem, there are no purposeful detailed studies of historical and pedagogical content. At the same time, the lack of research, which systematizes valuable knowledge on the history of the issue, considers the features and nature of the development of certain key ideas on this problem, negatively affects the solution of many current modern pedagogical problems. The analysis of the source literature within the framework of the studied problem made it possible to conclude that the creative heritage of great thinkers not only prevails specific didactic ways to form a healthy lifestyle, but also developed unconventional methods for improving the body through raising children. For example, Eastern scientists have repeatedly proved the benefits of the fasting method for the human body, emphasizing its importance for cleansing the body, improving the digestive system and treating a number of diseases. Early wakes, daytime sleep, rational nutrition with a lot of vegetables and herbs were considered important.

The study and analysis of the works of the thinkers-encyclopedists of the East show the importance of upbringing in different eras of careful attitude to health from the moment of the birth of a new life. It should be noted that ideas about a healthy lifestyle are most clearly revealed in Zoroastrianism: the sun is a symbol of healthy energy, gives the universe light and heat. The cult of the sun, which occupies a central place in the teachings of Avesta, is transformed in the mind of a nomad in the era of Turkic civilization.

In Saki civilization, a certain system of views on a healthy lifestyle has developed. Saki sought to establish in society such healthy values as proper nutrition, sports, training dexterity, speed of movement. The Huns, who considered good health to be the key to success, also had a special attitude to a healthy lifestyle. Sports, physical labor, the art of riding a horse were especially cultivated by the Huns.

In "Avesta", recommendations begin with the utero formation of a child. Marriage between close relatives was prohibited, attention was especially paid to the pregnant woman and her feeding, excessive enthusiasm for food was forbidden. It was believed that a person who cannot curb his wills and comply with the measure in food is not able to win in battle.

The greatest value for a person was considered his life. Among the sources for human life were indicated such as "to be inside nature, joy from nature" [2].

Retrospective analysis shows that in the X-XIII centuries (the era of the Eastern Renaissance) in the vast territory of Central Asia, culture flourishes, the development of science, medicine, written literature, urban planning, etc. The main achievement of epoch-making events was the declaration of the value of Man in society (healthy, happy person).

The founder of oriental medicine, Abu Ali Ibn Sino, considered medicine as a whole as a science that studies the human body to preserve health, rid the patient of diseases. Ibn Sina's teachings reveal the conditions for the formation of a healthy lifestyle: light food preserves health, any diseases can be cured by proper nutrition, advises to eat less at night, etc. According to the great enlightener, the acquisition of ethical virtues by man - justice, mercy, generosity - is the basis of a healthy human society.

Yusuf Balasaguni's programmatic ideas about a healthy lifestyle, interpreted in the famous poem "Kutadgu bilig," are of extreme interest in our time. A large-scale work consisting of more than thirteen thousand stanzas attracts scientists, researchers from different fields of science with the vastness of the issues under consideration, the relevance of problems. Ideas for the formation of a healthy lifestyle are presented in line with versatile educational problems that can be systematized in several thematic areas: instruction in moderate food consumption; observance of cleanliness and hygiene; the role of knowledge in the preservation and promotion of health; tips for caring for newborns; a woman and her moral character; ways of moral rehabilitation of a man; women's care for the younger generation, the external and internal world of man, etc.

Thus, the ideas of the formation of a healthy lifestyle are presented in line with versatile educational problems, which we systematized in several thematic areas: - instructions in moderate food consumption; - observance of cleanliness and hygiene; - the role of knowledge in the preservation and promotion of health; advice on caring for newborns; - a woman and her moral appearance; - ahead of a man's moral recovery; the external and internal world of man, etc. All the work of a thinker is a call to a healthy lifestyle, which is presented to him not only in the physical perfection of the person, but also in the spiritual. Consonant with ideas, the pedagogical heritage of Mahmoud Kashgari, Ahmed Yassaui and others is characterized. We see that all thinkers have the same components of a healthy

lifestyle: emotional well-being, spiritual well-being, environment, body hygiene, hardening, etc.

Emotional health Methods of raising a healthy lifestyle have been accumulating for centuries. Having arisen in one generation, they improved, modified and the best, effective, passed on to subsequent generations. The transformation was carried out in two directions: 1) oral folk art; 2) the traditional culture of the people (traditions, customs, rites, etc.).

The importance of health as a value, the formation of a correct attitude towards it from birth, is reflected in all folklore sources. For example, the Kazakh people believe that health is the greatest wealth (денсаулық – зор байлық); cleanliness - the basis of health, health - the basis of wealth (тазалық – саулық негізі, саулық – байлық негізі); the disease comes with the wind, goes with sweat (ауру желмен келіп, термен шығады); you will take care of yourself, you will be healthy (сақ жүрсең, сау жүресің) and etc.

At all times, important factors in the formation of a healthy lifestyle of a person were relief motives of the national idea, concentrated in traditions and customs. [1; 2; 4; 13; 14].

In the Kazakh steppe, a school of folk healers, mullahs, bucks, sons, doctors always successfully functioned. If in world history the names of Nostradamus, Vanga, Messing, etc., are known, then in Kazakh history Oteboydak Tleukabyluly is considered a famous healer, Maika bi is a visionary. Thus, Oteboydak Tleukabyluly, based on the work carried out in the steppe laboratory, produced 1108 types of various drugs, of which 858 were from medicinal plants, 318 were from animal organs and about 60 were from metals. Oteboydak Tleukabyluly, nicknamed "Teacher without teacher," could treat about 1,050 different diseases. The healer recorded more than four hundred and thirty anatomical descriptions of man. This is evidence of the fact that Kazakh healers treated various complex diseases, made medicines, prescribed an easier diet already in the 15th century [2].

According to the WHO definition, a people's doctor is a person who knows how to prepare medicines from various plants, minerals and apply them in treatment, providing medical care to the people in accordance with cultural and religious customs. Each nation has an inherent history, rites and customs, and its own treatments. Therefore, we believe that folk medicine is an ethnographic and ethnopedagogic phenomenon. People sought to find the causes of diseases, develop ways to prevent and combat them, and found their own methods of treatment for various diseases.

There is information in the literature about a common method of protecting against epidemics, when a long needle was inserted into the smallpox, which was then pierced through the earlobe of a healthy child. It was a kind of vaccination against smallpox [.Там же].

In Kazakh villages, every child from childhood knew the healing properties of herbs, took part in their collection, storage, thereby enriching their knowledge. In the formation of a healthy lifestyle , the Kazakh people identified the following patterns:

a) taking into account the age and individual characteristics of children

b) consideration of gender characteristics

c) personal development according to the laws of nature, etc.

It should be noted that in the Kazakh steppe there was a whole School of motherhood - Ana mektebi. The study made it possible to identify the following areas of their educational activities: lessons for daughters-in-law or young women on personal hygiene, caring for a newborn child, using effective methods in raising children, teaching girls to clean housekeeping, etc. A whole system of wellness measures existed for newborn babies. Wise women of the family gave valuable lessons on preserving health, in which they instructed their daughters-in-law to spend more time outdoors, take healing water treatments, and charge themselves with positive energy. The successful birth and development of the child depended on many health-saving factors. Bathing a child with wormwood had a beneficial effect not only on physical health, but also on the moral appearance of the child. The smell of grass remained in the genetic memory of a young organism for life. Systematic air baths, effective methods of bathing in saline solution, rubbing with natural ointments, infusions of animal fats, vegetable components contributed to the strengthening and hardening of the child's body.

Thus, in the works of thinkers and the practical experience of treating representatives of traditional medicine, a system of forming a healthy lifestyle can be distinguished.

We present it in the form of a table 1.

Table 1.

The system of formation of a healthy lifestyle

Factors	Principles	Patterns	Directions	Methods
Religion Nature Labour Game Traditions Customs	Personal hygiene Motor activity Overcoming bad habits Increase of the body's defenses mechanisms	Consideration of age, individual and sexual characteristics; The relationship between man and the world around him; Personal development according to the laws of natural nature; Unity of spiritual and physical development	Physical Biogenetic Mental Explanation Discussion	Story Encouragement Punishment Satire Humor Edification Instructions Training Repetition

It should be noted that in the conditions of social transformations, the set of family behavior stereotypes prescribed by traditional culture is being destroyed. Nevertheless, the family in Kazakhstan today is one of the most significant elements of culture and carries values determined by the specifics of national culture. In the context of the modern socio-cultural situation, characterized by ideological inconsistency, the transformation of the values of healthy lifestyle is a component of the transformation of national values.

In order to determine the readiness of Kazakh youth to observe the traditions of a healthy lifestyle (HLS) in their family life, experimental surveys of students of two metropolitan universities (KazATU named after S.Seifullin, Turan-Astana University) were conducted.

We conducted a selective survey among students of the 2nd, 3rd courses of the above-mentioned universities in order to:

- to determine what attention is paid to family traditions of health preservation;
- determine which family traditions of healthy lifestyle are observed in families;
- what methods of healthy lifestyle are used to introduce them to existing family traditions.

A total of 120 people took part. They were offered a list of questions:

1. Do you know the shezhire (family tree) of your family?
2. Do you think the family should have its own traditions of preserving a healthy lifestyle?
3. What traditions of preserving health exist in your family?
4. How did certain traditions from the national experience of preserving health appear and become entrenched
5. How does the introduction to the values of healthy lifestyle that were recommended by thinkers of the past (Avicenna, Tleukabyluly Oteyboydak, etc.)?
6. Would you like your children to transfer your family traditions of healthy lifestyle to their families?

Analyzing the answers to the first and second questions, it can be concluded that in most cases young people fully (80%) or partially (48%) know their shezhire. At the same time, in such families, the existence of their own family traditions is a prerequisite (97%). The answers received emphasize the importance of preserving health-saving skills and the importance of family values in today's rapidly changing society.

According to the results of the questionnaires, the tradition of celebrating Nauryz with family members is leading (100%), when other relatives are invited to the family additionally. The second place was shared by the cultural program, which includes collective visits to traditional events, cinemas, theaters, museums (86%) and public holidays – New Year, March 8, etc. (85%). Traditional Sunday family lunches/dinners were in third place (51%). Basically, national dishes are prepared

– besbarmak, baursaks, kaurdaks, etc., although a certain part of students believe that these dishes are too high in calories, it is necessary to add vegetables and herbs to them. After a hearty meal, physical labor, hiking is considered necessary, and a plentiful drink (about 2 liters) is added.

Therefore, working with students shows that there are families who underestimate the educational potential of healthy lifestyle traditions.

When analyzing the 4th question, the following results were obtained:

1. The traditions of healthy lifestyle appeared and became entrenched in our family, because they are fixed by society (86%)

2. They pass in our family from generation to generation (17%)

3. We purposefully made it a tradition (camping, balanced nutrition, tempering, etc.) of our family (28%)

4. They appeared by themselves (31%)

5. Other (0%)

It follows that in most cases traditions in the family arise because of their relevance in society, and only some people purposefully create traditions of healthy lifestyle in their family.

The analysis of the fifth question showed that the majority of young people do not know the recommendations of thinkers of the past regarding healthy lifestyle. They believe that Avicenna, Al-Farabi, Tleukabyluly Oteyboydak, etc. mostly thinkers – philosophers, poets, writers, teachers, psychologists.

Monitoring of the sixth question showed that most of the students would like their children to adopt the family traditions of healthy lifestyle into their families. A certain part wished to use in the future new, modern traditions of healthy lifestyle, balanced nutrition, the formation of nutrition culture skills.

The study of the results of previously conducted sociological studies indicates that in the system of life values of an individual, health as a basic value took 3-4 place after "family", "work". In the conditions of the modern socio-economic situation, the value of health is increasingly becoming instrumental. This is also due to the fact that with low starting opportunities for entering market relations, the majority of the population of our country is exploiting the most accessible resource, and young people often have the only resource - health.

Thus, the results of the survey showed that the families of students pay insufficient attention to family traditions of healthy lifestyle. But at the same time, the guys note that they would like to adopt the family traditions of healthy lifestyle into their future families. It is necessary to understand that family traditions are the basis for creating a healthy atmosphere in every family, contribute to its cohesion, understanding that they are one. The introduction of traditions depends not only on the norms established in society, but also on the focus on creating sincere relationships between family members.

The main importance of using historical material is to enable students to apply it to the formation and development of concepts that form the basis of a healthy lifestyle. In the university course of the subject "Pedagogy" and even "History of pedagogy" there are many concepts that can be more deeply assimilated on the basis of historical materials. Our work experience and the experience of many university teachers shows that concepts such as "education", "training", "preservation", "continuity" and others are better assimilated if their study is carried out using historical materials. For example, in order to have a complete picture of the state of the use of historical material in the teaching of subjects of the psychological and pedagogical cycle in the universities of the republic, we conducted a survey among teachers. During the survey, 68 teachers from two metropolitan universities of Nur-Sultan were covered. The questionnaire questions for teachers were selected in such a way that the analysis of the answers, together with other research methods, made it possible to present an objective state of the problem in teaching practice and to identify the reasons for the low level of its solution.

The analysis of the survey conducted and the attendance of teachers' classes showed the insufficiency and the surface of the use of historical and pedagogical material in the learning process. In the work on the formation of a culture of nutrition, teachers very rarely (20%) turn to the works of thinkers of the East, in the education of a sense of patriotism, national pride and internationalism of students, in the process of forming their worldview, 40% use them in teaching practice, and 15.0% of the teachers surveyed do not use them at all. Only 12% of respondents use the material systematically and 13.0% of teachers use it occasionally. The results of the survey showed that, despite the importance of the educational function of historical and pedagogical material in the learning process, only 12.5% of the teachers surveyed identified this function. Most of the respondents (54.5%) singled out its educational and educational function and 33% noted the educational function in the educational process. It was found that many teachers (60%) spontaneously own the methodology of using historical and pedagogical material in the learning process.

Thus, the study of the state of application of historical material has shown that despite the great educational, developmental and educational significance of these materials in teaching, the solution of this problem has not yet been given due attention in the practice of universities. Many respondents are not provided with sufficient material and find it difficult to apply theoretical knowledge in practice, they cannot connect the studied material with life, everyday life, which is also manifested in their pedagogical practice.

The current situation regarding the organization of the population with a balanced diet is complicated by the appearance in the country of low-quality products with various additives of synthetic origin, genetically modified products and a

wide advertising campaign. The use of these products often causes food allergies, bronchial asthma, dermatitis and intestinal disorders in children. Against the background of the growth of "diseases of civilization", it is necessary to form the skills of nutrition culture among young people, to teach them a balanced diet.

Based on the above, the following recommendations have been developed:

– it is necessary to preserve the uniqueness and originality of the ideas of the thinkers of the past and use their educational potential in the formation of a healthy lifestyle of the younger generation;

– it is advisable to rely on the ideas of national pedagogical experience in order to ensure the spiritual integrity of the Kazakh people in the practice of youth education;

– it is necessary to strengthen the theoretical and practical significance of historical and pedagogical disciplines in order to improve the methodological culture of researchers, comprehension and practical use of the ideas of thinkers of the past;

– it is necessary to develop special courses on the study of folk experience, as well as the heritage of Oteyboydak Tleukabyluly and other professional healers on the formation of a healthy lifestyle of the younger generation.

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SPORTS MANAGEMENT AS AN EDUCATIONAL DIRECTION: RETROSPECTIVE AND CURRENT STATE

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Abstract. *In a broad sense, sports management includes all aspects of sports management: professional and amateur, commercial and non-commercial, public and private.*

Sport is a widespread social institution that grew into an industry by the middle of the XX century, now valued at 425 billion dollars a year. The process of establishing sports management as an educational direction proceeded in parallel with the growth of the industry and eventually gave rise to a wide range of academic disciplines. Pedagogical approaches, in historical retrospect, have undergone changes, taking into account the specifics of the need for sports managers in certain economic, political and social conditions.

Goals and objectives of the study:

- to analyze the history of the emergence and development of sports management as an educational direction

- to identify regions in which academic disciplines related to sports management are most widely and successfully introduced into the educational process

- to suggest the prospects for the development of sports management as an educational direction.

The materials are analytical and statistical material from Russian and foreign sources, reflecting the stages of development of sports management as an educational direction, the level of development and goals of sports domestic and foreign universities. The work uses methods for studying complex social systems, elements of fuzzy logic, and cluster analysis.

Keywords: *professional sports; sports management; educational program; professional competencies, internationalization of education; universities; sports*

industry.

Sports management (management in sports), as an educational direction, includes professional training and retraining programs designed to help trainees (students, listeners) acquire basic knowledge and advanced experience in the functioning of the sports industry from various disciplinary points of view. For example, economists may study the impact of sports on the economy, globally or in a particular region. Sociologists can explore the role of sport as a social institution. Businessmen can study the financial, strategic or organizational aspects of the sport. Psychologists may explore group dynamics, leadership, or other interpersonal factors that influence sports. In addition to such scientific research, sports management also includes the application of these theoretical foundations in the specialized training of athletes in practice.

Sports management is a relatively young field, consisting of a wide range of academic disciplines. In Russian, there are various variations of the name of such educational programs: "sports management", "sports administration", "management in sports". Each of these terms is applicable to the study of the organization and behavior of the sports industry.

Ultimately, although sports management has become the most widely used term to define this field, all of these terms remain relevant in the professional training of sports managers.

In the development of this educational direction, the following stages can be distinguished (table 1):

Table 1.

Stages of formation of the educational direction "Sports Management"

Stage №	Duration	Number of educational programs for the training of sports managers	Region
I	1900-1950	1	North America
II	1950-1980	20 (approx.)	North America, Europe
III	1980-2000	More than 200	North America, Europe, Australia, New Zealand, Africa, Asia
IV	2000-present time	More than 300	North America, Europe, Australia, New Zealand, Africa, Asia, Latin America

Stage I:

Formation of the educational direction "Sports management": the first half of the XX century.

Despite two world wars and a global economic depression, sport experienced its heyday in the first half of the 20-th century, and by 1950 the sports industry was firmly established in society on both sides of the ocean. Sports associations and leagues began to assert themselves. Large clubs experienced a shortage of personnel and a need for highly professional coaches and managers. Football was the king of the sports scene, in 1906 the "National Collegiate Athletic Association" (NCAA) was formed. Baseball was the leader in the field of professional sports, boxing, golf, tennis were actively developing, major international sports competitions were held. Despite this, there was no formal training for sports managers. However, in some Universities in the USA, Europe, USSR, the incentive to win, combined with the growing popularity of sports, prompted scientific research in psychology, physiology and other areas related to the phenomenon of sports. As a result, unique academic programs in "Sports Management" were created, designed for the professional training of sports management practitioners. The first attempt to provide professional training for sports managers was made in 1949 at Florida Southern College. It was a curriculum approved by the Florida Department of Education in the field of baseball business. The curriculum included numerous specialized courses similar in content to those commonly included in modern sports management programs. This first course ran from 1949 and 1959.

Stage II: Formation of the basis of academic training in the field of sports management. II 1950-1980

In 1957, Walter O'Malley, owner of the "Brooklyn" baseball team, approached James Mason, a professor at the University of Miami, and proposed the concept of specialized education for aspiring managers in the booming sports industry. The developed curriculum was never implemented in Miami, but its concept served as the basis for the first training program in sports administration in 1966 at Ohio University, where the first master's degree in sports administration was established. Soon after, Biscayne College (now St. Thomas University) and St. John's University offered the first degree programs in sports management to undergraduates. In 1971, a second master's program was created at the University of Massachusetts. By 1980, 20 sports management programs had been developed in the United States. This is the basis used throughout the world to the present. During this period, two schools of sports management are formed: North American (in the USA and Canada) and European (in Great Britain, France, Switzerland, Germany).

In the USSR, since the middle of the 20th century, the scientific foundations for the management of physical culture and sports have been laid down in the cur-

riculum taught in physical education universities and colleges as a mandatory one. The first Russian-language textbook was the work of A.A. Afanasyev: "Organization of physical culture in the USSR" (1952), intended for sports universities. Scientific research in sports has become an integral part of the sports science of key universities in the industry: VNIIFK, GTSOLIFK and GDOIFK im. P.F. Lesgaft.

Stage III: The heyday of "Sports Management": from 1980 to 1999

By 1985, the sports management boom had resulted in 83 sports management academic programs in the US (Lambrecht & Kraft, 2009), and by the end of the 1980s, there were over 100, and by the mid-1990s, almost 200. This number exceeded 200, including over 20 doctoral programs, before the start of the new millennium. To this point, undergraduate, graduate, and doctoral programs have been designed to meet the needs of various stakeholders. On the one hand, undergraduate programs sought to meet the sports industry's need for effective practices [5]; doctoral programs sought to broaden the knowledge base of a new discipline and to train a teacher in a particular discipline. During these years, a continuous growth was recorded not only in the number of sports management programs, but also in the number of students mastering them.

To generalize and standardize the experience in organizing the educational process in the direction of "Sports Management", in 1985 the North American Society for Sports Management (NASSM), the first academic association for sports management, was created in order to encourage theoretical and applied scientific achievements and professional development in sports management [4].

Stage IV: The current state of the direction "Sports Management".

Currently, the Universities of the world implement more than 300 academic programs in sports management. Increasing the socio-economic and political role of sport requires more and more new competencies in the professional training of sports managers. High demand in the labor market, the geopolitical role of sports in the international arena, the integration of sports areas into other scientific fields (information technology - e-sports, tourism - rock climbing, choreography - breakdancing, sports dancing, etc.) require an increasing number of specialists who know the basics sports management. Similar programs can be seen not only in specialized sports universities, but also in classical and economic universities around the world. Today it is obvious that management is an integral element of the educational program focused on the training of specialists in the physical culture and sports industry. At the heart of the formation of educational content, it is advisable to use a practice-oriented approach, individualization of pedagogical techniques and methods, according to the conditions of specific regions and the needs of local labor markets.

Well-balanced sports management programs create a competency map that combines academic rigor and professional relevance, offering benefits to all stake-

holders, including students pursuing a career in the sports industry and the organizations that employ them. Every year, descriptors describing the equivalence and consistency of standards in a given subject area become more and more obvious, therefore, the number of sports industry specialists who have undergone high-quality professional training in the field of sports management is growing. The programs of such courses contain subject disciplines that allow you to gain skills in working with sponsorship and partner offers in sports, management of professional athletes, management of professional sports, and agency activities, personnel management in a sports organization, entrepreneurial activity in sports, the work of sports media, the specifics of product promotion fitness industry, the basics of advertising. More than two thirds of educational programs in sports management in the world are implemented in English and are master's [1]. This is due to the wide internationalization of the activities of a sports manager.

Sports management programs are currently associated with various aspects, including kinesiology, education, business, marketing, sports communications [3], etc.

Practice organizations represent the interests of industry segments. Examples include the Sports and Fitness Industry Association (SFIA); World Association for Sports Management (WASM); International Sports Press Association (AIPS); Sports Lawyers Association (SLA), etc.

Conclusions:

Educational programs in sports management have received wide recognition around the world. The development of large-scale communication among sports organizations promotes intercultural dialogue and global cooperation in the field of sports management. Regional sports management associations come together to form an international coalition to advance the interests of the discipline of sports management. Representatives of the European Sports Management Association, the Australian and New Zealand Sports Management Association, the Asian Sports Management Association, the Latin American Sports Management Organization, the African Sports Management Association and the North American Sports Management Society are present in the World Sports Management Association. Individually, each association represents regional academic interests in the field of sports management, striving to develop a unified approach to the academic discipline of sports management on a global scale. Thus, a course is being formed for the convergence of pedagogical approaches to the training of sports managers. The mechanism for training highly qualified specialists managing the dynamically developing field of sports is becoming international, interethnic, multicultural and equipped with modern tools of economics, sociology, psychology, journalism, sports linguistics, and information technology.

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FEATURES OF SOCIAL ADAPTATION OF FOREIGN STUDENTS AT THE INITIAL STAGE OF STUDY

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Annotation. *The article examines the problems of social adaptation of foreign students in the system of pre-university training. Special attention is paid to various factors of adaptation faced by students in the first months of their stay in Russia, and the role of the teacher in the process of adapting students to new living conditions, to social problem situations.*

Keywords: *new environment, stimuli, discomfort, unusual social conditions, new way of life, adaptation, language difficulties, relationships, educational space*

The adaptation of foreign students to the conditions of study at a Russian university is one of the urgent problems and is a fundamental factor determining in most cases the effectiveness of the educational process as a whole.

In a completely new environment for humans, adaptation is a complex socio-biological phenomenon, which is based on a change in the system of body function and habitual behavior. All types of adaptation take place simultaneously and are barriers both in the educational and cognitive, and in the communicative activity of a foreign student.

More than 120 students study at the preparatory faculty of RostGMU annually. Foreign students of the preparatory faculty are a special social group. They come from different countries of the world, from different climatic zones, are representatives of different societies with completely different cultures, traditions, systems of norms and values. When they come to Russia, they find themselves in fundamentally new, unusual social conditions. This creates problems related to

adaptation to a new way of life and learning in a foreign country, to a new educational system, to a new language of communication, to the international nature of study groups, etc. Therefore, in the work of the preparatory faculty, the main direction is to ensure an optimal psychological climate, create a positive emotional atmosphere that increases the level of cognitive activity of students, reduces anxiety and mental stress.

Foreign students with a high level of adaptation quickly adapt to changes in living conditions associated with coming to a foreign country through contacts with other foreigners and representatives of the host culture.

Those students who are accustomed to excessive parental care, in the first days after arriving in a new country, experience special stress. They are under stress: they complain of loss of appetite, fatigue, lethargy, insomnia, bad mood and irritability. Their adaptation is difficult and slow.

Those who come to study in Russia, as a rule, live in a hostel. This is a difficult situation even for nonresident Russian students. For foreign students, the dormitory is often a stumbling block in the adaptation process. Firstly, a significant number of this contingent deteriorates their living conditions, and secondly, a dormitory is not only a temporary place of residence for students, but also a place for independent studies, which, according to available methodological calculations, take at least 40% of the study time.

Every foreign student is acutely experiencing language difficulties. The inability to explain themselves to people from the service puts them in an extremely difficult position. Difficulties arise when buying things or food. The explanation of gestures and mistakes in the construction of phrases cause laughter and surprise, and sometimes they are indecent, which is very upsetting and embarrassing for foreigners.

Climate change is also a strong irritant for students. It can cause sleep disorders, headaches, high blood pressure, exacerbate chronic diseases. Rising and falling temperatures, changes in air humidity, fluctuations in atmospheric pressure, features of daylight can cause bad mood and discomfort. Physical factors of the megalopolis environment, such as air pollution, high acoustic noise, frequent absence of the sun during autumn, and a long cold winter also have a very strong negative impact on students from warm countries, disrupting the adaptation process up to depressive states.

The process of adaptation to Russian cuisine is also very difficult. For students living in a dormitory and forced to use the dining room, the type of food, its taste qualities, and the range of products may be unusual. Water quality is often noted among the negative factors.

All these factors contribute to the difficulties of adaptation of foreign students and significantly reduce the quality of education, which is one of the forms of social

adaptation. Social adaptation is understood as the process of inclusion of foreigners at the initial stage of training in various forms of social interaction, as a result of which the development of the student's social role is carried out. The problem of adaptation to the learning process in a Russian university is accompanied by the development of stress and negative feelings against the background of a large academic load, which, as a rule, does not meet the expectations of foreign students. Some of them are not ready for such loads. Such students voluntarily leave the university and Russia after a month, a maximum of six months. The vast majority of foreign students studying in Russia do not know how to clearly plan their study time. It is difficult for them not to be late for classes, especially in the first months of training, because in their countries such behavior is not considered reprehensible. In addition, they cannot concentrate on one activity, trying to do several things at the same time. It is also difficult for them to adequately perceive the time constraints of completing tasks and tests, since in their cultures the activity itself is important, not its time frame. In the process of adaptation, students have difficulties in mastering large volumes of educational material, in independent work with educational and scientific material, in the inability to rationally organize time for home classes.

Social adaptation forces a foreign student to adapt as actively as possible to the new social environment, to the conditions and nature of study. The main condition for pre-university training of foreign students is rapid mastery of the Russian language. The better the language is learned, the more effective the adaptation, the faster the student stops being shy to communicate with Russians, which means that his adaptation is easier and easier. Differences in educational systems cause confusion and discomfort among students. The most important task at the initial stage is to build relationships within the team – with classmates and teachers.

Learning a foreign language often causes fear among many students, saying something wrong, forgetting the right word, being worse than others. The task of the teacher is to help students correctly perceive their mistakes as a normal process of learning new things.

The teacher acts not only as a carrier of knowledge, but also as a model of a new socio-cultural environment for students, helping to realize complex sociological, psychological and educational tasks. At our faculty, teachers provide great assistance to students in adaptation, in solving their everyday problems, support them in their studies and psychologically.

The composition of the preparatory faculty groups is also important. Basically, each group consists of 9-10 people, so that the teacher can pay enough attention to each student. The issue of forming groups based on nationality is quite controversial. As the students themselves note, it is better when the group is international. This is very stimulating to the process of learning Russian.

Relations in the group of foreign students also develop in different ways. Some fellow students help to write lectures, take exams, prepare reports, are friendly and try to help. But there are also those who laugh at the bad Russian of a foreigner, his appearance, criticizes the reports.

The establishment of more friendly relations in the group is facilitated by the involvement of foreign students in active student life, holding sports and cultural events, organizing various excursions to historical and cultural places. The more successful this work is, the faster representatives of different cultures will be able to reach mutual understanding.

The process of adaptation of foreign students is a complex psychophysiological socio-pedagogical phenomenon that covers the entire educational process (training, upbringing and development), acting as a single system.

Getting foreign students used to the Russian educational space is a long and difficult process. Indicators of adaptability are the absence or low level of anxiety and a high level of self-esteem, positive emotions in relation to others, satisfactory well-being and a sense of comfort.

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THE STRUCTURE OF THE SYSTEM OF MONITORING THE HIGHER EDUCATIONAL PROCESS: CHARACTERISTICS OF THE MAIN PARAMETERS

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Abstract. *In the article, the authors substantiate the structure and disclose, as a first approximation, the main parameters of the objects of the system for monitoring the educational process of the higher educational institution during the internal quality assessment. The system for monitoring the educational process of a higher educational institution involves the implementation of control measures at all levels: republican, departmental and within the institution itself.*

Keywords: *monitoring, the structure of the monitoring system of the educational process, indicators and indicators of the educational process.*

Introduction

One of the global phenomena that characterize the current state of the education system in the world is the determination of the ratings of higher educational institutions. It serves several purposes: satisfies the needs of consumers in obtaining clear and objective information about the level of training of specialists in various educational institutions; promotes the emergence of healthy competition between them; is a certain justification for the allocation of state and non-state funds for their maintenance and development; helps to differentiate different types of universities, as well as curricula and disciplines.

MES RK annually collects data to monitor the activities of universities, based on this information, the rating of each university in the system of higher professional education is determined. With all the variety of models and methods for

assessing the quality of pedagogical activity, two approaches can be distinguished. **At the heart of the first** – measurable quantitative indicators of the results of pedagogical work. Supporters of the **second approach** call for an assessment according to meaningful qualitative criteria due to the creative nature of the teacher's work. Of course, it is most reasonable to use a combination of quantitative and qualitative methods in the assessment, but the more qualitative characteristics there are in the assessment system, the less objective and transparent it is.

For a higher education institution, which is evaluated not only "from within", but also "from outside" - by society and the state, it is very important that the system for assessing the quality of professional activity is, if possible, simple, understandable and technologically advanced. Rating, as a system of assessment based on formal indicators, undoubtedly has these advantages.

In Kazakhstan, the right of universities to internal assessment is enshrined in Article 59 of the Law "On Education", according to which educational organizations subject to state certification (including universities) conduct self-assessment and submit self-assessment materials to state educational authorities. The main limiting factors for conducting self-assessment and benchmarking of universities in Kazakhstan are: the lack of expertise and sufficient financial resources from universities [1].

Formulation of the problem. The object of our research is the development and implementation of an intra-university monitoring system as a factor in managing the quality of the educational process of a university. We believe that the structure of the university monitoring system includes: definition of the current goal and objectives; analysis of subjects, objects of monitoring as constituent components; establishing a set of parameters for each component, identifying indicators/ indicators of parameters, on the basis of which it is possible to assess the quality of the educational process of the university.

Main part

Along with the concept of a holistic pedagogical process, the concept of a professional educational process, which is defined by M.V. Zealous, V.D. Simonenko as follows: "The professional educational process is a socially organized interaction of teachers and students in professional educational institutions aimed at solving professionally developing and educational problems" [2]. The system-forming factor of the professional educational process is its goal; the main subjects are teachers and students; their interaction is aimed at mastering the content of education with the help of methods, forms, means, methods, techniques of vocational training and education; the professional and educational process ends with certain results that must be verified against the goal.

By the way, at the beginning of the XX century, P.F. Kapterev used the concept of "educational process" along with another – "pedagogical process", the latter in

the domestic literature was defined by him for the first time. In the first Soviet encyclopedia, "pedagogy" is defined as a science that studies the organization of the pedagogical process. In the works of V.A. Sukhomlinsky, the terms "pedagogical", "educational" and "educational process" are used on an equal footing [3].

We believe that the concept of "educational process" is much broader than the concept of "pedagogical process". Since, according to V.A. Slastenin, the teacher constructs the pedagogical process with a focus on the pupil and the team as a whole, while the student constantly sees the teacher, parents, and peers in front of him. The initial attitude of the pedagogical process is the interaction between the teacher and the pupil [4]. Also, it is worth noting the idea that the pedagogical system in dynamics is the pedagogical process. And the “educational institution” system is a system of a higher rank than the pedagogical system (among its subsystems: administrative, pedagogical, research, production, etc.).

Further, according to the regulatory legal acts, educational monitoring is considered as a systematic observation, analysis, assessment and forecast of the state and dynamics of changes in the results and conditions for the implementation of educational processes, the contingent of students, the network, as well as rating indicators of the achievements of educational organizations. [5]

Scientific researchers give a general understanding of monitoring as control, diagnostics, analysis of the state and assessment of trends in the development of the "object of monitoring" [6, p. 23].

Thus, we can conclude that monitoring is a process of tracking the status of an activity, a process, and the results obtained at various levels of monitoring are analyzed and serve as the basis for making management decisions.

In general, in all educational organizations, including higher specialized educational institutions, monitoring of the assessment of the quality of educational activities is carried out on:

- at the republican level (carried out within the framework of the State certification once every 5 years. The criteria for assessing the quality of educational activities are reflected in the "Instructions for organizing and conducting state certification in military, special educational institutions" developed by MES RK) [7];
- departmental level (thematic inspections of the DC of the NSC and inspections);
- at the university level (self-assessment).

As the role of higher education institutions in many countries is changing, so is the nature of their relationship with central governments. State control is gradually deregulated. Over the past decades, almost all over the world there has been a large-scale reform of the management of higher education, both at the systemic and institutional levels, in order to give it greater freedom, dynamism, flexibility and efficiency, which act as a kind of measure of the competitiveness of a single

higher education system. Despite the full capacity of the concept of "governance", in the context of higher education, it is always directly related to the autonomy, academic freedom and institutional responsibility of universities. Today, autonomy, collegiality, and transparency in higher education governance systems have become integral features of the best-performing education systems around the world.

To build a system for monitoring the educational process of a university, it is necessary to understand what "quality of education" is. Traditionally, the main criteria that determine the level of quality of education in the universities of Kazakhstan are:

- qualifications of the teaching staff, the main indicators are: the percentage of teachers with academic degrees, the number and structure of the teaching staff, the qualitative composition of the teaching staff, staff turnover;
- educational and methodological support, teaching methods and technologies, special attention is paid to information and communication technologies, distance learning technologies;
- the material and technical base includes indicators that provide conditions for education: the structure and volume of space, technical teaching aids, information and consumer services for teachers;
- intellectual potential, including: the volume and direction of research work, the amount of research funding, the presence of recognized scientific schools, the number of doctoral students, the number of published monographs, textbooks, the number of councils for defending dissertations;
- the qualitative and quantitative composition of students, the indicators of student admission, the results of intermediate and final certification, the number of students, the quality of training of applicants are used;
- the quality of university graduates includes indicators of employment of graduates, the number of graduates, indicators of career success [8].

The objects of monitoring the educational activities of the Academy at all the above levels are: educational, methodological, scientific and educational activities, as well as the assessment of the resources of educational activities (personnel, information, material and technical, medical, financial support, etc.). The process of monitoring in higher education institutions is shown in Figure 1.

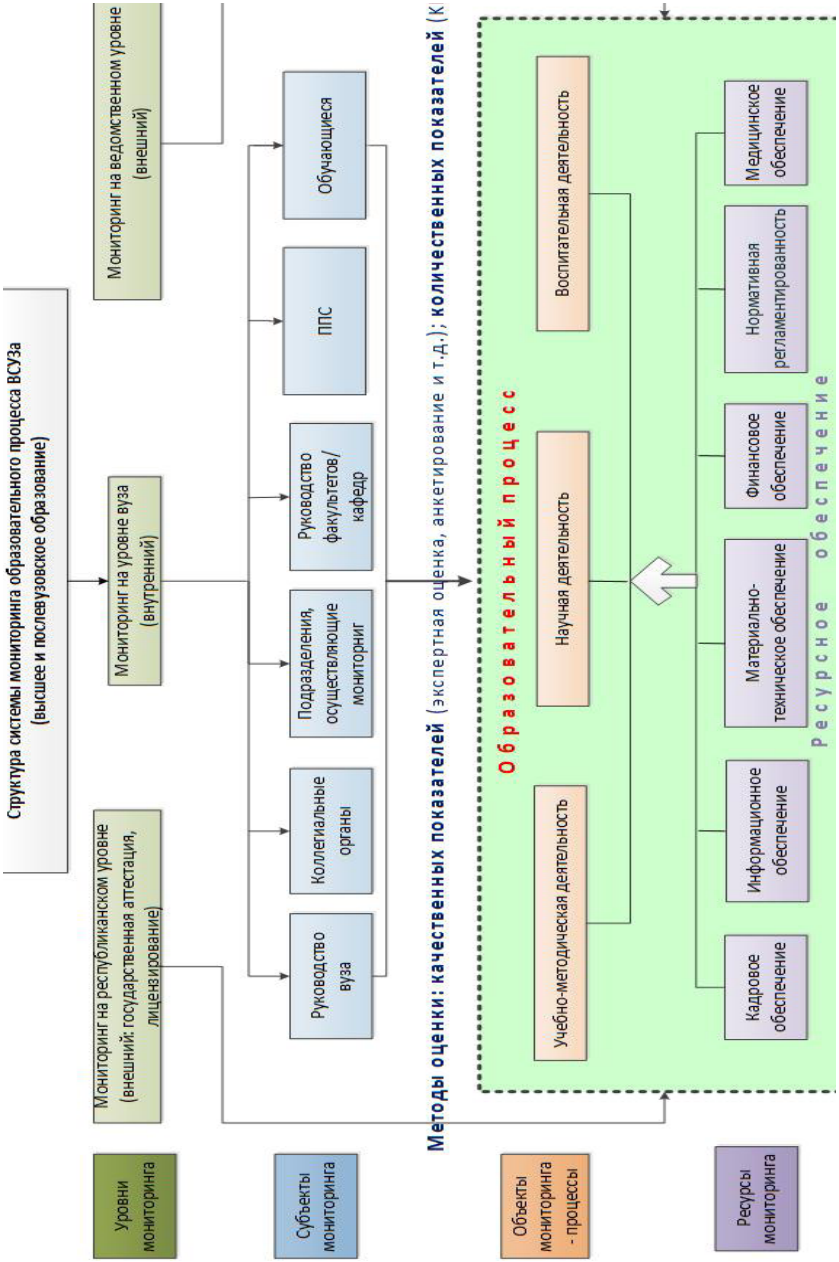

Figure 1. *The structure of the system for monitoring the educational process of the higher educational institution*

Next, let us briefly define the parameters that characterize the main objects of monitoring.

Block "educational and methodological activity" includes the following parameters:

educational and methodological complex (materials that determine the content, volume of the course, the order of its study and teaching: a program, a generalized type methodology, etc.; materials containing the course itself, means of consolidation and control (textbook); materials that provide the technological side of educational process, educational and methodological materials designed for teachers and parents [9]);

organization of the educational process: external formal features, didactic features, innovations in learning (Figure 2);

type of educational institution;

organization of continuity, succession of education (presence of substructures); type of educational institution;

the quality of the educational program; organization of the educational process: external formal parameters, didactic features, innovations in teaching;

implementation of research results in the educational process.

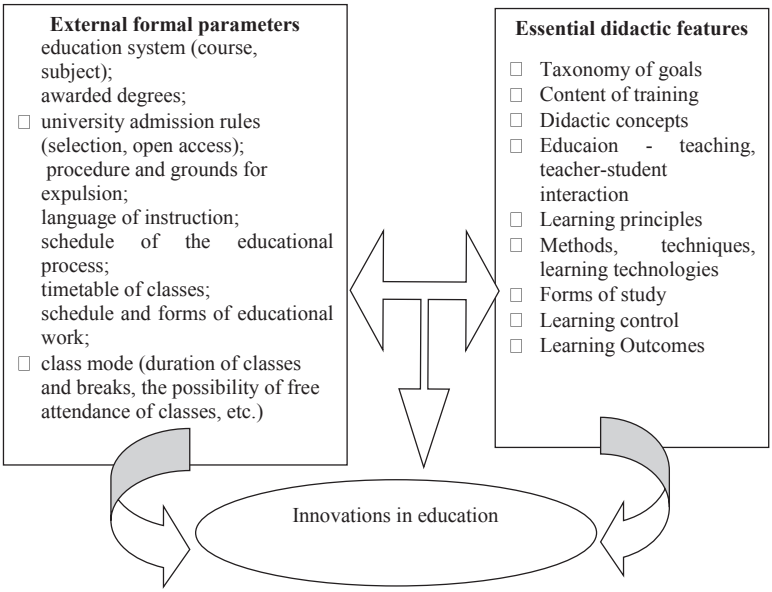

Figure 2. *Parameters of the organization of the educational process*

Research activity as an object of monitoring - productivity of scientific activity, efficiency of scientific activity, efficiency of state budget financing, relevance of scientific research, scientific potential, innovative potential, participation of teaching staff in grant research,

A.V. Bobkov, I.N. Katalazhanova, I.V. Pavlova note that the monitoring of scientific activity is systematized and structured according to three types of information [10]:

1) information about the goals of the system. This type defines the problem statement itself. For example, as the goals of the scientific activity of the subject of higher education, the following can be considered:

profit from licensing agreements for the use of intellectual property objects owned by the subject;

receiving income from research under contracts, agreements and grants;

advanced training of employees, the so-called "dissertation science";

ensuring indicators of scientific activity required for accreditation of the subject.

2) information about the parameters, which includes information about the main entities of the subject area, their characteristics, relationships between them.

3) information on indicators intended to assess the achievement of goals.

An approximate composition of the parameters and indicators of scientific activity is presented in table 1.

Table 1.

Parameters for evaluating the scientific activity of the university

Parameters	Primary composition of indicators/indicators
Productivity of scientific activity	The given number of articles, monographs, inventions
Efficiency of scientific activity	The given number of defenses of dissertations, inventions, know-how, licenses for the use of intellectual property
Leadership of research work of students, undergraduates/ doctoral students	The number of successful defense of a master's/doctoral student - in time/within a year from the date of completion of training; Opposition of master's/doctoral dissertations; Availability of prizes in student scientific events (at the republican, international and departmental levels)
Efficiency of state budget financing	The share of inventions, know-how, software, databases, monographs resulting from the implementation of state budget R&D
Relevance of scientific research	Percentage of inventions related to priority areas for the development of science and technology, the number of R&D, the results of which were commercialized

Participation in scientific events	Participation of teaching staff in scientific conferences, symposiums, forums, congresses: at the republican, international and departmental levels (in person); Availability of prizes in student scientific events
Innovation potential	The presence of technology parks, business incubators, the given number of students co-authors of publications and inventions

To carry out a **comprehensive assessment of the quality of educational activities in a higher educational institution**, it is advisable to use such a list of criteria and indicators that reflect its key systematizing components, namely [6, p. 37]:

1) normative-targeted support of educational work at the university;
2) diagnostics and design of educational work;
3) subjects (participants) of the educational process;
4) educational and didactic environment of the university;
5) the main directions and content of educational work at the university;
6) forms and methods of educational work;
7) the effectiveness of educational work at the university.

Of course, the search for tools for assessing the quality of the level of upbringing of students or the level of formation of professional (corporate) values seems to be especially difficult. Thus, within the framework of the research work on the topic "AP08856223 "Synergetic foundations and eutagogy for self-development of the individual and the development of spiritual and moral qualities", we established a connection between the development of "soft skills" and spiritual and moral qualities.

Evaluation of the resources of the educational activities of the university should be based on the following. The implementation of the educational programs of higher and postgraduate education is carried out in accordance with the obtained license, during which the higher education institution is obliged to comply with the established requirements.

Thus, the qualification requirements for educational activities, the procedure for obtaining and reissuing a license, approved by order of the Minister of Education and Science of the Republic of Kazakhstan dated June 17, 2015 № 391 [11], involve monitoring the resource support of the educational process of the university: regulatory regulation, personnel, information, logistical, financial and medical security.

Table 2.

Parameters and indicators for assessing the resource support of educational activities

№	Parameters	Composition of indicators
1.	normative regulation;	- availability of working curricula developed on the basis of educational programs (copies of working curricula for educational programs for the estimated period are attached); -compliance of educational programs with the requirements of the State Educational Standards (copies of educational programs in areas for the estimated period are attached); -data of the educational organization (full name of the educational organization, location of the educational organization (legal address and actual location address); -contact details of the legal entity (telephone, e-mail, website, contact details of the representative of the legal entity (full name of the head, copy of the appointment order); - title and constituent documents (certificate of a registered legal entity, branch or representative office, generated by the e-government portal "EGOV.KZ", charter), permits (a copy of the license for educational activities and an annex to it); - the number of the Educational program for which training is carried out, copies of RUEs and QED developed for the entire period of study, information on the staffing of pedagogical and teaching staff by level of training
2.	personnel support	- scientific potential; -information on the staffing of pedagogical and teaching staff by levels of training; - information on advanced training and retraining of personnel over the past five years in accordance with the profile of the disciplines taught or according to the teaching methodology; - information about the contingent of graduate students (all levels) by educational programs and languages of instruction
3.	information support	- information about the availability of a fund of educational, artistic and scientific literature, information about the availability of educational and scientific literature on digital media; - information about the presence of an automated information system
4.	logistical support	- information on the availability of a specialized scientific and technical, scientific and methodological, clinical, experimental base; - information about the material and technical support of the educational process, including the availability of computers, the availability of educational laboratories, educational subject rooms and technical teaching aids; information about useful training;

		- information on the availability of a catering facility that meets sanitary rules and regulations (copies of supporting documents on the availability of a catering facility that comply with sanitary rules are attached)
5.	Medical support	information on the availability of medical care, (copies of supporting documents on the availability of medical care are attached)
6.	Financial support	Budget planning: teaching staff business trips; teaching staff, etc.

And in conclusion, the system of monitoring the educational process of the higher educational institution involves the implementation of control measures at all levels: republican, departmental and within the institution itself. The subjects of the monitoring system are the teaching staff, students, the leadership of the higher educational institution, the leadership of faculties/departments, collegial bodies and units that carry out monitoring. We want to emphasize that such a set of subjects is due to certain functions in the management of the educational process.

Within the framework of this article, the authors substantiated the structure and revealed, as a first approximation, the main parameters of the objects of the system for monitoring the educational process of the higher educational institution during the internal quality assessment. Prospects for further investigation are the modeling of the entire system using the process approach and project management.

