



# SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

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如何最大限度地减少混凝土坝突然溃坝造成的社会、经济和环境损失  
**HOW TO MINIMIZE THE SOCIAL, ECONOMIC AND ENVIRONMENTAL LOSSES IN A SUDDEN CONCRETE DAM BREAK**

How to minimize social, economic and environmental losses in case of sudden destruction of a concrete dam

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抽象的。提出了集体决策的程序，以便能够快速评估混凝土水坝、水力发电站、核电站突然破坏所造成的社会、经济和环境损失的严重程度，优化该领域专家的专业构成和数量。清理灾难后果，\*确定流程操作的组成、执行顺序和资源强度，以尽量减少不可挽回的损失。结果表明，与最大限度地减少水坝和其他具有类似灾难性后果的物体的突然破坏造成的社会、经济和环境损失有关的解决方案是独特的、快速实施的、集体的和创造性的。

关键词：集体决策、突然破坏、灾难后果、损害评估、损失最小化。

**Abstract.** *Procedures for making collective decisions are proposed that make it possible to quickly \*assess the magnitude of social, economic and environmental losses from sudden destruction of concrete dams, hydroelectric power stations, nuclear power plants, \*optimize the professional composition and number of specialists in the liquidation of the consequences of the disaster, \*determine the*

*composition, sequence of execution and resource intensity of process operations to minimize irreparable losses. It is shown that the solutions related to minimization of social, economic and environmental losses from the sudden destruction of dams and other objects with similar catastrophic consequences are unique, quickly implemented, collective and creative.*

**Keywords:** *collective decisions, sudden destruction, consequences of a disaster, damage assessment, loss minimization.*

**Problem statement.** It is known that such hydraulic structures as irrigation canals, dams, hydroelectric power stations are of great socio-economic importance, having a positive impact on the growth of the country's GDP and on the standard of living of citizens. At the same time, it must be taken into account that over time, irreversible changes occur in *the body of the dam, contributing to its gradual destruction*. And even concrete and reinforced concrete dams cannot avoid such destruction. As noted in the literature, *the main causes of accidents and destruction* of concrete dams are errors in assessing the bearing capacity of the base rocks or an unacceptable distribution of forces at the contact of the base with the structure, etc. Moreover, during the operation of a concrete dam, chemical suffusion of concrete also occurs, which, together with loading the dam gradually weakens the structure of the concrete, which contributes to the propagation of the crack, etc. However, in the process of control measures, violations of the requirements of SNiP are regularly eliminated.

But there are reasons that can cause **sudden** *destruction of even a concrete dam*, for example, *an earthquake, a terrorist attack*, which can lead to tragic social, economic and environmental consequences, including loss of life, floods and destruction. Of course, during the design and construction of a dam, the possibility of such a situation is considered, but after all, during the *operation of any hydraulic structure, including dams, significant changes* can occur (and actually occur) in *the environment surrounding the hydroelectric complex: new administrative-territorial formations, new transport routes, new social and production facilities*, the flooding of which can lead to catastrophic consequences, to huge social and economic losses.

In such an unexpected dangerous situation, *the executive authorities of the administrative-territorial unit (ATO) need to quickly determine* the composition of *priority operations for each specific process* of eliminating the negative consequences of the sudden destruction of a concrete dam, including operations that form processes for *rescuing injured citizens, for their temporary accommodation and life support, processes for restoring the destroyed ATO infrastructure*, etc. At the same time, it is necessary to assess the time, labor and financial resources spent on the implementation of these operations, to determine the damage to the coun-

try, the quantitative and professional composition of specialists in the liquidation of the consequences of the disaster. Moreover, in the literature, as far as we know, there are no methods or algorithms that allow you to *quickly* identify the composition of priority operations to eliminate the consequences of such emergencies.

The article proposes procedures for making *collective* decisions that allow you to *quickly* \*assess the magnitude of social, economic and environmental losses from sudden destruction of concrete dams and other objects *with similar* catastrophic consequences, \*optimize *the professional* and *quantitative* composition of specialists-liquidators of the consequences of the disaster, \*determine the composition, sequence of implementation and resource intensity of process operations to minimize irreparable losses.

### 1. On the features of a sudden catastrophic situation.

What are the main features of the situation resulting from the sudden collapse of the concrete dam? **Firstly** , such situations ( *earthquakes, volcanic eruptions, sudden destruction of dams, nuclear power plants and other disasters and accidents* ) happen, as a rule, *suddenly* and therefore *cannot be foreseen in advance* \* **the exact** date of their occurrence, it is impossible *in advance* **accurately** determine *the quantity* and *professional the composition* of the liquidators of the consequences of the disaster and it is impossible \*quite **accurately** assess *the associated*, or rather , the amount of *social, economic and environmental losses associated with them* .