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IMPLEMENTATION OF ACADEMICIAN RAO E.V. BONDAREVSKAYA'S CONCEPT ON THE PERSONAL ORIENTATION OF THE EDUCATIONAL PROCESS AT THE PRE-UNIVERSITY STAGE OF TRAINING FOR FOREIGN STUDENTS

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Annotation. *The article is devoted to the concept of the personal orientation of education of a culturological type, the fundamental core of which is the education of a citizen, a person of culture and morality. The article considers the methodological foundations of student-centered education based on the analysis of the works of E.V. Bondarevskaya's, who contributed to the development of the theory of professional pedagogical culture.*

Keywords: *personality-oriented education, upbringing, personality, man of culture, preparatory faculty, foreign students.*

The concept of the personal orientation of education of a culturological type, the fundamental core of which is the humanistic education of a citizen, a person of culture and morality, was developed by the famous academician of the Russian Academy of Education Evgenia Vasilievna Bondarevskaya, the head of the Rostov scientific school, recognized and widely known in the country, whose activities are aimed at developing the theory and practice of personality and personality – oriented education. The fundamental nature of the research conducted by E.V. Bondarevskaya's, is combined with their practical orientation, scientific support for the processes of reforming education, organization of experimental work, scientific and methodological support for innovative processes in education. A conceptual guide for E.V. Bondarevskaya's is the belief that reality depends on education, on the upbringing of a person of culture [9].

The specific theoretical contribution of the scientific school of E.V. Bondarevskaya's on the development of modern pedagogical science, education and the theory of education is determined, for example, by the following results:

• the concept of personality-oriented education of a cultural type was created, its methodological substantiation was carried out, it was shown that personality-oriented education is a science-intensive pedagogical technology that implements fundamental philosophical, psychological, pedagogical ideas about a person and the processes of his individual and personal development;

• a theory of student-centered education has been developed, the components of which are: substantiation of the goals of the designed education in the image of a person of culture; determination of a system of principles that ensure the personal orientation of education, modeling the content and technologies of personality-oriented education, as well as ways to organize a single educational space that creates conditions for the personal development of students;

• the foundations of the theory of humanistic pedagogical culture are defined as an essential characteristic of a personality-oriented teacher, university and society;

• the design of personality-oriented educational systems was carried out, the strategies for their development were described, etc.;

The values of humanistic pedagogical culture are:

– personal meanings of teaching in the life of each student;

– individual abilities, independent learning activities and life experience of each person;

– pedagogical support and care, cooperation and dialogue between the teacher and the student;

– holistic development, self-development and personal growth of each student.

According to E.V. Bondarevskaya, the significance of the knowledge, cognitive, practical, behavioral or information component in education is instrumental in relation to the main value: the cultural, personal and semantic development of the student. Changing values naturally leads to a rethinking of the basic educational processes that ensure their implementation.

In the traditional system they are:

– training as equipping students with knowledge, skills and abilities; the cognitive component is a backbone concept;

– development of basic mental processes – memory, attention, thinking;

– upbringing as a directed formation of a personality with given properties.

And in a student-centered system, the main educational processes are:

– formation of personal meanings of teaching and life;

– developmental education;

– pedagogical support for each student in the development of his individuality, personality;

– upbringing as concern for the spiritual and moral development of the student.

These processes characterize the value attitude towards the student as a subject of life. From this follows "an understanding of the goal of personality-oriented education – not to form and not even educate, but to find, support, develop a person in a person and lay in him the mechanisms of self-realization, self-development, adaptation, self-regulation, self-defense, self-education and others necessary for the formation of an original personal image and worthy human life, for dialogic and safe interaction with people, nature, culture, civilization" [1, 2, 3].

Therefore, the content of the concept of student-centered education should include the following mandatory components: axiological, cognitive, activity-creative and personal. The axiological component aims to introduce students to the world of life values and assist in the choice of personal meanings. The cognitive component of the content provides students with scientific knowledge about a person, culture, history, nature, noosphere as the basis of a person's spiritual development. The activity-creative component contributes to the formation and development of students in various ways of activity, creative abilities necessary for self-realization of the individual in cognition, work, scientific and other activities. The personal component provides knowledge of oneself, development of reflective ability, mastery of methods of self-regulation, self-improvement, moral and life self-determination, forms the life position of a given person; is a backbone concept in the content of personality-oriented education. Therefore, the main efforts of teachers to update the content should be aimed at strengthening its personal-semantic orientation. The content of education must be filled with cultural, i.e. human meanings: humanitarization, ecologization, aestheticization of content. Promising ways to update the content are integration in order to create a single field of meanings, including the individual experience of students in the content. [1].

Personally-oriented content requires for its implementation adequate universal pedagogical technologies: cooperation, dialogue, activity-creative nature, focus on supporting the individual development of the student, providing him with the necessary space, freedom to make independent decisions, creativity, choice of content and methods of teaching and behavior, collaboration between teacher and students. The transition to student-centered education depends on the teacher – his desire, general and pedagogical culture, personal qualities. The teacher must meet the following requirements:

– have a value attitude to the student, to his culture, creativity;

– to show a humane pedagogical position;

– take care of the environment, the preservation of the spiritual and physical health of students;

– be able to create and constantly enrich the cultural-informational and subject-developing educational environment;

– be able to work with the content of educational material, giving it a personal and semantic orientation;

– own a variety of pedagogical technologies, be able to give them a personality-developing orientation; the content of education must be filled with cultural, i.e., human meanings; possible means for this are humanization, ecologization, aestheticization of content; promising ways to update the content - integration in order to create a single field of meanings, the inclusion of individual experience in the content;

– take care of the development and support of the individuality of each student [8].

To implement such a system of relations, teachers of the preparatory faculty need a sufficiently high level of general and pedagogical culture, combined with the creation of a cultural and pedagogical environment of the university that provides psychological comfort, spiritual and moral well-being, successful general cultural and individual creative development of each student.

The entry of mankind into the era of global informatization of society has led to an accelerated process of updating the content of curricula, optimizing and intensifying the teaching of disciplines using modern information and computer educational technologies, to the emergence of various concepts of student-centered education in distance and blended learning of students, including preparatory faculty, which marks the beginning of a new stage in the development of world pedagogical thought. The features of the new stage are as follows:

– the general view of education is changing in the direction of a deeper understanding of it as a cultural process, the essence of which is manifested in the humanistic and creative ways of interaction of its participants;

– the idea of a personality changes, which, in addition to social qualities, is endowed with various subjective properties that characterize its independence, ability to choose, self-regulation, reflection;

– the role of the individual in the pedagogical process is also changing, it becomes its system-forming beginning;

– the attitude towards the student as an object of pedagogical influences is revised and the status of the subject of education and his own life, which has a unique individuality, is finally assigned to him;

– conditions are created for the development and awareness of subjective experience, individual-personal abilities, for providing pedagogical support to youthful individuality – all of the above is considered as the main goal of education [3].

The results of the latest research on the psychological mechanisms of personality development are actively penetrating into pedagogy and becoming in demand. Along with the socialization of the individual, which was previously considered as the main mechanism of personal development, great importance is attached to per-

sonalization, self-identification, the desire for self-actualization, self-realization and other internal mechanisms of individual self-development. This marks the departure of pedagogical theory and practice from the paradigm of the formation of a personality with given properties and a turn towards the development of the theory of education as a personality-oriented, culturally appropriate pedagogical process [2].

Ideas of E.V. Bondarevskaya's continue to be implemented in the teaching of foreign students at the preparatory faculty. Humanistic education is considered as a holistic pedagogical process, the epicenter of which is a person who cognizes and creates culture through dialogic communication, exchange of meanings, creation of "works" of individual and collective creativity. This education, which ensures the personal-semantic development of students, supports the individuality, uniqueness and uniqueness of each person and, relying on its ability to self-change and cultural self-development, helps each person independently solve their life problems. [4, 5, 6]. Personally-oriented education actualizes the author's characteristics of pedagogical activity, placing increased demands on such personal qualities of a teacher as understanding the meaning of his profession, choosing values and goals, personal responsibility for students as a humanistic pedagogical position, creative construction of the educational process, the quality of their own pedagogical success and failure. Ensuring interdisciplinarity, interaction between the main scientific and educational departments of the university and the educational departments of the preparatory faculty contributes to the formation of a holistic scientific and educational humanized environment, is a real expression of the backbone role of education in the professional training of future medical students of all specialties [7].

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MODEL CHARACTERISTICS OF GYMNASTS AS A GUIDELINE FOR THE PROGRESSIVE DEVELOPMENT OF RHYTHMIC GYMNASTICS GROUP EXERCISES

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Abstract. *One of the main modern trends in the development of group exercises for rhythmic gymnasts is an increase in the level of complexity in working with the apparatus against the background of an increase in the intensity, consistency and speed of interaction between gymnasts in competitive compositions.*

The most acute problem of regulating the process of long-term training in rhythmic gymnastics group exercises is the absence in the federal standard of sports training for the sport "rhythmic gymnastics" of regulatory requirements for the level of preparedness of athletes at each stage of training and taking into account the specifics of competitive activity in this type of rhythmic gymnastics program. The article presents the results of a study aimed at scientific substantiation of the requirements for the level of preparedness of gymnasts and their model characteristics, which are a guideline for specifying control exercises that provide a systematic and gradual increase in gymnasts' sportsmanship and the effectiveness of their competitive activity in group exercises. An experimental verification of the effectiveness of the proposed model characteristics of female gymnasts performing in group exercises served as the basis for recommendations for their implementation in the process of sports training.

Keywords: *rhythmic gymnastics, group exercises, sports training, special readiness, model characteristics.*

The identified model characteristics of gymnasts performing in rhythmic gymnastics group exercises are based on the performance of the main competitions of recent years, in particular the Olympic Games 2012 and 2016, the World Cham-

pionship 2019, the European Championship 2021 and the Olympic Games 2021.

Over the last three Olympic cycles, we can observe how the level of difficulty in rhythmic gymnastics group exercises has increased (Figure 1).

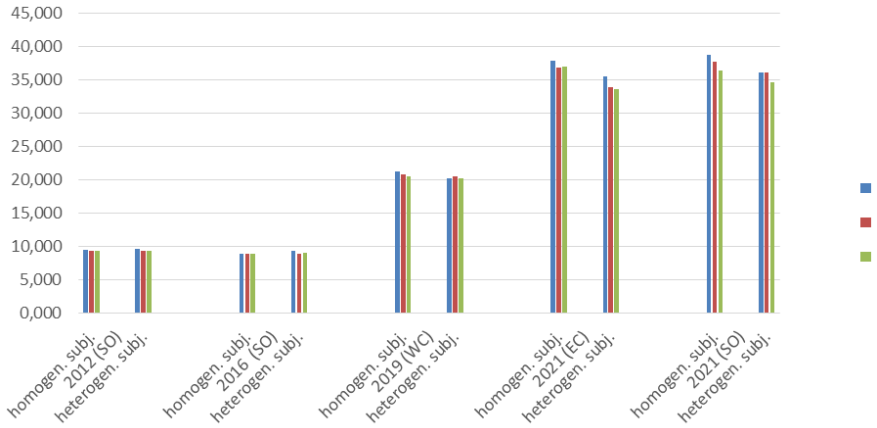

Figure 1. *The results of the increase in the level of difficulty performed by female athletes in group exercises in competitive compositions at the main starts in each Olympic cycle*

From the analysis of the results of the difficulty performed by gymnasts in group exercises in the last three Olympic cycles, we can conclude that the absence of restrictions on the acceptable level of difficulty gave a sharp impetus to improve the process of training gymnasts in this direction. At the moment, there is a predominance of the work of the subject on the elements of the body.

Modern competition rules make it possible to maximally show the coordination difficulty that gymnasts are capable of, and also allow to differentiate athletes in the process of team formation according to their level of preparedness. The content and difficulty of the competitive compositions of the strongest teams in the world in group exercises can serve as a guideline for the formation of regulatory requirements for the preparation of gymnasts in teams in group exercises.

To solve such a problem as determining the model characteristics of gymnasts performing in rhythmic gymnastics group exercises, special physical abilities were identified that have a greater effect on the success of gymnasts in a group exercise, then a comparative analysis of the competitive compositions of group exercises for the last two Olympic cycles was carried out, aimed at determining the number of motor actions that require the manifestation of these abilities (Table 1).

Table 1.

Quantitative indicators of motor actions that require the manifestation of special physical abilities of gymnasts in the competitive program of group exercises in the Olympic cycles 2013-2016 and 2017-2021 (n=30)

Special abilities	Av. value, $\bar{x}$		Time spent during the execution of 1 motor action (sec)	
	2013-2016	2017-2021	2013-2016	2017-2021
Homogeneous subject				
Vestibular stability (rotations of the gymnast), number	24	28	6,3	5,4
Orientation in space (gymnast changeovers), number	24	24	6,3	6,3
Flexibility (elements/acrobatics of gymnasts), number	19	18	7,9	8,3
Differentiation of various movement parameters (throws and catches), number	31	35	4,8	4,3
Heterogeneous subject				
Vestibular stability (rotations of the gymnast), number	31	35	4,8	4,3
Orientation in space (gymnast changeovers), number	24	25	6,3	6,0
Flexibility (elements / acrobatics gymnasts), number	19	20	8,3	7,5
Differentiation of various movement parameters (throws and catches), number	32	35	4,7	4,3

Gymnasts performing in a group exercise in the 2017-2021 Olympic cycle perform rotational movements every 5.4 seconds in programs with homogeneous apparatus and every 4.3 seconds with heterogeneous apparatus. Gymnasts change their location in 6.3 seconds in compositions with homogeneous objects and in 6.0 seconds in compositions with heterogeneous objects. Every 8.3 seconds, athletes perform an element of body difficulty or an acrobatic element that requires a high level of development of physical abilities, such as flexibility of the spinal column and mobility in the hip joints in compositions with homogeneous apparatus and 7.5 seconds in compositions with heterogeneous apparatus. It should also be noted that gymnasts in group exercises often use various types of throws and catches in compositions using criteria that require differentiation of various movement parameters: once every 4.3 seconds with homogeneous and heterogeneous objects.

All of the above motional actions must be performed with constant control of the object, accurate throws and stable catches.

Comparative analysis of the results of quantitative indicators of motor actions requiring the manifestation of special physical abilities in gymnasts performing in group exercises in the last two Olympic cycles, identified a number of differences (Table 2).

Table 2.

Statistical differences in indicators of the level of manifestation of special physical abilities by gymnasts in competitive programs in 2013-2016 and 2017-2021

Special physical capabilities	**Competitive compositions 2013-2016 (n=15)**	**Competitive compositions 2017-2021 (n=15)**	**P**
	$\bar{X} \pm Sx$	$\bar{X} \pm Sx$	
Homogeneous subject			
Differentiation of movement parameters, number	31±3.7	35±3.2	p≤0.05
Flexibility, quantity	19±1.7	18±3.8	p>0.05
Vestibular stability, number	24±3.1	28±4.4	p≤0.05
Orientation in space quantity	24±3.7	24±3.7	p>0.05
Heterogeneous subject			
Differentiation of movement parameters, number	32±3.5	35±2.8	p≤0.05
Flexibility, quantity	19±1.7	20±2.6	p>0.05
Vestibular stability, number	31±4.0	35±3.8	p≤0.05
Orientation in space quantity	24±3.5	25±3.9	p>0.05

The analysis showed that both in the previous and in the present Olympic cycles, with a relatively equal manifestation of the ability to orientation in space and flexibility, at the present stage of the development of group exercises, competitive compositions to a greater extent require the manifestation of such special physical abilities from athletes as differentiation of movement parameters and vestibular stability. It should be noted that the unmistakable performance of motor actions that require the manifestation of all the identified special abilities implies a high level of functional fitness of female gymnasts.

Thus, the model characteristics of gymnasts in group exercises were identified, which can be grouped according to the following features (Figure 2):

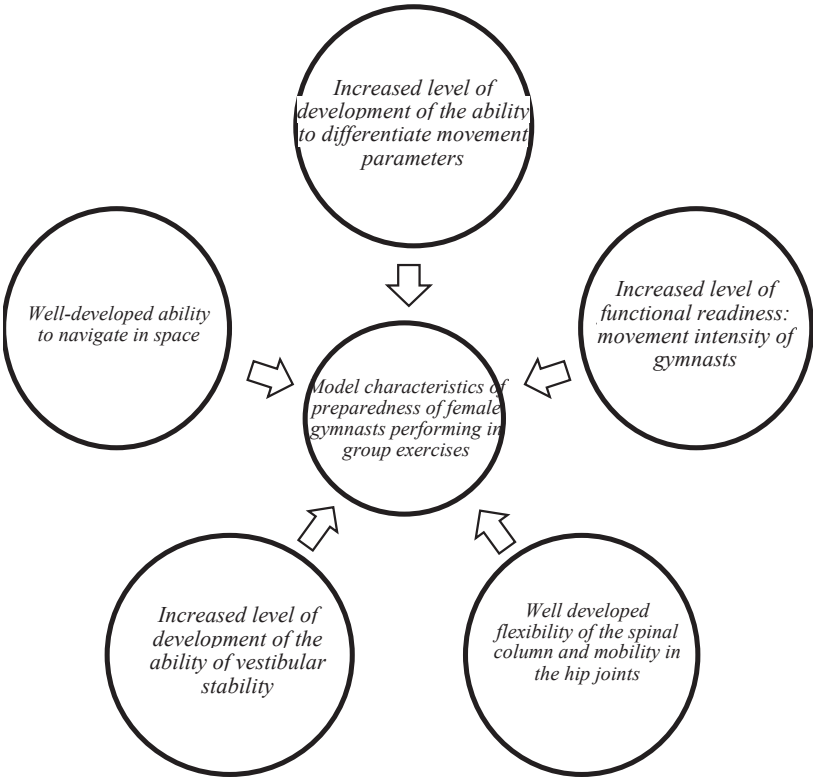

Figure 2. *Model characteristics of preparedness of female gymnasts in group exercises*

Conclusion

As a result of the work carried out, we can conclude that group exercises have become an even more coordinating and complex type of competitive program in rhythmic gymnastics, requiring gymnasts to continuously develop such special physical abilities as orientation in space and flexibility, as well as an increased level of development of the ability to differentiate various parameters of movements and vestibular stability. In this regard, already at the initial stage of training, it is necessary to apply control exercises to monitor the level of development of special abilities of gymnasts, characteristic of modern group exercises, and also pay attention to their purposeful development and improvement.

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INNOVATIVE FORMATS OF REPRESENTATION OF THE AUTHOR'S STRATEGY IN RUNET ART BLOGS

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Abstract. *the article presents the results of the analysis of modern theatrical blogs presented in the Russian segment of the Internet. The phenomenological approach to the art blog made it possible to identify its specifics from the standpoint of representing the author's strategy of the theatrical blogger, to determine the advantages of dialogic communication as one of the main forms of interaction between the blogger and the reader.*

Keywords: *blog, theater blog, telegrammer, author's strategy, blogosphere.*

Blog communication largely determines the existence of a modern person who is exposed to digital humanities, defined as a digital personality, and representing himself and his personal strategies in a continuous stream of interaction. A blog communicator is also a linguistic personality, striving to be reflected in the numerous solutions of a multitasking information space, and allowing himself to be in it the very author that consumers are waiting for. These conditions are updated by art blogging as a format of communication in the field of art, "characterized by a bright experimental character, the search for new creative models and new aesthetic attitudes, the borrowing of the rhetoric and aesthetics of non-professional video bloggers by professionals, which has become one of the trends in the development of the modern professional blogosphere" [9, p. 51].

A blog as a network diary, according to S.K. Herring, is distinguished by a number of features, to which the researcher refers to the frequent updating of web pages and the peculiarities of the arrangement of dated records - in reverse chronological order [15]. Also important are such properties of the blog as deployment on the time axis, interpretive nature, high innovative potential, high degree of publicity, polemical nature and interactivity with the active position of users. A modern blog, says S.N. Velitchenko, this is a synthetic phenomenon, located on the verge of literature, media, everyday life, visual and musical codes [4]. In this context, an art blog can be presented as a special type of blog created on art topics

in order to present art of various types and genres, while implementing the functions of social networks, becoming one of the main channels for disseminating information about art.

Art blogs represent a wide range of content (art criticism, news about art, personal content of artists, materials about art marketing, etc.) and a variety of communication formats (from media art projects to forums and cultural platforms for the widest audience). This is due to the fact that "digital technologies have opened wide access for a large part of the population to various areas of art (from museums and theatrical performances to various musical events and world cinema) and special knowledge", transforming art from an elitist into a mass one [9]. As a result of such changes, new actors appear in the modern media space who are able to express their opinion about art. Representing a community, they are hierarchized, they have their own system of values, and they are "an active source of the very evaluative consensus that used to be the prerogative of an exclusively professional environment" [6]. The environment in which the new actors operate is also changing.

The new communicative space, formed under the influence of new computer technologies, has an impact on all spheres of culture and art, as well as on the perception and thinking of a modern person. The world of new media in art is represented by a wide range of concepts that reflect their specificity and features of production. First of all, the researchers of this phenomenon pay attention to the problems of contemporary art of new media. Emphasizing that the Internet has become a catalyst for a global art movement that has begun to explore the cultural, social and aesthetic possibilities of new communication technologies, M. Tribe and R. Jana explore the technologies, thematic content and conceptual strategies of new media in art, emphasizing such features as appropriation, collaboration and exchange of ideas and expressions, while affecting identity, commercialization, privacy and the public domain [16]. The issues covered by the researchers are closely related to the problem of representation of the author's strategy studied in this article. This problem is actualized by the processes of finding oneself within the era-defining transformation created by technological development, as emphasized by the post-conceptual media artist Maurizio Bolognini [14]. At the same time, many researchers define the art of new media as a complex area that includes three main elements: the system of arts, scientific and industrial research, and political and cultural media activism. These elements are universal, each in itself, there is a difference between them, they represent different results of activity, which cannot be ignored when studying new media, as media artist S. Teterin believes [10].

In our opinion, an important idea that arises when thinking about art media and media art is the idea about the property of new media art (digital art) to build

your own feelings from meeting with a work. This principle is defined as the non-linearity of perception, which differs from the linear, traditional one in that it allows describing a project, the parameters of which have a certain freedom, and requires the participation of the audience (viewer). This allows to expand the themes of new media art: from politics to social consciousness, which becomes the beginning of social activism. Thus, new media are a platform for interactivity, being themselves an interactive product, they stimulate constancy of involvement in the exchange, creation and distribution of content. These reasons have become the reasons for the recently increased popularity of blog communication or blogging. Art blogging has become relevant in the field of art and value judgments about art. The problem of its influence on the behavior of professional critics writing about art remains one of the problems waiting for its researcher. The issues of art blogging, the author's strategy of a blogger writing about the theater, became the research tasks of this article. The goal was defined as identifying the features and strategies of the author of a theatrical blog on the example of Runet.

Modern Russian theater blogging is represented by a number of theater blogs. Popular actors, TV and film directors, critics blog in the section of the Teatral magazine - "Blogs 16+" (https://teatral-online.ru/razdel/296/). These are the web diaries of Boris Berman, Boris Akunin, Yulia Aug, Konstantin Bogomolov, Grigory Gladkov, Alexei Guskov, Anton Dolin, Alexander Zhurbin, Evgeny Mironov, Irina Petrovskaya, and others. This category of blogs belongs to the media blogosphere integrated into the structure of theatrical media, but representing an independent author's performance, the creation process of which is regulated by the author-blogger. They are distinguished by professionalism in thinking about the theater. Indicative are such top theatrical blogs on the LJ blogging platform - livejournal.com, where personal diaries of theater critics and journalists are presented: "Eyes Wide Shut" by Slava Shadronov (https://users.livejournal.com/-arlekin-/); Lev Semerkin's blog (https://users.livejournal.com/lev_semerkin); "Here's the theater for you!" by Elena Aksyonova (https://users.livejournal.com/lotta20); Alexander Barinov's blog: about theater and creativity (http://мистер-баринов.рф/) etc. The essence of a blog as a format of new media is associated with the existence of cultural software - a variety of programs and databases running on company servers that allow users to edit them: leave comments, communicate with each other [3]. One of the main principles of creating blogs about the theater should include: the principle of the possible, when the author of a theater blog writes about the theater as much as the blog allows; the principle of interactivity, which determines the author's attitude to communication and the expectation of a response from the recipients, and the principle of complementarity with the expectation and the possibility of commenting.

Based on the fact that new communication forms that have appeared under

the influence of information and computer technologies change the life cycle of the theater and theatrical communication and acquire the features of a new cultural phenomenon [3]. The process of perception of a work of art is changing. As emphasized by K.V. Belobrov, virtual space makes it possible to include in this process the perception and hermeneutics of theatrical art, creating its new cultural and phenomenological certainty [3].

The virtualization of theatrical communication leads to an expansion of the audience of the theater as a whole, which increases its importance as a kind of cultural medium, and the blogosphere expands the boundaries of the theater's representation in various territories, without geographic reference. Russian-language theatrical telegram channels succeed in this, thanks to which a specific type of activity is developing - theatrical telegrammers. One of them is theater blogger Viktor Vilisov, author and host of the Vilisov postdramatic telegram channel (since 2016). Vilisov emphasizes that a new language and a new way of dealing with theater is being formed among telegrammers [7]. The channel "Between Art and Theatre" by theater blogger Ilmira Bolotyan (since 2017) stands out (https://telegram.dog/bolotyanpishet). Ilmira Bolotyan, a professional philologist, an expert in the field of theatrical text, defines the specifics of his channel as the channel of an artist, "who views all events from the point of view of contemporary art, and not the history of the theater" [7].

Theater blogger Yevgeny Zaitsev, author and host of the Nemirovich and Danchenko telegram channel (since 2017), positions his goals as goals for changing the theater world, for him the channel is a way to deeply read the theater (https://telegram.dog/NemirovichandDanchenko). The performances of Olga Tarakanova on the author's "Post/Postdrama" channel (https://telegram.dog/postpostdrama) and Vanya Demidkin on the "Write Performance" channel (https://telegram.dog/pshperform) are original and brightly individual. The development of telegramming contributes to the expansion of the audience of theatrical journalism and journalism and, accordingly, the expansion of theatrical audience.

To study Russian theater blogs as a new form of digital creativity, a phenomenological approach was applied, in which the art blog is considered as a phenomenon of the modern communication process in Russia. The main subject of the analysis of art blogs were the features of the representation of the author's strategy of the blogger-theatre critic.

The concept of the author's strategy is traditionally studied in the context of literary criticism - this is the way the author relates to the image of the hero and the image of the reader in the process of artistic interaction.

The author's strategy as a subject of study was the sphere of knowledge for many literary critics. So, M.M. Bakhtin has been working on new rhetoric or metalinguistics (general theory of utterance) since the mid-1950s, focusing on the

genre embodiment of the utterance, defining its differential difference as a certain type of utterance that has its own specifics. The subject of the statement - the author is considered by narratologists as a generative subject, because, according to J. Genette, narration is the generative narrative act. If this is not the case, then it is difficult to talk about statements and about content [5]. Wolf Schmid in his work "Narratology" explores the main phenomena in the structure of narratives, based on the features of artistic narrative works, which include narrativity, fiction, aesthetics, and also draws attention to the narrative characteristics of the text as interference of the text of the narrator and the text of the character [13]. Studying the features of the narrative, V.I. Tyupa emphasizes its genre character, defining genre as "some kind of mutual arrangement of communication that unites the subject and the addressee of the utterance". It is the genre as a phenomenon that makes it possible to convey the author's inventions to the addressee and is a "historically productive type of utterance that implements some communicative strategy of this discourse" [12, p. 23]. V.I. Tyupa emphasizes the creative competence of the genre, which implies "text-forming conventionality of the subject and the form of utterance as a whole: who speaks and how he speaks (concepts of the author's position and rhetorical behavior of the speaker, that is, his speech mask)" [12, p. 23].

Author's thinking and its specificity most often appears among such concepts as "author's position" and "author's image", these concepts are used to study and explain the author's strategy in the narration of modern narrators.

A theater blogger is also a modern narrator. His authorial strategy manifests itself in a dialogical relationship with the audience, which always remains open. The same Bakhtin emphasizes the intentional nature of the author, when the author's intentionality is addressed either to the hero or to the reader. Theatrical blogs represent such authorial intentionality, in which the appeal to the reader prevails. It is in this dialogue with him that the reader moves towards the author's position, new objects in the form of theatrical phenomena are mastered, which become the basis of the created theatrical discourse, the meaning of "special, never before experienced dialogic communication with full-fledged alien consciousnesses and active dialogical penetration into the unfinished depths of a person" [2, p. 81-82]. According to M.M. Bakhtin, the author's position can be expressed based on the focus on the hero - he can be completely subordinate to the author's will, there may be no direct assessment, and the hero is on an equal footing with the author.

As T.I. Akimova points out, "the category that develops and supplements the concept of "author's position" from the point of view of the author's artistic interaction with the reader and the character is the "author's strategy" [1, p. 14]. It is the author's strategy that makes it possible to identify the features of the author's focus on the consciousness of the consumer in the blogosphere when creating texts for theatrical blogs, it is an important form of identifying the author's con-

sciousness. The author of a theatrical blog - a theatrical blogger represents the author's strategy from the standpoint of his attitude to his reader, to himself and to the world of theater in general, and through him to the world in the broadest sense. Dialogue techniques are used by theatrical bloggers to express the process of author's thinking, which is directed to another participant in blog communication - the blog reader.

We have identified the main specific features of dialogue techniques in identifying the author's strategy of a blogger, which include:

a) the predominance of the blogger's rhetorical attitude to the reader, building a dialogue based on authoritative judgments about theatrical phenomena - the position of an expert. This is largely due to the fact that when creating theatrical blogging texts, the blogger relies on traditional sources, that is, on the theatrical performance that exists in the form of a performance on the theater stage and this has a significant impact on the development of blogging as a digital phenomenon;

b) visual demonstration of communicative relations with the theatrical world and theater space;

c) demonstration of a dialogical attitude towards the reader on the part of the author of the blog in the context of commenting, as emphasized by I. Topchiy, which is distinguished by spontaneity, immediacy, openness, the ability to enter into a discussion with several participants at once, "arguing on various aspects of the problem raised" [11, p. 11];

d) step-by-step construction of the image of your reader as a subject of blog communication through understanding the author's intentionality in relation to the reader;

e) a tendency to create texts of the theatrical blogosphere, which are distinguished by a clear structure and expanded creative potential (V.I. Tyupa), the main thing in which is the presence of elements provoking the reader to co-creation, one of which is the constancy of dialogue with the reader, which is facilitated by the very presence of the author in the public space of the Internet and readiness for interactive interaction;

f) the formation of a space for “social reading” based on theatrical blog communication, defined as joint reading and discussion of what has been read, which most of all characterizes reader practices that are now actively moving into the digital sphere.

As the researchers emphasize, social reading is an unconditional phenomenon of the modern world and determines the main reading trend, reflecting new types of media behavior when a digitalized readership moves to social networks and online reader services. The very process of joint reading and discussion of texts has sufficient educational potential, according to O. Senenko [8], as it allows you to place accents and highlight problems that are not always noticed by an individual

reader. The theatrical blog is capable of forming a digital platform for social reading as a special communicative practice in relation to theatrical production, which forms a whole range of products created by blog readers: annotations for the performance, reviews of performances, theater ratings, discussions about the theater, etc. In fact, these are new reading competencies, according to O. Senenko, which allow developing and developing in the search for new channels of communication and information exchange.

Thus, the most important strategy for the representation of authorship in theater blogs is dialogic relationships. This is noted in various theatrical blogs - from blogs integrated in the media to stand-alone theater blogs, including blogs of theatrical telegrammers. Theater blogs contribute to a more conscious consumption of theatrical content in general and the theatrical mainstream in particular. Theater blogs also provide a virtual platform for discussing what has been viewed, initiating a dialogue, forming involvement in theatrical culture, introducing elements of entertainment, informality, and creativity. Theater blogs promote the spread of cultural interests through the blogosphere.

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MUSIC AS A HISTORICAL FACT IN N.M. KARAMZIN'S PROSE

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Abstract. *Music played a significant role in the work of many writers of the 18th century. The musical process of this time is valuable not only for its diversity and rapid development, but also for its close connection with literature. This article is devoted to the analysis of musical reviews of "Letters of a Russian Traveler" and "Moscow Journal". Descriptions of the musical realities of Europe and Russia play an important role in these works, acquainting readers with the cultural life of that time. However, as an example of early Russian criticism, the musical impressions of the "Letters of a Russian Traveler" and the theatrical reviews of the "Moscow Journal" serve different functions.*

Keywords: *N.M. Karamzin, music, historical fact, sentimentalism*

Introduction

The musical realities described in "Letters of a Russian Traveler" first introduced the Russian reader to the life of Europeans, and the criticism of the "Moscow Journal" set itself the task of presenting all the advantages and disadvantages of theatrical productions. It is worth noting that "Letters of a Russian Traveler" was first published in the Moscow Journal, and when we consider the sentimental reviews of the traveler in the context of the entire publication, between the theatrical reviews of "Letters of a Russian Traveler" and the musical reviews of the "Moscow Journal", we find numerous similarities as well as differences of critical reviews. Reviews of the "Letters of a Russian Traveler" and the "Moscow Journal" demonstrate the same approach to criticizing theatrical performances, noting similar advantages or disadvantages of performances. However, in "Letters of a Russian Traveler" most of the musical reviews represent the point of view of a sentimental traveler and are far from objective analysis, when the reviews of the "Moscow Journal", written according to a certain structure, are an example of objective criticism.

In the works of O.P. Markova and T.N. Livanova, the musical side of the "Letters of a Russian Traveler" and theatrical reviews of the "Moscow Journal"

are considered separately. However, in both cases, Karamzin acts as a spectator, informer, and adviser, gives his assessment of theatrical performances and artists. The musical reviews of the traveler anticipate the theatrical criticism of the editor of the "Moscow Journal".

I. The description of musical art

In May 1789, Karamzin went on a trip abroad, which had a decisive impact on all his subsequent work. In Europe, he spends more than a year (May 18, 1789 - July 15, 1790), getting acquainted with the culture of Germany, Switzerland, France, and England. E.I. Osetrov also noted this., saying that "Karamzin writes about what is now called tourist sites in guidebooks. With 'Letters of a Russian Traveler' a fashion for European trips began in Russia, connected with the desire to see painting, sculpture, architecture"(Osetrov, 1985). During his journey, he meets with J. Kant, J. G. Herder, C. Bonnet, I. K. Lavater, J. F. Marmontel and others.

It is also important that Karamzin goes on such a long journey as a "prepared" spectator, able to appreciate the foreign theater at its true worth. "The 'letters' indicate Karamzin's broad acquaintance with various aspects of European life: the political, social, family life of Europe finds in him a judge, obviously prepared for observation by preliminary study. The world of arts is equally accessible to Karamzin: painting, music, theater - everything in it finds a connoisseur, undoubtedly armed with knowledge." (Sipovsky, 1899)

In this regard, a rather controversial issue arises. Were all these musical impressions written by Karamzin himself? Throughout the "Letters of a Russian Traveler" Karamzin's "teachers" are mentioned: E. Jung, D. Thomson, L. Stern, Ossian, J.-J. Russo, F.G. Klopstock, A. Haller, S. Gesner, G. Kleist, and others. Can we assert direct borrowings from these authors? Comparing Karamzin's text with different sources, V.V. Sipovsky primarily points to L.-S. Mercier, J.F.P. de Saint Foy, J.-A. Dulor and K.F. Moritz ("Journey of a German to England"). Sipovsky writes: "From a number of comparisons we made, it is clear how widely Karamzin sometimes used various 'descriptions' of cities, 'guides' and other works useful to him ... but this use was not 'plagiarism', since, from the point of view of literary concepts of that time, it was not only not forbidden for the author of 'travels', but was even considered necessary, increased the dignity of his work ... "(Sipovsky, 1899).

T.N. Livanova took a different point of view, noting that "everything that relates to music in the 'Letters of a Russian Traveler' is mainly drawn from the notes of Karamzin himself and can only be borrowed from literature in a very small part"(Livanova, 1952). F.Z. Kanunova noted that Karamzin was never an imitator and epigone of European sentimentalism, "he used world art for the sole purpose of creating literature based on his achievements that meets the needs of Russian life

and, in particular, the requirements of Russian noble culture"(Kanunova, 1967).

E.N. Kupreyanov in her article "The Russian Novel of the First Quarter of the 19th Century: From a Sentimental Tale to a Novel" notes that "Karamzin strives in his 'Letters of a Russian Traveler' first to outline the national identity of the social life and culture of each of the European countries he saw, to characterize the national character of the German, French, English and other European nations" (Kupreyanov, 1962).

In the article by Yu.M. Lotman and B.A. Uspensky "'Letters of a Russian Traveler' Karamzin and their place in the development of Russian culture", it is noted that "the traveler of Karamzin is a traveler with a book in his hands. He looks at what he already knows from the descriptions and is not shy about borrowing from books in his work"(Lotman, 1984).

Ideas V.V. Sipovsky is trying to develop O.P. Markova in her book "Music in the creative mind of N.M. Karamzin". She also considers the problem of borrowing - non-borrowing of literary topics by a writer when description of musical impressions and notes: "The writer's appeal to sources known in his time can be regarded as a conscious act. The presence of 'calque' phrases, as well as phrases close to someone else's text, creates in a kind of 'good tone' in the work"(Markova, 2011).

Even though Karamzin used various sources, "Letters of a Russian Traveler" remains an innovative work for the XVIII century, representing the life of Europe from the perspective of a Russian nobleman. In any response to a musical performance, the personality of the sentimental traveler will dominate the objective description.

"Letters of a Russian Traveler", like many other works of Karamzin in the first person, were perceived by readers as an autobiography. S.E. Pavlovich in his work "The Ways of Development of Russian Sentimental Prose of the 18th Century" notes that "the author used letters as a common literary form, convenient to highlight his 'I' and strengthen the subjective element in the work"(Pavlovich, 1974). The question of the autobiographical nature of the heroes of Karamzin's prose is touched upon in the book by Yu.M. Lotman "The Creation of Karamzin", where the author proves that the image of the traveler is far from the author of the Letters of a Russian Traveler himself. "To imagine Karamzin as a 'sentimentalist of life' means to be deeply mistaken. Karamzin did not keep diaries. His letters are marked by dryness and restraint"(Lotman, 1998). This cannot be said about the hero of the "Letters of a Russian Traveler".

Starting from the first review of the opera by Johann Gottlieb Naumann "Medea in Colchis", the traveler demonstrates his awareness and interest in music, noting the manner of the singer's performance: "They played the Opera Medea, in which Todi sang. I heard this glorious singer back in Moscow, and I will say - perhaps to my shame - that her singing touches my heart a little. It is not pleasant for

me to see the tension with which she sings. However, being only a lover of music, I cannot appreciate its art. What "Medea in Colchis" belongs to the scenery, they were magnificent" (Karamzin, 1984).

Mentions about the artists, their playing and scenery are one of the main points on which further productions will be characterized, both in "Letters of a Russian Traveler" and in the "Moscow Journal", but this review told readers more about the traveler himself than about the production. Without mentioning the composer of this opera, the traveler focuses on his personal attitude to the talent of the "glorious singer".

II. Music – the cause of sentimental reflection

In "Letters of a Russian Traveler", music is presented not only as a description of historical reality. Karamzin uses music to demonstrate the feelings of the traveler, and to create a sentimental atmosphere, and to describe the life of countries. All musical impressions must be divided into three groups.

The first group is sentimental reflections and descriptions caused by any music. They do not refer to a specific composer, they do not affect the plot of the story in any way and do not carry any specific information. However, it is in such descriptions that the sentimental nature of the traveler will be revealed. Noting the lyrical digressions associated with the traveler's thoughts, E.I. Osetrov noted that "Karamzin's sensitivity always has artistic merit. Carefully noticing and immediately fixing on paper the manifestations of the human in a person, the slightest change in mental states, the author simultaneously puts himself to the test in numerous emphatically personal episodes, reproduced now with sadness, now with a gentle smile"(Osetrov, 1985).

For example: "July 12. Today in the morning I entered the court Catholic church during mass. The splendor of the temple, loud and pleasant singing, accompanied by the consonant sounds of the organ; the reverence of those praying, the uplifted hands of the Priests to heaven - all this together produced in me a certain delightful trembling. It seemed to me that I had entered the Angelic world, and I heard the voices of blessed Spirits praising the Inexpressible. My legs buckled; I knelt and prayed with all my heart." (Karamzin, 2007)

The next note will already be under the heading "July 12, at 10 pm." It is significant that this description is placed in a separate note. In this note, the most important thing is the feeling that the music and the atmosphere of the temple awakened in the traveler, but not the Dresden Hofkirche itself with its history and architecture.

The second group is descriptions of musical life. They are devoid of such sentimental poeticization. They have nothing to do with the history of music, but they convey the real life of this or that people from the point of view of the traveler. Here's an example:

"Meanwhile, night had fallen. The magister took off his wig, put it beside him, put a cap on his head and began to sing evening prayers in a discordant, wild voice. The Leipzig student immediately accosted him, and they, like good donkeys, started such a duo that it was necessary to cover their ears. — Fortunately, the singers soon quieted down; everything in the carriage fell silent, and I fell asleep"(Karamzin, 2007).

The third group of musical impressions are the so-called "facts of history". These are descriptions and criticism of theatrical performances. Readers are informed about the composer, performers, scenery, and so on. It is these musical impressions that correlate with the reviews in the Moscow Journal. One might even say that they foreshadow them.

In "Letters of a Russian Traveler" you can trace the evolution of reviews. At the very beginning of the journey, the hero, visiting the Berlin theater, will note: "The Theater was now presenting Schroeder's Familiengemählde - a play that did not make any pleasant impression on me, perhaps because it was badly played - and the Opera Two Hunters. In the latter, the role of the milkmaid was played by the actress who represented the Queen at Don Carlos: what a transformation! However, she plays the thrush girl better than the Queen. "(Karamzin, 2007)

However, the reviews of the French theater are by no means amateurish. They provide extensive information about theaters and repertoire, about artists and their best roles. This is the opinion of a connoisseur, not an amateur.

III Theatrical performances and opera in N.M. Karamzin's prose

It is difficult to determine the musical preferences of the traveler. He attends operas, ballets, listens to secular and sacred music. He is interested in both famous singers and dancers and street musicians.

Undoubtedly, in most musical impressions, the "sensitivity" of the traveler will manifest itself, which will practically disappear in the reviews of the Moscow Journal, but Karamzin's criticism begins with "Letters of a Russian Traveler".

Returning to Moscow, Karamzin takes up the publication of the "Moscow Journal", in which not only the works that brought Karamzin fame were published: "Letters of a Russian Traveler", "Poor Liza", "Natalia, Boyar's Daughter", "Liodor", but also criticism for foreign and Moscow performances. In two years of publishing the magazine, Karamzin presented Russian readers with a new page in the history of Russian prose. In her theatrical reviews, according to I.A. Kryazhimskaya, Karamzin opposed classicism. "He (Karamzin) - S.P. believed that the dominance of classicism in Russian art interferes with the normal and correct development of all its branches, primarily theatrical" (Kryazhimskaya, 1958).

T.F. Pirozhkova in the work of Karamzin, the publisher of the "Moscow Journal", also notes the importance of the journal, especially critical articles, for the development of the ideas of sentimentalism. "Criticism in the Moscow Journal

was necessary for Karamzin - he made the journal a propaganda organ of a new direction - sentimentalism, therefore, without criticism, he could not solve the problem of approving new ideas in literature"(Pirozhkova, 1978). With all the denial of classicism, Karamzin's critical activity both in "Letters of a Russian Traveler" and in the "Moscow Journal" was of an educational nature, introducing the Russian audience to the European theater.

The first issue of the "Moscow Journal" came out in January 1791, and the first theatrical review was devoted to Lessing's Emilia Galotti. The second edition also featured reviews of musical theatre. It should be noted that already in the first reviews, Karamzin developed a certain plan, according to which many theatrical performances were described in "Letters of a Russian Traveler".

Detailed description

Evaluation of translation and acting

Opinion about music and composer (if it is a musical performance).

Description of scenery and costumes

Outcome

In addition, throughout the entire edition, one can observe some changes in the style of reviews. The first reviews are voluminous, they are foreshadowed by reflections on the theater, about its current state, they have a sentimental style, but if we turn to later ones, we will notice that they have become more restrained and concise, only the most important is noted.

The review of the opera "Louis IX" by Francois Lemoine is one of the most voluminous. The review is anticipated by a reflection on the tasks that poets and theater should set for themselves:

"The theater should be just as fair as history, condemning tyrants and great villains, and praising good sovereigns, glorious and virtuous men"(Karamzin, 1791).

The review begins with a detailed retelling of each act of the opera, then Karamzin notes individual arias, singers, and dancers, mentions the quality of scenery and costumes, and praises the author. "In a word, in this performance we see together such talents and pleasures that we will not find in any other"(Karamzin, 1791).

However, not every review will be positive and so detailed. V.G. Berezina in her work "Karamzin the Journalist" notes: "If the play and its stage performance are worthy of praise, Karamzin writes a serious, deep article in which the hand of the critic-artist is felt. The reviewer talks fascinatingly about the play itself, subtly reveals all the psychological nuances of the image"(Berezina, 1973). An opposite example is the criticism of the comic opera "La Cavacuante", published in the same issue:

"The magnificent announcement of this play was, of course, partly the reason for the severity of the audience, but it must be admitted that this poem is too cold and boring, even if at least a lot of fun could come out of this content.

The talent of the glorious composer of music, T. Tarki, could not close the shortcomings of the poem"(Karamzin, 1791).

Similarly, Karamzin noted performances in "Letters of a Russian Traveler". The productions they liked were given voluminous informative reviews, like reviews of "Louis IX", all the rest were talked about superficially.

It should be noted that, having returned to Russia, Karamzin turns first to the foreign theatrical repertoire of those theaters in which he visited. Yu.M. Lotman explains this by the fact that "Karamzin's literary posture as the author of 'Letters of a Russian Traveler' doubled to accommodate two different types of audience. In Russia, before the Russian reader, Karamzin appeared in the exaggerated role of a 'European'. In this case, he was not afraid to make a shocking impression, rather, he even aspired to it. <...> The perception by contemporaries of the young publisher of the 'Moscow Journal' as a 'new man' and a 'European' was part of his 'game' and was a condition for public outcry for the activity of the reformer for which Karamzin was preparing. However, in the circle of his European acquaintances, Karamzin played an emphatic role of 'Russian', speaking sharply about those of his fellow tribesmen who strive to be like foreigners abroad"(Lotman, 1984).

Conclusion

Comparing the reviews of "Letters of a Russian Traveler" and "Moscow Journal", we can find a lot in common. Let's look at two short passages.

1. "Recently they presented Hatis, a great opera, which the music was composed by the glorious Picini. There's something great about composition uplifting the soul. Aria: Vivre ou mourir, sung by the unfortunate lovers driven by fate and the jealousy of cruel Cybella, beautiful, incomparable." (Karamzin, 2007)

2. "Music is still the first composition of Mr. Megul and proves that the Composer has great abilities. He completely entered different positions of the play and knew how to express the character of these in music. Only there is generally too much thoroughness in it, which is tiresome for attention, and which usually shows a young writer who wants to discover all his knowledge in harmony. The audience most liked the duo, which very vividly expresses feelings of jealousy. However, there is a lot of heat and power in all music"(Karamzin, 1791).

Both reviews noted the composer's talent and singled out the best arias. Undoubtedly, in the second excerpt the author presents a deeper knowledge of music, but if an excerpt from the "Letters of a Russian Traveler" is placed in the "Moscow Journal", then there will be no dissonance. The "Letters of a Russian Traveler" describes the content of the performances, mentions artists and composers. They are no less informative than the reviews of the "Moscow Journal".Thus, the "Letters of a Russian Traveler" and the theater reviews of the "Moscow Journal" are not only a source by which one can judge the cultural interests of that time, but also represent an example of early musical criticism.

After considering "Letters of the Russian Traveler" and reviewing of musical performances of the "Moscow Journal", we can highlight the similarities and differences in the description of music as a historical fact. Furthermore, the analysis allows us to trace the development of musical criticism in the work of N.M. Karamzin.

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THE ROLE OF MYTHOLOGICAL IMAGES IN UNDERSTANDING THE IDEOLOGICAL CONTENT OF P.A.OYUNSKY'S DRAMATIC POEM "THE RED SHAMAN"

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Abstract. *The work "The Red Shaman" by P.A.Oyunsky, created a century ago, does not lose its relevance today. According to the author of the article, the deep secrets of this unique work are only beginning to partially shine through the prism of the thinking of the modern reader. In this paper, the author tries to find out the role of mythological images in understanding the ideological content of this work, revealing the global problem of humanity.*

Keywords: *Oyunsky, Red Shaman, Yakut mythology, mythological images, the spirit of fire, spirits of heaven, deities.*

The multifaceted personality of Platon Oyunsky as a statesman, an extraordinary writer and thinker with a progressive view of the world, was formed at the beginning of the last century, closely intertwining his fate with the fate of his homeland. Young Oyunsky was embraced by humanistic ideas of a universal scale, masterfully expressed in his immortal work "The Red Shaman", which has mythological origins.

P. A. Oyunsky was not only a brilliant connoisseur of oral folk art and a talented olonkhosut, but also a researcher of Yakut folklore. His work "The Yakut fairy tale (olonkho), its plot and content" [3, p. 128-194], written in 1927, laid the foundations for its scientific study. In 1935, at the Institute of Nationalities under the CEC USSR, Oyunsky defended his dissertation for the degree of candidate of linguistic sciences. According to his concept, "the true history of the people cannot be known without knowing the oral folk art" [3, p. 79]. The writer-scientist argued that "in the artistic development of any nation, in the birth, formation and flourishing of its literature, everywhere and everywhere, the first degree of ascent was folk poetry, folk epic" [3, p. 79]. Folklore traditions, plots and motifs played an important role in his artistic work. Researchers A. A. Burtsev and M. A. Burtseva

write: "His most significant work - the dramatic poem "The Red Shaman", as well as the story-tradition "Kudangsa the Great" - are closely connected with Yakut mythology, with the plot and poetics of olonkho. Genetic connection with oral folk art led to the generalization of artistic thinking characteristic of P. A. Oyunsky ... The ideological and aesthetic originality of the art of P. A. Oyunsky lies not only in a deep connection with folklore, in the use of multifaceted symbolic images and conditional forms, but also in the specific synthesizing nature of his creative method" [3, p. 34].

Myths (from the Greek "mythos" - legend, saga) reflect the views of the most ancient people, starting from the primitive communal stage of the formation of mankind, on the universe, natural phenomena and man. They are transmitted as secret knowledge acquired by intuition and insight, without the participation of experience and rational logic. Arguing that the myth is not a primitive scientific, metaphysical construction, not a scheme or an allegory, A.F. Losev wrote: "A myth is not a poetic work, but its detachment is the erection of isolated and abstractly isolated things into an intuitively instinctive and primitively biologically related sphere with the human subject, where they are combined into one inseparable, organic fused unity" [11, p. 73]. He believed: "The word is the expressed self-consciousness of a person who has understood his intelligent nature; personality, nature, which has come to an actively unfolding self-consciousness. Personality, history and the word are a dialectical triad in the depths of mythology itself. This is the dialectical structure of mythology itself, the structure of myth itself" [11, 168].

The apparent paradox here is that a myth that arises without the participation of reason has its own strict logic. Ya. E. Golosovker believes: "The imagination of the myth-maker, inventing, learned something scientifically certified millennia later. The objects of science about the microcosm are created in the image and likeness of the objects of mythology. They learn by imagination" [4, p.76].

The logic of the myth is distinguished by outstanding anthropologists, ethnologists and psychologists. K. Levi-Strauss writes: "Perhaps one day we will understand that the same logic works in mythological thinking as in scientific thinking" [8, p. 207]. The American philosopher, anthroposophist Robert A. McDermott is more specific: "The daring insights and myths generated by the human mind in search of knowledge ultimately come from a source much deeper than the purely human. They come from the depths of nature itself, from the universal unconscious, manifesting with the help of the human mind and imagination *their own gradually revealing reality* [13, p.190]. Further, the philosopher clarifies: "In other words, mythology is a psychology erroneously understood as biography, history or cosmology" [13 p. 240].

About the miraculous metamorphoses of mythical heroes J. Golosovker wrote: "This process of metamorphosis is a description of the "how" and not an explana-

tion of the "how". 76]. And the French writer, a supporter of Freud's psychoanalysis, Roger Dadun believed: "The first myth was certainly a psychological myth, a myth about a hero" [5, p.460]. An English psychiatrist, University of Illinois professor William Ross Ashby gave a definition that attracted the attention of the researcher: "Mythology is a mystical language that serves to convey and expound the principles of life and the universe" [18, p. 86].

Based on the statements of well-known researchers, we can conclude that mythology should be perceived in the light of its psychological and mystical background. Modern science reveals many secrets of nature and human capabilities. But humanity will have even more discoveries in the field of knowledge of the human psyche, its incredible abilities, which, undoubtedly, is supported by mythology.

Folkloristics, which studies folk traditions, explains mythology from aspects of popular belief. Myth serves as an explanation of everything that happens to a person during life and after death. The characters of the myth were perceived by a person as real beings, they were endowed with a characteristic appearance, their own disposition, habitat and certain functions in their relationship with a person. Along with the development of life, some elements of the myth die off and are gradually forgotten, while others change, and some arise in accordance with the course of life. This could not be avoided by the Yakut mythology, which assumed the belief of the people in deities and spirits that stood on different steps of the religious system, the highest step in which was occupied by deities - Aiyy. The lower one is the spirits of nature. Aiyy were distinguished by the greatest strength and power, the most general and important functions: some of them were "responsible" for natural phenomena, others influenced human economic activity, others were "obliged" to provide fertility to people and livestock, and some protected animals, etc. The life and well-being of a person depended on their will. The author of the article does not exclude the possibility that with the development of society, some deities could transform into more convenient for human perception or disappear. However, the lower deities and spirits associated with the cycle of nature, on whose favor the quality and quantity of grass and other plants, as well as fish and forest animals depended, continue to live in people's memory. Faith in them did not disappear in the last century, as evidenced by the attempts to revive the teachings of Aiyy by Yakut religious scholars Vladimir Kondakov and Lazar Afanasiev.

The word has a special meaning in the oral tradition. Thus, A.A. Potebnya considered the origin of symbols in close connection with the evolution of language and thinking. He believed that different representations can coexist in the same image, the natural property of which is polysemy [12, p.97]. The linguistic tradition of the Sakha people testifies to the preservation of the symbolic universe of the word many lost fragments of the mythological model of the world of the

entire people. Figurative perception of a person is not complete without symbolic analogies associated with his practical experience.

The researcher Ya.I. Lindenau drew attention to the uniqueness of the myths of the Sakha people back in the 18th century, and since then various kinds of myths began to appear in the records of A.F. Middendorf, V.L. Seroshevsky, N.P. Popov, E .K.Pekarsky, I.A. Khudyakov, V.F. Troshchansky, V.M. and M.N. Ionov, A.E. Kulakovsky, P.A. Oyunsky, A.A. Popov, G.U. Ergis, D.K.

A.I. Gogole in his work "The origins of mythology and the traditional calendar of the Yakuts", referring to the works of famous folklorists, writes: "Since the 1980s, the study of individual mythological plots, as well as problems associated with the symbolism and reconstruction of the mythological views of the Sakha. (N.V.Emelyanov). Mythological deities in olonkho "Descendants of Yuryung Aiyy Toyon" and "Baai Barylaakh master spirit of the black forest", Petrov V.G. "Legends about Kudangse in artistic processing by P.A. Oyunsky", Oyunskaya S.P. "Echoes of mythical ideas in the Yakut riddles", Filippova N.I. "On one epithet of Yuryung Aiyy Toyon" / Mythology of the peoples of Yakutia. Yakutsk, 1980/. Such a new approach to the issue under study, based on the immanent approach to the materials of mythology, provided the appearance of representative works [5, p.4]

In 1995, for the first time, the academic publication of a collection of legends and myths of the Sakha, edited by Professor N.A. Alekseev, was carried out, which mainly included mythological stories about animals, birds, about the first ancestors and everyday stories, dating back to the 18-19 centuries. [14, p. 178 - 282.) Thus, the mythology of the Sakha people acquired the possibility of written popularization and perpetuation of myths.

The author defined the genre of the work "The Red Shaman" as a song - olonkho, but modern researchers attribute it to a dramatic poem. The protagonist of Plato of Oyunsky is the Red Shaman. This is a potentially evolving image. It will be a mistake to perceive this image only in the narrow concept of a shaman. The image of the Shaman was analyzed by the author in a previously published article.

One of the female mythological images of the work, which we also studied in a previously published article, Aiyy Kuo (literally: the Divine Maiden) occupies a passive role in the work, at first glance. Literary critic V. N. Protodyakonov wrote that this image symbolizes the extinction of an obsolete century. A. G. Gurinov argues that, if one adheres to this point of view, Aiyy Kuo personifies the culture of the people, referring to the following definition of the author: "A girl who looks especially beautiful." In the opinion of the author of the article, Aiyy Kuo, along with the Red Shaman, is the main character of the work we are considering, personifying a wonderful future, this is directly indicated by the characters of the work, singing:

Hail Aiyy Kuo,
Hail, Aiyy Mistress!
May the future rise,
May the future prosper! [1, p.21]

What can be compared with the beautiful Aiyy Kuo, the messenger of the heavenly gods, the personification of harmony? Only a Beautiful Future! After all, under any circumstances, even secretly from himself, a person hopes for his best lot in the future.

But what does Oyunsky mythologically personify Oruluos Dokhsun - Gogol the Bold, the son of the deity of heaven, pretending to be the Falcon, but only mentioned in the work? Afanasy Gurinov believes that this is a hint at the "Falcon" by Maxim Gorky, talking about his belonging to another nation. But we can assume that this is an allegorical image, symbolizing some forces that want to subjugate the future. But no matter how daring the young Gogol is, there is another force in the person of the wise Red Shaman, protecting a happy future, which humanity all over the world is waiting for at all times. The shaman defeats Gogol, who dared to take the soul of a young girl, personifying the future, with whose death his fellow tribesmen would have lost hope for a better life ahead.

The publicist O. G. Sidorov writes the following about his own perception of the scene that ends the drama: “In fact, at the end of this drama, only the spirit of fire, Khatan Temeria, and the old Yakut knife, three-quarters of a arshin long, stuck into the hearth of the hearth by the Red Shaman, remain on the stage. A flame and a sharp knife, a symbol of strength capable of "giving light, joy... to those downtrodden, poor" and destroying "suffering, grief." ... The drama reflects the figurative understanding of the surrounding reality, inherent in the Yakut people. "The Red Shaman" changed the world of Sakha. Since the advent of drama, one can count the revolutionary changes in the aesthetic perception of the environment, the entire universe, the knife symbolizes the desire for freedom: "Cover your path with blood!" [17, p. 131].

The author of this work believes that the purpose of the knife is to improve life, build a home, make household items, and ensure the preservation of human life by obtaining food. And in war, as you know, people use other weapons. The fact that the knife is used for other purposes by hardened people is not its direct purpose, about which the Shaman certainly had a specific idea. For every representative of the Sakha people striving for good and happiness, a knife cannot be a symbol of freedom, this is not in the spirit of the people. Each reader can interpret this scene in their own way. In the opinion of the author of the article, with this allegory, Oyunsky tells the new generations that it is impossible to achieve either freedom or harmony in life through violence. With his brainchild "The Red Shaman" Platon Oyunsky calls on people to be guided by reason, breathing into it the immortal

idea of humanity! By sticking his knife into the hearth of the hearth, equal to the shrine in every dwelling, the Shaman renounces shamanism, which in some way is associated with violence. At that moment, an insight comes to him that it is impossible to achieve freedom, freedom of the spirit, freedom of the mind by violence!

The drama ends with a scene of a good-naturedly chuckling spirit of fire - Khatan Temieriye, who, without any sorrow, proclaims that the shaman has died, and there will be treats for him in the future. But without a person in the dwelling, the fire dies out, and the spirit of fire should die of hunger. Why can he laugh good-naturedly? This is a direct clue that the owner of the dwelling is alive, he abandoned his mystical duties, disappointed in his former principles, but did not die, but on the contrary, was inspired, changed his views on life, became wiser, gained immortality with his mind!

Thus, the author of the article, having studied some mythological characters in the dramatic poem "The Red Shaman", comes to the conclusion that these images, along with the main character of the work, serve to reveal the ideological content of this work about a wonderful future that humanity can achieve not by aggressive force destroying each other, but by the creative power of the mind, without unleashing a murderous struggle against each other.

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ETHICAL AUTONOMY IN RELIGIOUS THOUGHT

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Abstract. *The article undertakes an analysis of the ethical concepts of philosophers and religious thinkers. The interaction of a person as a social being is compared with religious scriptures. An attempt is being made to bring together the philosophical and theological discourse for a comprehensive and more complete understanding of the reality of human actions being aware of the regulations or not.*

Keywords: *ethics, New Testament tradition, transcendental, Christianity, spiritual, salvation.*

The thinkers of Antiquity, who saw the source of the ethical in the transcendent, placed the main emphasis in their theoretical constructions on the sphere of the social. Both Plato and his disciple considered the starting point in the formation of the subject to be in the space of the policy, communication with their own kind.

Having built an ideal state, or at least comprehended its Idea, it is possible to educate an individual capable of making independent decisions regarding what is due. Their anthropocentric concept was based on the possibility of a subject with sufficient abilities to lead a life oriented towards the good and virtue.

According to Plato and Aristotle, man is good by nature and the evil he does is the result of delusion (that is, a banal lack of knowledge), which can be eliminated with the help of exhortation; or a social disease, the effective remedy for which is the punishment dictated by the wise, and, therefore, the natural law - the main source of power is the policy. A law which meaning is derived from life itself, and not vice versa, cannot be mistaken [1; 5].

Since the state has a decisive and most important significance in the existence of an individual, then politics is the main activity there (the most urgent topic

for thinkers of the 20th century), and the main virtue is justice. The conveyor of knowledge about the nature of goodness and virtue for the policy, according to Plato, is called upon to be a person - a sage, who comprehends the Truth with the help of philosophical methodology, and therefore has a kind of monopoly on it (more precisely, on access to it) [5]. The souls of all people are basically arranged in the same way, but not everyone has the will and courage (in the social sense) to obtain true knowledge, hence there is the need for the leadership of some citizens over others, in social division into classes, that is, into the most worthy, worthy and all the rest. Goodness that is the basis of due, is eternal, transcendent and inaccessible, in the realm of the immanent only its reflections appear.

Aristotle's man is, first of all, an opportunity for the ethical sphere. His main task is to become such, fully realizing its main purpose in this practical world. Specific experience is the determining factor [1]. Unlike Plato, Stagirite assigns responsibility for making "ethical statements" instead of the social sphere to the area of the individual, inner world of the individual. It is possible to become a virtuous person only by having reasonableness in relation to oneself, knowing what the good consists of and striving for it, in every life situation constantly making an ethical choice. The main goal here is to achieve the unity of the soul, the consistency of all its parts. The main role in the comprehension of the ethical is assigned to the subject and his mind, as the main ability that determines the activity [1].

The Old Testament tradition, postulating the existence of the One God as a source of subjectivity, nevertheless, paid much attention to the law that clearly and in detail regulates the entire life of an individual. In this case, a person was also closely connected with society, drawing his identity and God's choosiness in its space. Representatives of other peoples, at the same time, were practically excluded from the ethical concept. The sphere of due, having its source in the transcendent, in the realm of the immanent was based on normativity and ethnicity.

The situation underwent cardinal changes with the appearance of the Good News, namely, Christianity, on the historical stage, which brought its ideas about the Source of due and the beginnings of the formation of personality, all important areas of human existence.

Each cultural tradition has its own mythological core, which cannot be refused. One of the traditions that has changed the history of mankind is Christianity. In this study, we will not talk about it in a theological context, but about the ethical component within a certain cultural matrix. It is necessary to find out to what extent the anthropological can be burdened with the mythological. Only under this condition, it is possible to understand the future prospects for the existence and development of the sphere of due.

To begin with, we would like to turn to the figure, who, without exaggeration, is significant in this context, namely, the Apostle Paul, and his heritage. Special

attention should be paid to his Epistle to the Romans. The uniqueness of Paul lies primarily in the fact that he was not personally acquainted with Christ. He received his knowledge by revelation, being Saul, who did not belong to the Christian community.

The life of the Jewish people is determined by the Law or the Pentateuch of Moses. This written source regulates all aspects of human life. It clearly spells out the foundations of faith, the meaning of rituals, gives clear instructions for their exact execution, as well as food permits and prohibitions, legal norms and responsibility for their violation, a list of ethical norms is given, but on the basis of which national identity and relationships in society are built. Belonging to one of the "tribes", as well as the strict and literal observance of the Law, identified the individual's belonging to the people chosen by God himself. The rest of the peoples who do not know the Law live without God, and therefore are pagans and barbarians.

Unlike the Hellenic or Roman tradition, there cannot be many Gods. There is only one God, he is transcendent, the Creator of all things and the giver of the Law. Unlike other gods, he is unknowable and cannot have human features. The basis of the life and well-being of a person in particular and the Jewish people as a whole is service to God, based on faith that knows no doubt. This is the only way to avoid divine wrath, and the terrible punishment that may follow. The main purpose of existence is to increase the population similarly to sand or "stars in the sky". Thus, the basis of a person's life, his actions, relationships with others was thought of as a connection with the transcendent Creator, unquestioning adherence to his guiding will.

Paul turned out to be, without exaggeration, a revolutionary in relation to this tradition in his teaching. In his Epistle to the Romans, he criticizes and questions the existing path to fellowship with God, and thus the very foundations of the formation of the subject and all his activities. The apostle puts the concept of sin at the forefront of reflection and criticism. The highest goal of human life is to strive for reunification with the Creator. At the same time, it is not the text of the Law itself that serves as a guarantee for the guaranteed salvation of man.

The apostle states that the world is not divided, into those who have the Text - the Jews (as God's chosen people) and the rest (pagans and barbarians). It consists of people who have the Law and those to whom it is not available. "The Law is not in the Letter, but in the Spirit." It is not necessary to read the Law in order to act in accordance with it. It must be in the soul of the individual, be part of his subjectivity. The second, those who do not have the Law, live in sin, this is their "natural state", and therefore they are already doomed to perish. They do not know about the Creator, they are subject to their natural, and hence to base, passions, the true purpose of existence is beyond their awareness. The former live "under the law", they know what virtue and sin are, therefore, having committed evil, realizing

that they acted unworthily, they are aware about the punishment. This knowledge of punishment, or rather its inevitability, unwillingness or fear to accept it, is the main reason for virtuous behavior.

The difficulty is in the fact that a truly righteous way of life is not available to either the first or the second. Ignorance of the law is no different from its formal implementation. Paul makes the main emphasis on direct fulfillment, putting good into practice, and the main source of actions is the inner sphere of a person. Everyone can do the right thing, even pagans, focusing on virtue "by nature." The main role in this case is played by the moral principle and the mind of the individual, relying on which it is possible to achieve grace.

Formalism in the performance of rites and prescriptions, no matter how strictly they are adhered to, can no longer serve as proof of the desire for righteousness and the fulfillment of the Law. What is important is the internal component, volitional aspiration, and not external paraphernalia, such as, for example, obligatory circumcision adopted by the Jews. There is a strict distinction between two worlds: the human, carnal, and therefore sinful, and the virtuous, grace-filled, Divine. Paul speaks clearly and categorically: “For it is not the Jew who is like this outwardly ... but he ... who is like that inwardly, and that circumcision that is in the heart, according to the spirit, and not according to the letter: his praise is not from people, but from God"[4].

An individual can acquire his subjectivity only in communion with the transcendent. God is the source of truth because of his wisdom and infallibility beyond human understanding. Man, on the contrary, is created, his nature, unlike the divine, is imperfect, moreover, it is corrupted by original sin. He does not know the truth, and therefore lives by a lie. All people, no matter what tribe they belong to, are "under sin." They are not able to free themselves, without the intervention of the Spirit.

The law given to people does not guarantee their salvation, does not lead to it. It is given to the individual in order for him to know and feel their imperfection, to understand what sin is and how destructive it is. The world exists according to the laws of the flesh, it has forgotten about the spiritual, mired in the natural. Having renounced the transcendental, more precisely, having lost the way to it, the carnal man has lost his way. Honoring the institutions of Scripture, he replaced God with a law, worshiping the form, not the content. There was no way out of this situation until the truth of God came into the world, to which the law and the prophets testify ... - Jesus Christ. The Son of God, born of a woman, incarnated and came into this world in order to save people from death, not carnal, but more terrible - final, spiritual. He took upon himself the sins of men and shed his blood in order to snatch a person from the “realm of necessity”, opening to him the “realm of freedom” [4].

Now a person can free himself from the dictates of the law, escape from the kingdom of sin, living the life of a spiritual being. From now on, it is possible to justify oneself before God, to draw closer to Him through faith. With its help, it is possible to receive grace for everyone, both Jews and Gentiles. At the same time, the law does not disappear, but is renewed, transformed, becomes one for all. “So we destroy the law by faith? No way; but we affirm the law,” says Paul. A cardinal change has taken place, the very foundations and foundations of the existence of man and society have changed. It is not performance as a process that makes the individual a subject, but faith [4].

As an example, confirming the primacy of faith in relation to the law, Paul cites Abraham, the first patriarch of the Jews. His communion with God, who gave grace, was before the establishment of any law. This is the fundamental point. Kierkegaard also speaks about this in his work “Fear and Trembling”: Abraham can be called the Father of faith, through him it came to people. He is an example of receiving, experiencing religious experience, communicating with the transcendent, faith, which must be guided by everyone who wants to rise above their natural state.

Faith and "promise" cannot be confirmed by law alone. It is possible to consolidate society with legislative provisions, to regulate significant aspects of human life, prescribing the commission of some acts and establishing punishment for the commission of others. From this point of view, the rule of law is understandable and explicable. This is a positive thing. But there is another, negative side of the influence of law on society, noticed long before Paul by Confucius, who said: "By multiplying laws in the state, we multiply criminals." The apostle formulated this thought in a slightly different way: "For the law produces wrath, because where there is no law, there is no crime" [4].

The law, as has already been said, is directly connected with sin, which inevitably leads to the final death of the individual. “And who needs it, this “good”, If everyone will turn into ashes ...”, - said the poet. The finality of human death, mediated by the animal basis of man, makes righteousness, grace and salvation itself inaccessible. Through the law it is impossible to become a free person, and therefore be saved. The hopelessness of the situation was changed by the coming into the world of the Savior of people - Jesus Christ. Having passed the human path, having accepted human death, he was resurrected thanks to his divine nature - “by the glory of the Father”, but not in a carnal, created hypostasis, but in “renewed life”.

From that moment on, the path to salvation (humanization) is outlined quite clearly and understandably. A person must follow the example of Christ, go through his thorny path, reunite with Him, "die bodily" in order to "resurrect spiritually." This is possible only through awareness of the imperfection of one's nature, its depravity, and hence the slavish commitment to sin. It is necessary to

completely get out of the power of the law (“die”) and partake of grace, that is, to be born again in a new life. The first is destructive for a person, prevents his rebirth. The law, due to the imperfection of human nature, has thrown the individual into the realm of sin. Not knowing the forbidden, more precisely, not realizing that something can be forbidden and punishable, a person did not strive for it, did not feel an irresistible desire to get the object of his desire. “...for without the law sin is dead,” Paul concludes [4].

In this case, one should take into account the position of Alain Badiou, who described it in his book “The Apostle Paul. Justification of universalism” noted Paul’s division of the subject into two parts: the bodily (“I am carnal”), cruelly and inexorably dictating its will in actions; and spiritual, requiring obedience to the laws, its "old letter". It is thanks to the latter that the subject is able to realize his imperfection, "sold out" to sin. From now on, he is doomed to the knowledge of his duality, the cruel confrontation of these two natures that make him up. This knowledge contains the key to possible salvation.

The understanding of one's sinfulness, the passionate desire to overcome it, from that moment on, serves as the basis for dividing people, and not their belonging to "blood", "soil" or following the instructions of a certain text. There is no longer a Jew or Greek, there are only people who turn their thoughts and actions to God, trying to call him, trying, despite their imperfect nature, to live a spiritual life, “to acquire eternal life”; and "living according to the flesh", unable or unwilling to rise to a higher, spiritual level, thereby doomed to final death. Postulating this distinction, the apostle says: "...the children of the flesh are not the children of God, but the children of the promise are recognized as seed" [4]

Paul pays special attention to social organization and development. Unlike Plato, who considered the creation of a state and the establishment of power in it the prerogative of a philosopher who has a monopoly on knowledge of the true essence and purpose of things, the morals of people and the reasons for their actions; Aristotle, who defined the state as a natural result of the natural communication of people, formed on the basis of the utilitarian principles of security and economic prosperity of the population, the apostle transfers the source of the highest earthly power to the transcendent sphere. From now on, each individual must obey the state not for his own benefit or out of fear of the onset of adverse consequences for him, but out of admiration for the One, “... for there is no power except from God; the authorities that exist are established by God.” The concept of state power is changing, and with it the very concept of its basis - justice. The one who has transgressed the establishment of power, who has risen in opposition to the ruling regime, does not oppose other people or society, but the natural and wise, not always accessible to human understanding, higher order (hence another, more stringent, approach to punishing the guilty).

Along with the transformation of understanding of the origin and foundations of worldly power, interpersonal relations in society are also changing. They must be built (and here Paul repeats Christ's Sermon on the Mount, formulating one of the variants of the "golden rule" of ethics) on love for one's neighbor. All the rules, commandments and norms that controlled and directed human life, divided peoples for many centuries, are compressed to one, the most important phrase: "love your neighbor as yourself." It is love, sincere and steadfast, the only one capable of delivering interpersonal relationships from evil, and thereby from rupture, that can serve as the fulfillment of the law. The teaching of Christ changed the foundation of human life, moving it from the external, objective realm to the subjective.

Thus, man ceased to be only a natural, sinful being, living in earthly reality and not knowing another, heavenly one. A new subjectivity was postulated, which considers unity with God, communion with His grace, as the goal of human life. Salvation is possible due to following the law, which is inside the individual and consists in selfless and sincere love for one's neighbor. Only in this way can the individual become a full-fledged subject. His path lies to the transcendent, "For all things are from Him, by Him and to Him," concludes the apostle [4].

The unanimity of thinkers consists in the recognition of the divine source of the ethical. The uncreated allows us to view communication as a special event. This is the revolutionary and uniqueness of the New Testament. The Old Testament establishes punishment for disobedience to the commandments of God, the New gives hope for redemption and salvation. It is no longer the law that determines the life and actions of a person, not belonging to the “Greeks” or “Jews”. Not the external, social, henceforth the unifying source of life, but the internal - love, leading to grace. It is not the natural, but the divine component of the personality that becomes relevant.

Ethics, as determining the relationship between individuals, must be mediated by Revelation. Its secular version, built on rationalism, has the right to exist in modern conditions. But at the same time, there is a serious danger of simplifying ethical categories, reducing them to banal utilitarianism, and in the end, reaching a dead end, which, as history shows, very often ends in unjustified and uncontrolled violence.

Theology proposes to consider the other not as a deterritorialized sign, taken from nowhere and a potential source of arbitrariness and violence. The other is an analogy with the transcendent, a sign in the form of God represented by the Trinity. Faith must be a response to the love of one's neighbor and the call of God. Human freedom, brought down to earth, deprived of reliance on the divine, is fraught with catastrophe (fascism is a vivid example of this). In the absence of transcendental values, a person is prone to violence not only against his neighbor, but also against himself, such, unfortunately, is his earthly nature. The French

thinker Alain Badiou calls this being-towards-death. That is why the foundation is so necessary, which cannot be destroyed with the help of rationalism. Moreover, the foundation must stem from the Absolute, otherwise, the subject is waiting for the choice of non-existence [2; 3].

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US INFLUENCE ON EUROPEAN ENERGY POLICY IN THE CONTEXT OF THE UKRAINIAN CRISIS

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Abstract. *The Biden administration has announced that it had banned imports of Russian oil and natural gas into the United States. This raises some tricky questions, domestic and geopolitical, beginning with US relationship with the Euporean countries and other oil and gas exporting states. The US government is going to resume oil and gas leases on federal land in a bid to bring down petrol prices in the country and at the same time to increase transatlantic liquefied natural gas (LNG) deliveries, in the hope of weakening EU dependence on Russia. The initiative will require Europe to build new terminals for importing LNG, with current infrastructure unable to cope with a significant rise in imports. The author argues that in a sort term the Europe will not be able to reduce its dependence on Russian fossil fuels and get rid of.*

Keywords: *energy policy, oil, gas, Russia, USA, EU states, Ukraine crises, hydrocarbon supplies.*

The visit of US President Joe Biden to Europe in March 2002 is associated with a demonstration of the level of transatlantic relations and the solidarity of EU and NATO states. The meetings were precisely the display of strength of the anti-Russian alliance that was the main point of Biden's visit to Europe - to take part in three summits at once: NATO, G7 and EU.

The situation around Ukraine crises has prompted the European Commission to unveil plans to free Europe from dependence on all Russian hydrocarbon resources “well before 2030” and reduce its dependence on Russian gas by 2/3 by the end of this year. But it is not yet clear how the US and EU will be able to replace Russian energy resources[1].

The US energy policy was actively influenced by the United States’ opposition to Russian supplies to the European gas market. In this context, the American side

[1]Wolff, G.B. The EU Without Russian Oil and Gas. Intereconomics 2022. № 57,pp.66–67.

implemented the policy towards the Russian Nord Stream-2 project by launching an information campaign against the project. At the same time, the United States increased the supply of its own liquefied natural gas (LNG), advocating the expansion of hydrocarbon supplies from Qatar and the Caspian region. However, the political statements about the need to expand the geography of supplies from North Africa and the Eastern Mediterranean are not supported by real capacities. As a result, in the last year the United Stated and EU have faced a sharp increase in the price of natural gas, which has already had a significant impact on the development of the economies of the western countries[2].

Despite the negative impact of high prices, the EU has not changed its position regarding cooperation with Russia in the gas sector. However, in February 2022, after Russia launched a special military operation in the Donbass, The EU refused to use of Nord Stream 2 gas pipeline and reducing the volume of gas supplies from Russia and replacing it with supplies from other countries were actually proclaimed a priority of European energy policy. The energy policy of the EU was supplemented by the European Green Agreement, which provides for the decarbonization of the energy sector and the transformation of Europe by 2050 into a climate neutral continent[3]. This strategy increased the politicization of issues related to the supply of Russian gas, which began to be considered through the prism of the US and EU sanctions policy.

In the struggle against Russia over the Ukrainian conflict, the United States are actively using European countries to replace duce their dependence on Russian oil and gas by the supply of American LNG. At the end of 2021, the US overtook Qatar and Australia, which had previously led the world in LNG supplies. European countries began to purchase American LNG. In addition, in 2021, the United States increased gas supplies to China, displacing Qatar. Moreover, the United States signed an agreement on gas supplies to China, which would annually purchase 0.9 million tons of American LNG[4].

Thus, the situation on the European gas market, as well as the EU's foreign policy in general, is developing on the background of the political activity of the United States. In the struggle for European consumers the United States are actively using the Ukrainian factor, as well as new sanctions against Russia. However, due to the anti-Russian policy and involvement in Ukrainian affairs, the energy policy of the United States remains in the shadow. In recent years, the United States has

[2]Борисова О. Поиски США альтернативных путей поставок газа в Европу // Геоэкономика энергетики. 2022. № 51. С.1-4.

[3]Хлопов О.А. Энергетическая безопасность в условиях изменения климата и устойчивого развития // Теории и проблемы политических исследований. 2021. Том 10. № 3А. С. 110-119

[4]Hendrickson B.C. The West's Economic War Against Russia Is Imperiling the World // The National Interest. May 03.2022. URL: https://nationalinterest.org/feature/west's-economic-war-against-russia-imperiling-world-202185 (accessed 02.05.2022).

increased its LNG export capacity, which is estimated at 70 million tons of gas. In addition, new capacities are being built, estimated at an additional 80 million tons. Putting them into operation will make the United States one of the leaders in LNG supplies, allowing it to displace Australia and Qatar in the gas market. In this context, the position of the United States, which opposes to the Nord Stream 2 project, is understandable.

LNG will not only remain in demand in the future, but will also become one of the key factors in the gas market. At the same time, the situation in Europe showed that the refusal of long-term supplies from Russia was dictated by political motives. European countries have long criticized the long-term contracts concluded with the Russian company Gazprom. However, the spot market showed its vulnerability and unpredictability, which led to an increase in gas prices.

The price spikes in the European gas market that have been observed since 2021 and the struggle against Nord Stream-2 show that the European gas market has entered a new stage of development. The EU is not yet considering options for returning to the conclusion of long-term contracts for the supply of gas from Russia via pipelines.

Deliveries of Russian crude oil to the United States in 2021 amounted to 3.7 million tons - 1.2% of total US crude oil imports (294 million tons). But the supply of petroleum products, mainly fuel oil, was significant - 22.3 million tons (23.5% of total imports of petroleum products). Oil from Venezuela and Iran can replace Russian supplies of fuel oil, but no one can definitely predict how long it will take to establish such supplies.

In the UK, Russian deliveries account for 8% of total UK imports, but the share of Russian diesel fuel is much higher - more than a third of imports and about 18% of the British diesel market. The European Union is approximately 40% dependent on Russian natural gas supplies. Russia also provides about 27% of oil and 46% of coal. The proposal for a total embargo on Russian energy supplies has caused divisions among the bloc's members.

Poland is the strongest supporter of total sanctions against Russia. While the country will suffer from disruptions in gas supplies from Russia, the Poles hope they are well-prepared due to increased US LNG imports and the construction of the Baltic Pipe will help to bring gas to Poland from Norway.

US Presedent Joe Biden during his visit to Europe had to convince the Europeans to stop energy cooperation with Russia. By doing this, he solved two important problems at once. On the one hand, it would stimulate the production of American shale gas, and on the other hand, it would be able to sharply weaken both Europe's economic ties with Russia and European industry, especially those who are competitors to US firms. Therefore, the Biden administration persistently promoted among the allies the idea of a complete energy boycott of Russia.

The United States seeks to oust Russia and take its place as a major supplier of energy resources to Europe. This is important not only for the profits of US oil and gas companies. Much more important is another goal: to firmly tie Europe's economic interests to America's, so that it will always be on the side of the United States in resolving Asia-Pacific problems to contest with China. If European countries begin to buy American energy resources in large quantities, the US will have more opportunities to interfere in the EU's independence strategy.

It is obvious that these efforts to lure Europe over to its side in energy supplies are fully consistent with the long-standing US tactic, which intends to "steal" Europe from Russia. This tactic dates back to the Cold War, when the US denounced Europe for buying gas from the Soviet Union[5].

The EU demonstrates a certain duality of its positions. The EU leaders talk about the concept of independence from Russian energy recoursesls, which should be realized in the coming years. But it is a big question to what extent this idea of EU independence will be realized as the EU's dependence on Russian energy resources will not weaken in the near future.

The US Senate Judiciary Committee approved the "anti-cartel bill" NOPEC (No Oil Producing and Exporting Cartels Act). This document will allow the US government to file antitrust suits in courts against OPEC members and other states involved in cartel arrangements in the oil market. White House Press Secretary Jen Psaki said the United States will continue to put pressure on OPEC countries to adjust oil prices[6].

Previously, the United States failed to put pressure on OPEC+ to bring down oil prices. Washington, in the midst of the Ukrainian crisis, called on Saudi Arabia to increase oil production in order to "undermine funding" of Russia's military operation in Ukraine. This did not please Saudi Arabia, which threatened to stop investing in the American economy.

Back in 2021, oil was expensive for the United States, and this year oil than $110 per barrel. Moreover, the oil price once has approached $120 in March 2022 and may well rise even to $130 per barrel. For the United States, this is an extremely painful, because expensive oil, which is traded in dollars, spins up national inflation and, most importantly, leads to an increase in the cost of gasoline[7]. And this is an extremely sensitive commodity for Americans - if two years ago a gallon (3.78 liters) cost $1.75, now its price has risen to $5.5.

[5]Cohen A. How Biden's New Energy Restrictions Defeat His Goals For Helping Ukraine // Forbes. 25.04. 2022. RUL: https://www.forbes.com/sites/arielcohen/2022/04/25/biden-energy-and-infrastructure-restrictions-defeat-the-russia-ukraine-war-goals/?sh=1342afb11c87 (accessed 30.04.2022).

[6]Chasmar J. White House cites oil 'supply issues' amid gas price surge, promises more pressure on OPEC // FoxBusiness. 26.10.2021. URL: https://www.foxbusiness.com/politics/white-house-oil-supply-issues-gas-price-opec (accessed 30.04.2022).

[7]Подоба З. С. Сланцевая революция в США и ее влияние на международные торговые потоки нефти и газа // Вестник Московского университета. Серия 6: Экономика. 2021. № 2. С. 3-32.

In the United States, affordable cheap fuel is a national idea, the main pride of America. To allow a price increase is a risk of social instability. That is why the White House is trying so hard to make the oil price go down, but trying to do this at the expense of others, in this case, at the expense of the OPEC+ countries[8].

The main reason for high oil prices is the embargo imposed by the United States on Russian oil, which is used by American refineries, and the upcoming oil embargo by the European Union, to which Europe is again being pushed by the United States. With accusations against Russia and Saudi Arabia, the US authorities are trying to hide their own miscalculations in front of American voters.

The appoved antitrust bill against OPEC is likely the psychological pressure from America. The United States sends a signal to OPEC so that the organization should increase production faster, otherwise USA will not impose these sanctions[9].

Such potision would strongly set Saudi Arabia against the Unied States could lead to chaos and serious price fluctuations in the market. If we assume that the American court finds OPEC+ guilty of cartel collusion, then the member countries of the alliance, primarily Saudi Arabia, will be required to sharply increase production, which will immediately reduce commodity prices around the world and hit, first of all, American shale explorers.

The cost of oil production in the US is much higher than in Saudi Arabia. Due to the unpredictability of the consequences of such proceedings the commodity and stock markets, the capitalization of oil companies would suffer[10]. At the same time, experts believe that OPEC can hardly be called a cartel. Firstly, it does not control the entire oil export market, but only a part. Secondly, OPEC makes public calculations and public statements about its plans to reduce or increase production by members. Thirdly, there are big contradictions within OPEC.

Criticism of OPEC+ means, first of all, criticism of Saudi Arabia. However, the US is afraid to completely break off relations with the Arabs. Personal relationships are important, and the Saudi prince has never spoken to Biden until now. Saudi Arabia and the Emirates are unhappy with American attempts to make a deal with Iran.The Arabs are dissatisfied with the methods of seizure of Russian assets because they understand that they can be next.

The US are the largest producer and exporter of oil, and are able to increase production and bring down world prices. Moreover, the US oil lobby continues to

[8]Pino D. Biden's Low-Energy Policy // National Review, 17.03.2022. URL: https://www.nationalreview.com/magazine/2022/04/04/bidens-low-energy-policy/ (accessed 02.05.2022).

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oppose NOPEC. It is profitable for American oil companies to sell oil at a price above $100 per barrel. And for them, as well as for the entire global industry, it is dangerous when the regulated and predictable oil market will plunge into chaos after the adoption of this document. Oil producers do not want to risk stability in order to provide Americans with low gasoline prices.

President Joe Biden, who before had l called for an end to drilling on federal lands, now are looking for ways to temporarily increase U.S. energy production to help drive down the price of gas. His administration has been under growing pressure to do more to lower gas prices, while with Republicans are saying it should allow more drilling and to sell liquefied natural gas to EU countries. The EU leladers said that they hope to cut Russian imports by two-thirds by the end of the year, by importing liquefied natural gas (LNG) from other countries, and bringing forward renewable projects and energy efficiency measures. The initiative will require Europe to build new terminals for importing LNG, with current infrastructure unable to cope with a significant rise in imports. Many EU politician and businessmen admitted that they would not be able to do without Russian gas and oil in the near future.

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RUSSIA THROUGH THE PRISM OF CULTURE

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Annotation. *The article is devoted to Russian culture. Its originality is due to the mentality and geopolitical position. The culture of Russia is shown as an integral part of world culture, which presented the world with remarkable achievements in all areas of art. The contribution of great Russian writers and poets, artists and architects, composers and ballet dancers to world culture is highlighted. Speaking of Russian culture, one cannot fail to mention the great Russian language, since it is the richness of the language that determines the richness of the cultural consciousness of the world. The article notes that Russia is one of the greatest sports powers, a leader in figure skating, rhythmic gymnastics, and synchronized swimming. The role of art as a spiritual and cultural asset in the development and improvement of society is emphasized.*

Keywords: *Russian culture, Russian language, achievements of art, writers and poets, artists and architects, composers and ballet dancers, role of art, development of society*

The peculiarity of Russian culture lies in the collision of two principles – Western and Eastern, which is determined by the geopolitical position of Russia, as well as the Russian mentality. Being at the crossroads of continents, Russia was formed and developed as a multi-ethnic country.

Polyethnicity contributed to the formation of a unique diversity of culture, the creation of original art, which became not only a subject of national pride and admiration, but also a world heritage. As you know, spiritual values do not have a national identity, they are publicly available, they enrich the world culture.

World culture is inexhaustible, diverse in all its manifestations, Russian culture has made a huge contribution to its development.

The culture of Russia makes up a large part of the Russian intangible heritage. It unites the traditions of numerous peoples of Russia, reflects historical events, geographical features, and the influence of other cultures.

The preparatory faculty for teaching foreign citizens of the Rostov State Medical University traditionally pays special attention to familiarizing its students with the cultural traditions of the country and the Don region, the work of famous Russians who have enriched the world heritage with their great works. We consider this an important component of the socio-cultural adaptation of foreign students to life in Russia [1, 2, 3, 4]. At the pre-university stage of education, this aspect of the work is organically included in both extracurricular and classroom activities. At the Russian language lessons, foreign students get acquainted with the content of country-specific texts with special interest, the topics of which successfully motivate students to enter dialogic speech, thereby motivating the development of speaking skills [5, 6, 9]. Acquaintance of foreign students of the preparatory faculty with the cultural traditions of the country and the Don region takes place not only during classes, but also on exciting excursions to Sochi, Moscow, Kazan, St. Petersburg, Taganrog, Azov, where our wards visit theaters and museums with pleasure [8]. In the second semester, students read adapted texts in the classroom based on the works of Russian classics. The best students take part in conferences and olympiads of regional studies, organized both at the faculty and in other universities of Russia [7]

The cultural heritage of Russia was based on its own and world cultural experience. It has become an integral part of world culture and has presented the world with remarkable achievements in all areas of art.

Russia gave the world such names as F.M. Dostoevsky, L.N. Tolstoy, A.S. Pushkin, A.P. Chekhov, M.A. Sholokhov, M.A. Bulgakov, who have become phenomena of modern world culture. Researchers from different countries are turning to their work, and their books are translated into many languages.

The whole world knows the Russian theater, as well as the name of the remarkable Russian theater director, the actor and the teacher, the theater reformer, the author of the theory of stage art, a peculiar method of acting technique Konstantin Stanislavsky. The goal of the Stanislavsky system is to achieve complete psychological authenticity of acting.

Truthfulness in the Stanislavsky system is one of the most important components. No actor, no director can portray something better than what exists in nature, in the real world. To achieve such a result, the actor should use his life experience and imagination, thanks to which he will be able to believe that he is performing exactly the actions that his hero does. Stanislavsky believed that art must

certainly be a good educator, both for the acting troupe and for the public who came to the theater. Stanislavsky wrote: "The *public* goes to the theater for entertainment and imperceptibly leaves it enriched with new thoughts, sensations and requests thanks to the spiritual communication of authors and actors with them."

Ballet has long been a symbol of Russian culture. It is a cultural treasure of Russia. The whole world knows the names of Anna Pavlova, Galina Ulanova, Maya Plisetskaya and many other great ballet dancers who not only shone on the best stages of the world, but also determined the fate of this amazing art form.

We admire Anna Pavlova, one of the greatest ballerinas of the 20th century. Immediately after graduating from the St. Petersburg Theater School, she made her debut on the stage of the Mariinsky Theater, where her talent quickly gained recognition. She became a soloist, and in 1906 she was promoted to the rank of prima ballerina. Pavlova participated in the performances of Diaghilev's "Russian Ballet" in Paris and London.

Pavlova was distinguished by musicality and psychological content. Her image is usually associated with the image of a dying swan in a ballet solo that was created especially for her. In one of the reviews, the critic admired what he saw: "If it is possible for a ballerina on stage to imitate the movements of the noblest of birds, then this has been achieved: in front of you is a swan."

Pavlova's glory is legendary. Her selfless service to dance aroused worldwide interest in choreography and gave impetus to the revival of foreign ballet theater.

Two monuments were erected to the icon of classical ballet Galina Ulanova during her lifetime - in her hometown of St. Petersburg and in Stockholm. Already at the age of 19, she was entrusted with the leading role in Swan Lake. And the peak of her work is the scene of madness in Giselle, which Galina Ulanova performed so movingly and passionately that even men could not hold back tears. Critics wrote that she surprisingly combines the perfect dance technique with the techniques of dramatic acting and acting plasticity. Galina Ulanova gave spirituality to even a simple, everyday movement. The impression was that in Ulanova's dance the movement does not stop, does not end, but, as it were, gradually fades away, dissolves in the air. During a tour of the Bolshoi Theater in London in 1956, her performance caused such a stir, which, according to eyewitnesses, had not been since the time of Anna Pavlova. Ulanova's highest achievements were the roles of Mary in the Bakhchisarai Fountain and Juliet in Romeo and Juliet.

Galina Ulanova reached unprecedented heights in performance. She was imitated, the teachers of the leading ballet schools of the world demanded that the students do steps like Ulanova.

The great Maya Plisetskaya is an outstanding dancer of the second half of the 20th century, who entered the history of ballet with her phenomenal creative longevity. Even before graduating from college, Plisetskaya danced solo parts at the

Bolshoi Theater. She created a unique style characterized by grace, graphicness, sharpness and completeness of the gesture and pose, each individual movement and choreographic drawing as a whole.

The ballerina possessed the rare talent of a tragic ballet actress, a phenomenal leap, expressive plastique and a keen sense of rhythm. Her performing style was characterized by technical virtuosity, expressive hands and a strong acting temperament. Plisetskaya is the first performer of many roles in the ballets of the Bolshoi Theater. Since 1942, she has been dancing miniature by M. Fokine "The Dying Swan", which has become a symbol of her unique art. In all respects, she was suitable for the role of a ballerina: a big step, a high, light jump, rapid rotations, unusually flexible, expressive hands and the finest musicality. She literally hovered in the air, which delighted the audience. Inborn artistry, expressive plasticity, Plisetskaya's phenomenal jump, flexible back, easy step and high musicality made her a prima ballerina. Maya Plisetskaya performed leading roles in all classical productions. She especially succeeded in tragic images.

As a choreographer, Plisetskaya staged ballets Anna Karenina, The Seagull and The Lady with the Dog to the music by *Rodion Shchedrin*, playing the main roles in them. She starred in many ballet films, as well as in feature films as a dramatic actress. The great ballerina was showered with many awards, including the Anna Pavlova Prize, the French Orders of the Commander and the Legion of Honor. She was awarded the title of Doctor of the Sorbonne. Since 1990, she performed with concert programs abroad and taught master classes.

The whole world bows before the greatest art of these wonderful ballerinas.

Russian music has come a long way in its development. The names of such great composers as M. Glinka, A. Scriabin, M. Mussorgsky, N. Rimsky-Korsakov, P. Tchaikovsky, S. Rachmaninov, D. Shostakovich, I. Stravinsky are known all over the world.

The music of I. Stravinsky combines a large number of styles. He created works that bear a bright imprint of Russian culture.

A. Scriabin, a Russian composer and pianist, teacher, a representative of symbolism in music, was the first to use color in the performance of music, thereby introducing the concept of "light music".

The brilliant musician S. Rachmaninoff symbolizes Russian music throughout the world. The composer conducted a lot, gave concerts in America, Canada, and European countries.

D. Shostakovich created a large number of musical works, including symphonies, ballets, operas, concertos, which became famous not only in our country, but also abroad.

N. Rimsky-Korsakov created wonderful opera symphonies, cantatas, and instrumental concertos.

P. Tchaikovsky's work is very diverse: he wrote operas, ballets, symphonies, overtures, fantasies, suites, quartets, concertos, piano and violin pieces. In each piece of music, he created unsurpassed images.

Russian national features found their original expression in the work of M. Mussorgsky, who created works in various genres: choirs, orchestral pieces, songs, romances, operas.

D. Shostakovich's style of music includes a huge variety of constituent elements from simple song hits to abstract symphonic generalizations, organically soldered by the master's hand. With all the diversity of Shostakovich's work, the leading and most significant theme of exposure of base vices and evil clearly stands out in him.

The musical works of M. Glinka confirmed the rise of national culture. He paid great attention to folklore, in his operas he discovered the world of folk tales, national epics. Glinka made an invaluable contribution to the development of the Russian school of composers. Russian melodies and intonations were skillfully combined in his works with contemporary European composer trends of that time.

The works of these and many other composers glorified our country. Their music is heard all over the world. World classical music is unthinkable without the works of Russian composers. The musical works of Russian classics combine volume, artistic depth, lightness and drama of images, which is why they are loved and recognized by everyone.

The Russian school of painting is considered one of the strongest schools in the world. Paintings by Russian artists are exhibited in the most famous museums and exhibition halls. These are landscapes, portraits, still lifes, canvases on battle, historical and everyday subjects. The paintings of Russian artists are distinguished by the highest craftsmanship, spirituality and patriotism. Every famous artist had his own style.

The canvases of the artist I. Repin are a separate world that tells about experience, pain, joy and compassion. The modern viewer, looking at the paintings of the master, begins to think about sincerity and kindness. “Barge haulers on the Volga”, “They did not wait”, “Cossacks” and many other paintings are the artist’s wonderful heritage.

K. Bryullov's paintings are very popular not only in Russia, but also abroad. Everyone knows the painting "The Death of Pompeii", written after a trip to Rome. The famous works of the master will forever remain the property of the people.

The great Russian artist V. Vasnetsov was called "a true hero." The paintings of the master "Alyonushka", "Bogatyrs", "Ivan Tsarevich on the Gray Wolf" and others are known to everyone.

A. Rublev is a famous icon painter. He left a great legacy in the form of the icons "Trinity", "Annunciation", "Baptism of the Lord".

V. Surikov among his friends was called a "composer" for the construction of the composition and the choice of juicy color. The painting "Morning of the Streltsy Execution" was a triumph. Tretyakov bought it right at the exhibition. Historical masterpieces "The Conquest of Siberia by Yermak", "Suvorov's Crossing the Alps" still captivate the viewer.

V. Serov's artistic talent manifested itself already in childhood. “Girl with Peaches”, “Portrait of Princess Olga”, “Portrait of Emperor Nicholas” and many other works are the legacy of the great portrait painter.

Seascapes made I. Aivazovsky famous. Perhaps these are childhood memories, where contact with the majesty of the water surface became the brightest inspiration. The widely known paintings "The Ninth Wave", "The Black Sea" the artist painted many paintings on biblical themes, which he was very interested in. Painting "Chaos. The Creation of the World" occupies a special place among his works, it was recognized as an outstanding work of art, and this was confirmed by the gold medal of Pope Gregory XVI.

Russian architecture is great. Before the adoption of Christianity in Russia, wooden architecture prevailed, it developed over many centuries, embodying the tastes and preferences of the ancient Russian people. Wood was used not only as a building material, but as a material for art. All houses and fortresses were built in such a way that, if necessary, they could be dismantled and transported to a new place, where they were rebuilt. The uniqueness of architecture lay in the fact that, despite the apparent similarity of buildings, each building was individual. Later they began to use stone. A technological breakthrough was the use of red bricks. For the first time, red brick was used for the construction of St. Basil's Cathedral. The temple impresses with its complex structure and colored tents. Basil's Cathedral is one of the most beautiful churches in the world, rightly considered a symbol of Russia.

Speaking of Russian culture, one cannot fail to mention the great Russian language, one of the most widely spoken in the world. Likhachev Dmitry Sergeevich wrote: “One of the most important manifestations of culture is language. Language is not just a means of communication, but above all a creator. Not only culture, but the whole world has its origin in the Word.” The richness of the language determines the richness of the cultural consciousness of the world. The Russian language is unusually rich. Accordingly, the world that Russian culture has created is also rich. The richness of the Russian language is due to the fact that it was created on a vast territory, diverse in its geographical conditions, natural diversity, variety of contact with other peoples, the presence of a second language – Church Slavonic. Our language has absorbed everything that has been created by folklore and science.

Russia is one of the greatest sports powers. Russian athletes set world records,

the achievements of some exceed the wildest expectations. For many years, Russia has been a leader in figure skating, rhythmic gymnastics, and synchronized swimming. The masterpiece performance of the numbers turns them into works of art, this is already more than a sport.

Russia is a great country with its own cultural heritage. Art forms spiritual values, brings up the understanding of beauty. Mankind has been creating art for centuries and studying it. Art is the greatest spiritual and cultural asset of society, plays a huge role in its development and improvement.

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THE PROBLEM OF REHABILITATION IN PSYCHOSOMATIC PRACTICE

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Abstract. *The article deals with the issues of rehabilitation of psychosomatic disorders related to the border area of medicine and clinical psychology. Psychosomatic disorder, as an object of study, is one of the most controversial categories, both in medicine and in psychology. Being in an interdisciplinary discourse, at the intersection of psychology and medicine, psychosomatics suggests that the issues of treatment and rehabilitation of psychosomatic patients should be addressed in an interdisciplinary field, but standards and protocols for the psychological component of rehabilitation in psychosomatic practice have not yet been developed. There are three main areas of rehabilitation work: restorative, compensatory, adaptive. The lack of a generally accepted understanding of the targets of rehabilitation measures at various stages of the rehabilitation process of psychosomatic patients, the lack of consideration of a broad medical and psychological context, various complexes of etiopathogenetic factors in the development of rehabilitation measures are shown.*

Keywords: *psychological rehabilitation, rehabilitation protocols, targets of rehabilitation work, interdisciplinarity, universality of mental processes, biopsychosocial model*

Modern rehabilitation practice in the field of medicine and psychology is extremely diverse and has a long history. Rehabilitation in medical practice is a long and firmly established area of activity for specialists. A large number of publications are devoted to the rehabilitation of patients after somatic diseases. [1-8] This article discusses the issues of rehabilitation in such a border area of medicine and

clinical psychology as psychosomatics. Psychosomatics initially belonged to an interdisciplinary direction. Deutsch, Weizsacker, Brautigam declared the integrativity of psychosomatics as a direction in medicine. E. S. Slyusareva, E. V. Evmenenko and E. L. Tinkova [9], as well as many other scientists, speak of psychosomatics as an interdisciplinary direction, including a large number of branches of scientific knowledge. So the treatment of diseases belongs to the field of medicine, the study of the relationship between emotions and psychophysiological processes is studied within the framework of physiology, the study of the patient's attitude to his illness, as well as the peculiarity of his behavior associated with the disease - in the context of clinical psychology, the psychotherapeutic direction is engaged in identifying strategies and methods for changing behavioral and emotional patterns that are devastating to human health, social disciplines study the correlation of socio-economic living conditions and cultural characteristics with the prevalence of psychosomatic diseases. Despite the fact that psychosomatics was originally one of the main sections of clinical psychology, psychosomatic disorder, as an object of its study, is one of the most controversial categories in both medicine and psychology.

Having originated as "a medically unexplained disease, in the center of which is the shift of a mental conflict into a somatic one" [10], the content of this construct over the past decades has been transformed into a pathology of the functions of organs and body systems, where psychogenic factors in etiology play a leading role [11].

Being in an interdisciplinary discourse, at the intersection of psychology and medicine, psychosomatics suggests that the issues of treatment and rehabilitation of psychosomatic patients should also be addressed in an interdisciplinary field. From the point of view of purely medical practice, the rehabilitation process is well studied and worked out, various methods are used: massage, physiotherapy, kinesiotherapy, physiotherapy exercises, psychotherapy, manual therapy, orthopedics, speech therapy. At the same time, the psychological aspects of the rehabilitation of patients remain insufficiently studied. Even the psychology of rehabilitation recognized in a number of countries (rehabilitation psychology) and given the status of an independent discipline, its theoretical foundations require further analysis [12,13].

Despite all the variety of approaches to rehabilitation, there is a social demand for better and more efficient provision of the recovery process after illnesses. This is especially true in the current situation of the coronavirus pandemic. And here, in our opinion, the resource is in the sphere of the mental. And although all specialists recognize the need to work with psychological factors in the recovery process, and this has already become a commonplace among somatic professionals, standards and protocols for the psychological component of rehabilitation in psychosomatic

practice have not yet been developed. Mental health specialists appeal to the necessity of an individual approach in such matters and the impossibility of "one size fits all". Of course, the individualization of psychological assistance in rehabilitation is an undeniable and proven approach, but, nevertheless, we believe that the time has come to talk about the need to develop protocols for the psychological rehabilitation of psychosomatic patients. Such a position is possible due to the universality of certain mental processes that take place in any psychosomatic disease [14]. Theorists of the psychosomatic approach in clinical psychology have identified the main features and patterns of development of mental and psychological processes in patients with a psychosomatic profile [15]. Based on these universal patterns of mental activity of patients, manifested in psychosomatic pathology, we can identify universal invariants that are mandatory systemic features that allow us to classify the disease as psychosomatic - on the one hand, and allow us to make them "targets" for exposure in the process of complex rehabilitation on the other.

Comprehensive rehabilitation as the only true and effective approach to the process of recovery of psychosomatic patients is confirmed by the practice of rehabilitation of somatic nosologies by both domestic and foreign specialists. So, in particular, a biopsychosocial, holistic or holistic approach is the main one in the rehabilitation of patients with neuropsychiatric disorders abroad. [16] The main components of the holistic approach include: a therapeutic environment, well-coordinated work of an interdisciplinary team, a combination of psychotherapeutic, psychosocial and drug effects, a combination of individual and group treatment, diagnostics of the preservation of functions and identification of impaired functions, targeted rehabilitation, work with families [17, 18]. If we pay attention to rehabilitation in a related field - psychiatry, we will also see the complexity in the work of specialists. So with psychiatric patients, three main areas of rehabilitation work are distinguished: restorative, compensatory, and adaptive. The restorative direction of rehabilitation is associated with a change in the individual functioning of the patient by improving cognitive functions (improving neuropsychological and cognitive functions, stimulating understanding of the socio-emotional context of situations), self-learning skills and competencies, providing a positive learning experience and opportunities for intrinsic motivation. The compensatory direction is the development of alternative methods for setting and implementing the goals of the tasks of everyday life. The adaptive direction consists in working with the patient's environment and changing it to suit his individual goals [19].

Domestic researchers analyzed the use of the biopsychosocial model of rehabilitation of patients with cerebrovascular diseases in foreign and Russian practice. They showed that today there is no generally accepted idea of the targets of rehabilitation measures at various stages of the rehabilitation process, and the broad medical and psychological context, a different set of etiopathogenetic fac-

tors in the development of rehabilitation measures are also not fully taken into account [20]. In our opinion, this situation is caused by an implicit confrontation between specialists in somatic practice and specialists in psychological profile. The psychosomatic approach, as a holistic direction in medicine, struggled to make its way initially, back in the 20th century. Even despite the fact that modern medicine conceptually recognizes and agrees that one of the leading factors in the polyetiogenesis of such diseases is problems in the psychological sphere, in the practical field this hidden confrontation manifests itself in the absence of coordinated and effective work of specialists in psychological and medical profiles. At best, they do not interfere with each other, recognizing a shared responsibility for the result of treatment and rehabilitation in case of psychosomatic pathology.

Although the issues of rehabilitation have been worked out by various specialists quite widely, the studies carried out and the proposed rehabilitation measures are based, as a rule, on individual psychological parameters. Instrumental methods that are used both in diagnostics and rehabilitation predominate, and these methods often do not meet the criterion of inclusion in the research complex. From a methodological point of view, in almost all works on the topic of rehabilitation, there is a tendency to conceptualize the biopsychosocial model by enriching the biomedical model, traditional for medicine, with socio-psychological factors, which, according to researchers, are the most significant. Many domestic and foreign researchers are developing new methods for diagnosing the functional state of individual organs, physiological systems of the body, etc., however, the number of studies that comprehensively and generally assess human health is very small. Most of the published works were performed on small samples, respondents of a certain age, or use a limited composition of the characteristics of the human body, which does not allow them to be considered universal, complex and integrative [20].

It should be noted that, despite the vast array of publications on complex rehabilitation, there is fragmentation in the work of specialists or, at best, eclecticism, all etiological factors are not taken into account when developing rehabilitation measures for patients of various age and professional groups at different stages of recovery.

The topic of rehabilitation affects the interests of various specialists, in connection with this, today there is no generally accepted idea in many of its aspects. Both the very definition of rehabilitation, its content, tasks, terminology, and the criteria for assessing its quality and effectiveness are debatable. With a more careful approach to this issue, attention is drawn to the fragmentation and lack of coherence of ideas about the rehabilitation of patients. [21-25] That is, we can say that interdisciplinarity as an advantage of the psychosomatic approach is at the same time its main vulnerability.

The problematic aspects of the rehabilitation of patients with a general somatic profile, which were mentioned above, fully relate to the psychosomatic direction. The issue of rehabilitation of psychosomatic patients is more likely to be reduced to recommendations of a general plan - a healthy lifestyle and, at best, advice to turn to psychotherapy, while this category of patients is most susceptible to relapses. These relapses just indicate that the transfer of a serious condition during an exacerbation through medical intervention into a sluggish, chronic one is essentially not a treatment, but a delay, a prolongation of psychosomatic pathology for an indefinite period, but in fact for the rest of the life of such a patient. The presence of a huge number of such chronic patients, both in our country and abroad, indicates the absence of a systematic approach to curing this type of pathology and subsequent rehabilitation.

Thus, the most important task of psychological rehabilitation in psychosomatic practice is to overcome the gap between theory and practice, in which theoretically sound models are often not in demand in the practical field of work of specialists, while real help is provided spontaneously and intuitively. To solve this systemic problem, serious methodological and empirical studies are needed to create a working model for the rehabilitation of psychosomatic pathology. The demand for such a model is obvious, both for specialists and for the patients themselves. In this case, it will be possible to talk about the creation of protocols for the psychological component of rehabilitation in psychosomatic practice.

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OSTEOARTHRITIS OF THE TEMPOROMANDIBULAR JOINT

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Abstract. *In this article reviewed complex treatment of the patients with osteoarthritis of temporomandibular joint were applied preparation struktum. After the treatment, the patients show an enhancement in the opening of the mouth and the movement of the lower jaw, and the functions of chewing and speaking were also normalized. Application of struktum in complex treatment brought regulation of intraarticular metabolic processes and quick recovery of the patients.*

Keywords: *temporomandibular joint, osteoarthritis, struktum*

Currently, the diagnosis, treatment of diseases and injuries of the temporomandibular joint are the main urgent problem of dentistry and maxillofacial surgery. To properly assess the pathologies of the temporomandibular joint, it is naturally advisable to determine the leading mechanisms of the pathogenesis of these diseases. Along with diagnostics, the process of complex treatment of the temporomandibular joint is also extremely difficult.[1]

Osteoarthritis of the temporomandibular joint is one of the pathologies of the musculoskeletal system that have a complex diagnosis. Osteoarthritis is the most common joint disease. Almost 60% of patients who go to dentists are patients with osteoarthritis of the temporomandibular joint. Therefore, effective treatment of osteoarthritis of the temporomandibular joint is important from a prognostic and social point of view. In this regard, the development of new methods of treatment has great scientific and practical value. [2]

Osteoarthritis of the temporomandibular joint is characterized by a peculiar

clinic, pathogenesis and treatment tactics for all pathologies of the maxillofacial region. The diversity of the clinic and the complexity of the diagnosis of osteoarthritis require an individual approach to this process, gives relevance to the search and development of sound therapeutic methods. [3, 4]

The aim of the study is to improve the results of treatment of patients with osteoarthritis of the temporomandibular joint.

Material and methods

Clinical studies cover the treatment of 60 patients. After studying the traditional clinical and laboratory indicators in the diagnosis of patients, we introduced a package of anamnestic information compiled by us. In addition, local parameters have also been studied. Of the imaging methods, the 7th orthopantomogram program, computed tomography and magnetic resonance imaging were used. Indicators of the active phase of inflammation and pathological serological proteins were studied from biochemical markers. One of the indicators that play an active role in chronic and destructive processes in the joints are lysosomal enzymes of neutrophils and macrophages. Therefore, we studied the dynamics of the activity of the elastase enzyme, which plays an important pathological role in inflammatory and destructive pathologies of the temporomandibular joint. In this regard, we performed enzyme immunoassay in patients to determine the level of polymorphonuclear elastase. The concentration of oxyproline, an amino acid considered to be the main component of collagen, was also determined in the peripheral blood of patients before and after treatment. Audiometry was performed in all patients. From the international rheumatic diagnostic criteria, we used the improvement criteria of the American College of Rheumatology.

Statistical processing of the obtained data was carried out, taking into account modern recommendations. In the complex treatment of patients, the drug structum was used. Structum is a drug that stimulates the regeneration of cartilage tissue. Reduces degenerative processes in the joint tissue. The main components are chondroitin sulfate. The drug was prescribed 500 mg / 1 capsule 2 times a day, for a month during the reception of food. During the complex treatment, contraindications and side effects of the drug were taken into account.

Conclusions

The results of complex treatment have shown the clinical value and effectiveness of the drug structum. We have developed the main aspects of the features of pathogenetic treatment. All patients after complex treatment showed an improvement in the opening of the mouth and movement of the lower jaw. The function of chewing and speaking has normalized. Palpation of periarticular tissues was painless. Signs of crepitation were not observed in 85% of patients. Positive dynamics was also observed in the laboratory parameters. All these indicators regulated the

normal condition of the temporomandibular joint and led to a rapid recovery of patients.

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SOCIAL FACTORS AND THEIR INFLUENCE ON THE PATHOLOGICAL PROCESSES OF INFECTIONS ASSOCIATED WITH THE PROVISION OF MEDICAL CARE

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Abstract. *Currently, infections associated with the provision of medical care are of great importance in the context of infectious diseases. The spread of nosocomial diseases is associated with the direct influence of social factors on the introduction of infection into the body and the further development of the pathological process. In the modern world, the degree of influence of social factors on infectious diseases, including infections associated with the provision of medical care, is quite high, which gives reason to study in more detail the pathological processes of the most common HAI in the Russian Federation. Infections that are the main cause of the development of the pathological process in patients of medical institutions of the Russian Federation have been identified. Based on the analysis of domestic and foreign scientific literature, social factors were proposed that have a direct impact on the course of HAI pathological processes, such as smoking, alcohol consumption, malnutrition, and poor living conditions. The conclusion is substantiated that the above social factors influence the pathological processes of infections, for example, that smoking on an ongoing basis leads to morphological changes in the epithelium of the bronchial mucosa, an inflammatory process develops in the respiratory tract with further involvement of cellular immunity.*

Keywords: *pathological process, infectious diseases, infections associated with the provision of medical care; infectious process*

Introduction

The pathological process is a natural development of changes caused in the body under the influence of pathogenic factors. These events include damage to organs and tissues, followed by their dysfunction, accompanied by adaptive responses. The unique combination of these two processes determines the form of the disease and its development.

Pathological process is a more general category than "disease". The same pathological process, such as thrombosis, hemolysis or edema, can contribute to the pathogenesis of various diseases. Some of the complex pathological processes that contribute to the pathogenesis of many diseases are called typical. Typical pathological processes include inflammation, allergy, hypoxia, tumor growth, fever, and infection [6].

For example, infectious diseases are the third most prevalent worldwide after diseases of the cardiovascular system and tumors. According to the dynamics of infectious diseases in the Russian Federation for 2020, there is an overall decrease in the incidence of various types of infectious diseases compared to the same period in 2019. There are also some exceptions to the general picture, including an increase in the number of cases of community-acquired pneumonia, rabies, acute upper respiratory tract infections and tularemia [4].

In the context of this article, it is of interest to study the pathological processes of a different spectrum of healthcare-associated infections (hereinafter - HAI), since this group of diseases includes all types of infections, including urinary tract infections, which is more often observed in high-income countries, postoperative infections are more common in countries with low economic levels [15], infections of the gastrointestinal tract, bloodstream and respiratory tract. The situation is exacerbated by the emergence of antimicrobial-resistant microorganisms, which contribute to the spread and increase in severity of HAI. Health care facilities facing this type of infection face significant challenges in patient care, cost burdens, and possible impact on the image and reputation of the health care facility.

Along with the pathology of the development of infectious diseases, the question of analyzing the influence of social factors on the course of the pathological process of HAI remains unexplored. One cannot but agree with the opinion of doctor of medical sciences, Professor I.I. Elkin regarding the fact that "social factors can be the cause of the widest spread of infectious diseases and at the same time can be the driving force by which their complete destruction is achieved."

Purpose of the study: to identify social factors that can influence the pathological process of infections associated with the provision of medical care in the Russian Federation.

Materials and methods of research: in the course of writing the article were used: analytical, comparative and systematic research methods. The data of various articles of scientific journals included in the list of VAK, scientific works of domestic and foreign authors were also analyzed.

Research results

After analyzing the literature, we can say that social factors affect not only any particular link in the pathological process, but also have an important effect on the functionality of the organism as a whole and its ability to respond to various

stimuli that are in the environment.

The ability of an organism to adequately respond to a change in the environment and change its vital activity is called reactivity, which is an important concept for understanding the pathological process and the factors that can influence it.

According to the statistical report on the incidence of healthcare-associated infections, the main group of infectious agents HAI was identified in the Russian Federation. Thus, the etiological structure of microorganisms in the country that cause infections of the lower respiratory tract is represented mainly by Klebsiella, accounting for 26.5% and Acinetobacter - 19.4%, respectively. Among catheter-associated infections, E. coli (39.0%) and enterococci (22.0%) are representatives. Among infections mediated by surgery, Staphylococcus aureus predominates - 47.2%, epidermal staphylococcus is in second place - 25.7%, and Escherichia coli is in third place - 8.2% [1].

In the context of determining the social factors influencing the pathological processes of infections, a group of researchers represented by I.V. Vasilenko, O.E. Borovkova believe that such factors include: the level of sanitary culture (poor hygienic conditions), the nature and working conditions of medical personnel, migration processes of the population, and the state of healthcare in general [2]. In our opinion, these factors directly affect the occurrence and spread of the pathology of infectious diseases, but the degree of their influence on the course of the pathological process caused by HAI requires further study.

Based on the experience of foreign [11, 16] and domestic researchers [5], the author proposed the following social factors that directly affect the course of pathological processes of infections, with the provision of medical care: smoking, alcohol consumption, malnutrition, poor living conditions.

1. Tobacco smoking. It is the main risk factor for the development of various diseases of the lungs and respiratory tract [8; 12; thirteen]. In the Russian Federation, according to Rosstat, about 22.5% of the citizens of the country smoke daily, where the main representatives are the age groups from 40 to 50 years [3]. Tobacco smoking on an ongoing basis leads to morphological changes in the epithelium of the bronchial mucosa, loss of cilia and subsequent hypertrophy of mucous and goblet cells. In the respiratory tract, an inflammatory reaction develops with further activation of macrophages, neutrophils, release of proteases, and the release of cytokines is triggered.

These processes lead to an increase in the sensitivity of the epithelium to infectious agents. It is also known that tobacco smoke components are able to inhibit some of the key functions of the immune response by altering the response of Toll-like receptors, while disrupting the regulation of NF-κB, CD4-lymphocyte proliferation and phagocytosis. In addition, there is evidence that tobacco smoking

inhibits innate anti-pneumococcal defenses, which contributes to pneumococcal infection [10, 13].

The studied pathological processes allow us to assume that the influence of such a social factor as smoking can provoke the development of pathologies of the pulmonary system due to the fact that damage to the airways induced by tobacco use damages the natural barrier, suppressing the body's anti-infective defenses and contributes to a higher risk of complications, due to decrease in the immunological reactivity of the body. This creates the most favorable conditions for the infection and development of HAI and other respiratory diseases.

2. Alcohol. Alcohol consumption is quite common in Russia. Alcohol consumption has been shown to impair upper airway ciliary function, impair the function of 150 immune cells (i.e., alveolar macrophages and neutrophils), and weaken the barrier function of the epithelium in the lower airways. There are also data on the effect of alcohol on the mucosal immunity of the respiratory tract [6]. This disorder can lead to sepsis and pneumonia, contributing to an increase in the frequency and degree of postoperative complications, including delayed wound closure [16].

There are several major causes and mechanisms by which alcohol abuse increases the risk of nosocomial pneumonia, which can be grouped into three general categories:

1) colonization of the oropharynx by pathogenic bacteria;

2) an increased frequency of aspiration as a result of a depressed level of consciousness and a decrease in the pressure and cough reflexes;

3) violation of the integrity of the host's immune system.

The effect of alcohol on the digestive system is also strong. By inhibiting the activity of the pancreas, alcohol has an irritating effect on the stomach, lowers the concentration of insulin in the blood, increasing the content of sugar in it, increases the acidity of gastric juice [7], which, in turn, leads to an increased risk of developing infectious processes such as mucosal inflammation the lining of the stomach (gastritis) under the influence of streptococcus, Escherichia coli, etc. In addition, the fact of drinking alcohol can affect the general reactivity of a person, thereby making him more susceptible to the influence of infectious agents and aggravate the course of HAI, which is directly related to a decrease in immunity.

3. Improper nutrition is a serious problem of our time, where the fast pace of life contributes to the disruption of digestion. Depending on the caloric content of the diet, the fat volume of the tissue changes in response to undernutrition or overeating. These changes affect the secretion of hormones and cytokines from adipose tissue (adipocytokines). Many of these adipocytokines are involved in immune signaling, may influence immune cell biology, and alter the immune response. Like any other physiological system, the development of the immune system is

affected by nutritional status. One important example of this is thymic atrophy and the increase in thymocyte apoptosis that occurs during early childhood malnutrition. In addition, medical studies, for example [14], have shown dysfunction of both innate and adaptive immunity during malnutrition. This explains the increased susceptibility to many types of infections in malnourished people, such as influenza, tuberculosis, streptococcal pneumonia, and gastrointestinal infections.

Obesity can be the result of malnutrition. Obese people have an increased risk of developing complications such as sepsis, pneumonia, and bacteremia after surgical procedures; they are more prone to infection with Helicobacter pylori. In addition, obesity is associated with a lower antibody response to vaccinations, including influenza, hepatitis B, and tetanus.

In the case of malnutrition, the disruption of protective immunity is due to a disruption in leptin metabolism, which is critical for stimulating immune cell proliferation and function. One possible explanation is that the systemic metabolic environment in obesity promotes cellular metabolism in immune cells that maintains short-lived effector cells while generating long-term memory cells. As a result, the interaction of these factors initiates a decrease in the overall immunological reactivity and an increase in the body's vulnerability to HAI, including.

4. Bad living conditions. Unsatisfactory living conditions of the patient is one of the most important social factors that affects the pathological processes of infectious diseases, many scientists in their research G.Zh. Tokmurzieva, E.S. Uteuliyev, et al point to the direct impact of housing conditions on human health [9]. The presence of sources of air pollution, lack of space per person in families, poor ventilation, etc. are not only the cause of the spread of infections, but also, as a result of the constant influence of negative environmental factors, deplete the reserve of immunological reactivity.

In this case, we can draw an analogy with smoking and highlight factors such as polluted air, poor ventilation and high humidity in the room, which, in turn, affecting not only the change in the physiological state of the respiratory system, contribute to the spread and reproduction of many microorganisms, while creating the most comfortable conditions for them.

At the heart of HAI pathologies, there is a decrease in immunity and body resistance due to a deterioration in thermoregulation, disruption in the cardiovascular system, which are manifested by changes in blood flow, as well as metabolic disorders. When the above factors affect the body, the chance of HAI infection increases, since the entrance gates of infection are not only the organs of the respiratory and digestive systems, mucous membranes, but also the skin due to the fact that when exposed to the above conditions, the normal pH of the skin changes, and also increases the risk of inflammatory processes, which provide quick access to the bloodstream and, as a result, contribute to an increase in the spread of infection

through organs and systems.

Thus, the influence of the above social factors contributes to a decrease in immunological reactivity, which implies a complicated course of the disease due to the low activity of cellular immunity.

Conclusion

Social factors are of great importance during the pathological process of various infectious conditions. The influence of social factors such as smoking, alcohol consumption, malnutrition, as well as poor living conditions can lead to negative consequences for the course of HAI. Based on the analysis, it can be judged that these factors affect the physiological resistance of the body. Violation of the function of the body's defense systems, induced by these social factors, contributes to a more severe course of the disease. Understanding the mechanisms of the influence of social factors on human health allows us to build a more profitable treatment strategy and avoid complications of the HAI pathological process.

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IMPROVING THE TREATMENT OF PERIODONTAL DISEASES IN PROFESSIONAL ATHLETES

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Abstract. *340 athletes were examined. The athletes were divided into 2 treatment groups of 20 patients in each group. Patients of the second group, in addition to traditional therapy, received applications to the gum with propolis for 10 days. In 16–19 – year- old athletes, sextants with a bleeding rate of 1.40±0.11 are most often detected, that is, gingivitis occurs, while periodontitis of the most severe severity was diagnosed in professional boxers aged 26–32 years, which indicated an insufficient level of periodontal care. At the final stage of clinical trials, the gingivitis index in the main observation group decreased to the minimum value for all groups and terms – 0.63±0.027 points. Whereas, in the control group, the data obtained indicated the development of an inflammatory process of moderate severity – 1.45±0.024 points ($p<0.001$). In patients of the main observation group, the papillary bleeding index was determined at 0.55±0.030 points, versus 1.63±0.021 points, values in the control group ($p<0.001$). A drug based on propolis, due to the absence of allergic reactions and high efficiency, can be recommended in the complex anti-inflammatory therapy of periodontal diseases in professional athletes.*

Keywords: *athletes, physical activity, periodontitis, treatment*

Correction of the functional state and adaptive capabilities of the body of a professional athlete in the conditions of the development of chronic odontogenic foci of infection should be based on effective therapeutic and preventive technologies and should be aimed at strengthening adaptive capabilities both at the local and systemic levels, and at restoring metabolic reserves of organs and tissues of the oral cavity with the normal functioning of biosystems in it [1]. As for the problem of inflammatory and dystrophic periodontal tissue diseases, the prevalence and intensity of which among the able–bodied population reaches 90–97 %., the development and implementation of effective non – drug treatment and prevention

technologies without side effects is, especially for professional athletes, increasing the reserve and regulatory capabilities of their body in conditions of excessive physical and psycho-emotional stress, an urgent and unresolved problem of modern sports medicine and dentistry [2].

The aim of the study is to identify the frequency of occurrence of major dental diseases among professional athletes and the effectiveness of biologically neutral drugs in their treatment

Methods

340 athletes were examined at the pre–competition stage of the training cycle, having the same regime, but with different orientation and intensity of the training process. At the first stage of the study, professional athletes of the Olympic reserve aged 18–32 years with a sports experience of 9–13 years were clinically examined. At this stage of research, information about injuries to the maxillofacial region of athletes was accumulated and the dental status of athletes was determined. Inflammatory periodontal diseases and their severity were diagnosed on the basis of clinical and radiological studies. The second group consisted of professional athletes who were not involved in the national team, and with a relatively low workload. The subjects were identical in age, gender and level of sportsmanship. All athletes were masters of sports, including international class. At the next stage, the athletes were divided into 2 treatment groups of 20 patients in each group. Patients of all groups initially underwent conservative treatment with training in individual oral hygiene, selection of hygiene products, professional oral hygiene, elimination of supra – and subgingival dental deposits, closed curettage of periodontal pockets with the help of curettes Gracie. Selective grinding of teeth was carried out in the presence of traumatic occlusion. Patients of the first group with chronic generalized periodontitis of mild degree (CGP) were medicamentally treated with irrigation of periodontal pockets with 0.05 %. chlorhexidine solution for 10 days. Patients of the second group, in addition to traditional therapy, received applications to the gums with Asepta Gel (Vertex AO, Russia) with propolis for 10 days. After rinsing the mouth with water, the inflamed areas were isolated and drained, and covered with a layer of gel and so remained for 10–12 minutes, 2 times a day for 10 days. Patients were advised to drink and eat 1 hour after the procedure which was completed.

Results of the study and their discussion

The statistical data obtained indicate a sufficient number of teeth removed for various reasons and a low and insufficient volume and level of dental care provided, especially periodontal care in all examined age groups of professional athletes.

The following table presents the data of clinical and epidemiological studies of the intensity of inflammatory and destructive periodontal diseases and its various nosological forms among the examined professional boxers engaged in high – performance sports.

In the younger age group: in 16–19 – year- old athletes, this indicator was at the level of 1.50±0.11. In the age group of 26–32 years, the lowest indicators were noted for the number of sextants with tartar – 1.45±0.10. As for individual nosological forms of periodontal diseases, according to the obtained indicators, it can be concluded that sextants with a bleeding rate of 1.40±0.11 are most often detected in 16–19 – year-old athletes, that is, gingivitis occurs, while periodontitis of the most severe severity was diagnosed in most cases in the examined professional boxers aged 26–32 years, which indicated an insufficient level of dental, in particular, periodontal care, both in younger and older age groups.

In the course of our clinical and epidemiological studies, statistically verified and age – related indicators of the prevalence of diseases of hard tissues of teeth and the need for their correction in young and adult athletes of the Olympic reserve are presented. So, on average, 32.90 %. of the detected affected teeth in all examined professional boxers need treatment of carious lesions.

When comparing the data obtained by the above element, the maximum values were recorded in the average age group – 6.85 %.. Whereas in the oldest age group of athletes, the indicators were determined within 3.62 %...

The incidence of complications in all examined groups of dental caries that were subject to removal (element "X") most often due to the development of destructive forms of apical periodontitis averaged 7.75 %... The proportion of restored teeth (element "P") among the youngest persons did not exceed an average of 36.04 %.., the minimum in this group were the indicators for the number of removed teeth (element "Y"), which were recorded at 11.28 %... The highest rates for the number of teeth extracted for certain reasons were found in the third group of examined athletes, who made up the oldest age group – 16.72 %... The statistical data obtained indicate the high need of professional boxers representing the interests of the country at major international competitions for timely and highly qualified therapeutic and orthopedic dental care and serious problems in its organization on the ground, especially during the period of intense physical and emotional stress in the pre–competition and post–finish periods of the training cycle

Due to the lack of time for proper rest, balanced nutrition and lack of opportunity to receive timely dental care, it is very urgent to introduce effective means of prevention and treatment of inflammatory periodontal diseases that would show their anti–inflammatory effectiveness in a short time and preserve it for a long time, which is very important from the point of view of improving the quality of life of an active athlete and achieving high sports results. The scheme of treatment of periodontitis developed by us using a complex of traditional methods and a combined adhesive gum balm in the main group containing a relatively high concentration of antiseptic substances and natural antioxidants, according to the results of clinical studies, can be recommended as an additional supportive and

corrective therapy. So, if the gingivitis index (GI) in athletes of the main group at the initial stage of the examination was 1.92±0.052 points, then in the control group it was determined at 1.75±0.043 points, which indicated the development of moderate pathology in periodontal tissues. On the next day of the examination, after the start of the course of basic therapy, the index indicators in patients of the first group significantly decreased and were already 1.31± 0.030 points, which was lower than in the control group – 1.65± 0.040 points at the same time ($p<0.001$). At the final stage of clinical trials, the gingivitis index in the main observation group decreased to the minimum value for all groups and terms – 0.63± 0.027 points. Whereas, in the control group, the data obtained indicated the development of an inflammatory process of moderate severity – 1.45± 0.024 points ($p<0.001$).

According to the HDI index, after probing the gingival sulcus from the palatine surface of the first and third quadrants and on the labial (buccal) surface of the second and fourth quadrants of both jaws, the degree of bleeding of the gingival papillae was determined. The index data was identified for each quadrant, after which the average value was output. The highest degree of bleeding according to this index is characterized by intense bleeding on the tooth or gum during probing. The papillary bleeding index (PBI) in patients of the main group of professional athletes on the first day of the examination was 2.24±0.044 points, and in the control group – 2.32 ±0.036 points.

On the 2nd day of clinical observations and after the start of treatment, the papillary bleeding index in patients of the first group after gel application was 1.73±0.025 points, and in the control group – 2.13± 0.041 points, which was significantly higher than the values of the previous group ($p<0.001$). In subsequent periods of observation and index evaluation of treatment results, a similar dynamics was recorded in the indicators of the studied index, as evidenced by the data recorded after 10 days. During these periods, in patients of the main observation group, the papillary bleeding index PBI was determined at 0.55± 0.030 points, versus 1.63±0.021 points, values in the control group ($p<0.001$).

It is necessary to note the high level of tooth decay in the examined persons with caries, which often, along with injuries, leads to tooth loss and disorders in the entire dental system. Our data have proven its effectiveness in the treatment of inflammatory diseases of periodontal tissues. Thus, the treatment and prevention of possible relapses of periodontal diseases with the use of an effective propolis–based drug increases the effectiveness of conservative basic therapy and may, due to the absence of allergic reactions, be recommended for widespread introduction as an important element of complex periodontal treatment in professional athletes.

Conclusions

The highest rates for the number of extracted teeth were found in the third oldest age group – 16.72 %. of cases. According to certain nosological forms of periodontal diseases in 16–19–year-old athletes, sextants with a bleeding rate of 1.40±0.11 are most often detected, clinical manifestations of severe periodontitis were more often detected in the examined athletes aged 20–25 years.

At all stages of therapeutic and preventive measures, the index indicators in patients of the main group decreased more pronounced than in athletes in the control group – on day 10, the index of papillary bleeding PBI in the main group was 0.55± 0.030 points, versus 1.63±0.021 points, values in the control group.

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THE EFFECTIVENESS OF ENDOVIDEOSURGICAL METHODS FOR THE DIAGNOSIS OF INTRA-ABDOMINAL BLEEDING AFTER ABDOMINAL OPERATIONS

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The effectiveness of endovideosurgical treatment of intra-abdominal bleeding after abdominal operations was compared. The main group (n=85) included patients who underwent endovideosurgery for early postoperative bleeding, and the control group (n=44) included patients who used traditional methods of surgical correction. In 85 patients of the main group, laparoscopic hemostasis was attempted by clipping, suturing, electrocoagulation and joint methods. In the control group, a traditional relaparotomy was performed. Laparoscopy made it possible to avoid relaparotomy in 67 (78.8 %) of 85 patients, as well as to exclude intra-abdominal bleeding in 7 (8.2 %) patients. Indications for relaparotomy were revealed in 11 (12.9 %) observations during diagnostic laparoscopy. The average duration of laparoscopic surgery in the main group (33.1±22.8 min) was significantly reduced compared to the duration of relaparotomy in the control group (72.4±28.4 min). The lethal outcome in the control group was 4.5 % (2/44). No deaths were registered in the main group. The use of laparoscopy in the diagnosis and treatment of postoperative intra-abdominal bleeding does not exclude traditional surgical interventions and should be used if laparoscopic treatment is impossible or ineffective.

Keywords: *postoperative complications, intra – abdominal bleeding, endoscopic treatment, endovideosurgery, laparoscopic hemostasis.*

However, according to the literature, limited liquid derivatives (abscesses, hematomas, bilomas, exudates and transudate cavities) do not have specific ultrasound signs [1]. Therefore, for the differential diagnosis of intra – abdominal fluid accumulation, it is important to perform puncture and relaparoscopy under the control of ultrasound [2].

The nature of the source of intra-abdominal bleeding depends on the type of initial surgical intervention, and in some clinical cases it is not possible to verify the source due to spontaneous cessation of bleeding during repeated surgical interventions [3].

In the postoperative period, intra – abdominal bleeding develops in 0.06-0.28 % of operated patients and accounts for 4.4–29.9 % in the structure of postoperative abdominal complications [4]. Currently, endovideosurgery is widely used for the treatment of postoperative intra-abdominal bleeding. According to a number of authors, laparoscopic intervention is indicated in patients with reduced hemodynamic parameters, and in other clinical cases, urgent relaparotomy is indicated [2].

The aim of the study was to compare the effectiveness of endovideosurgical methods for diagnosing intra-abdominal bleeding after abdominal operations.

Methods

The studies were conducted in 2010–2021 at the clinical bases of the departments of General Surgery of the Azerbaijan State Institute of Advanced Medical Training named after A.Aliyev. The results of retrospective cohort studies of the anamnesis of patients aged 18–87 years who were hospitalized for various operations performed on abdominal organs and who developed gastrointestinal or intra-abdominal bleeding in the postoperative period, as well as prospective data obtained during the study, are presented. The main group included patients with a burdened course in the early postoperative period after abdominal operations, who preferred the active use of endovideosurgery in surgical tactics and treatment of complications (n=85). The control group included patients (n=44) whose primary surgical interventions and the structure of postoperative bleeding were similar to the main group, but used traditional open surgical methods of correction.

The average age in the main group of patients was 54.1±8.5 years, in the control group – 51.9±6.7 years ($p<0.05$). The total average age of patients included in the study groups was 52.6±8.2 years. The ratio of men and women was approximately 2:3. The traditional examination of patients was carried out according to a generally accepted scheme using traditional laboratory and instrumental diagnostic methods, including endoscopic, X – ray and ultrasound examinations.

The presence of clinical signs of intra-abdominal bleeding in 85 patients in the postoperative period was indicated for laparoscopy. Laparoscopic hemostasis was attempted in all observations by clipping, suturing, electrocoagulation and joint methods.

Results

Therapeutic and diagnostic endosurgical interventions were performed for intra – abdominal bleeding after both traditional laparotomy and minimally invasive interventions. Although the main clinical manifestations of postoperative intra-abdominal bleeding occur in the form of hemodynamic disorders with a decrease

in blood pressure, in some patients there is not a clinically significant drop in blood pressure, but bleeding from the drainage tube into the abdominal cavity, pallor of the skin and mucous membranes, dry mouth. Weakness manifests itself in the form of non – localized abdominal pain. Some observations also revealed positive peritoneal symptoms. Laboratory tests were not always informative, as some patients had a decrease in the number of red blood cells, while others did not have full – fledged anemia due to low bleeding intensity.

In the main group, the state of the hemostasis system was studied in all patients with postoperative bleeding. On the basis of the coagulogram, the state of the total coagulation activity of the blood was assessed, the amount of fibrinogen in the plasma was determined. Great importance was attached to the study of the composition of erythrocytes in dynamics. In addition to clinical and laboratory signs of intra – abdominal bleeding, the presence of signs of fluid accumulation in the abdominal cavity on ultrasound, as well as the removal of more than 200 ml of blood from the drainage tube stored in the abdominal cavity for 2 hours after surgery was considered the main indication for laparoscopy.

Therapeutic laparoscopy or relaparoscopy was used for hemostasis in 85 patients with a clinical picture of postoperative intra-abdominal bleeding. Relaporotomy was performed in all 44 cases in the control group.

In the main group, repeated therapeutic and diagnostic endosurgical interventions were performed for both post-laparotomic and post – invasive complications. The types of primary operations and their number in the main group were as follows: laparoscopic cholecystectomy in 23 of 85 patients (27.1 %), minilaparotomic cholecystectomy in 5 (5.9 %), traditional cholecystectomy in 18 (21.1 %), left hemihepatectomy in 4 (4.7 %), diagnostic laparoscopy in 5 (21.1 %), diagnostic laparoscopy with puncture liver biopsy in 5 (21.1 %), ulcer surgery duodenal surgery for the disease was performed in 8 (9.4 %), splenectomy in 1 (1.2 %), hernia removal surgery in 1 (1.2 %), gynecological surgery in 15 (17.6 %). In the control group, laparoscopic cholecystectomy was performed in 4 out of 44 patients (9.1 %), minilaparotomic split cholecystectomy in 6 (13.6 %), traditional cholecystectomy in 11 (25.0 %), left – sided hemihepatectomy in 1 (2.3 %), duodenal ulcerative surgery was performed in 14 (31.8 %), hernia removal surgery in 2 (4.5 %), gynecological surgery in 6 (13.6 %).

We did not use additional screening methods in cases with clinically significant symptoms of intra-abdominal bleeding and performed laparoscopic intervention in the absence of contraindications. Ultrasound examination was performed in patients with suspicious clinical and laboratory data, in which free fluid was found in one or more abdominal cavity sections.

Complications with bleeding were excluded in 7 (8.2 %) of 85 patients, despite a decrease in blood pressure and hemoglobin levels.

Laparoscopic intervention in 23.1 % (18/78) of cases in the first hours of the postoperative period, 46.2 % (36/78) of cases on the first day of the postoperative period, 21.8 % (17/78) of cases on the second, 3.8 % (3/78) on the third day, 2.6 % (2/78) on the fifth and 2.6 % (2/78) on the sixth day.

The volume of blood found in the abdominal cavity, including clots, ranged from 30 ml to 2000 ml. Symptoms of ongoing bleeding (predominance of a large amount of liquid blood with a small amount of clot) in 49 (62.8 %) of 78 patients, as well as signs of stopped bleeding (presence of a large number of blood clots with a small amount of liquid blood in 29 (37.2 %)). Hemostasis from 78 clinical cases in 38 (48.7 %) – electrocoagulation, 17 (21.8 %) – clipping, 14 (17.9 %) – suturing, 9 (11.5 %) – mini – laparotomy incision performed with a tampon.

The sources of persistent intra-abdominal bleeding from 49 patients with a gallbladder bed were 7 (14.3 %), bleeding from clipped cystic arteries in 5 (10.2 %) and vessels in the projection of the hepatic-duodenal ligament in 7 (14,3 %), 8 (16,3 %) postoperative ulcers of the anterior abdominal wall, 5 (10.2 %) liver tissue, 3 (6.1 %) ovaries, 6 (12.2 %) uterine muscles, thick veins, 2 (4.1 %) large fatty vessels, 2 (4.1 %) abscess cavity, 1 (2.0 %) splenic veins, 2 (4.1 %) strained peritoneal hematomas and 2 (4.1 %) small intestinal hematomas.

In 29 patients with bleeding arrest, the source of bleeding was detected in 41.4 % (12/29) of cases of gallbladder bed, in 13.8 % (4/29) of cases of liver tissue damage, in 17.2 % (5/29) of ovarian cases. insufficiency, 6.9 large (2/29) cases of large fatty vessels, 3.4 % (1/29) cases of abscess cavity, 6.9 % (2/29) cases of peritoneal hematoma and 10.3 % (3/29) cases of small intestine disease formed hematoma.

After determining the feasibility of therapeutic laparoscopy, blood and blood clots were evacuated from the abdominal cavity, the abdominal cavity was washed and sanitized, and an adequate field of vision was provided for surgical intervention.

During the study, laparoscopy in patients with postoperative intra-abdominal bleeding was recommended: 1) intra – abdominal bleeding in hemodynamically stable patients; 2) questionable clinical and laboratory signs of intra-abdominal bleeding, despite confirmation of the presence of free fluid in the abdominal cavity during ultrasound;

Contraindications to laparoscopy are: 1) patients in critical, terminal condition; 2) maintenance of hemodynamic instability in patients with intensive preoperative preparation.

Intensive blood drainage, a rapid decrease in hemodynamic parameters, a sharp decrease in hematocrit and circulating blood volume are considered indications for emergency relaparotomy, since endosurgical identification of the source of bleeding and stopping bleeding is accompanied by a great loss of time.

The transition from laparoscopy to relaparotomy in patients with postoperative intra-abdominal bleeding included: 1) the inability to identify the source of bleeding; 2) the ineffectiveness of endosurgical hemostasis; 3) the occurrence of complications that cannot be eliminated by minimally invasive correction during laparoscopy.

According to the results of the diagnostic stage of laparoscopic intervention, bleeding complications were excluded in 7 (8.2 %) of 85 cases, relaparotomy was recommended in 11 (12.9 %), of which 5 (5.9 %) did not master the operation. the method coincided with the period when we used laparoscopy only for diagnostic purposes.

In 11 (14.1 %) of 78 patients operated in the main group, the indications for relaparotomy were as follows: 2.6 % (2/78) of patients with continued bleeding in the gallbladder bed due to the impossibility of hemostasis, 5.1 % (4/78)) extensive pronounced hematoma (diseases of the peritoneum and small intestine) 3.8 % (3/78) of patients with a large defect of the muscular layer of the uterus after conservative myomectomy and requiring careful examination and suturing, 2.6 % (2/78) massive arterial bleeding in a patient after splenectomy and the impossibility of its endosurgical stop.

After determining the feasibility of therapeutic laparoscopy, blood and blood clots were first evacuated to create an adequate field of vision in the intervention area. Bleeding from the gallbladder bed was observed in 24 (30.8 %) of 78 patients. In 14 of them (58.3 %), hemostasis was performed by electrocoagulation, in 3 (12.5 %) – by tamponade of a minilaparotomic incision, in 5 (20.8 %) – by clipping. Due to the ineffectiveness of endoscopic hemostasis, conversion to relaparotomy was performed in 8.3 % (2/24) of cases. In 11.5 % (9/78) of patients with bleeding from vessels in the projection of the hepatic–duodenal ligament, clipping of bleeding vessels was performed. In all cases, the bleeding was stopped, there were no relapses, and relaparotomy was not performed.

Bleeding from abdominal wall ulcers was observed in 11.5 % (9/78) of cases. To stop bleeding, 6 out of 9 patients (66.7 %) had additional hemostatic sutures, and in 2 (22.2 %) clinical cases electrocoagulation was performed, of which 1 (11.1 %) had additional clipping.

Hemorrhage from liver tissue was detected in 11.5 % (9/78) of cases. In 55.6 % (5/9) of cases, bleeding after puncture biopsy was stopped by electrocoagulation, and in 22.2 % (2/9), bleeding (after left – sided hemihepatectomy) was stopped by suturing. After one left – sided hemihepatectomy and one puncture liver biopsy on the background of cirrhosis, conversion to relaparotomy was performed in 2 (22.2 %) clinical cases due to the ineffectiveness of hemostasis.

Electrocoagulation of bleeding sites was performed in 10.3 % (8/78) of patients with ovarian bleeding, hemostatic measures were effective in all cases.

Bleeding from the vessels of the muscular layer of the uterus was detected in 8.9 % (7/78) of cases, while electrocoagulation and suturing were effective in both cases 28.6 % (2/7). In 42.9 % (3/7) of cases, a relaparotomy was recommended due to a large defect in the muscular layer of the uterus.

Bleeding from the vessels of the large omentum was detected in 7.7 % (6/78) of cases. Bleeding was stopped in 33.3 % (2/6) of cases by coagulation and (2/6) clipping, in 16.7 % (1/6) by suturing and (1/6) by tamponade from a minilaparotomy incision.

Bleeding from the abscess cavity occurred in 5.1 % (4/78) of cases. In 50 % (2/4) of patients, the abscess cavity was thoroughly sanitized and examined, the bleeding sites were coagulated, the cavity was drained. In 25 % (1/4) of the observations, tamponade of the abscess cavity from a minilaparotomy incision was performed, and in 25 % (1/4) relaparotomy was performed due to the inefficiency of hemostasis.

Currently, for the diagnosis of intra-abdominal bleeding (IBD) modern high – tech diagnostic techniques are increasingly being used – ultrasound, CT and endovideosurgical technologies that allow not only to establish the cause and source of IBD, but also at the same time without operative access, that is, with minimal trauma for patients, to perform therapeutic manipulations, and when severe injuries and profuse IBD are detected, to set indications for laparotomy. Laparoscopy is a universal and highly informative method of instrumental diagnosis of early postoperative intra – abdominal complications. The possibilities of this method are comparable to those of relaparotomy, which allows it to be used for various complications.

Laparoscopic treatment of postoperative intraperitoneal bleeding is possible with non-intensive bleeding and the condition of adequate sanitation of the abdominal cavity. For the purpose of hemostasis, various means are used (ligation, electrocoagulation, the use of hemostatic sponges and adhesive substances, tamponing).

The use of laparoscopy allowed us to avoid relaparotomy in 67 (78.8 %) of 85 patients, as well as to exclude intra-abdominal bleeding in 7 (8.2 %) patients. Francesco Corcione et al. 160 laparoscopic surgeries performed for early complications after endosurgical or endoscopic procedures were reported. Indications for relaparotomy were detected in 12.9 % (11/85) of our observations. The average duration of laparoscopic surgery in the main group (33.1±22.8 min) was significantly reduced compared to the duration of relaparotomy in the control group (72.4±28.4 min). The lethal outcome in the control group was 4.5 % (2/44). No deaths were registered in the main group.

Thus, a comparative analysis of the results of treatment of patients with postoperative intra-abdominal bleeding revealed that laparoscopic intervention on

the abdominal cavity has a number of advantages over traditional relaparotomy. These include, first of all, the fact that the method is not traumatic, the postoperative period proceeds easily, the pain syndrome disappears early and motor activity is restored. Secondly, the use of laparoscopic treatment leads to a decrease in the frequency of postoperative complications, mortality, as well as a reduction in the length of hospital stay.

It should be noted that the use of laparoscopy in the diagnosis and treatment of postoperative intra-abdominal bleeding does not exclude traditional surgical interventions and should be used if laparoscopic treatment is impossible or ineffective.

Conclusions

1. The use of diagnostic and therapeutic laparoscopy in case of suspected postoperative intra-abdominal bleeding avoids relaparotomy in 81.2 % of cases.

2. The use of laparoscopy for the diagnosis of postoperative intra-abdominal bleeding makes it possible to exclude bleeding in 8.2 % of cases, to justify indications for relaparatomy in 18.8 % of cases.

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ANALYSIS OF THE IMPACT OF IMPLANT PROSTHETICS ON THE IMPLANT AND PERIPHERAL TISSUES ON VARIOUS MODELS

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Abstract. *In 10 different mathematical models, the angles of placement of implants in the bone were taken equal to 90, 17 and 30 degrees, and the level of placement was taken equal to 1 mm and 3 mm (in accordance with the configuration of the jaw bone). The length of the cantilever bar system prepared on implants was 0 mm, 5 mm and 10 mm in different models. The load on the model will actually be equal to the chewing pressure of 100 N (approximately 10.2 kg) when chewing a 1 cm solid food mass. The pressure will be applied from 3 different points. From the anterior section - the center of the lump will fall on the place of contact of the central incisors; in the right posterior region - the center of the food lump will fall on the contact of the 2nd premolar with the 1st molar; from the left posterior region - the center will fall into place in the area of contact of the 2nd premolar with the 1st molar. After 3D analysis, the Von Mises stress values in the implant area and the corresponding color scales were obtained, as well as the maximum and minimum stress values in accordance with the color scale.*

Conclusion. *Based on the analysis and comparison of the obtained values, it was determined that the stress distribution is optimal in some implant models, in some it is small, and in some it is large due to uneven stress values. The study of models based on the method of 3D three-dimensional stress analysis by the finite element method and the results of these studies are reflected in the article.*

Keywords: *implants, finite element stress analysis, bone stress, law jaw.*

Prostheses on implants have a positive effect on many factors, including the quality of life of the patients themselves [1]. The force of chewing when using removable prostheses and prostheses on implants varies from 100 to 1200 N. The force of chewing varies depending on the anatomical features and the state of the bite. An increase in the force of chewing in the distal direction was revealed. Recent research in the scientific literature shows that removable prostheses fixed on 4 implants give the best results [2]. These prostheses are mainly used in patients

with a low level of supporting bone tissue in the distal part and in patients with fixation and stabilization problems [3]. Despite numerous studies proving the high efficiency of dental implantation, at the same time, both initial and later implant losses are reported after their installation [4]. The loss of the implant in a longer period occurs after orthopedic treatment and is often associated with complications of biomechanical etiology.

The aim of our work is to analyze the effect of implant prosthetics on the implant and peripheral tissues on various models, depending on the level of implant placement, the angle of placement, as well as the length of the console on the structure.

Results

In 10 different mathematical models, the angles of placement of implants in the bone were taken equal to 90, 17 and 30 degrees, and the level of placement was taken equal to 1 mm and 3 mm (in accordance with the configuration of the jaw bone). The length of the cantilever bar system prepared on implants was 0 mm, 5 mm and 10 mm in different models. The load on the model will actually be equal to the chewing pressure of 100 N (approximately 10.2 kg) when chewing a 1 cm solid food mass. The pressure will be applied from 3 different points. From the anterior section - the center of the lump will fall on the place of contact of the central incisors; in the right posterior region - the center of the food lump will fall on the contact of the 2nd premolar with the 1st molar; from the left posterior region - the center will fall into place in the area of contact of the 2nd premolar with the 1st molar. After 3D analysis, the Von Mises stress values in the implant area and the corresponding color scales were obtained, as well as the maximum and minimum stress values in accordance with the color scale.

Conclusion

Based on the analysis and comparison of the obtained values, it was determined that the stress distribution is optimal in some implant models, in some it is small, and in some it is large due to uneven stress values. The study of models based on the method of 3D three-dimensional stress analysis by the finite element method and the results of these studies are reflected in the article.

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PORTAL HYPERTENSION AS A LONG-TERM OUTCOME OF UMBILICAL CATHETERIZATION IN NEWBORNS

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Abstract. *Umbilical vein catheterization ranks first among the options for central venous access in newborns in the delivery room and intensive care unit. Access can be used not only for infusion therapy, drug administration, but also for exchange blood transfusion, parenteral nutrition, blood pressure monitoring, and blood sampling for laboratory tests [1]. Thus, the placement of an umbilical catheter is an essential manipulation in the provision of resuscitation care for newborns. However, in some cases it is associated with the development of not only early, but also delayed complications.*

Keywords: *Newborn, umbilical catheterization, portal hypertension, thrombosis, complications.*

Identification of complications associated with the placement and use of central catheters is an important step in the care of newborns. The process of placing an umbilical catheter requires monitoring the state of the liver before the manipulation, if possible, as well as systematic ultrasound or radiological monitoring after the procedure, in order to timely diagnose complications. The terms of standing of the umbilical catheter should be as short as possible [2].

Being an interventional intervention, umbilical catheterization is associated with the risk of developing a number of serious complications: catheter dislocation, extravasation, damage to the liver parenchyma, development of catheter-associated bloodstream infections, and thrombotic complications. The incidence of complications increases significantly in case of a violation of the technique of placing a catheter, as well as with its prolonged stay in the vascular bed [1]. Given

these factors, an objective assessment of the need to provide central venous access in a particular patient plays an important role.

The American Academy of Pediatrics recommends routine detection and analysis of complications in order to minimize the number of the latter [3]. Of particular interest is the presence of signs of extrahepatic portal obstruction in newborns. It is characterized by the presence of a thrombus in the extrahepatic segment of the portal vein with or without involvement of the intrahepatic portal branches [4].

The most common reasons for the development of extrahepatic portal obstruction are factors that lead to damage to the umbilical vein (installation of an umbilical catheter, catheter - associated infections of the bloodstream); factors leading to dysfunction of the hemostasis system (hereditary thrombocytopathy, thrombophilia) and vascular malformations.

Despite the polyetiology of the process, umbilical vein catheterization remains the most common cause. In some cases, there is a combined effect of several factors. For example, the placement of an umbilical catheter in a patient with a deficiency or a qualitative anomaly of anticoagulant factors.

So, in 35% of cases, thrombophilia occurs in patients with extrahepatic portal obstruction. In such cases, not only increases the risk of thrombotic complications, but also significantly worsens the course of the disease. These factors determine the need for additional examination of patients for the presence of hereditary thrombotic disorders [4].

In more than 50% of cases, it is not possible to establish the true cause of extrahepatic portal obstruction [4]. Reduced ability to inhibit thrombin, as well as insufficient activity of fibrinolysis, cause the tendency of newborn children to develop thrombosis. Under physiological conditions, the functioning of hemostasis links is balanced. Whereas with prolonged standing of the umbilical catheter, the risk of thrombotic complications increases. This is due to the traumatic effect of the catheter on the vascular endothelium, as well as the very fact of the presence of a thrombogenic surface [5].

In a study by G.H. Dubbink-Verheij, R. Visser, A.A. Roest et al compared the incidence of thrombosis in the portal vein system in children with and without an umbilical catheter (control group). The results showed that thrombotic complications in children from the control group never occurred. The umbilical vein was obliterated, which was confirmed by a series of ultrasound images. This proves that, despite the peculiarities of the functioning of the hemostatic system in the neonatal period, in the absence of a trigger factor, portal vein thrombosis does not develop [6].

Thrombotic obstruction in the portal vein system is the most common cause of noncirrhotic presinusoidal suprahepatic portal hypertension in children [4].

Portal hypertension (PH) is considered to be a pathological increase in pres-

sure in the portal vein system with a pressure gradient between the portal and inferior vena cava of more than 5 mmHg. According to A. Grama, A. Pirvan, C. Sirbe et al, this pathology occurs at a frequency of 1 per 100000 live births [4].

Portal thrombosis is asymptomatic, but with the formation of portal hypertension and the development of complications, the following symptoms appear: bleeding from esophageal varices, splenomegaly, ascites [5,7].

It should be noted that complications of portal hypertension are practically not found in newborns. They take time to develop, so they are typical for older children [4]. In the neonatal period, it is only possible to detect signs of vascular damage and thrombosis, which over time, if left untreated, will lead to the development of extrahepatic portal obstruction and portal hypertension [7].

The mechanisms of PH development in children are similar to those in adults and are due to an increase in intravascular resistance in the portal vein system, which leads to the formation of shunting blood flow due to porto-caval anastomoses [7].

The study by A. Grama, A. Pirvan, C. Sirbe et al involved 63 children aged 6 months to 18 years with significant signs of extrahepatic portal obstruction. The exclusion group consisted of patients with diagnosed liver cirrhosis, fibrosis, Budd-Chiari syndrome, and malignant neoplasms. Among the presented patients, 61 children had a history of at least one of the risk factors for thrombosis in the neonatal period (97%). An umbilical venous catheter was used in 46 children (73%). 13 children (21%) had only 1 risk factor. Among them, 7 patients had thrombophilia, 4 had an umbilical catheter, and 1 had a history of abdominal surgery [4].

According to a number of studies, the incidence of extrahepatic portal obstruction caused by implantation of an umbilical catheter ranged from 41-73% [7-9].

J.O. Ugwu, C.D. Emegoako, C.A. Ugwunne et al presented a clinical case of bleeding from esophageal varices in a 9-year-old girl with a history of the use of an umbilical catheter in the neonatal period for the purpose of an exchange transfusion operation, followed by the development of extrahepatic portal thrombosis and a symptom complex of portal hypertension [10].

In our clinical practice, we encountered the development of portal hypertension in a 3-year-old patient with a history of evidence of umbilical catheter delivery in the neonatal period.

So, during the ultrasound examination of the abdominal organs, diffuse heterogeneity of the liver structure, an increase in the size of the organ, impoverishment of the vascular pattern, and fibrosis in the projection of the portal zone were revealed. For the purpose of a detailed study of the vascular system of the liver, the patient underwent duplex scanning of the hepatic vessels, as a result of which the presence of signs confirming the presence of portal hypertension syndrome was

established. Upon a detailed study of the anamnesis, it became known that after the birth, an umbilical venous catheter was implanted in the child for the purpose of infusion therapy for a period of 8 days. Other risk factors for the development of portal venous thrombosis during the collection of anamnestic data could not be identified. Examination for violations of hemostasis was not carried out.

Conclusion

Extrahepatic portal thrombosis with the development of portal hypertension is a rather rare complication that occurs in the pediatric population. However, in recent years, the frequency of this pathology is growing rapidly. This may be related to the increased use of umbilical catheters in neonatal practice. In order to reduce the incidence of PH in children, it is important to screen patients with an umbilical catheter, as well as to monitor after its removal, using Doppler ultrasound, in order to detect portal vein thrombosis earlier. This will prevent the development of adverse effects not only in the neonatal period, but also at an older age [11].

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ADAPTATION OF STUDENTS TO NEW CONDITIONS OF LIFE

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Annotation. *The article conducted a study on the adaptation of 2nd year students at the Medical Institute of NEFU. Definitions, terms and types of adaptation are presented, an analysis of the survey is presented.*

The purpose of the work is to find out whether first-year students of the Medical Institute, Faculty of Nursing have adapted to the students.

A survey was conducted among 2nd year students, the results showed successful adaptation of students.

Keywords: *adaptation, maladaptation, types of adaptation, student.*

Student life is a wonderful time for new acquaintances, finding strong friendship for many years, love, the brightest moments of life. At the same time, a very important stage of life, when a person lays the foundation for his future. Adaptation plays a big role in all of this. Adaptation of a student to a new way of life and to study at the university is the most important component of the student's self-development as a person, becoming his personality, a good specialist in the future.

Adaptation is the adaptation of a person to changing conditions of existence, it is the key moment of his life.

Disadaptation is manifested in a feeling of internal discomfort, tension, anxiety, a decrease in self-worth and self-confidence, which blocks a person's ability to successfully interact with the environment and can lead to mental health disorders.

There are 3 main types of adaptation.

Biological adaptation is the adaptation of an organism to adapt to natural conditions.

Physiological is adaptation to changes in the environment. Social adaptation is adaptation to a certain social group.

The philosophical dictionary considers adaptation as the adaptation of one living being to another living being or to the environment. But a person living in changing social conditions must have the ability to adapt to them, since any social environment requires from a person forms of behavior that are adequate to it (work, family, rest), i.e. in addition to biological, a person is capable of social adaptation.

Man is a biosocial being, therefore "adaptation", as a process, is considered both at the biological and at the social levels.

Having studied the scientific literature on the topic "Adaptation of students to study at universities, colleges", I can assume that students who have good self-discipline and when the student has a large social circle successfully pass the adaptation. Also, the adaptation of first-year students is influenced by the help of curators and the entire teaching staff. Curators, carrying out work on adaptation, help to quickly assimilate in a new place, build the foundation for the future development of the student.

The purpose of our study is to find out whether first-year students of the Medical Institute, Faculty of Nursing have adapted to the students. To achieve the goal, we will conduct a survey among first-year students of the Medical Institute, group MI-SPO-SD-21. The relevance of this study lies in the fact that the group we have chosen is a new direction at the NEFU Medical Institute. After that, we will make an analysis based on the results obtained, and we will see how students have adapted to study in the new direction of "Secondary vocational education".

The methodology by which we worked consists of 16 judgments, in relation to which students must express the degree of their agreement. Processing of the results is carried out by converting the numbers into points in accordance with the key and then summing up the points obtained separately for each scale and the methodology as a whole.

27 people took part in the survey. This is 67.5% of the total number of NEFU MI students of the MI-SPO-SD-21 group. Of these, 22 girls and 5 boys. Students studied before entering the institute in general education schools, in gymnasiums.

The survey showed that the majority of students - 24 respondents successfully passed the adaptation. The student feels comfortable in the group, easily finds a common language with classmates, follows the norms and rules adopted in the group. If necessary, he can turn to classmates for help, is able to be active and take the initiative in the group. Classmates also accept and support his views and interests. We believe that this was due to the student's personal qualities as flexibility and resilience, they think realistically, creatively and do not give in to discouragement. Also such qualities as self-discipline, honesty, courage and kindness.

For 3 students, adaptation was difficult. The student keeps aloof, shows restraint in relationships. It is difficult for him to find a common language with classmates, he does not share the norms and rules adopted in the group, he does not meet with understanding and acceptance of his views from classmates, he cannot turn to them for help. Here we can refer to non-communicativeness, because of this, the student cannot immediately establish trusting relationships with classmates, not the ability to work in stressful conditions, self-doubt. Therefore, such people are more often maladjusted.

High indicators on the scale of adaptation to educational activities indicate that the student easily masters academic subjects, successfully and on time completes educational tasks; if necessary, he can ask for help from the teacher, freely expresses his thoughts, can show his individuality and abilities in the classroom.

Low scores on the scale of adaptability to learning activities indicate that the student has difficulty mastering school subjects and completing learning tasks; it is difficult for him to speak in class, to express his thoughts. If necessary, he cannot ask the teacher a question. In many subjects he studies, he needs additional consultations, he cannot show his individuality and abilities in the classroom.

Thus, as a result of the survey, it was revealed that students adapted well to the study group and to learning activities. Having considered the answers to the questions separately, we can conclude that students who have not adapted experience great difficulty in communication, cannot quickly find a common language with their peers. But, after some time, they will be able to adapt to the study group, because from the answers you can see that they are adapted to the learning activities.

Conclusion

One of the important conditions for the successful adaptation of students to study at the institute is the work of the entire teaching staff, curators. Since his further professional career, self-development and his health largely depend on the success of the student's adaptation.

We would like to give some recommendations to help students adapt faster.

- Try to build on and develop strengths.
- Avoid emphasizing your mistakes, but draw conclusions from them.
- Be able to interact with peers.
- Accept the individuality of each person, and learn to find a common language.
- Think with optimism.

Following these recommendations, we hope that students will easily adapt to a new stage of life.

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INFLUENCE OF FUNGICIDES ON EARLY PERIODS OF SOFT WHEAT ONTOGENESIS

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Abstract. *The effects of exposure to degradable fungicides of a new generation: AltSil, Alkasar, Terrasil and Comfort on seedlings of spring soft wheat Serebristaya and Pavlogradka at the early stages of development. It has been shown that fungicides up to several times increase the range of phenotypic variability that occurs in wheat populations treated with seed protectants. Fungicides affected seedlings mainly as inhibitors of the development of morphological traits, reducing the average values of their severity. A rearrangement of ontogenetic correlations between the traits of the root system in the experimental population of the Serebristaya cultivar, caused by the action of AltSil fungicide in a double dose, was revealed. In general, the Serebristaya variety turned out to be more sensitive to the effects of all fungicides in all respects compared to the Pavlogradka variety. Taking into account the higher mutability of the Serebristaya variety, it is recommended to use it to create genetically diverse populations as a material for practical breeding.*

Introduction

The genetic resources of cultivated plants and their wild relatives are one of the basic components that determine the food and environmental security of every sovereign state, including Russia. They have acquired particular relevance and strategic importance at the present stage due to the growth of genetic erosion in cultivated plants. According to the FAO (1998), 75% of the world's genetic diversity of agricultural crops was lost in the XX century [5]. The genetic relationship of varieties in many regions of Russia and in the world entails vulnerability and possible loss of stability of grain production under the influence of negative envi-

ronmental factors [10, 11].

Significant damage to agricultural production is still caused by phytodiseases of grain crops [9]. The conjugate existence of host and parasite and their variability provide the richest material for natural selection. The result of coupled evolution may be the formation of new virulent races. The wide range of populations of phytopathogenic fungi, such as rust, powdery mildew, is due to the high migratory abilities of these parasites [1]. Since 1995, varieties with the LrTr gene that are immune to leaf rust have become widespread in Western Siberia and the Southern Urals, which has led to an acceleration in the evolution of the parasite and a change in the racial composition of leaf rust. In Western Siberia, the shortfall in yield from brown rust in the years of epiphytoties reaches 30% [11].

Thanks to globalization, the best genotypes are distributed at great speed to breeding centers in different regions to be used as donors of valuable traits. At the same time, variability in the regions increases as a result of attracting new genetic material, but the variability of the species as a whole decreases due to the disappearance of the genetic material of local varieties that are withdrawn from the breeding process. This is the reason for the massive damage to crops as a whole (epiphytotics) due to the same type of susceptibility to them of varieties close in genotype [6].

In connection with the intensive race-forming processes in the populations of pathogens of the most harmful diseases that have taken place in recent years in the conditions of Western Siberia, work has been launched to enrich and expand the genetic base for breeding and evaluating the effectiveness of known disease resistance genes [11].

In the breeding process, a special place is occupied by the improvement of economically valuable traits of existing varieties and the development of new ones using induced mutagenesis [7]. The integration of the chemical mutagenesis method with traditional breeding methods enhances and maintains biodiversity, which continues to decline for various reasons at the present time. An increase in biodiversity stimulates selection, prevents epiphytoties and the negative effect of abiotic stressors on cultivated plants [12]. As a result of a broad search for new inducers of variability, mutagenic properties of many fungicides were found that can cause genetic changes in traits in cultivated plants [7, 13–15]. At the same time, preference is given to destructible fungicides introduced instead of indestructible ones, which leads to a decrease in the environmental load. Degradable pesticides are not included in the general ecological cycle, do not accumulate in food, feed chains and biotopes, which meets the requirements of environmental safety [2]. Fungicides are able to enhance the morphogenesis processes occurring in plant populations. As a result of the emergence of forms with new genotypes, a wider range of genetic diversity of the source material for breeding arises, which

forms the basis of artificial selection and ensures success in the implementation of breeding programs.

In order to detect the mutagenic effect of fungicides that can enhance the morphogenesis process in treated wheat populations, the authors studied their effect on the degree of development of seedlings, the variability of morphological traits of wheat, and their relationship at the early stages of ontogenesis [3, 4, 13–15].

Material and methods

The treatment of seeds of soft spring wheat varieties Pavlogradka and Serebristaya was carried out in 2017-19 with fungicides: AltSil (active ingredient - tebuconazole); Alcasar: (active ingredients - difenoconazole + cyproconazole); Comfort: (carbendazim); Terrasil: (tebuconazole). Each of the fungicides was used in two concentrations: at a dose recommended for grain production (n) and at a double dose (2n) to enhance the shaping process and assess the possible damaging effect on the cellular and organismal systems of wheat plants. The test objects were the original varieties without treatment of seeds with protectants. Germination of grains of experimental samples was carried out by the roll method in accordance with the requirements of GOST, 60 seeds per roll, 3-fold repetition. In 2019, 36 variants of the experiment were laid, 10 of them after 18 months after seed treatment. For the first time, the dormant period of the treated seeds in the experiment was one and a half years (expiration of the period of use, i.e., the time of onset of decomposition of fungicides).

Results and discussion

In our previous publications, the development of seedlings after one, six and twelve months of storage of treated seeds was discussed [3, 4, 13-15]. It was shown that the morphological features of seedlings depend on the type of fungicide and the dormancy period of treated seeds.

It was found that the fungicides used in our experiment at a double dose affected plants mainly as inhibitors, reducing the length of sprouts in the treated populations compared to the control: in the Serebristaya variety by 14-31% (tab. 1), in the Pavlogradka variety - by 15-41% (tab. 2). The length of the central root in the first grade decreased by 9-18%, in the second - by 5-24%.

Table 1.

Statistical indicators of the studied populations of variety Serebristaya

Indicators \ Mutant line		AlS (2n)	AkS(2n)	Terrasil (2n)	Comfort (2n)	Serebr without processing
Sprout length, mm	$\bar{x} \pm S\,\bar{x}$	140.6 ± 9.16	127.4 ± 9.32	112.6 ± 8.78	136.4 ± 8.50	162.5 ± 1.94
	C v (%)	35.7	40.1	42.7	34.1	6.5

Number of roots, pcs.	$\bar{x} \pm S\bar{x}$	5.16 ± 0.18	5.0 ± 0.17	4.56 ± 0.16	4.83 ± 01.6	5.0 ± 0.09
	C v (%)	18.8	18.8	18.8	18.1	10.1
Main root length, mm	$\bar{x} \pm S\bar{x}$	89.0 ± 4.21	93.2 ± 5.52	98.6 ± 6.16	95.1 ± 3.55	108.3 ± 1.57
	C v (%)	26.0	32.5	34.2	20.4	8.0

Table 2.

Statistical indicators of the studied populations of the variety Pavlogradka

Indicators \ **Mutant line**		**AlP (2n)**	**AkP(2n)**	**Terrasil (2n)**	**Comfort (2n)**	**Pavlogr. without processing**
Sprout length, mm	$\bar{x} \pm S\bar{x}$	102.6 ± 4.61	98.9 ± 4.25	88.5 ± 6.04	127.6 ± 6.57	149.2 ± 1.97
	C v (%)	24.6	23.5	37.4	28.2	7.2
Number of roots, pcs.	$\bar{x} \pm S\bar{x}$	5.36 ± 0.12	5.03 ± 0.09	5.26 ± 0.83	5.46 ± 0.14	5.63 ± 0.28
	C v (%)	12.4	9.5	8.6	14.2	8.7
Main root length, mm	$\bar{x} \pm S\bar{x}$	96.1 ± 2.54	77.2 ± 2.45	80.4 ± 2.53	94.8 ± 3.23	100.7 ± 1.84
	C v (%)	14.5	17.4	17.3	18.7	10.0

It was shown that under the action of fungicides, the range of variability along the sprout length increased several times in conditionally mutant populations (Cv = 34–43%) of the Serebristaya variety (tab. 1, fig. 1), while in the control it remained at a low level (Cv = 6.5%). Significantly increased intrapopulation variability in Pavlogradka variety mutants (Cv: 24-37%) as compared to control (Cv=7.2%). However, the range of variability in them had a narrower range than in mutants of the Serebristaya variety (tab. 2, fig. 2).

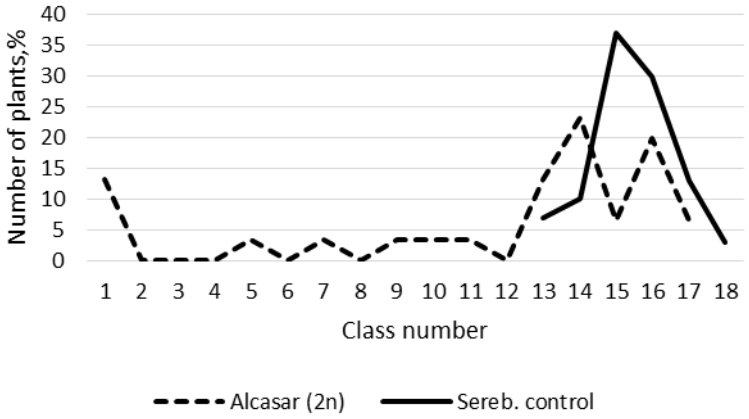

Figure 1. *Variability of sprout length of variety Serebristaya under the influence of Alkasar fungicide*

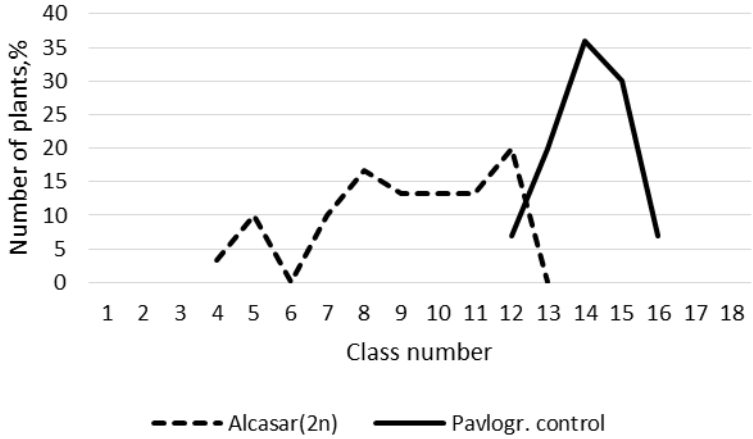

Figure 2. *Variability of sprout length of variety Pavlogradka under the influence of Alkasar fungicide*

The variability of the root length in both varieties showed greater stability under the influence of all fungicides than the length of the sprout. According to this trait, mutants of the Serebristaya variety (Cv = 20.4-34.2%) had a greater variability, in the control - 8.0%; in the variety Pavlogradka - 14.5-18.7 and 10.0%, respectively.

In our last experiment, features of the rearrangement of phenotypic correlations in the ontogeny of seedlings were revealed, which we did not find in any of

several previous laboratory tests.

The influence of fungicides on the relationship of quantitative characteristics of common wheat was determined. The correlation coefficient between the length of the sprout and the length of the main root of the Serebristaya variety, determined on the seventh day of seedling development, was positive, but low (r^2 = 0.28), as well as between the length of the sprout and the number of roots. In mutant lines of this variety, the correlation coefficients were 0.73 - 0.88. This means that the growth of shoots in all mutant populations directly depended on the elongation of their main roots at this stage of development due to the advanced growth of the central root (fig. 3). Repeated measurement of morphological traits in seedlings on the eleventh day of development showed that there was a rearrangement of ontogenetic correlations, and not the central root, but additional germinal roots in the aggregate, which had strongly developed by this stage of ontogenesis, made a greater contribution to the development of the sprout. This is easily explained, does not contradict the logic of events, and was a typical manifestation for all samples of the previous series of the experiment.

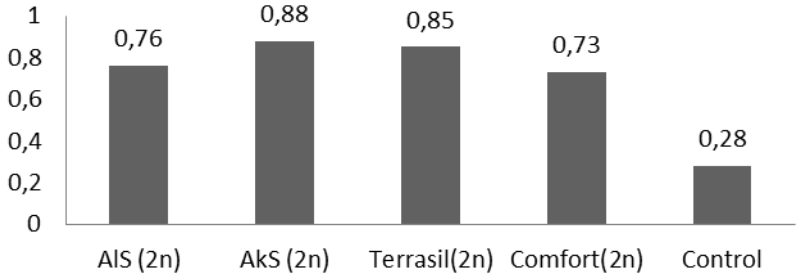

Figure 3. *Correlation: Sprout length/Main root length, Serebristaya variety*

However, in the last experiment, which was carried out one and a half years after seed treatment with fungicides, such a relationship was found already on the seventh day of germination (fig. 4). This is probably due to the fact that already on the third day of germination, when assessing the germination energy of caryopses, most mutants of the Serebristaya variety showed a cessation of the growth of the main root due to inhibition of the formation of meristematic tissue in the cone of its growth by AltSil fungicide (fig. 5).

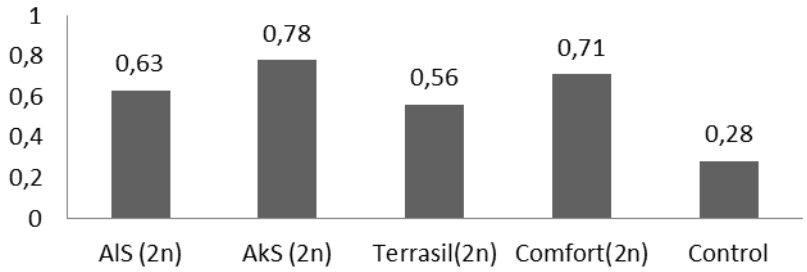

Figure 4. *Correlation: Sprout length/Number of roots, Serebristaya variety*

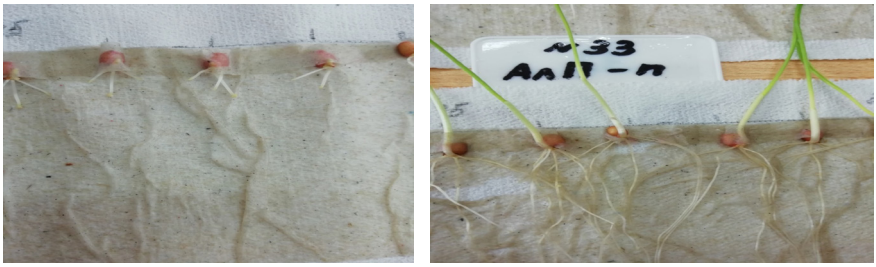

Figure 5. *Cessation of growth of the central root in the mutant variety Serebristaya (AltSil, 2n) on the 3rd day of germination (left) and further normal development of additional roots (7th day).*

Another feature of this experiment was that the genetic differences of the studied varieties in terms of the range of variability of traits under the influence of fungicides were even more pronounced. The Serebristaya cultivar turned out to be more sensitive to the effects of all fungicides and, in all respects, in comparison with the Pavlogradka cultivar. Taking into account the high responsiveness (mutability) of the Serebristaya variety to the effect of biologically active chemical compounds, it can be recommended for creating a genetically diverse material for breeding.

Conclusions

1. It was shown that the fungicides used in our experiment in a double dose affected the plants mainly as inhibitors, suppressing the development of seedlings. The length of the main root decreased less significantly than the length of the sprout in the same forms.

2. The effect of biologically active substances on the variability of mutant lines of Pavlogradka and Serebristaya varieties was revealed. It was found that the range of variability along the length of the sprout increased up to several times in

conditionally mutant populations. The radicle length trait showed greater stability under the influence of all fungicides than the sprout length, due to its more stringent genotypic control.

3. The influence of fungicides on the relationship of quantitative characteristics of common wheat was determined. The correlation coefficient between the length of the sprout and the length of the main root of the Serebristaya variety was low ($r^2 = 0.28$), as well as between the length of the sprout and the number of roots. In mutant lines of this variety, the correlation coefficients were 0.73 - 0.88. This means that the growth of shoots of mutant populations directly depended on the elongation of their central roots.

The indicators of the relationship between the length of the sprout and the number of roots in the mutant forms of the Serebristaya variety differed from each other: the fungicides AltSil ($r^2 = 0,63$) and Terrasil ($r^2 = 0,56$) affected the weakening of this relationship, Comfort ($r^2 = 0,73$) and Alcasar ($r^2 = 0,78$) caused a close relationship between the development of conjugate traits. Thus, the contribution of the number of plant roots to the development of Serebristaya seedlings and its mutant populations was very significant.

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BIRDS OF EASTERN SIBERIA - MODERN CLIMATE WARMING AND ITS CONSEQUENCES

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Annotation. *Based on many years of research and analysis of special literature, modern materials are presented on the development of the climatic situation in Eastern Siberia and its connection with the dynamics of the bird population. The sharp warming of the climate, noted in the second half of the 20th and early 21st centuries, is associated with a change in atmospheric circulation from latitudinal to meridional. This is especially true during periods of increased solar activity. Eastern Siberia is located in the central part of Inner Asia. Here, the transfers of air masses coming from the northwest (North Atlantic flow) and the southeast (monsoons) coming from the Pacific coasts of Asia die out. As a result, there is a strong heating of large areas, often accompanied by extensive and prolonged droughts. Here, warming is expressed almost 3 times stronger than the average for the northern hemisphere of the Earth. The overall situation is further complicated by very long dry periods. Significant drying of waterlogged and shallow lake ecosystems and reduction of river flow led to mass migrations of shorebirds and waterfowl to the northern borders of their ranges. Three nodal plots are well distinguished, which determine the species stricture of evictions birds. At first, the western flow of migrants prevailed, which was by an eastern flow replaced, which was much more powerful. At that time, birds easily overcame the Baikal rift zone, which is the zoogeographical boundary in the distribution of birds to the west and north. The total species composition of birds in this region increased by more than 20.0%. As a result of these processes, Eastern Siberia became the scene of a grandiose restructuring of the bird fauna, which took place in a very short period (on a historical scale).*

Keywords: *Eastern Siberia, climate warming, birds, migration to the north, increase in species diversity, general restructuring of the bird fauna.*

The modern period (the second half of the 20th - the beginning of the 21st cen-

turies) in Russia is by a strong climate warming characterized, which is especially in certain regions pronounced. It should be noted specially that the high unevenness of climate warming in the northern hemisphere of the Earth is due to significant heterogeneity (several natural zones) and, mainly, the mountainous relief of many territories (Zherebtsov et al., 2011; 2013; Obayzov, 2015; Mel'nikov, 2016; 2021). One of the regions characterized by a strong climate warming is Eastern Siberia, which includes two large geographical regions, Cis-Baikal and Transbaikalia. The location of this territory in the Central regions of Asia determines the high specificity of the climate, due to the fact that these regions are the arena for the interaction of air flows from the entire periphery of the Eurasian continent. Here, the air flows of the Atlantic and Pacific Oceans, as well as the flows of the Arctic and adjacent southern territories (Indian Ocean), are greatly weakened or even damped. The mountainous framing of Eastern Siberia additionally enhances the spatial closure of the surface oceanic air masses of the atmosphere directed towards the center of the continent (Naprasnikov, 2003).

A significant increase in solar activity in the period under review was combined with a change in the latitudinal transfer of air masses to their meridional movements, which were concentrated at the land-water boundary of the continent. At the beginning of the process, a meridional transport was of air masses in the North Atlantic sector of Eurasia observed (in the late 1950s and early 1960s). The system of large, severe droughts that began in the east of North Africa and Western Asia, gradually shifting to the east, consistently covered the southern regions of Central Asia (Koshelenko, 1983). From the middle to the end of the 1960s, meridional transport began in the Pacific sector, which led to the development of catastrophic droughts in Mongolia and eastern China (1968-1978) (Koshelenko, 1983; Zherebtsov et al., 2011; 2013; Mel'nikov, 2016; 2021). Obviously, this is due to a strong weakening of the zonal atmospheric circulation, due to which the temperature of adjacent regions evens out. During the period of meridional air mass transfers, an increase in the heating of vast territories is of Inner Asia observed, which leads to a noticeable increase in the surface air temperature of these regions and the development of great droughts. These regions include the south of Eastern Siberia, with adjacent regions of Mongolia and China.

Subsequently (by the end of the last century), droughts moved to more northern regions, the forest ecosystems of which were engulfed by very strong fires. The Siberian frontal contact zone of air masses of northwestern and southeastern directions, which determines the areas of intense precipitation, has moved far to the north - to the level of southern Yakutia, which significantly increased the aridity of the southern regions of Russia and the northern regions of China and Mongolia. Here, very long low-water periods were established, as a result of which almost all shallow-water and small lake-marsh ecosystems dried up (up to 98.0%), and

large ones significantly reduced their size. These aspects of the problem are well illustrated by recent works on the formation of the climatic system of Cis-Baikal, the basin of Lake Baikal, the upper part of the basin of the Selenga river, Daurian ecoregion and all of Siberia (Levy et al., 2004; Novorotsky, 2006; Shimaraev, Starygina, 2010; Berezhnykh et al., 2012; Kirilyuk et al., 2012; Obayzov, 2012; 2015; Loshchenko, Latysheva, 2015; Mel'nikov, 2016; 2021; 2022; Vologzhina and Latysheva, 2019).

Severe droughts that engulfed the interior of North Asia (temperature increased by an average of 1.9° C/100 years compared to 0.7° C/100 years of the entire Northern Hemisphere of the Earth) led to the mass migration of birds to the northern borders of their areas and shifting the zones of their optimums in the same direction (Mel'nikov, 2016; 2021; 2022). This, above all, was characteristic of shorebirds and waterfowl. In Eastern Siberia, there are four waves of mass evictions of this group of birds. Birds of wetlands and shallow waters were the first to react to the change in the level of watering in the regions of Inner Asia. Already at the end of the 1950s, massive waves of short-term evictions of the Lapwing *Vanellus vanellus*, the White-winged Black Tern *Chlidonias leucopterus*, the Marsh Sandpiper *Tringa stagnatilis*, and the Asian Dowitscher *Limnodromus semipalmatus* were observed (Mel'nikov, 2016; 2021). Later, as droughts developed and covered vast territories, at the end of the last century, two more waves were of mass evictions observed, including, mainly, waterfowl: Ruddy Schelduck *Tadorna ferruginea*, Schelduck *Tadorna tadorna*, Eastern Spot-billed Duck *Anas poecilorhyncha*, Gadwall *Anas strepera*, Red-crested Pochard *Netta rufina*, Pochard *Aythya ferina*, Ferruginous Duck *Aythya nyroca*, and Baer's Pochard *Aythya baeri* (Mel'nikov, 2021). At the beginning of the 21st century, the number of migrating birds of lake-marsh ecosystems decreased noticeably, but steppe and forest species began to appear, which formed the fourth wave of evictions.

It is noteworthy that the native bird species of the steppe and desert biomes began to move out last. Until now, their numbers and species structure in the forest-steppe regions of Eastern Siberia are small. They appear here as individuals, in pairs and in small groups. Only in the very south of Transbaikalia are there impulses of rather large evictions of Pallas's Sandgrouse *Syrrhaptes paradoxus*, with a few nesting of separate flocks. In all other episodes of evictions of new species of steppe birds, only their long-range flights are to new territories observed with separate cases of episodic nesting. Even native species of steppe and desert waders of the genus Charadrius (Greater Sand Plover *Charadrius leschenaultii*, Lesser Sand Plover *Ch. Mongolus*, Kentish Plover *Ch. alexandrinus* and Oriental Plover *Ch. veredus*) appeared in the south of Eastern Siberia only in separate pairs and small groups, and cases of establishing their nesting here are very rare. After the first impulse of evictions, when the frequency of their meetings increased (at the

end of the 20th century), they no appeared in this territory. Most likely, they were over the territory of their natural zone redistributed. All this indicates a very high level of adaptation of truly steppe and desert bird species to the habitat conditions in their natural zone.

In general, the number of eviction species of passerines was also low. A noticeable abundance in some plots of the areas was achieved only by species that came from the western directions, gradually developing the southern regions of Eastern Siberia: Greenfinch *Chloris chloris*, Linnet *Acanthis cannabina*, Ortolan Bunting *Emberiza hortulana*, Common Starling *Sturnus vulgaris*, Common Magpie *Pica pica*, Jackdaw *Corvus monedula*, Grasshopper Warbler *Locustella naevia*, Booted Warbler *Hippolais caligata*, Spotted Flycatcher *Muscicapa striata*, Chaffinch *Fringilla coelebs*, etc. (Mel'nikov, 2021; 2022). However, some new species of passerine birds that evicted from the southern regions of Eastern Siberia and adjacent territories and came to this region from the east and southeast can also reach high abundance in some new plots of their areas: Blyth's Pipit *Anthus godlewskii*, Green-headed Wagtail *Motacilla (tschutschensis) taivana*, Citrine Wagtail *Motacilla citreola*, Asure-winged Magpie *Cyanopica cyanus*, Daurian Jackdaw *Corvus dauricus*, Siberian Bush Warbler *Tribura (thoracica) davidi*, Oriental Reed Warbler *Acrocephalus orientalis*, Daurian Redstart *Phoenicurus auroreus*, Siberian Thrush *Zoothera sibirica,* White's Thrush *Zoothera varia*, Bearded Reedling *Panurus biarmicus*, Siberian Penduline *Remiz coronatus*, Chestnut-eared Bunting *Emberiza fucata*, Chestnut Bunting *Ocyris rutilus*, etc. (Mel'nikov, 2021; 2022).

The most significant changes in the number and areas that have gone far to the north are characteristic of shorebirds and waterfowl. As we have already indicated above, in the southern and forest-steppe regions of Eastern Siberia, the main part of small and shallow-water lake-marsh ecosystems has dried up. This was especially well manifested in the endorheic Torey basin (south of Transbaikalia) and the territories adjacent to it, including the upper reaches of the Selenga river (Koshelenko, 1983; Novorotsky, 2006; Berezhnykh et al., 2012; Kirilyuk et al., 2012; Obayzov, 2012; Mel'nikov, 2016; 2021). It was the loss of the main habitats that caused the mass migration of birds of these groups to more northern regions. In the south of Eastern Siberia, the abundance of shorebirds and waterfowl and their species composition have sharply decreased. They retained sufficiently high values only in the key areas of the areas, which are distinguished by a large square and a high diversity of wetland ecosystems (the of the Selenga river delta, the Upper Angara numerous islands, the delta of the Upper Angara and Kichera rivers, the Barluk-Sayan floodplain of the Oka river, the Erbgachen plain and etc.). The main part of the waterfowl of the region move in the Central Yakutsk Plain, where the most optimal conditions for their nesting have developed. Undoubtedly, some species began to develop the tundra zone - birds of this group in Eastern Siberia

are by nesting from eastern Taimyr to the Yana and Indigirka rivers characterized (Mel'nikov, 2009).

The main reason for the significant dynamics of the areas of shorebirds and waterfowl is their use of intrazonal wetland ecosystems for nesting. They are found in all natural zones and mountain belts, and their dynamics and qualitative structure strongly depend on the specific environmental conditions. The main adaptation of these groups of birds is a dynamic spatial structure - they easily move from one natural zone to another, which is most often due not to anthropogenic impacts, but to the dynamics of the habitat, primarily associated with the climatic conditions of a particular observation period. In this regard, the birds of these groups have very extensive areas, often overlapping in different climate cycles, high variability of species structure at the migration sites and in new nesting areas. Evictions are one of the main adaptations of birds of the coastal water complex to living in extremely dynamic and unstable wetland ecosystems. Some of these adaptations are easily explained by the concept of the cyclic dynamics of coastal bird areas (Krivenko and Vinogradov, 2008).

In connection with the new data obtained, several questions arose related to the dynamics of the areas of birds, as the most mobile group of animals very quickly and clearly responding to changes in natural conditions and, above all, climatic ones. The first question is about the zoogeographic boundaries that limit the distribution of birds. In some cases, they are insignificant (landscape changes, low mountains, water barriers, etc.) and can be easily overcome by birds; nevertheless, they persist for quite a long time (Maksimov, 1989; Dorzhiyev and Yelayev, 1999; Mel'nikov, 2009; 2022; Baranov, 2012). This is especially pronounced in Eastern Siberia (the uniquenesses of Lake Baikal), which is an ecotone territory and many species are found here on the periphery of their areas. This is what hinders their further resettlement, since further territories become unsuitable for their habitation (Dorzhiyev, Yelayev, 1999). At the same time, there are many cases when birds overcome very serious orographic barriers, significantly expanding their areas.

The only reasonable reason for the long preservation of the boundaries of areas, with minor obstacles to their expansion, seems to us the existence "of climatic hearths", often determined not by clearly defined geographical barriers, but by specific environmental factors. It is hard to imagine that even significant mountain ranges could be real barriers to limiting the distribution of birds. Their well-defined migrations in spring and autumn, often in very difficult meteorological conditions, show that they easily find paths suitable for long-distance movements. Therefore, large geographic barriers, even vast oceans, cannot be the cardinal reason limiting their distribution.

At the same time, climatic conditions that determine the main parameters of their reproduction (the beginning of breeding, the time of formation of clutches,

the duration of the nesting period, the possibility of forming repeated clutches in the event of the death of the first nests, etc.) can be a serious reason limiting the distribution of birds, a factor. Undoubtedly, evolutionary processes associated with the formation of the morphobiological appearance of separate species also play an important role here. They also determine the possibilities of such species for the development of new territories. However, bird species that develop the northern territories on the basis of migration processes are able to overcome any barriers. In this case, there is no doubt that the existence of zoogeographic boundaries is determined by the conditions of existence in a particular territories, among which climatic factors are of decisive importance. In this regard, the term "natural hearth" has the right to exist, a territory that differs well from neighboring regions by its ecological parameters (Maksimov, 1989).

It should be noted that A.N. Afanasiev (1967) identified four hearth in the USSR on the Trans-Ural territory with the same secular variability of river runoff. Therefore, these territories are natural hearths. However, subsequent work on the study of the dynamics of climatic conditions showed that the size of these hearths can be much smaller, and their total number is noticeably larger. The orographic features of particular regions, along with the specific dynamics of surface air flows, can cause significant deviations in the climatic conditions of certain geographical areas, sharply separating them from the general atmospheric circulation system (Zherebtsov et al., 2011; 2013). In most cases, such areas can be as specific natural hearths considered that determine the characteristics of the distribution of birds.

Our are conclusions confirmed by the easy overcoming of existing zoogeographic boundaries by birds during periods of sharp changes in climatic conditions. It should be that the Baikal rift zone noted, a zoogeographic boundary running along the Baikal breaking, at the beginning of the last century performed its role of restricting the spread of birds to the northwest and northeast quite well. No new species, indicating the beginning of their settlement, have yet been at that time noted, although it should be recognized that the bird fauna of Eastern Siberia has been studied far from enough. A clear, albeit insignificant, climate warming in Russia began to manifest itself in the late 19th and early 20th centuries (Mel'nikov, 2022). An analysis of materials on the bird fauna of Eastern Siberia in the middle of the 20th century (by this time a lot of data on the distribution of birds had accumulated) showed that 57 species were already vagrant (Gagina, 1961). However, this region includes Cisbaikalia and Transbaikalia, separated by the Uniquenesses of Lake Baikal, which is part of the Baikal rift zone. It divides Eastern Siberia into two fairly independent regions, differing in climatic conditions. In the Cis-Baikal region, the northwestern (North Atlantic) transport of air masses plays a leading role in the formation of climatic conditions, and in Transbaikalia, the southeastern (monsoon), coming from the Pacific coasts of South Asia.

During this period, 57 new species of birds were in Eastern Siberia recorded: 32 vagrant species were found in Cisbaikalia, 26 such species were found in the Uniquenesses of Lake Baikal, and 13 new species of vagrant birds were noted in Transbaikalia, which came from the east and southeast and were not previously noted on its territory. By the middle of the 20th century, 29 new species of birds came from the western direction to Eastern Siberia (the Cis-Baikal region). Only 3 species, previously recorded in Cis-Baikal, penetrated the territory of Transbaikalia. The situation in the eastern direction is much more complicated. The fact is that 22 bird species of Transbaikalia have significantly advanced their ranges to the north and north-west, reaching the Uniquenesses of the lake Baikal (they do not include 13 new species of birds of Transbaikalia), and 16 of them overcame this zoogeographical boundary, hitting Cisbaikalia. Consequently, by this time, 19 species had already overcome the Baikal rift zone, significantly expanding their areas to the northwest and southeast. Obviously, birds from the eastern part of Russia were significantly by adverse climatic conditions more affected.

It should be noted that already in the first half of the 20th century there were indications of the expansion of the boundaries of the areas of many birds, incl. and in Eastern Siberia. The general direction of their movements is north and northeast. This process was undoubtedly associated with a strong climate warming (Mel'nikov, 2022), although a number of authors associate it with anthropogenic changes in the territory and the emergence of new open landscapes as a result of the intensive use of forest resources and the plowing of steppe regions (Baranov, 2012) . However, it is necessary to pay attention to the fact that throughout this period there was a subtle warming of the climate, subsequently intensified by the shift of severe droughts from west to east in the southern regions of Inner Asia. This caused mass migrations of birds to the northern boundaries of their areas, which was of decisive importance in changing the boundaries of the distribution of birds in these regions. A very strong and prolonged drought in 1975-77, which engulfed China and the eastern outskirts of Mongolia, had a particularly strong influence on the dynamics of bird areas. After its completion, a very long dry period (several decades) was established in these territories, which played a very important role in the dynamics of the areas of shorebirds and waterfowl in Central Asia. At present, this process continues and the frequency of appearance of primordial steppe and desert vagrant bird species near the northern borders of the areas has noticeably increased. At the same time, signs of the end of the low-water period and the development of a cycle of increased moistening of the territory appeared.

An assessment of the situation in the modern period showed that the total number of new bird species in Eastern Siberia has increased significantly. Bird species 237 have been recorded here that have not previously been recorded in at least one region of this territory. The largest number of new bird species was recorded in the

Cis-Baikal region and the Uniquenesses of Lake Baikal. At present, they are found in these regions of Eastern Siberia only as vagrant birds - 102 species (Pre-Baikal) and 103 species (Uniquenesses of the lake Baikal). In Transbaikalia, 84 species of new vagrant birds have been recorded. However, for the entire second half of the 20th and the beginning of the 21st centuries, 155 species of birds that were not previously found in this territory were recorded in the Cis-Baikal region, 141 species in the Uniquenesses of Lake Baikal, and 128 new species in Transbaikalia. Settling to the east, 37 species of new birds from the western direction overcame the Baikal rift zone and appeared in Transbaikalia. At the same time, 77 new species crossed it from the east and began to develop Cisbaikalia and even more northern regions, getting into Yakutia. A significantly larger number of birds recorded in the Cis-Baikal region and the Uniquenesses of Lake Baikal is due to the fact that new species appeared here, which previously inhabited only Transbaikalia. In Transbaikalia, only bird species that came here from the territory of Mongolia and China and even more southern regions of Asia are new. It is interesting that more than 10 species of birds are new to Eastern Siberia, which previously inhabited only the Subarctic and the Arctic. Of course, their meetings here are explained by the increased Arctic influence on the interior regions of Asia, due to changes in air currents and cold air inflows during the migratory periods of birds.

However, a large number of new bird species did not lead to a noticeable increase in their overall abundance. The main part of the new species occurs as single individuals, pairs and small groups. Only in some cases, episodic nesting of some of these species is noted (Mel'nikov, 2009; 2016; 2021). Of the previously noted 57 species of birds, as before, 9 species remained accidentally vagrant birds. At the same time, flights and sightings in all parts of Eastern Siberia in 11 species of birds became more frequent. A noticeable increase in abundance was characteristic of 12 mass species, and the remaining 25 species are characterized by either single nesting or a noticeable increase in abundance with mass nesting only in certain plots of their new areas. The distribution of new bird species along different distribution flows is also noteworthy. During the period under review, the areas of 27 bird species expanded from the southwest, and 39 species from the southeast. Consequently, the eastern flow of dispersing birds clearly began to predominate.

In this case, it is necessary to pay attention to the fact that severe droughts came from the west, at the same time determining the flow of dispersing birds from this direction. However, the most severe and extensive droughts that occurred later were characteristic of the eastern regions of Russia, which determined the differences in the directions of the flows of dispersing birds. An analysis of the order of evictions and the appearance of new species shows that three main regions stand out from the southern directions, from which mass evictions of birds was observed. The highlands of the Eastern Sayan and the adjacent mountain sys-

tems of Mongolia stand out very well. This is a major hub of concentration of western bird species penetrating here through the large intermountain Uniquenesses of the Altai-Sayan mountainous country (Baranov, 2012). It was from here that they began to reach the southwestern outskirts of Eastern Siberia during the period of major droughts moving to the east. Another major node that determines the species structure of migrating birds is associated with the Selenga river basin and from here the main part of the birds of Mongolia settles. The third node is associated with large lacustrine-marsh Uniquenesses of Eastern Mongolia (Huh lake, Buir lake, Tashgai Tavan lakes and Numrug river), Northern China (Lake Dalai-nor) and southern Russia (Torey basin). The sequence of development of strong and prolonged droughts determined the general order of evictions of birds of different species to the northwest and northeast, mainly from different southern directions.

One of the most interesting general aspects of the dynamics of bird areas in Eastern Siberia is the overlapping of the areas of western and eastern closely related bird species. During the period of the Pleistocene glaciations, the common areas of many bird species in Eastern Siberia were broken. Their further evolution led to the formation of different, but closely related species. The number of such species is several dozen, and their detailed analysis can lead to new conclusions about the speed and directions of bird evolution. At present, the areas of relatively few species have closed, but the general tendency to capture the once unified territory is already quite visible. Consequently, Eastern Siberia became the scene of a grandiose restructuring of the bird fauna, which took place in a very short period (on a historical scale).

It should be borne in mind that at that time, a centuries-long climate cycle lasting about 2000 years ended with a warm-dry period (Krivenko and Vinogradov, 2008; Mel'nikov, 2009; 2016; Zherebtsov et al., 2011; 2013). The current situation makes it possible to better understand the mechanisms that determine the dynamics and development of bird areas during periods of great climatic anomalies. In this case, we are looking at the results of a strong warming of the climate of the centuries-old level and its influence on the reshaping of the bird fauna after its strong cooling (Little Ice Age of Europe). This period had a strong impact on the adjacent territories. In any case, we can clearly see its results associated with the displacement of the areas of many species of tundra birds to the steppe regions and the reverse process of their return to the north (Tarasov and Korshikov, 2018). Using the example of Eastern Siberia, we clearly see the initial stages of the reshaping of bird areas under conditions of strong climate warming, which many authors refer to as global processes.

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THE CONCEPT OF RECONSTRUCTION AND RESTORATION OF THE ARCHITECTURAL ENSEMBLE OF THE FORMER SAINT-BETHANY SEMINARY (LATE 18TH - EARLY 19TH CENTURIES) IN THE CITY OF SERGIEV POSAD, MOSCOW REGION

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Annotation. *The Saint-Bethany Seminary is an extensive architectural complex of a former educational institution, opened in 1800 by Metropolitan Platon (Levshin) in the district of the Trinity-Sergius Lavra. After 1917, a prominent educational institution changed its function many times. By the 21st century, the buildings had fallen into disrepair. The article highlights the main stages of work on the reconstruction and restoration of the architectural ensemble of the former Saint-Bethany Seminary, as well as adaptation for modern use, which is the placement of an Orthodox gymnasium for boys in grades 5-11 and the memorial museum of Metropolitan Platon (Levshin).*

Keywords: *Saint-Bethany Theological Seminary, Orthodox Gymnasium, Museum of Metropolitan Platon.*

Nowadays, the monuments of religious architecture, which underwent significant transformations during the Soviet period, need not only restoration, but also revalorization, that is, the return of signs of cultural significance lost under the influence of time and / or destructive factors to the object. Success depends on the restoration of not only the physical state of the object, but also its value parameters in the mass consciousness of society. One of the options for revalorization could be a return to the object of its historical function on a new round of history.

The Trinity-Sergius Lavra and its environs objects of religious architecture have a rich centuries-old history. After their transfer to the jurisdiction of Russian Orthodox Church at the end of the 20th century, they are now intensively restored and regain their significance in the socio-cultural space. But there is a lack of funding for the rehabilitation of a number of worthy monuments that continue to deteriorate and collapse. Among them is the Saint-Bethany Theological Seminary

(20, Ptitsegradskaya st., Sergiev Posad, Moscow region) near the Saint-Bethany Monastery of the Trinity-Sergius Lavra, endowed with the status of an object of cultural heritage of regional significance.

Metropolitan of Moscow Platon (Levshin) was a well-known Russian Orthodox Church leader of 18th-19th centuries who enjoyed the patronage of the royal family and was especially popular among the broad masses of the people. In the early 1780s, being the rector of the Trinity-Sergius Lavra for many years, Metropolitan Platon set about founding the Bethany hermitage not far from the Lavra, which later became the Saint-Bethany Monastery. Founded in 1783 and arranged with special care, the new monastery was visited by the Emperor Paul I, who advised, knowing the extensive experience of the Metropolitan's teaching activities in the Trinity and Perervin seminaries, to found the Saint-Bethany Theological Seminary [3, p. 603]. In 1797-1800s, on the high steep bank of the Ershevsky (later Bethany) Pond opposite to the Saint-Bethany Monastery the architect S. Boldyrev built the so-called Old Building of Saint-Bethany Seminary - a two-story U-shaped structure in a romantic style, with four towers at the corners. Its galleries opened up an astonishing panorama of the Trinity Sergius Monastery. Until his death in 1812, Metropolitan Platon actively organized the life and education of seminarians [1, p. 115].

Deep reverence for the memory of Metropolitan Platon contributed to the preservation of the furnishings of his chambers, the memorial premises of which attracted a significant flow of pilgrims to the Saint-Bethany Monastery. In the museum, which has been operating for decades, there were guardians assigned from the monks [5, ll. 13-13rev.]. Pilgrims visiting Bethany, of course, saw the ensemble of the Seminary located nearby.

During the first decades of 19th century the number of students at the Saint-Bethany Theological Seminary gradually reached 298 people [2, p. 20]. In 1826, according to the plan of the architect M.I. Beauvais the 2nd, the construction of the second, New Building of the Seminary was started, completed in 1829 [7, p. 35]. A two-story brick building in the Russian Empire style placed along the red line of the street, covered the Old Building from the side of the road from the Lavra to the Saint-Bethany Monastery. In 1832, the architectural complex of the Seminary was additionally expanded with a one-story dining building to the left from the New Building, in 1838 - a hospital wing for 18 people was built (not preserved) [11, ll. 3.5], and in 1846 - a one-story bathhouse [7, p. 36]. In 1866, a two-story house for tutors was built (not preserved) [12, p. 7-8]. In 1882-1884, the architect B. Biling carried out work on the reconstruction and expansion of the main buildings of the Saint-Bethany Theological Seminary [6]. In 1893, a church in the name of the St. John the Theologian was built in the assembly hall of the New Building and the false church dome was erected over it [10, p. 38-41].

After the Revolution of 1917, the Seminary, as well as the Saint-Bethany Monastery, was closed. During the 20th century, the functional purpose of its historical buildings was changed several times: the complex of buildings was successively occupied by an orphanage (late 1920s - late 1940s), a dermatological and venereal dispensary and an agricultural technical school (1949-1992) [13, p. 75]. By the end of the 20th century, dissonant buildings appeared on the territory of the former seminary - a residential multi-storey building, a small shop and garages, different annexes to the main buildings.

By Decree of the Moscow Region Government dated March 15, 2002 N 84/9 "On approval of the list of historical and cultural monuments" [4], the architectural ensembles of the former Seminary and the Saint-Bethany Monastery were approved in the status of objects of cultural heritage of regional significance.

In the early 1990s, the Saint-Bethany Monastery transferred to the jurisdiction of the Trinity-Sergius Lavra, and the work on restoration of survived monastery structures and reconstruction of lost buildings began.

In 1992, the buildings of the former Saint-Bethany Seminary were also transferred to the Trinity-Sergius Lavra [1, p. 367]. The revival of the historically established ensemble began with the restoration of the seminary church of St. John the Theologian in the New Building. However, in 1993 a fire broke out, after which only the framework of the New Building remained. Other buildings of the complex have been partially restored and are now used as Trinity-Sergius Lavra workshops.

At present, the Russian Orthodox Church has shown an interest on restoring the ensemble of the Saint-Bethany Theological Seminary. However, during 30 years since its transfer to the jurisdiction of the Lavra, no design developments have been carried out and / or implemented, so it was necessary to address this issue.

The proposed concept offers the specific points of carrying out large-scale restoration and reconstruction works on the former Saint-Bethany Seminary territory and the buildings and structures that were part of its historical boundaries. This work contributes to the return of the educational function to the former seminary complex – it will be possible to place here an Orthodox gymnasium for boys named after Metropolitan Platon (Levshin).

The resource potential of the territory and buildings of this historical architectural complex was assessed with a focus on its adaptation for an educational institution and required careful consideration of the current building standards of Russian Federation - SP 251.1325800.2016 "Buildings of educational organizations" [8] and SP 118.13330.2012 "Public buildings and structures" [7] and other regulatory legal acts.

The analysis of dimensions showed that the capacity of available space makes

it possible to locate the entire range of educational and residential premises intended for 140-180 students in grades 5-11 with the division of buildings into educational, residential, sports and dining ones with the allocation of a sufficient amount of space for auxiliary purposes (educational, experimental, sports and recreational, utility facilities, a garage and a parking lot for gymnasium transport).

Given the significant role of Metropolitan Platon (Levshin) in the history of Russian Orthodox Church and in organizing the Saint-Bethany Seminary, it seems expedient to create a museum in memory of him within the modern Orthodox gymnasium (on the first floor of the New Building) with exposition spaces, fund and administrative premises, and a reception group. At present, the famous church personality, author and teacher at the turn of the 18^{th} – 19^{th} centuries is not represented with due completeness in any museum of the Moscow region and the country.

The territory of the gymnasium. It will be necessary to carry out a wide range of works on the improvement and reconstruction on the former Saint-Bethany Seminary territory. First of all, it is necessary to recreate the enclosure, having previously lowered the ground level along Ptitsegradskaya Street. Also, it seems appropriate to move its route to a certain distance, approximately 25 m from the facade of the New Building, by reconstructing the nearby memorial square (located opposite the future gymnasium at the address: 1-7 Ptitsegradskaya st.), to divert traffic from the windows of the gymnasium classrooms and to organize a proper entrance group.

The project would require to remove some discordant structures from the boundaries of the gymnasium territory, adjusted for normal functioning of the cultural heritage object. In particular, it is necessary to remove a number of existing garage buildings on the Bethany Pond banks. This measure will free up a passage to the former bathhouse building, which will be transformed to the gym. Within the territory of the Orthodox gymnasium, a road and path network will be planned in detail (taking into account the historically existing directions of transport and pedestrian traffic); fruit and vegetable gardens, lawns and flower beds, viewing, recreational and utility areas will be placed.

Old Building. The building needs the following types of restoration work:

- strengthening of load-bearing structures;
- patching and laying bricks in places of fallout and destruction (corner extension (1870s) to the northern tower, the lower part of the wall of the southeastern tower, fragmentary - the basement along the entire perimeter of the building);
- removal of later layers and structures (an annex (1950-1980s) to the western facade, bricked window openings on the southern and northern facades);
- caulking of masonry mortar (~80% of the structure's masonry volume);
- restoration of 100% plaster and stucco facade decoration;

• restoration of 5 existing (on different facades) and reconstruction of 98 new window and door fillings (based on the results of archival data comparison with an assessment of a full-scale survey of the object being restored), including (by analogy) samples of the interior decoration style preserved at the object;

• restoration of interiors: finishing of walls and ceilings with plaster compositions (based on archival data);

• a set of works on laying engineering, heating and sewer systems, taking into account the designed loads and increased safety requirements for children's educational institutions, as well as compatibility with architectural monuments - similar in all buildings:

- installation of power supply systems throughout the building;
- supply of water and sewerage systems to the locations of the sanitary units and fire-fighting systems;
- installation of a heating system throughout the building;
- installation of ventilation and air conditioning systems.

The process of restoration and reconstruction of the interiors in the Old Building will be correlated with proposals related to their subsequent adaptation - after restoration work and bringing of engineering equipment, sleeping rooms with sanitary blocks designed for 3-4 students, as well as accompanying rooms for teacher-observers and recreational rooms will be located on two floors.

New Building. In a building damaged by a fire in 1993, the following types of work will be required:

• reinforcement of the load-bearing structures of the preserved core (the entire volume of wall structures - external walls and internal partitions);

• removal of later layers and structures (one-story annex to the western facade, bricked doors and windows openings);

• additional laying of masonry in places of fallout and destruction (fragmental collapses of the southern wing walls, fallout of masonry in the inner part of the 2nd floor walls, destruction of masonry fragments of window and door openings);

• the raise of the walls to the design height (fragments of the bearing walls at the eastern facade);

• restoration of preserved (tray and cylindrical vaults of the basement and 1st floor ceilings) and reconstruction of lost ceiling structures (floor ceilings of the 1st and 2nd floors);

• reconstruction of roof structures over the entire volume of the building, as well as dome structures over its central part;

• restoration of preserved (~5% of the total volume of decoration) and reconstruction of the lost plaster and stucco decoration of facades;

• restoration of preserved (the main staircase) and reconstruction of lost (the side staircases in the wings) staircase structures;

• installation of internal partitions (in classes of Russian and foreign languages, in classes of physical and mathematical orientation);

• laying tiled (corridors of the 1st floor, laboratories, sanitary and technical utilities) and parquet (corridors of the 2nd floor, museum rooms, classrooms) floors (based on the results of a comparison of archival data with an assessment of full-scale survey of the object being restored);

• finishing wall and ceiling surfaces with plaster compositions using elements of fresco painting (the temple premises and the assembly hall on the 2nd floor);

• reconstruction of windows and doors fillings (based on archival data);

• a set of works on laying engineering, heating and sewer systems, taking into account the designed loads and increased safety requirements for children's educational institutions, as well as compatibility with architectural monuments - similar to the work carried out in the Old Building.

The largest in terms of volume and diverse in content types of restoration and reconstruction work planning to carry out in the New Building should be correlated with the plans for the subsequent placement of different types of premises here. After taking these restoration and reconstruction measures, the following elements of educational environment will be located in this building:

• premises and classes for general and specialized education;
• recreational facilities for students, teachers and staff;
• offices of medical worker, psychologist and speech pathologist;
• museum halls;
• administrative (school and museum) and fund premises;
• sanitary facilities (3 pcs. on the 1st and 2 pcs. on the 2nd floors);
• auxiliary and technical premises.

Refectory Building. In this structure, which is distinguished by a greater preservation of structural system and even the finishing of outer and inner walls surfaces, the following types of work will be carried out:

• repairing and laying bricks in places of falls and destruction (a masonry at the corners of southern annex outer walls);

• removal of later layers and structures (metal, wood and brick solid fillings of windows and doors openings, a carport near the southern annex);

• caulking of masonry mortar (fragmentary - on all facades, except for the eastern one);

• restoration of plaster and stucco decoration of facades (80-100% of the total area of all facades);

• strengthening and restoration of interfloor and attic floors;

• restoration of existing ones (18 windows on the 2nd floor on the eastern facade) and reconstruction of lost window and door fillings based on archival data and surviving analogues at the facility;

• restoration of interiors with a focus on the planned direction of the adaptation program for this building: restoration of stairs, construction of partitions necessary for the adaptation project (on the 1st floor - in the kitchen, dining room and washroom, as well as in lobby of the southern annex); laying flooring (tiled - in the kitchen, bathrooms and lobby, parquet - in the dining room, recreational facilities and the library) and finishing the surfaces of walls and ceilings with plaster compositions;

• a set of works on laying engineering, heating and sewer systems, taking into account the designed loads and increased safety requirements for children's educational institutions, as well as compatibility with architectural monuments - similar to the work carried out in the Old Building.

The 1st floor of the former Refectory Building will house a complex of kitchen and dining rooms, as well as a culinary and carpentry workshop; on the 2nd floor a student library and recreational facilities will take place. To a large extent, the functional purpose of the building corresponds to the historical program of organizing spaces there.

Guesthouse Building. The building of a former Saint-Bethany Monastery guesthouse, currently used for the needs of the Trinity-Sergius Lavra, is in fairly good condition and considered to be included within the adjusted boundaries of the new educational institution. The facades of this building need only fragmentary repair and additional layout of the masonry, brick decor restoration, as well as treatment of the entire surface of the facades with colorless sanitizing protective compounds. After carrying out these restoration works and the engineering equipment supplies, sleeping rooms for 3-4 students with sanitary blocks designed will be located on two floors of Guesthouse Building, as well as accompanying rooms for teacher-observers and recreational rooms.

Water Tower. In addition to the restoration of the former water tower facades, which consists of removal of the brick solid filling window opening on the western facade, fragmentary patching and additional laying of masonry and brick decor, as well as full surface treatment of the facades with colorless sanitizing protective compounds, some redevelopment of the premises will be carried out to organize workshops and leisure spaces there.

Bathhouse. In the former specialized building of the bathhouse, will be required a restoration of the facades (fragmentary repair and additional layout of the masonry - ~ 30% of the total wall area; a full surface treatment of the facades with colorless sanitizing protective compounds), as well as reconstruction of spatial structure in the interiors (removal of walls and partitions built in Soviet times). The redevelopment of premises and the supply of special equipment will be needed to organize a gym building with the following types of premises: sports hall, gym, locker rooms, showers and sanitary utilities, teacher's room, inventory

and technical premises.

The restoration and reconstruction of the architectural ensemble of the former Saint-Bethany Theological Seminary for the purpose of placing an Orthodox gymnasium on its territory will be an example of an integrated approach to the rehabilitation of a cultural heritage site of regional significance. Renovation of the historical architectural ensemble as a significant element of the modern educational environment will contribute to an active inclusion of the gymnasium into the cultural life of Sergiev Posad and will expand the resource of jobs for its population.

The creation of the memorial museum of Metropolitan Platon (Levshin) in the structure of the gymnasium will allow updating educational and tourist programs aimed not only at the inhabitants of this ancient city, but also the Moscow region as a whole.

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THE ROLE OF WATER IN THE SYNTHESIS OF MOLYBDENUM CATALYST FOR OLEFIN EPOXIDATION

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Abstract. *The effect of water on the process of obtaining a molybdenum catalyst for the epoxidation of olefinic hydrocarbons has been studied. A probable mechanism for the dissolution of metallic molybdenum powder during the synthesis of the catalyst has been proposed.*

Keywords: *molybdenum metal powder, water, molybdenum catalyst, epoxidation, octene-1, molybdenum dissolution mechanism.*

Introduction

One of the most important intermediates in basic organic synthesis is propylene oxide (PO), the most effective method of obtaining which is currently recognized as the process of epoxidation of propylene with organic hydroperoxides. The best catalysts for this process are various molybdenum compounds, which exhibit high activity and selectivity in the hydroperoxide oxidation of olefins.

The best known and one of the most effective methods for preparing an industrial complex molybdenum catalyst (CMC) is a method involving the dissolution of powdered molybdenum metal in a mixture of ethyl alcohol and oxidized ethylbenzene containing 25-27% ethylbenzene hydroperoxide (EBHP).

The main regularities of the stage of preparing a molybdenum catalyst have been studied in sufficient detail by the developers of the process for producing propylene oxide with styrene [1]. A number of works [2–4] are devoted to the study of its structure and composition. However, there is still no consensus on this matter, as well as on the influence of individual components on its synthesis. In particular, the role of water in the synthesis of an industrial molybdenum catalyst has not been fully elucidated.

It is known [5] that during the synthesis of CMC, the decomposition of EBHP occurs only in the presence of water in the reaction mass, and the decomposition

rate depends on the concentration of water.

An analysis of the patent literature has shown that in some cases water is specially included in the composition of the catalyst in order to increase the selectivity of the catalyst [6, 7].

The purpose of this study was to obtain additional information about the role of water in the synthesis of a molybdenum catalyst.

Experimental part

We used ethylbenzene oxidate with a concentration of ethylbenzene hydroperoxide of 27% wt., ethyl alcohol with a water content of 0.08 and 6.3% wt., molybdenum metal powder, TU 48-19-69-80. Octene-1, TU 38.402-69-75-89, was used as a kinetic model of propylene.

The synthesis of the molybdenum catalyst was carried out in a three-necked flask with a stirrer equipped with a refrigerator at a temperature of 50 ± 0.5°C according to the procedure described in [1].

Epoxidation was carried out with ethylbenzene hydroperoxide at a temperature of 110°C in the presence of a molybdenum catalyst in a jacketed glass reactor equipped with a reflux condenser and a magnetic stirrer. The temperature was maintained constant with a thermostat. The course of the reaction was monitored by the change in the current concentration of hydroperoxide, which was determined iodometrically [8]. The percentage of epoxide was determined chromatographically. The concentration of dissolved molybdenum was determined by the vanadometric method [9].

At the initial stage of our work, we studied the effect of water on the conversion of molybdenum during the preparation of the catalyst. The catalyst complex was prepared by dissolving molybdenum metal powder in a mixture consisting of equal volumes of ethyl alcohol and oxidized ethylbenzene with a hydroperoxide concentration of 27% wt.

Table 1 and Figure 1 show data on the effect of water concentration in ethanol on the dissolution of metallic molybdenum powder.

Table 1.

Influence of water concentration on the process of dissolving molybdenum powder (T = 50°C; loading Mo = 7 g/l; reaction time 2 hours)

Water content in ethanol, % wt.	EBHP conversion, %	The concentration of Mo in the catalyst solution, % wt.	Mo conversion, %
0.08	25.3	0.12	14.9
6.3	90.7	0.87	89.9

The data obtained indicate that the concentration of water in the reaction mixture has a significant effect on the conversion of molybdenum and ethylbenzene hydroperoxide, as well as on the content of dissolved molybdenum. From a comparison of experimental data, it can be seen that the conversion of ethylbenzene and molybdenum hydroperoxide increase by 3.5 and 6.0 times, respectively, and the concentration of dissolved molybdenum in the reaction mixture increases by 7.2 times.

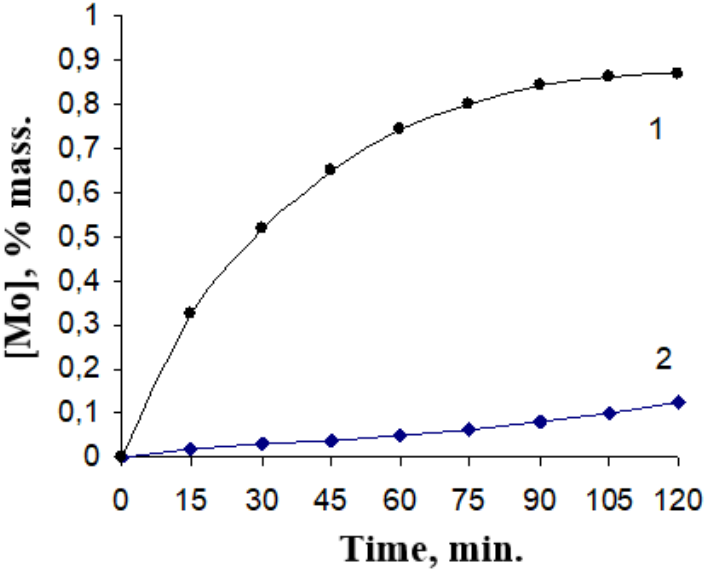


Figure 1. *Kinetic curves of the accumulation of dissolved molybdenum. The water content in ethanol: 1 – 6.3% wt., 2 – 0.08% wt.*

The following series of experiments was devoted to determining the optimal amount of water in the reaction mixture of molybdenum dissolution. In the experiments used ethyl alcohol with a water content of 0.08% wt. The concentration of water in ethanol was changed in the range of 0.5-5% wt. by adding the calculated amount of distilled water.

Table 2 shows the results of this series of experiments.

Table 2.

Effect of water concentration in ethanol on the dissolution of molybdenum powder (T = 50°C; load Mo = 7 g/l; reaction time 4 hours)

Catalyst	Water content in ethanol, % wt.	Mo concentration in solution, % wt.	Mo conversion, %
Sample 1	0,5	0,45	55,3
Sample 2	1,0	0,63	77,4
Sample 3	2,0	0,74	85,7
Sample 4	3,0	0,87	100
Sample 5	4,0	0,87	100
Sample 6	5,0	0,87	100

As can be seen from the data in the table, 100% conversion of molybdenum is achieved when the water content in ethanol is 3% wt.

The obtained samples of catalysts (table 2) were tested in the reaction of octene-1 epoxidation with ethylbenzene hydroperoxide. Experimental data are presented in table 3.

Table 3.

Results of Epoxidation of Octene-1 with Ethylbenzene Hydroperoxide (T = 110°C; Octene:EBHP = 6:1 (molar); [Mo] = 5 10^{-4} g-at Mo/mol EBHP; τ = 60 min)

Catalyst	Water content in ethanol, % wt.	Mo concentration in the catalyst, % wt.	EBHP conversion, %	Selectivity for EBHP, %	Yield per submitted EBHP, %
Sample 1	0.5	0.45	93.1	82.8	77.0
Sample 2	1.0	0.63	91.8	84.0	77.1
Sample 3	2.0	0.74	90.6	85.9	78.0
Sample 4	3.0	0.87	90.1	82.6	74.4
Sample 5	4.0	0.87	89.0	80.8	72.2

As can be seen from the table, the water content in ethanol also affects the performance of the epoxidation process. With an increase in water content, the conversion of hydroperoxide decreases, and the selectivity index of the reaction

for hydroperoxide and the yield of the target product for the supplied hydroperoxide have an extreme dependence. Maximum selectivity and yield are achieved in the presence of catalyst sample number 3, for the preparation of which alcohol was used with a 2% water content.

The decrease in EBHP conversion and selectivity and yield with an increase in the amount of water in ethanol above 2 wt % can probably be explained, based on the literature data, by the phenomenon of competitive inhibition [10]. With a larger amount of water, the formation of the Mo-Water complex is possible instead of the active Mo-EBHP complex.

The next step in our work was to determine the effect of water on the dissolution of molybdenum during the synthesis of the epoxidation catalyst.

As is known from the literature [11], finely dispersed metallic molybdenum is covered with an oxide film of MoO_3 composition. When interacting with water, molybdenum anhydride forms molybdenum oxide hydrate H_2MoO_4, which in turn can be reduced to molybdenum blue on the surface of metallic molybdenum.

Based on the obtained experimental and published data, we made an assumption about a possible mechanism of molybdenum dissolution during the synthesis of a complex molybdenum catalyst. We assumed that the dissolution of molybdenum powder occurs through the stage of formation of molybdenum blue on the surface of molybdenum powder.

A number of experiments were carried out to test the correctness of this assumption.

In the first experiment, distilled water was added to the molybdenum powder. After 30 minutes, the layer of water above the surface of the molybdenum turned blue (molybdenum blue formed). The mixture was stirred and the aqueous solution of Mo-blue was poured off the surface of the powder. The molybdenum powder was washed with water and again filled with a fresh portion of distilled water. However, no re-staining to blue was observed. The result of this experiment indirectly confirmed the presence of an oxide film on the surface of metallic molybdenum.

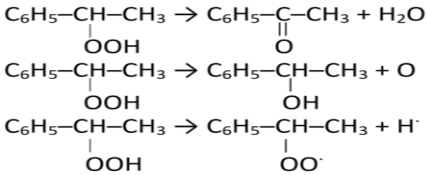
To obtain information about the reactions occurring during the synthesis of a complex molybdenum catalyst, the following experiment was carried out. A mixture composed of ethanol containing 2% wt. water, oxidized ethylbenzene and molybdenum powder were mixed at room temperature and observed the ongoing changes in the solution.

After 2 hours, the surface of the molybdenum powder turned blue, as a result of the formation of molybdenum blue, as in the previous experiment. Further, Mo-blue was distributed in the volume of the reaction mixture, since it is readily soluble in ethyl alcohol.

Taking into account the data obtained in the experiments, we made a hypo-

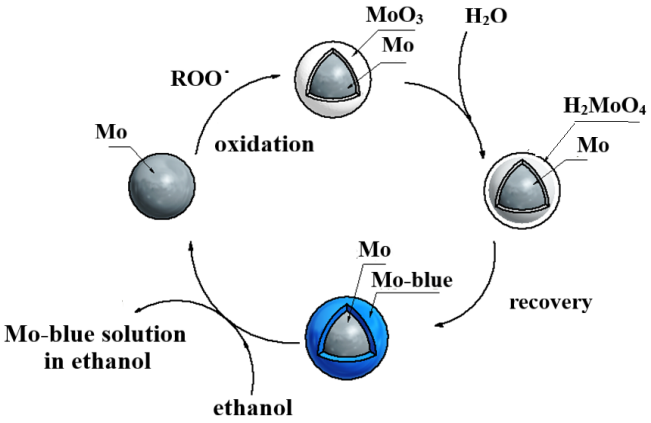
thetical description of the mechanism of dissolution of molybdenum during the synthesis of the catalyst.

At the beginning, the reaction takes place on the surface of the metal: molybdenum trioxide reacts with water, forming molybdenum oxide hydrate - molybdic acid. The latter is reduced to molybdenum blue on the surface of metallic molybdenum. Ethanol dissolves molybdenum blue and transfers it to the volume of the reaction mixture. Further, Mo-blue catalyzes the decomposition of ethylbenzene hydroperoxide with the formation of methylphenylcarbinol, atomic oxygen, acetophenone, water and peroxide radicals:



Molybdenum, freed from the oxide film, is again oxidized to molybdenum trioxide by peroxide radicals and oxygen, and the cycle is repeated.

Figure 2 shows a diagram of the hypothetical mechanism of molybdenum dissolution during catalyst synthesis.



Figures 2. *Mechanism of the reaction of dissolution of metallic molybdenum in an ethanolic solution of ethylbenzene hydroperoxide*

Based on the foregoing, it can be noted that the role of water in the process of obtaining a molybdenum catalyst is mainly in the interaction with MoO_3 to form molybdenum oxide hydrate H_2MoO_4.

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STRUCTURE AND PROPERTIES OF ALUMINUM ALLOY 1420 AFTER IRRADIATION WITH ARGON IONS

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Abstract. *The article presents the results of a study on the implantation of aluminum alloy 1420 with argon ions. It has been shown that the optimal mode, which allows the maximum weakening of the alloy, is the mode at: E = 36 keV, j = 300 μA/cm², Φ = 4.9 10^{17} cm^{-2} (irradiation time 7 min). An increase in the ion current density by a factor of 1.5 (up to 450 μA/cm²) makes it possible to reduce the irradiation time by about a factor of 2, which ensures a similar level of softening: σ_B = 351 MPa, $\sigma_{0.2}$ = 161 MPa, δ = 19.8%, lower fluence value 3.7•10^{17} cm^{-2}.*

Keywords: *aluminum alloys, argon ions, ion implantation, fluence, target.*

Introduction

Increased requirements to the level of physical-mechanical and tribotechnical properties of structural materials have led to an active search and development of promising methods for controlling the structure and properties of the surface layer. Particularly active are works on research of technological possibilities of processing of surfaces of machine parts by ion and laser beams.

Ion-beam modification of surface layers allows using high-current installations to increase concentration of alloying elements-impurities up to units and tens of percent, to increase corrosion resistance, heat resistance, wear resistance, to improve mechanical properties, resistance to fatigue.

To control the structure and properties of the material by ion-beam treatment it is necessary to investigate and describe the mechanism of hardening and increase

of wear resistance at ion implantation.

Four main mechanisms of increasing wear resistance during ion implantation can be distinguished: hardening of the surface layer, creation of favorable residual stresses, changes in the chemical composition and adhesive properties of the surface, changes in the deformation patterns of the surface layers [1]. It seems that the mechanism of increasing the wear resistance of aluminum alloys with ion implantation is not limited to the listed phenomena and processes and includes structural-phase transformations and changes in the lattice parameters of the modified metal or alloy.

In order to further study the mechanism of effect of high-energy ion beams on the structure and properties of aluminum alloys, the influence of the parameters of the mode of ion irradiation of aluminum alloy 1420 by a stream of argon ions with different irradiation fluence has been studied.

Materials and research methods

The materials used in the study were plate blanks of aluminum alloy 1420 of the Al-Mg-Li-Zr alloying system. Alloy 1420 is characterized by optimized lithium content and additionally alloyed with zirconium. The alloy has a lower density (2.52 g/cm^3), improved fracture and crack resistance characteristics and is an alternative to alloy 1163T. It is also characterized by increased specific strength.

For the irradiation experiments, the original plates were cut into small specimens of 60x60x2 mm so that in the future two specimens could be made from them for mechanical testing.

The samples under study were irradiated on an ion implanter designed for experimental work on the irradiation of various materials with gas ion beams with energies in the range of 5-70 keV. The implanter is equipped with technological ion source based on low-pressure glow discharge with cold hollow cathode generating gas ion beams of circular cross-section (S ~ 100 cm^2, E = 10-70 keV, j = 50-400 μA/cm^2).

The ion source is capable of generating both continuous and pulsed-periodic (millisecond) beams of gas ions of comparable average power. A system is provided for moving samples relative to the ion beam during irradiation (at a speed of up to 10-40 mm/s).

The implanter is equipped with a pre-pumping pump, an oil-free high-vacuum pump (first stage), and a high-vacuum turbomolecular pump to provide a working vacuum.

In order to set the required temperature conditions of sample irradiation, as well as to reproduce the conditions of experiments on the effect of accelerated ion beams on the materials under study, the temperature of target heating during irradiation was automatically controlled. For this purpose, a multichannel computer system for measuring digital signals was used.

Such a system allows remote multichannel temperature measurements in the ion implanter using a system of thermocouples and accumulation of results in the form of digital and graphical databases on a computer hard disk.

Before the experiments on sample irradiation, calibration measurements of the temperature of metal targets heating by powerful beams of accelerated ions at different irradiation parameters (values of ion energy E, ion current density j, fluence (F) and target movement speed under the beam v) were carried out.

As an illustration, Fig. 1 shows the heating curves of the studied samples of alloy 1420 sized 50x50x2 mm during their irradiation with argon ions in a continuous mode with variation of the irradiation parameters.

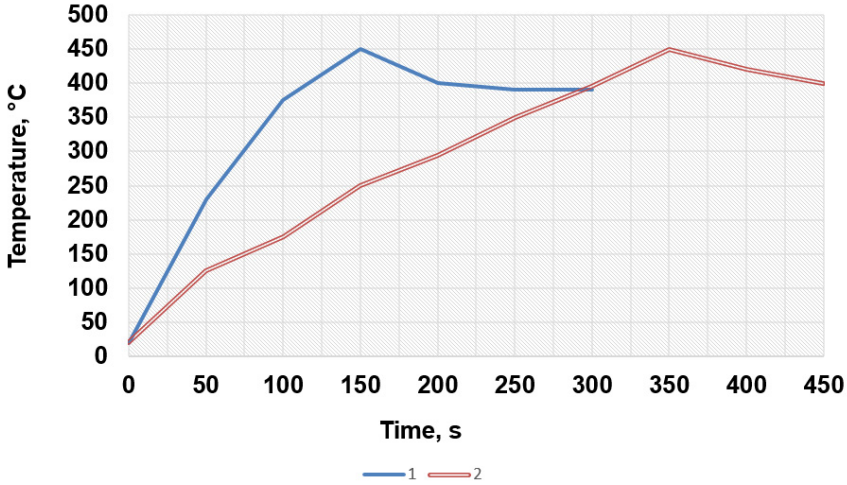

Figure 1. *Curves of the heating of alloy 1420 samples by the beam of accelerated argon ions with the energy E = 36 keV and different parameters of irradiation: 1 - j = 350 μA/cm², F = 3.6-1017 cm⁻²; 2 - j = 200 μA/cm², F = 4.5-1017 cm⁻²*

In addition, during the irradiation of alloy 1420 samples, the temperature on both sides of each sample was monitored. It was found that the temperature difference along the thickness of the sample during irradiation can reach 40-45 ºC in some temperature intervals (if the sample lies on a massive metal tray). The temperature difference can be reduced by suspending the sample on thin threads with low thermal conductivity.

The data of the preliminary study of temperature regimes made it possible to promptly select the irradiation regimes of the samples so that their temperature during the irradiation did not exceed the required limits. In the course of each

irradiation, however, the temperature of the samples was monitored (for this purpose, a thermocouple was welded to one of the identical irradiated samples, a witness sample).

Alloy 1424 was irradiated on the implanter both on one side and sequentially on both sides of the samples. During the irradiation, the samples were immobile with respect to the accelerated ion beam (since moving was not necessary due to their small size).

Information on the structural-phase state and mechanical properties of the alloy under study after various treatments was obtained by metallographic analysis, transmission electron microscopy and static uniaxial tension tests.

Metallographic analysis of alloy 1420 samples was performed on a Leica DM IRM optical microscope with the Image Expert Pro3x image processing software and hardware complex in a cross section perpendicular to the irradiated surface.

To detect grains in aluminum alloys, a reagent of the composition was used: 1.0 mL HF, 26 mL HNO3, 1.6 mL HCl, 100 mL H_2O. Etching of microslides of alloys was carried out in different reagents in 9% aqueous H_3PO_4 solution (up to 15 min), in Keller's reagent (30 ml 5% aqueous HF solution + 30 ml 5% HNO_3 solution + 90 ml 5% HCl solution + 50 ml distilled water) or in 2% NaOH solution at 60-80 °C.

Electron microscopic study of alloy 1420 samples was carried out in a transmission electron microscope JEM-200 CX thin-foil method. The structure of the samples was studied in two sections: parallel to the irradiated surface (at a distance of about 150 μm from it) and perpendicular to this surface (along the sample thickness).

The foils were made from massive samples 2 mm thick in the following way: 0.3 mm thick plates parallel to the sample surface (from the side of the irradiated surface, with the cladding layer about 0.06 mm thick removed) and perpendicular to this surface were cut on an electrosparking machine. Then, they were mechanically thinned on sandpaper to a thickness of 0.1 mm, and then electrolytically (at a voltage of 20-40 V in chloro-acetic electrolyte of composition: 23% $HClO_4$ and 77% CH_3 COOH) to a thickness suitable for electron beam transmission (~0.1 μm). The temperature of the electrolyte did not exceed 5°C.

Static uniaxial tensile tests of aluminum alloy samples in the initial, deformed and irradiated states were performed at room temperature according to the standard technique (GOST 1497-84). Error of measurements was 3% for tensile strength and yield strength and 5% for relative elongation. The obtained values of mechanical properties are the result of averaging not less than five samples.

The results of mechanical tests of bursting specimens made from the original samples of alloy 1420 sheets in artificially aged state, as well as from irradiated in different modes, are shown in Table 1.

From the data presented in Table 1 it is clear that upon unilateral irradiation of 2.0 mm thick billets of alloy 1420 by argon ions with an energy of 36 keV and a relatively low fluence: 5-10^{16} cm^{-2} (during 45 s), at an ion current density of 300 μA/cm^2, there is a decrease in the time resistance σB by ~ 38 MPa. Thus the conditional yield strength $\sigma_{0,2}$ increases on ~53 MPa, and relative elongation δ increases on ~2,8 %, that is rather essential for alloy 1420.

A further increase in the irradiation fluence to 1.1-1017 cm^{-2} leads to an even greater decrease in the time resistance. In this case, the yield strength remains practically at the level of the initial value, and the relative elongation increases to 15.0%.

With increasing irradiation fluence to 3.5-10^{17} cm^{-2} (irradiation duration of 5.5 min) alloy 1420 continues to deteriorate: the time resistance reached the value of 343 MPa, the conditional yield strength - 225 MPa, and the relative elongation - 17.5%.

Table 1.

Mechanical properties of alloy 1420 sheets with a thickness of 2 mm after various treatment options

Processing type	Processing mode	Sample heating temperature T, °	Mechanical properties		
			σ_B, MPa	$\sigma_{0,2}$, MPa	δ, %
Cold rolling	quenching + artificial aging	–	450	300	9
Implantation of argon ions	E = 36 keV; j = 300 μA/cm^2, Φ = 5-10^{16} cm^{-2}	90	412	353	11,8
Implantation of argon ions	E = 36 keV; j = 300 μA/cm^2, Φ = 1.1-10^{17} cm^{-2}	115	372	302	15,0
Implantation of argon ions	E = 36 keV; j = 300 μA/cm^2, Φ = 3.5-10^{17} cm^{-2}	350	343	225	17,5
Implantation of argon ions	E = 36 keV; j = 300 μA/cm^2, Φ = 4.9-10^{17} cm^{-2}	420	340	154	21,3
Implantation of argon ions	E = 36 keV; j = 300 μA/cm^2, Φ = 9.4-10^{17} cm^{-2}	420	343	150	16,2

Maximum softening, in combination with the highest value of relative elongation, is achieved at irradiation with fluence F = 4.9-10^{17} cm^{-2}: yield point $\sigma_{0,2}$ = 154 MPa, relative elongation δ = 21.3 %, herewith temporary resistance within measurement error is not changed (in comparison with the irradiation with the previous fluence value) and makes 340 MPa. The subsequent increase in the

irradiation fluence also does not lead to a change in the value of time resistance σ_B.

At the sequential irradiation of samples from two sides at the same parameters of irradiation but, accordingly, with twice larger fluence (9,8-10^{17} cm^{-2}) temporary resistance and specified yield strength remain at the same level but relative elongation slightly decreases up to 16,9 %.

It should be noted that the required properties ensuring the possibility of cold rolling of alloy 1420 sheets are as follows: temporal resistance - 365 MPa, conventional yield strength - 220 MPa, relative elongation - 15-18% (these properties are achieved as a result of annealing in the narrow temperature range of 370 ± 10 ºC for 1 h).

In order to establish how ion irradiation affects the microstructure of alloy 1420, in particular, whether it is homogeneous over the sample thickness during unilateral irradiation, metallographic analysis of the initial structure of alloy plates after cold deformation as well as after different irradiation modes was performed.

It was established that the microstructure of alloy 1420 in the initial cold-deformed state is characterized by a string structure indicating the presence of elongated fine grains.

After irradiation in regimes: E = 36 keV, j = 300 μA/cm^2, P = 5-1016 cm^{-2} and E = 36 keV, j = 300 μA/cm^2, P = 1.1-10^{17} cm^{-2} the alloy microstructure observed in the optical microscope practically did not change.

After irradiation in other modes (see Table 1), i.e. in those cases when the 1420 alloy is unstrengthened, significant changes are observed which manifest themselves in broadening of deformation bands and formation of both equiaxed and elongated grains inside the original ones, with formation of chains parallel to the sheet surface.

This testifies to the fact that under the action of irradiation with argon ions the recrystallization processes occur in alloy 1420. In some areas the uncrystallized structure is still observed, but the initial grain structure has changed considerably: whereas in the annealed state the lines cannot be distinguished, now the lines are clearly distinguishable, and in some areas the grain boundaries are visible at high magnification. The grain length ranges from 4 to 18 μm, and the width ~ 2-8 μm.

It should be noted that the structural changes in the alloy 1420 after irradiation with Ar^+ ions with energy of 36 keV at ion current densities of 300 and 450 μA/cm^2 and fluences of more than 3.5-10^{17} cm^{-2} occur throughout the thickness of the sample.

This conclusion is based on the analysis of the microstructure of the samples in the longitudinal and transverse sections on the irradiated and non-irradiated sides of the samples, as well as in their central part. The microstructure is sufficiently homogeneous along the thickness.

As a result of cold deformation, a banded structure is formed in the alloy. The

average width of the deformation bands does not exceed ~ 0.5-0.9 μm (Fig. 2 a). At their boundaries there are isolations of excess phase (Fig. 2 b). Some isolations are also observed inside the deformation bands (Fig. 2 c).

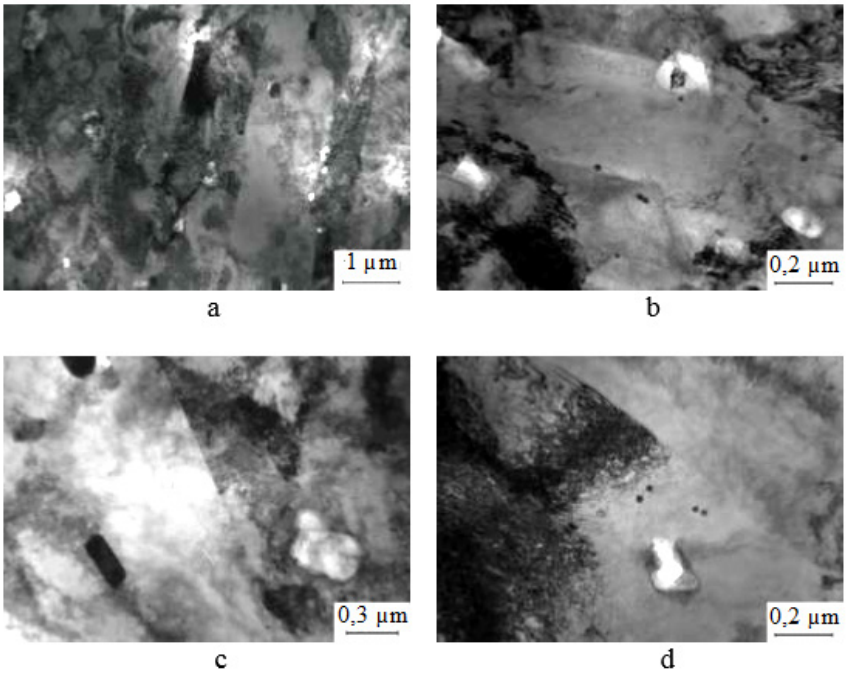

Figure 2. *Microstructure of alloy 1420 after cold deformation; light-field images: a - deformation bands; b-d - intermetallic Al_6Mn*

Calculation of the interplanar distances from the additional reflections on the electronograms revealed that the detected segregations are Al_6Mn intermetallides. At the boundaries of the bands they have an arbitrary shape, and in their volume - the form of laths up to 0.4 microns long or ellipses of the same length. The presence and predominant distribution of the detected Al6Mn phase particles are consistent with the notions [2] that in aluminum alloys with Mn addition, which alloy 1420 belongs to, manganese-containing intermetallids form during ingot crystallization and homogenization, which during subsequent deformation are arranged along the main direction.

In the volume of deformed grains (deformation bands), and sometimes at their boundaries, in addition to Al6Mn intermetallic particles with a diameter of

~ 26 nm, the so-called dispersoids with composition Al3(Zr,Sc) are revealed. It is known that dispersoids in aluminum-lithium alloys have an ordered internal structure, due to which, during their formation, superstructural reflexes appear on the corresponding electronograms [3]. The reflexes on electronograms of deformed alloy 1420 have a very low intensity, which indirectly confirms the small volume fraction of dispersoids.

Ultra-dispersed (0.2-0.35 μm in diameter) dislocation-free equiaxial subgrains were detected at some boundaries of the deformation bands. Such subgrains, according to existing ideas, are the nuclei of recrystallization. They nucleate mainly on the boundaries of deformed grains.

The deformation bands reveal inhomogeneously distributed dislocations (Fig. 2 a-c). In some bands they form dense clusters, in others they form broad dislocation entanglements that are cell boundaries. In addition, there are bands in which dislocations are virtually absent. The observed heterogeneity in the dislocation distribution is most likely due to the fact that the deformed grains in aluminum-based alloys have different stick-slip energies [4]. As a consequence, the nature of dislocation redistribution during intermediate annealing of the deformed material also differs from grain to grain.

The electron microscopic study also showed that aging at room temperature for several months of the deformed alloy 1420 practically did not affect the state of the structural components considered above, since the alloy is not prone to natural aging. At the same time, there was a disintegration of supersaturated solid solution with release of stable S-phase Al_2LiMg.

A single-sided irradiation with argon ions at the regime E = 36 keV, j = 300 $\mu A/cm^2$, F = $1.1\text{-}10^{17}$ cm^{-2} led to the formation of a highly heterogeneous grain structure. Thus, deformation bands with a width of 0.25-0.6 μm were preserved in some areas of the irradiated sample (Fig. 3 a, b).

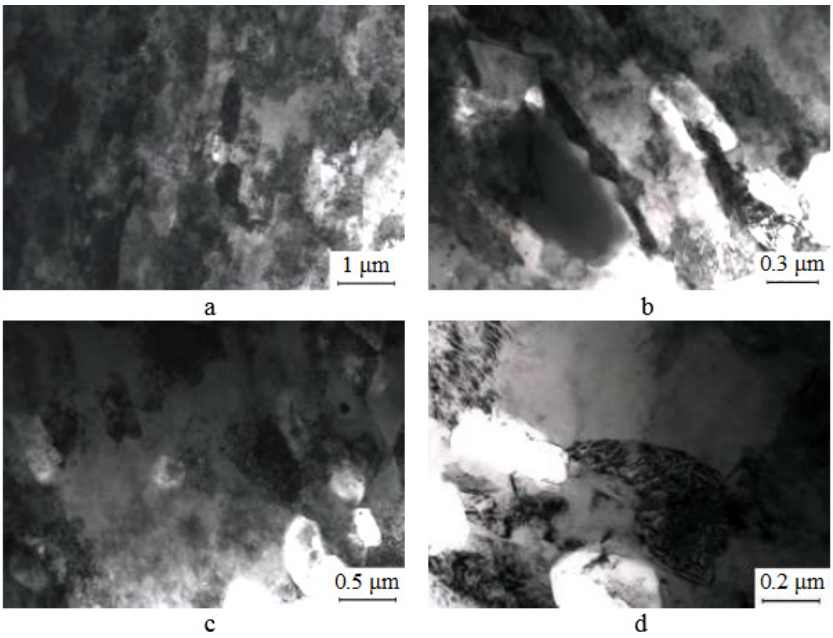

***Figure 3**. Microstructure of the alloy 1420 after cold deformation and irradiation by Ar^+ ions (E = 36 keV, j = 300 μA/cm², Φ = 1,1-10^{17} cm^{-2}) in the center of the sample cross section; bright-field images: a, b - deformation bands; c, d - subgrain structure*

Rough intermetallides are revealed at the boundaries of bands and subgrains. They either form a continuous film or have the form of equiaxed particles with diameters up to 0.45-0.6 μm. Analysis of electronograms taken from each of the above intermetallicides allowed us to conclude that they are predominantly of Al6Mn composition.

On the electronograms of the irradiated sample of alloy 1420 there are very weak, weakly visible superstructure reflexes. Their low intensity can be attributed to a very small amount of δ´-phase precipitations with an ordered structure.

Under the action of unilateral irradiation at E = 36 keV, j = 300 μA/cm², F = 4.9-10^{17} cm^{-2} the deformed structure was completely transformed into a recrystallized structure (Fig. 4 a-d). Analysis of electron microscopic images indicates that the formed recrystallized grains are characterized by dimensional heterogeneity. The diameter of the grains varies from 0.4 to 5 and more microns. The grains have equilibrium triple junctions, but retain an elongated shape in the rolling direction. In the volume of the grains, dislocation entanglements are observed.

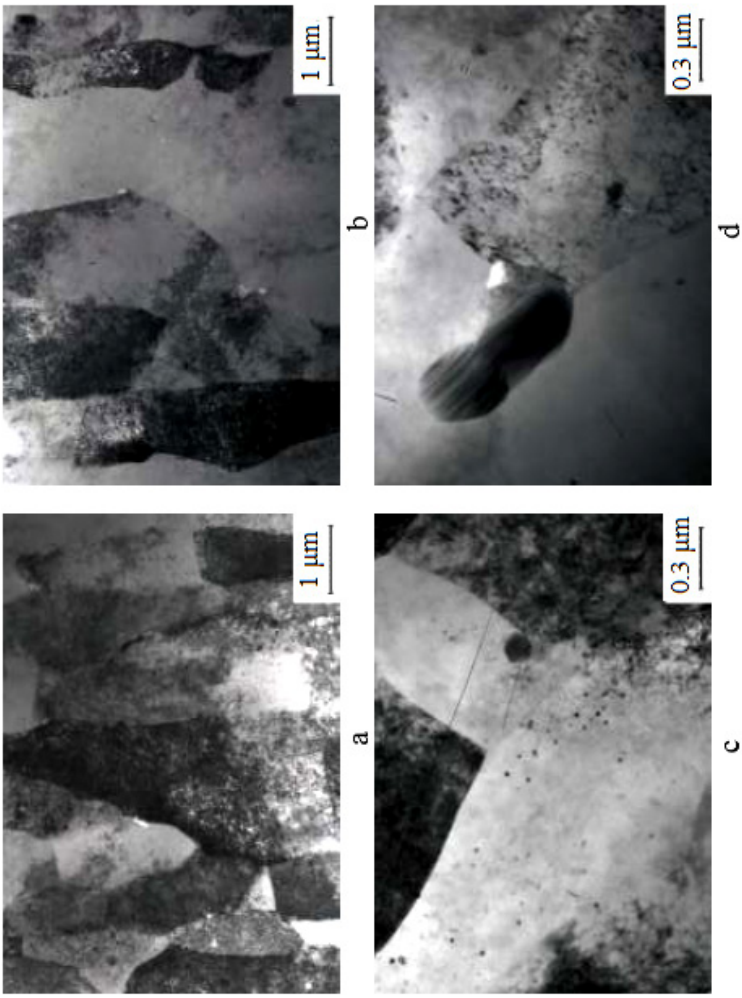

Figure 4. *Microstructure of the alloy 1420 after cold deformation and irradiation by Ar^+ ions ($E = 36$ keV, $j = 300$ μA/cm^2, $F = 4.9\text{-}10^{17}$ cm^{-2}) in the center of the cross-sectional area of the sample: a-c - light-field images of grain structure, d - intermetallide Al_6Mn*

On electronograms of irradiated alloy 1420 intense superstructure reflexes (001), (110) Al are revealed. Their appearance, as noted above, is connected with separation of particles with L12-type ordered structure. These particles include both dispersoids of Al_3(Zr, Sc) and the precipitates of the hardening phase δ´(Al_3Li).

The diameter of low-contrast particles, the density of distribution of which is rather high, is ~ 10-15 nm. The aggregate of these facts allows to consider that the largest particles are dispersoids of Al_3(Zr,Sc), and the small ones are δ´-phase.

Under the action of unilateral irradiation at E = 36 keV, j = 450 μA/cm^2, F = 3.3-10^{17} cm^{-2} a recrystallized structure was formed in the alloy. In the sample equiaxial grains with large-angle boundaries were observed. Their diameter did not exceed 3.5 microns. The boundaries of such grains are mostly free from exudations. In the volume of the grains there are sparsely arranged intermetallic Al6Mn. During irradiation, the intermetallids acquired an equiaxed shape, with their diameter decreasing to 0.1-0.2 μm. High dislocation density was observed in the equiaxed grains formed during irradiation.

In some areas of the irradiated sample, deformation bands were preserved. Under irradiation their width increased by ~ 2 times and is not less than 1-3 microns. The broadening of the deformation bands usually occurs during annealing of deformed semi-finished products [5, 6].

Especially noteworthy is that irradiation caused a sharp decrease in the density of Al_6Mn precipitations at the fringes of the bands. In the volume of the bands the Al6Mn intermetallides, as well as in the recrystallized grains, have an equiaxial shape and their diameter does not exceed 0.1-0.2 μm.

In the irradiated samples, as well as in the deformed ones, the evolution of stable S-phase (Al_2LiMg) was detected as a result of the decomposition of the solid solution by the main alloying components Li and Mg.

Thus, electron-microscopic examination of alloy 1420 samples in the initial deformed state and after irradiation has shown that the structural state of alloy 1420 after irradiation in the modes leading to softening, namely during irradiation with fluences of 4.9-10^{17} cm^{-2} (at j = 300 μA/cm^2) and 3.3-10^{17} cm^{-2} (at j = 450 μA/cm^2), has a number of features which affect its mechanical properties.

These features include the following:

- Recrystallization processes occur in the alloy under irradiation, which manifest themselves, depending on the irradiation regime, either in the broadening of the deformation bands or in the formation of an equiaxed grain structure;

- The irradiation reduces the density of grain boundary precipitations, and the homogeneous nucleated Al_6Mn intermetallics are crushed or completely dissolved; the preserved intermetallics take an equiaxed form;

- during irradiation a small amount of metastable δ´-phase (Al_3Li), which has

an ordered structure, is formed.

In order to directly compare the effect of ion irradiation (accompanied by sample heating) and conventional heating on the structure of cold-deformed alloy 1420, the regimes of sample heating during ion-beam treatment with a muffle furnace were reproduced. The performed electron microscopic study showed that in the absence of irradiation heating in the furnace to 200 °C for 95 s has no effect on the structural state of the deformed alloy 1420.

Electron microscopic analysis of alloy 1420 structure after heating in the furnace to 450 °C for 150 s revealed that in the process of heat treatment in the alloy mixed structure is formed. In the sample the deformation bands with the presence of dislocation plexus are preserved. At the same time, redistribution of dislocations occurred in a number of bands, which caused formation of cellular and sub-grain structure.

Spherical $Al_3(Zr,Sc)$ dispersoids up to 22 nm in diameter (very weak superstructure reflexes are visible on electronograms) and thin S-phase plates 20-30 nm heterogeneously born on dislocations (phase reflexes are present on corresponding electronograms) were observed in the deformation bands and equiaxed grains. Heterogeneous nucleation of S-phase, as seen in the presented figure, occurs at the grain boundaries.

The study leads to the conclusion that in the alloy 1420 during purely thermal treatment (heating and cooling) in some areas only recrystallization processes begin. Whereas after irradiation (with identical thermal regime of the process) in the alloy formed a homogeneous recrystallized structure with equiaxed grains with large-angle boundaries with diameter 1-3 microns.

Summary

Optimal mode which allows to maximally strain alloy 1420, is the following mode: E = 36 keV, j = 300 μA/cm^2, F = 4.9-10^{17} cm^{-2} (irradiation time 7 min).

Experimental results showed that the 1.5-fold increase in ion current density (up to 450 μA/cm^2) permits approximately a 2-fold reduction of irradiation time providing a close level of softening: σ_B = 351 MPa, $\sigma_{0.2}$ = 161 MPa, δ = 19.8 %, at a lower fluence value of 3.7-10^{17} cm^{-2}.

Comparison of the electron microscopy results of heated without irradiation and irradiated samples indicates a significant acceleration of the alloy microstructure rearrangement processes under the influence of ion bombardment, which allows the process of accelerated radiation annealing of metal after cold plastic deformation. Regimes of ion bombardment that do not cause heating of alloy 1420 samples above 150-200 °C can be used for surface alloying of this alloy for the purpose of hardening.

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EVOLUTION OF THE COMPOSITION OF THE ION-DOPED LAYER OF TITANIUM ALLOY VT6 AFTER IRRADIATION WITH ARGON IONS

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Abstract. *The article presents studies of the introduction of aluminum atoms into the surface layer of titanium alloy VT6: direct implantation of aluminum ions and application of a thin aluminum film by magnetron sputtering followed by ion-beam stirring with argon ions. The evolution of the composition of the ion-alloyed layer of VT6 titanium alloy after ion implantation with aluminum ions is shown.*
Keywords: *titanium alloys, ion implantation, ions, fluence, aluminum ions*

Introduction

Performance characteristics of metals and alloys, which include corrosion and erosion resistance, resistance to fracture, friction and wear, fracture resistance under corrosion fatigue and a number of other properties, are determined by the structural-phase state of the surface layers [1-3]. The method of ion implantation is a promising way to modify the performance properties of many structural materials and, in particular, titanium alloys [4-6].

This method makes it possible to reduce the time and temperature of exposure to the material by dozens of times, to perform selective processing of individual parts, and it is also possible to automate the processing process. However, ion synthesis is a complex physical and mechanical process in which the formation of secondary phases, their morphology, structure and properties of surface layers are determined by a complex of physical conditions, and depending on them can vary

over a wide range.

The introduction of ions of the alloying element into the surface layers of titanium alloys by ion-beam methods leads to the formation of intermetallic secondary phases that provide not only high mechanical properties, but also good physical and chemical characteristics (antifriction and anticorrosion).

In this regard, it seems interesting to compare two options for the introduction of aluminum atoms into the surface layer of VT6 titanium alloy: direct direct implantation of aluminum ions and application of a thin aluminum film using magnetron sputtering followed by ion-beam stirring with argon ions.

Materials and research methods

The samples of titanium alloy VT6 in the form of 10x10x2 mm plates in the hardened state, which were cut from sheets by electrospark cutting, were used for the studies.

The samples were mechanically polished using polishing pastes and cleaned in organic solvents. After mechanical polishing, the samples were subjected to electrochemical polishing.

Thermal pretreatment consisted in an incubation at 800 °C for 1 hour in vacuum ~10-4 Pa in order to carry out the processes of sample return and their transition to the equilibrium state. The samples were cooled in vacuum at room temperature.

Tantalum sputtering was performed by magnetron sputtering on a small-sized experimental setup (Fig. 1) to a thickness of ~30-40 nm at 200 °C for better adhesion of the film and sample.

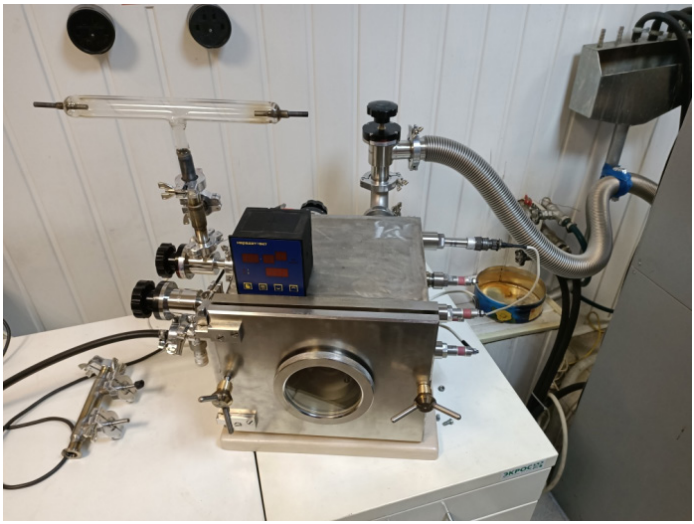

Figure 1. *Small-size installation for magnetron sputtering*

The aluminum films were stirred by argon ion implantation in a pulsed-periodic mode with an energy of 36 keV, an irradiation fluence of 5-10^{17} cm^{-2}, a current density in the pulse of 350 μA/cm^2, a pulse repetition frequency and duration of 100 Hz and 320 ms, respectively, on an original ion-beam unit (Fig. 2). The temperature of the samples during the ion irradiation was controlled with a thermocouple and did not exceed 100 °C.

Figure 2. *Installation for ion implantation*

In addition to stirring the aluminum film under the action of argon ion irradiation, direct implantation of aluminum ions into the surface of samples of titanium alloy VT6 was carried out. The implantation fluence was (1.3-9.6)-10^{17} cm^{-2}.

The surface topography of the samples was studied by atomic force microscopy (AFM) on probe microscope SOLVER 47 PRO in contact mode. Mean arithmetic surface roughness (Ra) of the samples studied was calculated from AFM images of 15 surface areas with a base size of 1 × 1 μm^2 for each sample using the probe microscope data processing program.

The chemical composition of the surface layers was investigated by X-ray photoelectron spectroscopy (XPS) on a SPECS spectrometer, using MgKα radiation (1253.6 eV) in combination with layer-by-layer etching of the surface with argon ions (estimated etching rate ~1 nm/min).

The phase composition was determined qualitatively on a D2 PHASER X-ray

diffractometer with Bregg-Brentano geometry and a LYNXEYE linear counter. Samples were mapped using CuK_{α} radiation, diffractograms were analyzed using "DIFFRAC.EVA" software module, phases were identified using PDF-2/Release 2010 RDB database of the International Centre for Diffraction Data (The International Centre for Diffraction Data).

Microhardness of the samples' surface layers before and after irradiation was measured by indentation of a diamond indenter on the PMT-3M device under a load of 20 g and keeping the sample under load for 5 seconds. To increase reliability of the result, the measurement procedure was performed at least 20 times.

Results and discussion

Studies by atomic force microscopy showed that ion-beam stirring of aluminum film by argon ion implantation in pulse-periodic mode does not lead to changes in the surface morphology of the samples (Table 1). The value of the surface roughness parameter Ra for the sample in the initial state does not differ from the Ra values after aluminum sputtering and argon ion implantation.

Table 1.

Changes in surface roughness of samples of titanium alloy VT6 in the initial state, after aluminum sputtering, ion implantation and after ion-beam mixing

Sample	Roughness Ra, nm	RMS, nm
VT6 initial state	8,7	2,8 (36%)
VT6 + Al (35 nm)	8,2	2,2 (24%)
VT6, Al ion implantation	6,8	2,3 (32%)
VT6 + Al (35 nm) + Ar	7,7	2,5 (32%)

The implantation of aluminum ions into titanium resulted in obtaining the ion-alloyed surface layers of 320 nm thickness (irradiation fluence of $2.6\text{-}10^{17}$ cm^{-2}), 650 nm thickness (irradiation fluence of $6.5\text{-}10^{17}$ cm^{-2}) and 920 nm thickness (irradiation fluence of $9.7\text{-}10^{17}$ cm^{-2}) (Fig. 3, Table 2).

The maximum aluminum concentration in the surface layer of the sample of VT6 titanium alloy ion-alloyed at the fluence of $2.7\text{-}10^{17}$ cm^{-2} makes 32 at% and occurs at a depth of 130 nm from the irradiated surface.

As the distance from the ion-alloyed surface to the depth of the implanted layer, the aluminum concentration sharply decreases and at 320 nm from the irradiated surface does not exceed 5 at%.

With increasing irradiation fluence the aluminum concentration in the surface layers increases up to 55 at. % and the concentration maximum shifts to greater depths. So, in case of implantation with fluence of irradiation of $6.7\text{-}10^{17}$ cm^{-2}

the maximum is at the depth of 310 nm, and with fluence of irradiation of 9.7-10^{17} cm^{-2} - at 480 nm from irradiated surface. However, in addition to aluminum ions, oxygen and carbon impurities from the residual atmosphere of the vacuum chamber of the implantation unit are present in the surface layers. The presence of oxygen and carbon contributes to the formation of titanium and aluminum oxides and titanium carbide.

The study of the structural-phase state of the ion-alloyed layers of titanium alloy VT6 under all implantation conditions by the method of transmission electron microscopy has shown the existence of the following phases (Table 2): α_2-phase (intermetallide Ti_3Al with the structure $D0_{19}$) and γ-phase (intermetallide TiAl with the structure $L1_0$); solid solution of aluminum in hexagonal titanium (α-phase). The formation of these phases in the surface layers of titanium is consistent with the state diagram of the Ti-Al system [7].

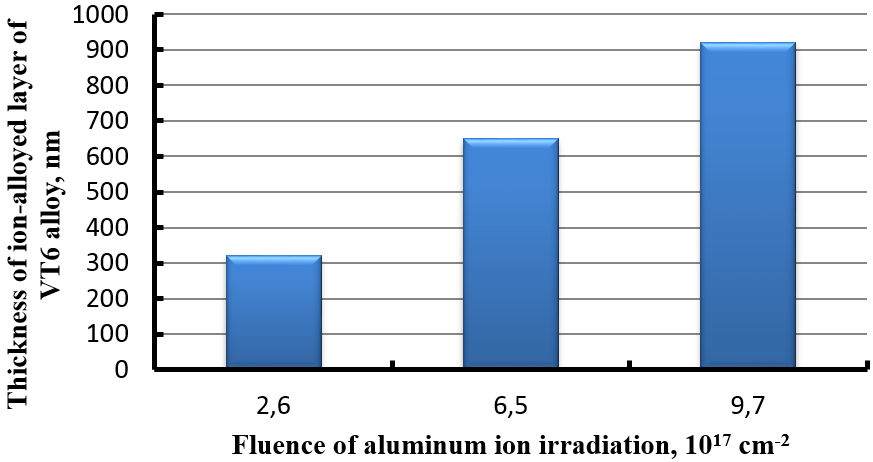

Figure 3. *Influence of aluminum ion irradiation fluence on the thickness of ion-alloyed layers of titanium alloy VT6*

Table 2.

Main characteristics of surface implanted layers of titanium alloy VT6

Fluence of irradiation, 10^{17} cm^{-2}	2,5	6,5	9,7
Thickness of ion-alloy layer, nm	320	650	920

Average size of formed phases, nm	16	38	54
Average size of formed phase conglomerates, nm	–	50	180
Phase composition	α_2–Ti_3Al, γ–TiAl, α–фаза, TiO_2, (рутил), TiC	α_2–Ti_3Al, γ–TiAl, α–фаза, TiO_2, (гекс.), TiC,γ–Al_2O_3	α_2–Ti_3Al, γ–TiAl, α–фаза, TiO_2, (гекс.), γ–Al_2O_3

The microdiffraction pattern of the sample of Ti alloy VT6 implanted at the irradiation fluence of $2.6\text{-}10^{17}$ cm^{-2} is a set of diffuse rings (Fig. 4, b), which is associated with the formation of finely dispersed, intermetallic phases Ti_3Al and TiAl with their uniform distribution in the depth of the ion-alloyed layer. The average grain size of the phases formed was 16 nm.

With increasing irradiation fluence the average grain size of formed phases increases and they are combined into conglomerates (Fig. 5, Table 2), which leads to the appearance of many point reflexes on the Debye rings of microdiffraction patterns. At maximum irradiation fluence of aluminum ions the formed grains of intermetallic phases have average size of about 50 nm, and average size of conglomerates reaches 180 nm (Fig. 5).

Comparison of light-field and dark-field images of surface ion-alloyed layers of titanium alloy VT6 has shown that crystallites of the Ti3Al phase are formed next to TiAl, possibly due to the phase transition of α2 into γ-phase. Based on the data obtained by the EOS and PEM methods, the places of localization of the phases formed were identified (Fig. 6).

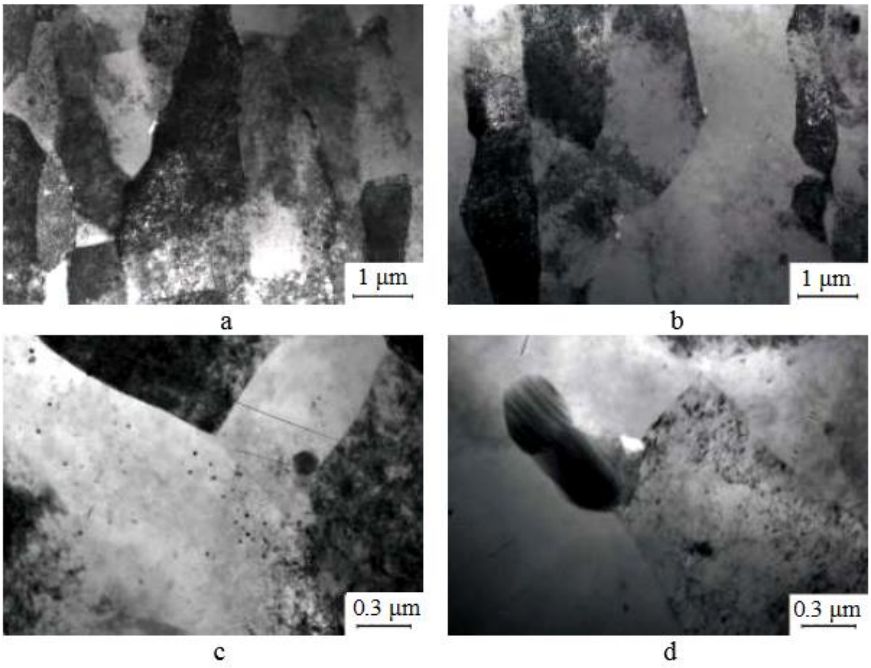

Figure 4. *PEM images of ion-alloyed layers of titanium alloy VT6 fluence 9.7-1017 cm-2):*
a - light-field image; b - microdiffraction pattern; c, d - dark-field images

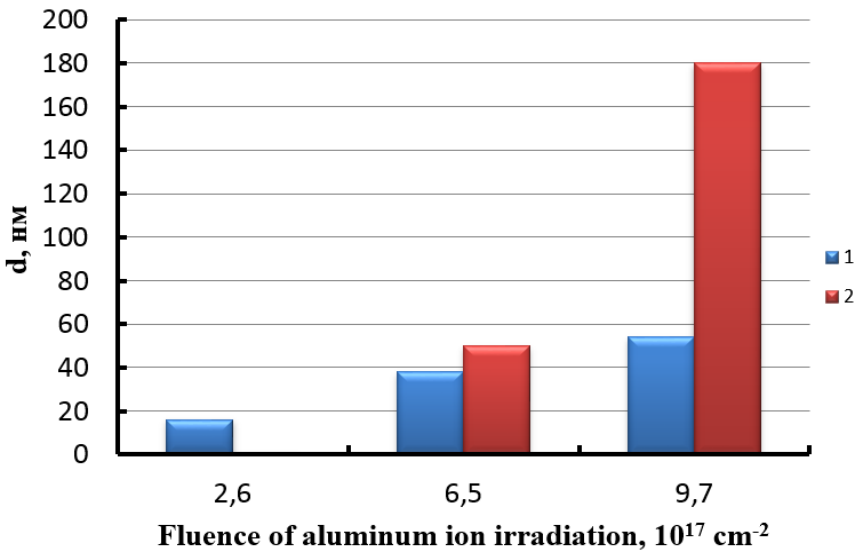

Figure 5. *Effect of aluminum implantation fluence in the tianium alloy VT6 on the average grain size of the formed intermetallic phases (1) and their conglomerates (2)*

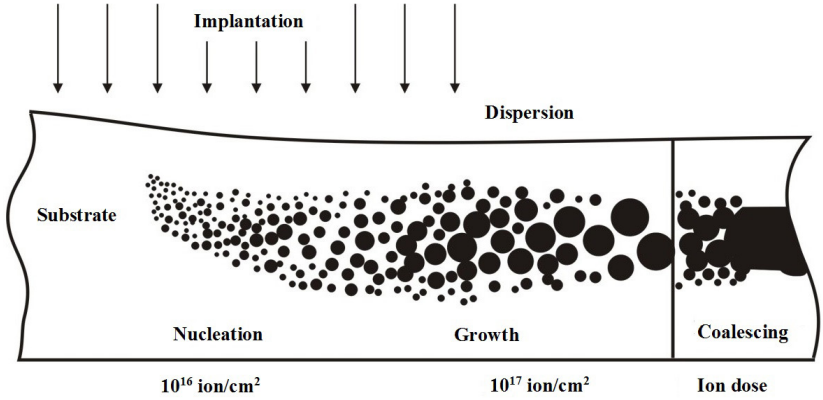

Figure 6. *Formation of conglomerates of intermetallic phases in VT6 titanium alloy with increasing aluminum implantation fluence*

The scheme of evolution of the surface layers of VT6 titanium alloy implanted with aluminum ions depending on the implantation conditions is shown in Fig. 6. In the ion-alloyed layer there is region 1, which corresponds to the surface oxide-carbide film, the thickness of which increases with increasing irradiation dose.

Below this region is region 2, containing two intermetallic phases (α_2-Ti_3Al; γ-TiAl) and a solid solution of aluminum in titanium; α_2-phase (Ti_3Al) is formed at greater distances from the surface in contrast to γ-phase TiAl (region 3). Solid solution of aluminum in titanium (α-phase) is formed throughout the depth of the alloyed layer.

The study of mechanical properties showed that in all implanted samples of titanium alloy VT6 the microhardness at depths up to two micrometers exceeds the microhardness at corresponding depths for the initial state of the alloy. For the sample with treatment time 60 min the increase of microhardness in 1,2-2 times in near-surface area with thickness ~2 microns was observed.

The ion implantation of aluminum in the VT6 titanium alloy makes it possible to form the nanocrystalline equilibrium phases of intermetallic (Ti_3Al and TiAl) and solid solutions of variable composition in the surface layers of the targets corresponding to the diagrams of state of the Ti-Al system. The dependence of the average grain size growth of the formed phases in the surface ion-alloyed layers of VT6 titanium alloy on the implantation time and irradiation fluence has been established. At irradiation fluence of $6.5\text{-}10^{17}$ cm^{-2} and more the aggregation of grains of formed phases in conglomerates is observed in the surface ion-alloyed layers of titanium, the average size of which also increases with increasing fluence. The places of localization of the phases formed in the process of implantation along the depth of the alloyed layers depending on the implantation conditions have been determined.

High-intensity metal ion implantation is an effective method of forming surface layers in metallic materials containing nanocrystalline intermetallics. Increasing the target temperature due to high ion flux density as well as the duration of ion treatment allows the formation of modified layers up to several micrometers thick. Such surface layers, containing a high density of nanosized intermetallic phases, have significantly better physical and mechanical characteristics compared to the original target materials.

X-ray photoelectron studies of the elemental composition of thin surface layers of nanometer-range VT6 titanium alloy before and after stirring revealed that argon ion implantation in pulse-periodic mode with the chosen parameters to a weak stirring of aluminum film with ~35 nm thickness with a substrate (Fig. 7).

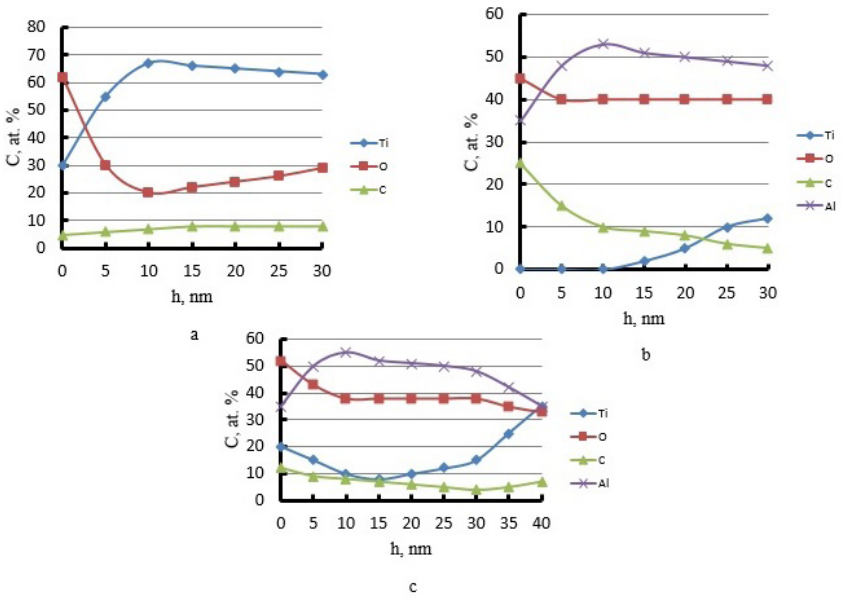

Figure 7. *Profiles of elements distribution in the surface layers of titanium alloy VT6:*

a - in the initial state; b - after aluminum sputtering;
c - after stirring by argon ions

Another direction of solving the problem of mixing of aluminum and titanium atoms is annealing of samples with a sprayed aluminum film. In order to realize vacuum annealing it is necessary to maintain the parameters of the working environment rarefaction in the furnace, the temperature of sample heating and their holding time. Heating temperature primarily determines the intensity of diffusion processes development. At heating temperatures below the aluminum film melting point (627 °C) an intensive mutual diffusion process is not observed. At the same time at temperatures above the aluminum film melting point, mechanical removal of the film from the surface of the titanium target can occur.

Annealing of samples after ion-beam stirring at 900°C for 30 min in vacuum ~10^{-4} Pa and following cooling together with the furnace leads to the reduction of aluminum content in thin surface layers down to trace amounts of ~1- 2 at.% (Fig.8).

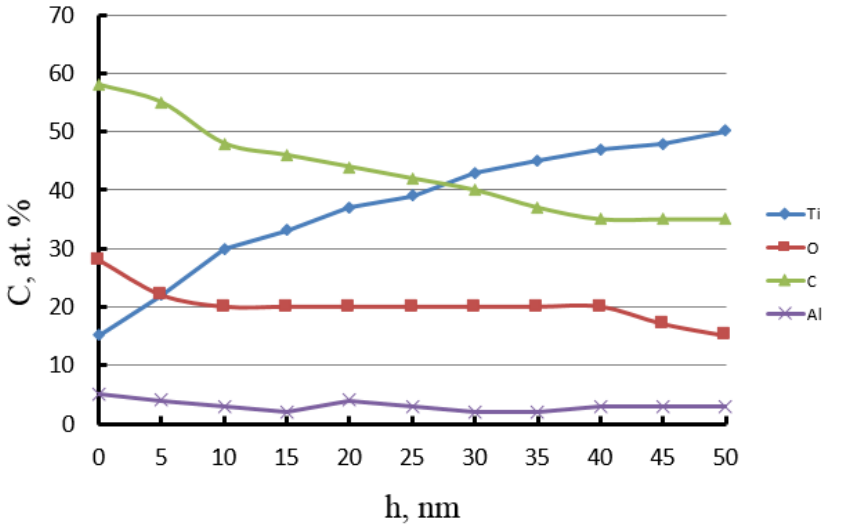

Figure 8. *Distribution profiles of elements in the surface layers of titanium alloy VT6 after stirring by argon ions and vacuum annealing*

Measurements of microhardness have shown, that if after ion-beam stirring value of microhardness within dispersion of values does not differ from microhardness of a sample in an initial condition and makes ~500 MPa, after vacuum annealing value of microhardness has increased more, than on 30 % - up to ~860 MPa.

For intensive ionic mixing of aluminum film deposited on VT6 alloy during titanium ion implantation, the energy of implanted argon ions should be increased by increasing the accelerating voltage to 60-70 kV.

Summary

The study of mechanical properties has shown that in all implanted samples of titanium alloy VT6 the microhardness at depths up to two micrometers exceeds the microhardness at the corresponding depths for the initial state of the alloy. For the sample with treatment time 60 min increase of microhardness in 1,2-2 times in near-surface area with thickness ~2 microns was observed.

The mode of high-intensity ion-beam treatment, realized at alloying a target of VT6 titanium alloy with aluminum, allows to receive layers, which thickness exceeds the value of projective path of ions by orders of magnitude. The formation of ion-alloyed layers up to 2 μm thick has been detected when aluminum ions are implanted into titanium. The dependence of titanium and nickel ion-alloyed

layers thickness growth on the implantation conditions has been established. The increase in the thickness of the ion-alloyed layers of titanium occurs with the increase in the time of material processing.

The expected effect of ion mixing due to ion bombardment of aluminum film with argon is not observed. Therefore, to realize such a mixing mechanism of titanium and aluminum, it is necessary to increase the energy of the implanted ions, on the one hand, and, on the other hand, the possible replacement of argon ion by titanium ions. In the latter case, the process of direct implantation of titanium ions into the aluminum film will be realized.

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AIRCRAFT SUPERMANEUVERABILITY

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Abstract. *One of the ways to increase the effectiveness of combat aircraft is to improve maneuverability. The article analyzes the capabilities and characteristics of combat aircraft with access to supercritical angles of attack when performing a number of tasks.*

Keywords: *"supermaneuverability": "cobra", "hook", "bell", "controlled corkscrew", dynamic output to ultra-large angles of attack.*

In the 60s, relying on a fairly extensive experience in the use of aviation during numerous local conflicts, aviation designers explored possible ways to improve the tactical flight data of fighters. The analysis showed that the further increase in the combat potential of aircraft due to increased maneuverability is in the area of large angles of attack and low speeds, that is, beyond the limitations of existing aircraft. Self-flying in such modes could not fly yet, but there was already a clear understanding of the fact that this would give the aircraft the opportunity to quickly change the direction of movement, and in some cases, without changing the trajectory, to reorient in space - to turn around relative to the vertical or horizontal axis and thereby gain an advantage for attacking the target. In the 60s, relying on a fairly extensive experience in the use of aviation during numerous local conflicts, aviation designers explored possible ways to improve the tactical flight data of fighters. The analysis showed that the further increase in the combat potential of aircraft due to increased maneuverability is in the area of large angles of attack and low speeds, that is, beyond the limitations of existing aircraft. Self-flying in such modes could not fly yet, but there was already a clear understanding of the fact that this would give the aircraft the opportunity to quickly change the direction of movement, and in some cases, without changing the trajectory, to reorient in space - to turn around relative to the vertical or horizontal axis and thereby gain an advantage for attacking the target.

The flight experiment showed [1] that in a certain narrow range of speeds, with

a short-term exit to large angles of attack, with a complete deviation of the stabilizer for cabring, and when the aircraft is moving with a rapid increase in the angle of attack, the development of lateral movement does not occur, at the same time, with a low rate of change in the angle of attack, the aircraft in a number of cases he was falling down. The obtained results indicated that there is a fundamental possibility of a short-term (dynamic) exit of the aircraft to ultra-large angles of attack, followed by a return to operational flight modes. Performing such a maneuver requires a high rate of taking the handle "on itself" when entering the mode, which, combined with a high rate of stabilizer shifting, allows you to get large, up to 70 degrees / sec. angular pitch velocities, due to which the aircraft due to inertia enters the area of large angles of attack, where it again has stability in the angle of attack. This moment should ensure a return from large angles of attack. Access to ultra-large angles of attack is possible on the Su-27 with neutral or negative overload stability when switching the remote control system (SDU) to the "hard link" mode (manual control) and disabling the limiter of limit modes. The exit from the maneuver requires the same high rate of recoil of the handle "from itself" at the moment of reaching the maximum angle of attack, followed by its transfer to a position close to neutral. When the angle of attack is reduced to 10-15 degrees, the RUS must be taken over, which should simultaneously be accompanied by an increase in engine thrust and switching the SDU to the "flight" mode in order to prevent the aircraft from switching to negative angles of attack. The average maneuver execution time is 5-7 seconds, while reaching the maximum angles of attack (pitch) occurs at 2-3 seconds. The maximum value of normal overload, equal to 4, selected from the condition of the minimum change in the angle of inclination of the trajectory, which creates the effect of flying "tail first" for the ground observer, is reached 1-1.5 seconds after the start of the maneuver, and then the overload value decreases intensively. This is a consequence of high angular pitch velocities, at which there is a rapid disruption of the flow from the wing of the aircraft (at the normal rate of taking the handle "on itself", the aircraft goes to destructive overload already at 2-3 seconds). "Dynamic exit to ultra-large angles of attack" was first performed by I.P. Volk (09/29/1987). "Dynamic exit to ultra-large angles of attack" is carried out in the speed range of 300-450 km/ h from the mode of horizontal flight, climb and descent, as well as on a turn with a roll angle of up to 80 degrees.

One of the features of the "dynamic exit to ultra-large angles of attack" maneuver is the high deceleration rates of the aircraft, which cannot be created in other flight modes [1]. The most important indicator of the maneuverability of the aircraft is its ability to change the direction of flight in time. This property can be called the trajectory agility of the aircraft. To characterize the maneuverability of the aircraft, the angular velocity of rotation and the radius of curvature of the

trajectory are used:

- in the vertical plane

$$\omega_y = \frac{g}{V}(n_y - \cos\theta), \quad r_y = \frac{V^2}{g(n_y - \cos\theta)},$$

where:

n_y - normal overload;

V – flight speed;

θ - the angle of the direction.

- in the horizontal plane

$$\omega_z = \frac{g}{V}\sqrt{n_y^2 - 1}, \quad r_z = \frac{V^2}{g\sqrt{n_y^2 - 1}}.$$

But to characterize the maneuverability of aircraft at a given V and θ, the main indicator de-termining turnability is the value of normal overload. The maximum maneuverable characteristics (ca-pabilities) of such aircraft are determined by the maximum available normal overload, which in turn depends on the altitude and flight speed. If this overload is exceeded, there is a danger of the aircraft stalling, or deformation of the structure, or loss of consciousness by the pilot. The maximum available normal overload corresponds to the maximum angular velocities and minimum radii of trajectories in the plane of the maneuver. The angular velocity of the turn in the vertical plane can be increased either by increasing the normal overload, or by reducing the flight speed, or both at the same time. The over-load can be increased by increasing the vertical component of the thrust force of the engines, deflect-ing the thrust vector in the plane of symmetry of the aircraft towards the axis of lift. The greater the angle of deviation of the thrust vector, the greater the force bending the trajectory of the aircraft, how-ever, at the same time the longitudinal component of the thrust decreases, which leads to a decrease in flight speed and the total force bending the trajectory. Therefore, the turning radius in the vertical plane decreases, and the angular velocity increases. Horizontal and spatial maneuvers are the most widely used in combat. In order to increase the "turnability" of an aircraft with a controlled thrust vec-tor (UHT) during such maneuvering, it is necessary to deflect the thrust vector not only in the plane of symmetry of the aircraft, but also in the horizontal plane. This can be especially clearly demonstrated by the example of the "turn". The maximum angular velocity in the horizontal plane is achieved at the maximum available overload. To increase the angular velocity, it is necessary to either increase the overload, or reduce the flight speed, or both (within certain limits). It is possible to increase the normal overload

by increasing the angle of attack, up to a critical one, which does not lead to a further increase in the lifting force, and therefore the force bending the flight path in the horizontal plane. It is also possible to increase the overload without exceeding the limits on the angle of attack by deflecting the thrust vector in the plane of symmetry of the aircraft. A more significant increase in the speed of the aircraft's turn in the horizontal plane is possible by deflecting the thrust vector in the horizontal plane, which leads to a decrease in flight speed, an increase in normal reloading and an increase in the force bending the trajectory in the horizontal plane. By changing the angles of deviation of the thrust vector in two planes accordingly, it is possible to increase the maneuverability of the aircraft in any inclined plane [2].

Further development of the Su-27 family of aircraft led to the creation of Su-37 and Su-30MK aircraft equipped with UHT engines. The controlled all-rotating front horizontal tail mounted on the influx of the wing shifts the aerodynamic focus forward, increasing the efficiency of aircraft pitch con-trol, and allows you to significantly change the parameters of stability and controllability of the aircraft. The deviation of the PGO causes an instantaneous reaction of a statically unstable aircraft and provides an instantaneous realization of extreme overloads and high speeds of pitch angle change. High rates of change in the angle of attack make it possible to use a large additional component of the lifting force that occurs during non-stationary flow. With an increase in the flight angle of attack, the deflected PGO operates in the mode of a slit pre-wing for the root part of the wing and, together with the wing mechanics automatically deflected at the angles of attack, improves flow, minimizes drag and increases the aerodynamic quality during maneuver. The slat effect also prevents unintentional piling and entering the corkscrew. As a result of the aerodynamic interaction of the influx and PGO with the mechanization of the wing, and the stabilizer, the effect of a slit high-bearing wing of a large chord with variable curvature and profile characteristics is achieved. In general, the influx and PGO create a controlled vortex system around the aircraft, significantly improving the characteristics of the aircraft in the pitch channel, and acting similarly to the powerful mechanization of the wing. All this prevents the loss of the aircraft's load-bearing properties during a combat maneuver and practically eliminates shaking at high angles of attack, which on other aircraft interferes with piloting and aiming.

The maneuverable capabilities of the aircraft achieved exclusively by aerodynamic means in combination with a controlled thrust vector allow performing aerobatic figures without any restrictions, even without aerodynamic reference to the flight path [3]. During the tests on the Su-30MK, such ma-neuvers as "cobra", "hook", "colo-colo", "controlled corkscrew" were performed, associated with reach-ing near-zero speeds and large attack angles. Aerobatics performed on super-maneuverable aircraft in a vertical plane with access to supercritical angles

of attack cannot yet be recommended for use in aerial combat and much work remains to be done to study the possibility of their combat use. In particular, little consideration is given to the use of elements of "supermaneuverment" when attacking a ground target. For example, the use of a "turn on the hill" reduces the time of repeated attack, "bell" or "cobra" can be used as components of combat maneuvers performed with intensive braking at critical angles of attack. At the same time, the aircraft goes to "blind" approach speeds, at which the enemy radar track-ing is disrupted. There are even known test results of the use of the "bell" by the Su-24 aircraft when attacking a ground target, when the attack time was reduced compared to standard methods [4].

However, it should be noted that the main disadvantage of such maneuvers is the loss of me-chanical energy, which limits the possibilities of intensive maneuvering for some time. In any case, ma-neuvers with access to supercritical angles of attack significantly expand the combat capabilities of fighters, and large angles of attack are "aerodynamic weapons", the issues of combat use of which have not yet been fully investigated.

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COMPOSITION AND STRUCTURE OF SURFACE LAYERS OF TITANIUM ALLOY VT6 AFTER IMPLANTATION OF TANTALUM IONS

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Abstract. *The paper presents the results of the investigation of the surface layer composition of titanium alloy VT6 obtained after ion implantation with tantalum ions. It is shown that tantalum ion implantation can lead to a significant reduction in surface roughness, as well as a beneficial effect on the corrosion properties of the titanium alloy.*

Keywords: *titanium alloy, ion implantation, tantalum ions, fluence, microstructure.*

Introduction

Titanium and its alloys are becoming more and more common as structural materials every year. The main advantages of titanium are high specific strength and high corrosion resistance in a large number of media. However, for some applications based on particularly aggressive media, the corrosion resistance of pure titanium is not sufficient for long-term and safe operation. It is possible to improve corrosion resistance of titanium by alloying it with such elements as tantalum, molybdenum and niobium. Tantalum shows greater resistance to corrosion damage than titanium, but its wide application is limited by high density and high cost.

In works [1-3] it is noted that alloying titanium with 5 % of tantalum leads to improvement of corrosion resistance up to the level of technically pure tantalum. Creation of coatings of Ti-Ta system contributes to reduction of cost and metal intensity of structures. The use of ion implantation of tantalum in the titanium alloy VT6 can be a promising direction to improve the corrosion resistance of the parts

of hollow welded femoral endoprostheses (Fig. 1) [4-6].

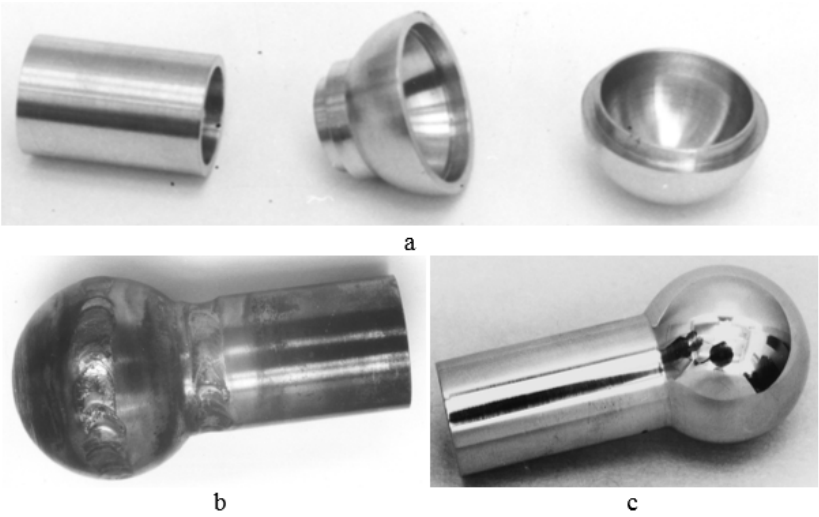


Figure 1. *Composite head and stem before welding (a), appearance of endoprosthesis after welding (b) and appearance of endoprosthesis after final machining (c)*

Materials and research methods

The weight of a hollow welded prosthesis made of alloy VT6 was 204 g. The weight of a similar prosthesis made of HT6 alloy was 325 g.

The samples of titanium alloy VT6 in the form of 10x10x2 mm plates in a hardened state, which were cut from sheets by means of electrospark cutting, were used for the studies.

The samples were mechanically polished using polishing pastes and cleaned in organic solvents. After mechanical polishing, the samples were subjected to electrochemical polishing.

Thermal pretreatment consisted of an incubation at 800 °C for 1 hour in vacuum ~10-4 Pa in order to carry out the processes of sample return and their transition to the equilibrium state. The samples were cooled in vacuum at room temperature.

Tantalum ion implantation in a pulse-periodic mode with an energy of 36 keV, irradiation fluence of $(1.1\text{-}7.6)\cdot 10^{17}$ cm^{-2}, with a current density per pulse of 350 $\mu A/cm^2$, pulse repetition frequency and duration of 100 Hz and 320 ms, respectively, on an original ion-beam facility (Figure 2). The temperature of the samples during the ion irradiation was controlled with a thermocouple and did not exceed 100 °C.

Figure 2. *Installation for ion implantation*

The surface topography of the samples was studied by atomic force microscopy (AFM) on a SOLVER 47 PRO probe microscope in contact mode. The average arithmetic surface roughness (Ra) of the studied samples was calculated from AFM images of 15 surface areas with a base size of 1×1 μm^2 for each sample using the probe microscope data processing program.

The chemical composition of the surface layers was investigated by X-ray photoelectron spectroscopy (XPS) on a SPECS spectrometer, using MgKα radiation (1253.6 eV) in combination with layer-by-layer etching of the surface with argon ions (estimated etching rate ~1 nm/min).

The influence of the ion implantation mode parameters on the penetration depth of tantalum ions into the VT6 alloy target was investigated by Auger spectrometry and secondary ion mass spectroscopy.

Microhardness of surface layers of samples before and after irradiation was measured by indentation of diamond indenter on PMT-3M device under load of 20 g and sample holding under load for 5 seconds. To increase the reliability of the result, the measurement procedure was performed at least 20 times.

Implantation of the base metal and the weld metal of VT6 alloy was carried out at the modes presented in Table 1.

Table 1.

Parameters of ion implantation of VT6 titanium alloy and its welded joint with tantalum ions

Mode number	Accelerating voltage, kV	Плотность тока ионного пучка, мкА/см2	Implantation fluence, cm^{-2}
1	36	300	$1{,}1 \cdot 10^{17}$
2	36	300	$5{,}2 \cdot 10^{17}$
3	36	300	$7{,}6 \cdot 10^{17}$

Results and discussion

The experimental data on the implantation of alloy VT6 and its welded joints with tantalum ions were obtained as a result of the research are presented in Table 2.

Table 2.

Depth of penetration of tantalum ions into VT6 target as a function of implantation mode parameters

Irradiated target	Penetration depth of tantalum ions, nm		
	Implantation fluence, cm^{-2}		
	$1{,}1 \cdot 10^{17}$	$5{,}2 \cdot 10^{17}$	$7{,}6 \cdot 10^{17}$
Base metal	190	390	580
Metal weld	240	520	790

The data presented in Table 2 show that with increasing fluence values of tantalum implantation, the penetration depth of its ions increases both in the target of BT6 alloy and in the weld metal of the specified titanium alloy. The depth of penetration of tantalum ions into the weld metal exceeds the depth of penetration into BT6 titanium alloy at the same values of implantation fluence.

The irradiation of VT6 titanium alloy with tantalum ions is accompanied by an increase in the fatigue endurance limit of both VT6 alloy and its welded joints.

Irradiated samples of BT6 alloy withstand a greater number of cycles to failure compared to the original samples. The sample irradiated with tantalum ions (fluence 7.6-1017 cm^{-2}) at equal cycle stress (340 MPa) withstood 1.93 times more cycles to failure than the original sample (unirradiated).

Irradiation of welded joints of alloy VT6 made by fusion welding (argon-arc welding) is also accompanied by an increase in the fatigue strength of samples in

bending tests (Table 3).

Table 3.

Endurance limit of specimens of alloy VT6 (test base 107 cycles), MPa

Sample Condition	Non-irradiated (control)	Implantation fluence, cm^{-2}		
		$1{,}1 \cdot 10^{17}$	$5{,}2 \cdot 10^{17}$	$7{,}6 \cdot 10^{17}$
Base metal	592	612	625	644
Welded connection	456	501	543	592
$K = \sigma_{СВ}/\sigma_{ОМ}$	0,77	0,82	0,87	0,92

It can be noted that with increasing fluence of tantalum implantation there is a tendency to alignment of the fatigue strength of the base metal and the welded joint of BT6 alloy.

The effect of the temperature of a titanium target of VT6 alloy on the penetration depth of tantalum ions was studied as part of the ongoing research. Studies on tantalum implantation in the VT6 titanium alloy were conducted by heating the target in the temperature range of 300-900 ˚C.

It was found experimentally that at irradiation temperatures in the range of 300-500 °C tantalum diffusion into the deep layers of the target is practically absent and the deposition of impurity tantalum atoms in the form of a surface sublayer on the VT6 alloy target prevails.

A noticeable increase in the depth of penetration of tantalum atoms deep into the titanium target begins at the heating temperature starting from 600 ˚C.

The experimental results showed that the maximum penetration depth is observed in the zone corresponding to the central region of the beam, i.e., the maximum ion current density, which reaches 6.2-8.5 μm with tantalum concentration at this depth at 12-13 at %. At depths of about 18-20 μm from the target surface, the tantalum concentration is about 5-7 at. %.

Studies of samples implanted at 900 ˚C also showed a fairly intensive alloying of the target with tantalum, but the thickness of the ion-alloyed layer was somewhat less than after irradiation of the target at 700 ˚C (Figure 3).

Based on the results obtained, it can be concluded that increasing the surface temperature of the titanium target during implantation contributes to an increase in the depth of the ion-alloyed layer with a simultaneous decrease in the concentration of the implanted impurity atoms in it. From the point of view of increase of the ion-alloyed layer thickness the use of titanium target heating temperature higher than 700 °C should be recognized as inexpedient.

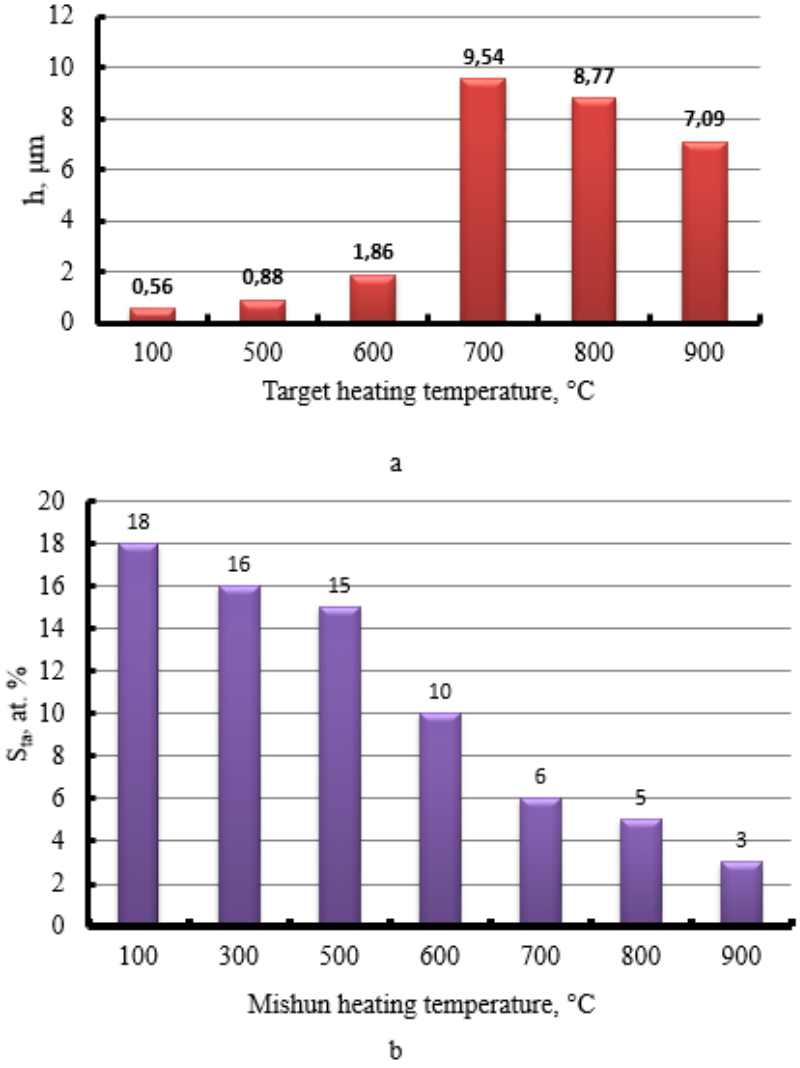


Figure 3. *Influence of titanium target heating temperature during implantation on the ion-alloyed layer depth (a) and tantalum concentration (b) in it*

To increase the concentration of tantalum in the ion-alloyed layer, the technology of preliminary formation of a tantalum film with a thickness of about 0.3-0.5 μm on the surface of a titanium target using magnetron sputtering, which is then subjected to titanium ions implantation, seems very promising. As a result, an ion-alloyed layer with a high percentage of tantalum should be formed.

The results of studies of changes in the dislocation structure of the target in the sublayer, which is located directly under the ion-alloyed layer, showed that the ion implantation of tantalum atoms causes the evolution of the dislocation structure of the alloy VT6 in the quenched state.

Irradiation of the target with tantalum ions with a fluence of $1.1\text{-}10^{17}$ cm^{-2} leads to an increase in the scalar dislocation density to 7.4-109 cm-2. Gradually increasing the irradiation fluence to $5.2\text{-}10^{17}$ and $7.6\text{-}10^{17}$ cm^{-2} causes the scalar dislocation density to increase to $9.6\text{-}10^{9}$ and $1.2\text{-}10^{10}$ cm^{-2}, respectively.

In addition to the growth of dislocation scalar density, the formation of dislocation substructures is observed. The character of dislocation substructures evolves from chaotic clusters (Fig. 4, a) to club-like formations (Fig. 4, b).

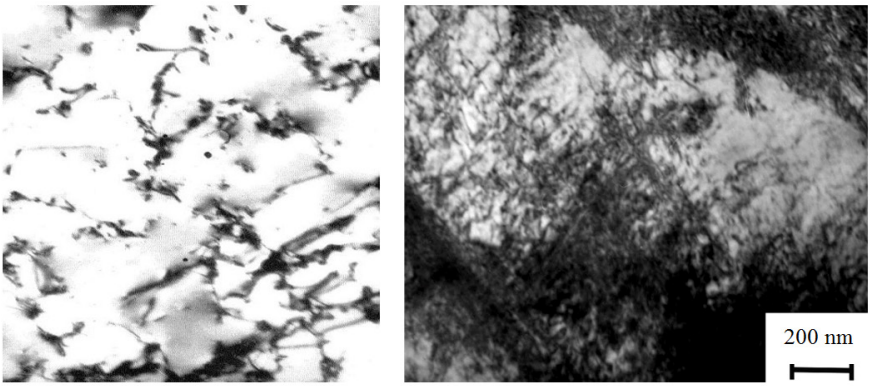


Figure 4. *Dislocation structure in the form of a chaotic dislocation cluster (a) before implantation and ball dislocation structure (b) after implantation of BT6 alloy with tantalum*

The studies also showed that both the scalar dislocation density value and the character of dislocation substructures change as they move from the surface deep into the irradiated target. Figure 5 shows the change in dislocation structure with increasing distance from the surface of VT6 alloy implanted with tantalum ions.

As the distance from the target surface within the sublayer with increased scalar dislocation density, the type of dislocation substructures changes: from cellular, cellular-mesh, club and reticular to dislocation clusters and purely chaotic structure.

Figure 5. *Change of dislocation structure with increasing distance from the surface of the target of VT6 alloy implanted with tantalum ions; distance from the irradiated surface, μm: a - 0.4; b - 10; c - 18; d - 40; e - 75 (x18 000)*

Thus, when titanium alloy VT6 is implanted with tantalum ions, under the ion-alloyed layer there is a sublayer in which the scalar dislocation density increases. The thickness of the ion-alloyed layer is 0.3-0.9 μm, while the thickness of the sublayer can reach 50-90 μm.

Dislocation substructures in the sublayer during ion implantation of VT6 alloy with tantalum ions are similar to dislocation substructures, which appear in metals during their plastic deformation with a degree up to 15%. Moreover, the dislocation substructures formed by implantation are non-oriented.

The scalar dislocation density in the implanted target layer changes gradually as it moves from the irradiated surface to its deep layers. The greatest value of scalar dislocation density in the implanted target of VT6 alloy is located at a distance of 13-14 microns from the irradiated surface. With the increase of the fluence value, the maximum of the scalar dislocation density is observed to grow with an overall increase in the thickness of the sublayer.

Dislocations in the near-surface layer of the ion-implanted target arise due to plastic deformation of the sublayer when the target is bent and dislocation loops are injected from the ion-alloyed layer into the sublayer.

Implantation of tantalum ions leads to a significant decrease in surface roughness at a fluence of $5.2\text{-}10^{17}$ cm^{-2}. At the same time, some increase in Ra value is observed at implantation fluence of $7.6\text{-}10^{17}$ cm^{-2}. At an implantation fluence of $1\text{-}10^{18}$ cm^{-2}, the Ra value is approximately 60% of the initial value (Figure 6).

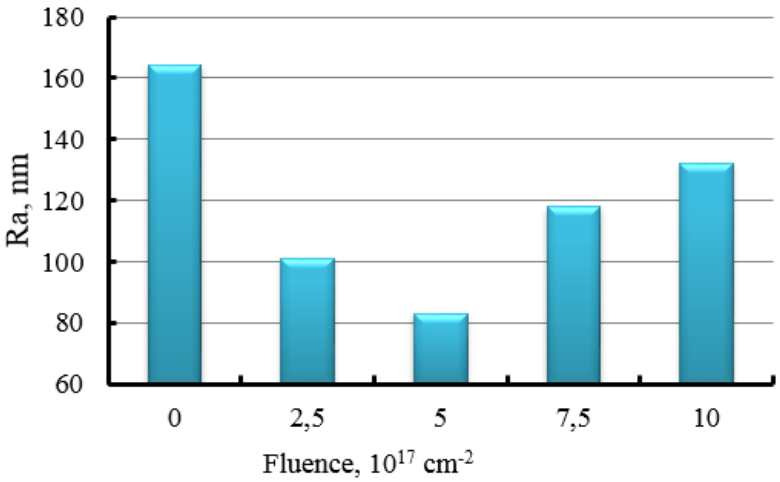


Figure 6. *Dose dependences of roughness Ra of titanium VT6 samples implanted with tantalum ions*

Some increase in the waviness of the specimen surface after implantation of ions of implanted impurities with a fluence of 2.5-1017 cm-2 from 540 to 590 nm is observed (Table 4).

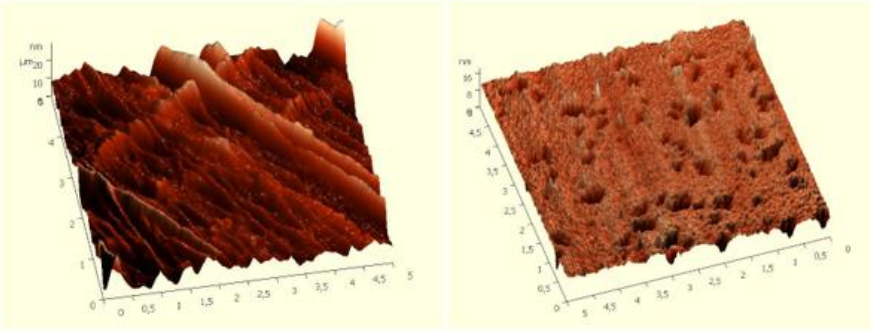
Table 4.

Surface texture parameters of VT6 alloy samples

Sample	Fluence, cm^{-2}	Surface texture parameter	
		Waviness Wa, nm	Average roughness Ra, nm
No implantation	0	540	165
Implantation with tantalum ions	$2,5 \cdot 10^{17}$	590	86
	$5 \cdot 10^{17}$	550	97
	$7,5 \cdot 10^{17}$	515	110
	$1 \bullet 10^{18}$	480	188

Further increase of fluence implantation of tantalum ions contributes to reduction of waviness of the sample surface up to 480 nm at a dose of $1\text{-}10^{18}$ cm^{-2}.

The data presented in Table 4 indicate that tantalum ions, when implanted with a low fluence, deform entire surface areas, dramatically reducing the average surface roughness value of the target. Increasing the fluence to a value of $(5\text{-}7.5)\text{-}10^{17}$ cm^{-2} contributes to smoothing the relief of the irradiated surface without significantly changing the value of the average roughness. Figure 7 shows three-dimensional images of surfaces of samples of titanium alloy VT6 in the initial state and after implantation of tantalum ions with a fluence of $5.2\text{-}10^{17}$ cm^{-2}.



a b

Figure 7. *Surface morphology of samples of VT6 alloy before (a) and after (b) implantation by tantalum ions with a fluence of 5.2-1017 cm-2, obtained with the program "Gwyddion". Magnification 300*

The average height of protrusions and general smoothing of the sample surface after tantalum ion implantation are noticeable.

Ion implantation of titanium alloy VT6 with tantalum ions causes a change in the microhardness of the surface layer (Fig. 8).

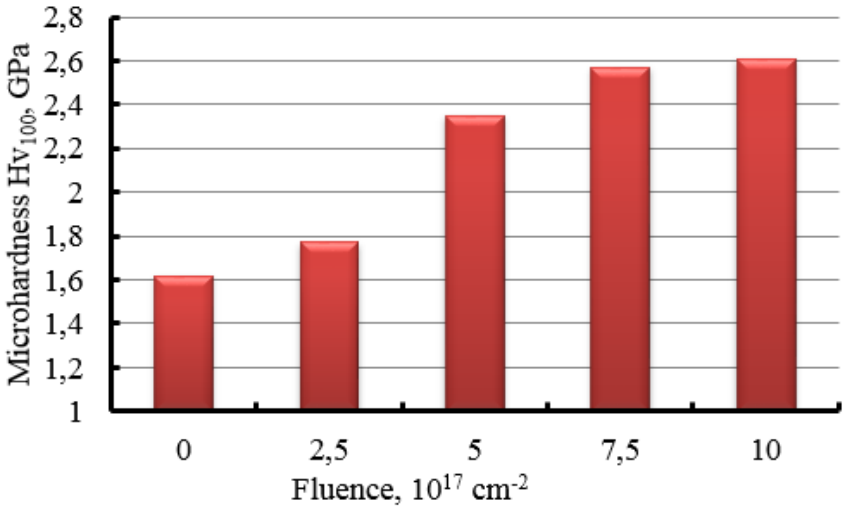


Figure 8. *Dependence of microhardness of titanium alloy VT6 on tantalum ion implantation fluence*

The obtained dependence of microhardness value of the surface layer of BT6 alloy on the fluence value of irradiation shows that tantalum ion implantation allows to increase the microhardness relative to the initial state approximately in 1,55-1,60 times. Thus the increase in value of fluence of irradiation above $5\text{-}10^{17}$ cm^{-2} appears already ineffective.

Ion-beam treatment is a promising technology for obtaining internal coatings, its main advantage is the high speed of the process and the possibility to use it as a finishing operation.

The samples of titanium alloy VT6 with the size of 50x100x2 mm were implanted. Implantation was performed on both sides of the sample. The implantation fluence was varied within the range of $1\text{-}10^{17}$ - $1\text{-}10^{18}$ cm^{-2}.

As a result of vacuum ion-beam processing, samples with ion-alloyed layers with 3.5 %, 10.4 %, 16.5 % and 21.5 at.% tantalum were formed.

For corrosion resistance tests, VT6 titanium (base metal) was used as the control material. Implanted specimens were tested under similar conditions.

The corrosion resistance of the deposited layers was studied in two types of solutions: 68 % nitric acid solution in distilled water and 10 % aqueous hydrochloric acid solution. Control of dimensions was carried out on an instrumental microscope with the accuracy of 0.001 mm, weight was controlled with the accuracy of 0.0001 g.

The corrosion resistance of implanted samples in comparison with tantalum and titanium of BT6 grade is given in Table 5.

The growth of corrosion resistance of the implanted layers with the increase of tantalum content is explained by the tendency to form the protective film Ta_2O_5 which is more resistant in comparison with the oxide films based on titanium (TiO_2, Ti_2O_3, TiO).

The alloying of titanium with 3.5 at.% tantalum during ion implantation leads to a 15.5-16-fold decrease in the corrosion rate of the material in 68% boiling nitric acid solution. The corrosion rate of the material of the ion-alloyed layer containing 22.5 at.% Ta is 190 times lower compared to the titanium alloy VT6.

Table 5.

Corrosion rate of titanium, tantalum and tantalum implanted surface layers in 68 % boiling nitric acid solution (at 120 °C) and 10 % boiling hydrochloric acid solution (at 103 °C)

Study material	Rate of corrosion, mm/year	
	Solution of 68% HNO_3	Solution of 10% HCl
Titanium alloy VT6	0,570	95,875
Tantalus	0,001	0,726
Ion-alloyed layer on VT6 alloy with 3.5 at.% tantalum	0,036	179,856
Ion-alloyed layer on VT6 alloy with 10.4 at.% tantalum	0,0066	131,522
Ion-alloyed layer on VT6 alloy with 16.5 at.% tantalum	0,012	107,768
Ion-alloyed layer on VT6 alloy with 21.5 at.% tantalum	0,003	61,703

Summary

When titanium alloy VT6 is implanted with tantalum ions under the ion-alloyed layer there is a sublayer in which an increase in the scalar dislocation density is observed. The thickness of the ion-alloyed layer is 0.3-0.9 μm, while the thickness of the sublayer can reach 50-90 μm.

Implantation of tantalum ions leads to a significant decrease in surface rough-

ness at a fluence of $5.2\text{-}10^{17}$ cm^{-2}. At the same time some increase in Ra value is observed at the implantation fluence of $7.6\text{-}10^{17}$ cm^{-2}. At the implantation fluence of $1\text{-}10^{18}$ cm^{-2} the Ra value is about 60% of the initial value.

The alloying of titanium with 3.5 at.% tantalum during ion implantation leads to a 15.5-16-fold decrease in the corrosion rate of the material in 68% boiling nitric acid solution. The corrosion rate of the material of the ion-alloyed layer containing 22.5 at.% Ta is 190 times lower compared to the titanium alloy VT6.

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SELECTION OF A QUARTZ RESONATOR OF AN AUTOMATED TELEMETRY SYSTEM RADIO CHANNEL FOR MONITORING THE PROCESS OF DRILLING OIL AND GAS WELLS

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Abstract. *When organizing a radio channel, a quartz resonator is the main element of transceivers. The stability of its frequency determines the reliability of the radio channel, so high demands are placed on it. The article discusses some problems of choosing a quartz resonator for devices operating in difficult conditions, in particular, when exposed to vibration and shock loads, as well as changing over a wide temperature range.*

Keywords: *radio channel, quartz resonator, quartz oscillator, vibration and shock resistance, temperature-frequency response*

Introduction

In the oil and gas industry, almost all process automation systems, from well drilling to hydrocarbon pipeline transport, are distributed automated systems. They must carry out automatic exchange of information and ensure the functioning of control systems in real time. As a result, in all these systems, the problem arises of transmitting various information over communication channels, which can be both traditional wired and wireless, for example, optical or via radio waves. Of course, wired data transmission systems are more reliable, but due to the location of most oil and gas industry facilities in hard-to-reach places, when building distributed telemetry and control networks, radio communication often turns out to be the only acceptable solution [1].

When using wireless sensor networks (WSN), the issue of ensuring the reliability of the transmission is especially acute, since communication channels are exposed to a large amount of interference, which can lead to distortion of the transmitted data.

In general, the reliability of the information exchange process and its reliability depends on two groups of factors.

First, from the quality indicators of infocommunication and radio engineering systems and devices, primarily to ensure the required frequency stability. This is due to the fact that the accuracy of determining the duration of time intervals and phases of signals that underlie the organization of information exchange depends on the stability of the frequency of the generators [2]. The stability of the frequency depends primarily on the used quartz resonator, circuits for compensating the operating frequency drift, etc.

Secondly, from the properties of the wireless communication channel itself, such as the parameters of the antennas used, the properties of the physical environment in which radio waves propagate, the temperature and humidity of the environment, the distance and relative position of the transmitting and receiving devices, the speed of movement of the transmitter and receiver relative to each other, the presence of shielding structures, interference from the operation of other devices, etc.

When creating a distributed automated telemetry system for any object, the factors of the second group are given for the developer, which must be taken into account, but practically cannot be changed. Therefore, it is possible to improve the quality indicators of the communication channel by choosing the most suitable quartz resonator for the given operating conditions and the algorithm for compensating for the drift of its operating frequency.

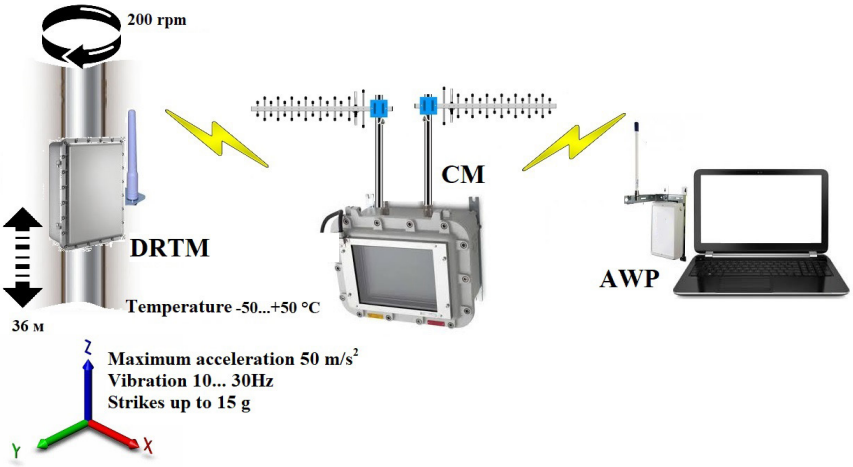
Purpose of the study – develop an algorithm for selecting a quartz resonator that is optimal from the point of view of operation under conditions of significant thermal and mechanical effects.

Analysis of problems caused by the operating conditions of a quartz resonator

The projected radio channel is intended for use in an automated telemetry system (ATS) when drilling oil and gas wells [3]. It must provide communication between two AST modules - the module for receiving and transmitting data DRTM and the communication module MS (fig. 1).

The crystal oscillator is part of the DRTM module, which is a unit located on the drill string and, accordingly, moving with it. The rotation speed of the drill string is about 200 rpm, the linear speed in the vertical direction during drilling (reciprocating movement up and down over a distance of about 36 m) varies over a very wide range, from units to several tens of m/h during drilling (this value

depends on a very large number of factors and individually for each well) and up to 0.3 - 0.7 m/s during tripping operations of drill pipes. The DRTM module is located on a sub between the top drive and the drill string and is subject to mechanical vibration and shock.



DRTM – data receiving and transmitting module;
CM – communication module; AWP – automated workplace

Figure 1. *Fragment of an automated telemetry system for well drilling control*

The ambient temperature varies in the range from minus 50 to + 50°C.

The communication between the individual components of the WSN, in this case between the DRTM and the CM, is the transmission of a frequency modulated signal at the reference frequency of the transceiver. For its formation, a quartz generator (QG) is most often used, which is the main element of transceiver devices. The main requirement for the reference signal is high frequency stability, and with the increase in the number of used frequency ranges and the increase in their load, these requirements for the reliable operation of communication channels are constantly tightened.

Thus, it is necessary first of all to consider how the operating conditions of the ATS will affect the operation of the QG.

In its simplest form, QG is a device consisting of a quartz resonator (CR) and a driving circuit. QR is a thin plate cut from a quartz crystal in a plane located at a certain angle to the optical and electrical axes. The orientation of the quartz plate relative to the crystallographic axes has the greatest influence on the frequency-temperature characteristic (FTC), defined as the maximum possible level of de-

viation of the resonator frequency from the nominal value in a given temperature range, in the range from several minutes to several hours [4]. FTC characterizes the drift of the operating frequency of quartz with a change in temperature. Most often in practice, an AT cutoff is used, which has a cubic dependence of frequency on temperature and provides the possibility of temperature compensation in a wider range compared to other types.

To eliminate or reduce the effect of temperature on the frequency of the master oscillator, thermal compensation and temperature control are used. The difference between these technical solutions is as follows. In the first case, the deviation of the QG frequency depending on the temperature is reduced by means of an automatic control system built into it with a temperature sensor, usually a thermistor, i.e. the change in the frequency of only the resonator itself is compensated (it has the greatest effect on it). In the second case, the quartz resonator (or the resonator and thermally sensitive elements of the oscillator circuit) is thermostated in such a way that its temperature is maintained constant. This ensures the constancy of the oscillator frequency in the range of operating temperatures, regardless of the temperature-frequency characteristics of the quartz resonator. Quantitatively, the dependence of the frequency drift of quartz under the influence of temperature is estimated by the frequency-temperature stability$\Delta f/f$ – the maximum possible deviation of the generator frequency in the operating temperature range in parts per million (ppm) or parts per billion (ppb).

QR without additional frequency stabilization (XO, *Crystal oscillator*) have frequency-temperature stability in the range of 15–100 ppm, generators with temperature compensation(TCXO, *Temperature Compensated Crystal Oscillator*) – 0.1–5 ppm in the temperature range of minus 40…85°C, and with temperature control(OCXO, *Oven Controlled Crystal Oscillator*) – up to 0.02 ppm [5].

The next group of factors, the influence of which must be taken into account when choosing a QG, is the presence of very significant dynamic shock and vibration loads. In normal situations, QRs are subjected to such loads during transportation or when mounted on moving objects, so the corresponding indicators (shock and vibration resistance, *G-sensitivity*) are not even always reflected in the QR specifications.

Shock resistance - the ability of the resonator, and, consequently, the generator, to withstand the mechanical effects of a certain force. Such impacts can lead not only to a deterioration in frequency stability, but also to mechanical damage to the resonator. To improve shock resistance, a special resonator package with three or four support points [4] is used, which allows it to withstand shocks of 1000 - 20000 g, while two-point mounting in a surface-mounted ceramic package withstands shocks of 50 - 200 g.

Vibration resistance is defined as the change in generation frequency as a func-

tion of the level of vibration applied to the generator (measured in ppb/g). Since QR operates on the basis of the inverse piezoelectric effect, additional mechanical influences on the resonator change its operating frequency and increase the phase noise values. Vibration resistance is determined along all three axes [6].

When mechanical loads are applied to quartz resonators, various kinds of deformations occur in them, accompanied by rather complex oscillatory processes, which can lead to various defects. The most common types of failures are a crack in the crystal, separation of traverses, and destruction of the crystal. In addition, under the influence of mechanical loads in quartz resonators, not only local stresses arise in the structure, but also a change in electrical characteristics [7, 8].

Fig. 2 shows the construction of a QR.

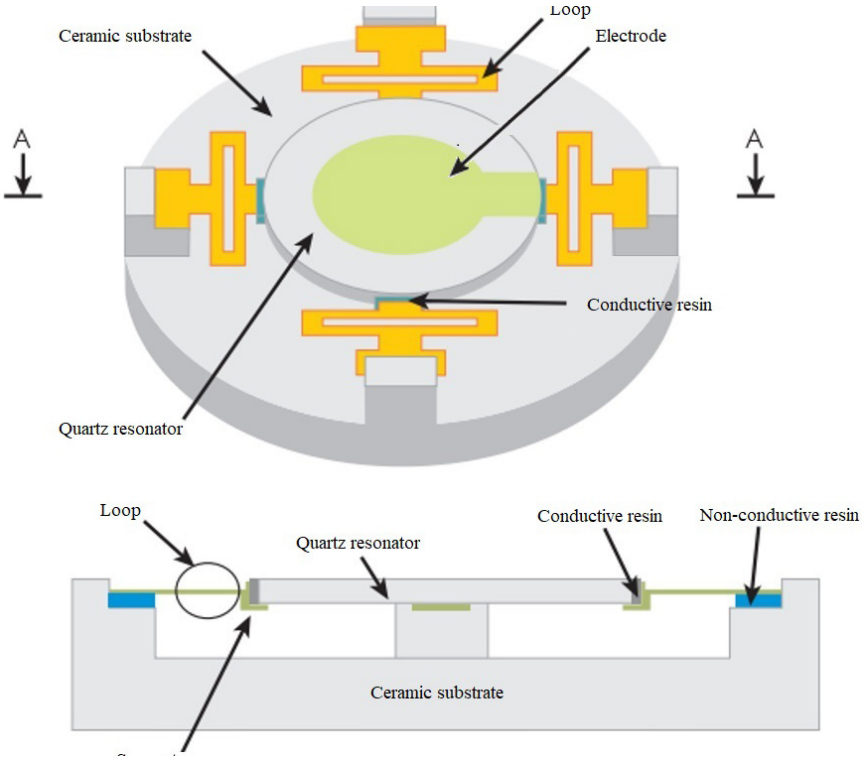


Figure 2. *Construction of a quartz resonator*

During operation, the QR is subjected to various influences: vibrational (harmonic, periodic, random), impact (single and multiple impacts), linear accelera-

tion. As a result, various damages to quartz are possible, such as a crack in a quartz crystal, its complete destruction, loop breakage, destruction of the conductive compound, etc. These effects will affect not only the mechanical reliability, but also the stability of the operating frequency of quartz, so they must be taken into account when choosing quartz.

Practical recommendations for choosing a quartz resonator for operation under conditions of significant mechanical stress

As a rule, the choice of QR for any transceiver is made based on the required operating frequency and dimensions, sometimes the design is added to this, which determines the mounting on the board. If there are serious requirements for the stability of the operating frequency, the temperature instability indicator is taken into account.

However, the telemetry system under consideration, for which the QR is selected, imposes specific requirements on its mechanical strength due to the presence of constant vibration, overloads, and the likelihood of shock loads. Despite the fact that the QR will operate at negative ambient temperatures for a significant period of time, ensuring thermal stability in this case is not the main goal. The value of temperature shift is critical for those wireless systems that use several communication channels close in frequency, and even a small change in frequency can cause mutual overlap of adjacent channels [9]. Therefore, the frequency stability should be no worse than the value at which the receiver and transmitter "lose" each other. The problem of compensating for the temperature drift of the operating frequency QR is solved by the methods discussed above. At the same time, the issues of frequency drift caused by the impact of vibration and shock loads are usually not taken into account. In addition, these characteristics are not properly reflected in the technical documentation of QR manufacturers.

Accordingly, issues of vibration and shock resistance of QR require close attention for the considered application.

It was noted above that under the conditions of mechanical influences, the resonator housing is of great importance. Modern miniaturized QRs initially have a distinct advantage in terms of shock and vibration protection due to the lighter weight of small surface mount packages. In such packages, the quartz is usually held together with just two drops of conductive epoxy (silver-filled), which also acts as the electrical connection of the crystal. QR, designed for equipment operating in conditions of high vibration or shock loads, have four attachment points. This is achieved by placing two additional drops of silver epoxy on top of the existing two. Although the quartz plate is still physically attached only in two places, such attachment is considered four-point due to the increased reliability of mounting [10]. Leading QR manufacturers for critical applications use five-point attachment, which adds another physical attachment point (that is, it actually be-

comes a three-point attachment).

Thus, when choosing QR, it is advisable to consider models with increased vibration resistance. Models with reduced sensitivity to several external factors at the same time, in which stability is maintained, for example, with the help of a microcontroller, it is vibration effects that may not be compensated, or may not have sufficient mechanical reliability. Unfortunately, not all manufacturers indicate in the characteristics of their QR vibration and shock resistance, or at least the type of fastening of a quartz plate, which can be used to get an idea of its reliability under mechanical stress.

Detailed information of this kind is contained, for example, in the catalogs of Vectron [11],

where either a direct characteristic is given (for example, "...maximum frequency sensitivity to linear accelerations along orthogonal axes, not exceeding 0.2 ppb/g"), or as a note it is indicated "Reliable 4-point mounting", "Rugged design for harsh conditions" and etc. In addition, the type of cut is indicated (for example, AT), which also allows one to draw certain conclusions about the properties of the QR.

This company produces a line of special QRs with low g-sensitivity (change in frequency as a result of accelerations on the QR), of the order of 0.1–0.35 ppb/g in total along all three axes, which was achieved precisely due to a special type of square relief mount.

Conclusion

Many companies, including Russian ones, produce vibration-resistant QR models, but the lack of information on vibration and shock resistance in the catalogs makes it very difficult to choose a resonator for specific operating conditions. Therefore, it is advisable to clarify with the manufacturer those characteristics that are decisive for a given radio communication system, but are rarely of interest to most consumers. If for some reason such information is not available, and QR is used in a responsible product, it may make sense to independently test the selected model for vibration and shock resistance, as well as conduct climatic tests for low and high temperatures.

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