**Second** , also **unknown** :

- \*possible *amount of damage* from the sudden destruction of the dam,
- \*composition of *priority* operations to eliminate the consequences of this disaster and
- \* *resource intensity* of all decisions-operations to *save* people, *preserve* the most important *social, economic and environmental* facilities, i.e. the amount of *time, labor and financial resources* spent on the implementation of the composition of all *priority* operations is unknown.

Indeed, due to the flooding of large areas, *epidemics are possible, disruption of the life support* of the ATO population due to the destruction of transport routes and power lines, disruption of the *supply* of food, drinking water, electricity, medicines, and other goods necessary for life.

**Thirdly** , although *advance cannot be exactly famous professional composition and the number* of specialists who will participate in the elimination of the consequences of the catastrophe, however, it can be said with confidence that, *in addition to the specialists* of the Ministry of Emergency Situations, the team of liquidators will include professionals competent in various subject areas: *epidemiologists* (to eliminate and prevent the occurrence of foci of possible epidemics ), *microbiologists, builders, medical workers* (of various specializations), *psychotherapists* and a number of others.

**Fourth**, even a *negligible a delay* in the start of *rescue and recovery* operations in the disaster zone can turn out for the country *irreparable* social, economic and environmental losses.

Therefore, not only such *situations themselves* are *unique*, but also *decisions made by executive authorities* and related

\* *with an assessment of damage* from a sudden catastrophe,

\* *with the development* of the composition of *priority* operations for *the prompt* elimination of its consequences,

\*with a quantitative assessment of the time, labor and financial resources spent on the implementation of all *priority* operations and

\*with *the formation of* the quantitative and professional *composition of the involved liquidators* of the consequences of the disaster,

are *unique, operationally realizable, collective and creative*, i.e. *quantitative values* \*value of damage, \*professional and quantitative composition of specialists-liquidators of consequences catastrophes, \* the composition and resource intensity of priority operations cannot be *predicted* (or suggested) even by AI, especially since no one knows when *“strong”* AI (see, for example, [1]).

## **2. Damage assessment - the magnitude of social, economic and environmental losses from the sudden destruction of the dam,**

To determine the damage from the destruction of dams, nuclear power plants or other objects with similar catastrophic consequences, it is advisable to use the expert method of stepwise refinement of the values of indicators with an assessment of distribution characteristics, which has a number of undeniable advantages (see, for example, [2-3] ). Among the most important, we will pay attention to the opportunity to use the so-called *“informed intuitive judgment”* of a specialist expert by creating conditions for active interaction with other specialists in areas related to various aspects of the problem under study. Moreover, the direct *communication* of specialists with each other is replaced by a sequence of steps, each of which *implements a full cycle of expertise*, including informing expert experts about the results of the previous step. Therefore, there *is no negative impact on the result* of the implementation of the algorithms *of the presence in the expert group* of superiors and subordinates, friends and enemies, persons with different reaction rates, with different cultural and religious traditions, etc. It is extremely important to increase *the accuracy* of the results of the examination due to \* *the presence* of feedback during the implementation of each subsequent round; \* *providing* the expert *with the opportunity* to indicate three or two values of the desired indicator; \**determining*, based on the results of simulation modeling, *the probability* of an indicator falling into *a given range of values and presenting the total distribution* as an average (mathematical expectation) *of the sum of triangular or uniform distributions* of estimates of individual experts, *allows you to get the*

resulting distribution of indicator values *even provided* that the experts indicate three or two values of the desired indicator and **a large variance of estimates**. And the calculation of the statistical characteristics of distributions (*mathematical expectation, variance, coefficient of variation, median, skewness, kurtosis*) of histograms and distribution tables provides *an opportunity to estimate the probability that* the values of the desired indicator fall within a given range (see, for example, [3]). At the same time, **the identification of spontaneous groupings of experts**, whose estimates are close relative to the desired values of the indicator, makes it *possible to investigate the reasons for the formation of such groups*.

3. Priority operations to eliminate the consequences of the sudden destruction of the dam: composition, sequence of execution, resource intensity.

Here we will show that in the event of such a catastrophe, we can use the methods we previously developed to \*promptly form the composition of priority operations, \*rank them according to the order of execution, and \*estimate resource intensity.

**3.1. Operational allocation of the composition of priority operations related to the elimination of the consequences of a sudden catastrophe.** For the operational formation of the composition of priority operations, one can use the method of selecting the desired subset of objects from a set of large power (see [4-6]), i.e. highlight a limited set of basic, least expensive operations aimed at minimizing the negative consequences of a sudden destruction of a concrete dam. To this end, the following steps must be taken:

**Step 1.** Using a table or generator of random numbers from a database containing information about specialists competent in the field of emergency response, potential participants in the examination are selected to identify and then streamline a limited subset of the main operations aimed at minimizing losses from the catastrophe.

**Step 2.** Selected experts are invited to take part in solving a specific task - to identify the most significant, priority operations of a specific process that minimizes social, economic and environmental losses associated with sudden dam failure. Let it be about the process of searching for and rescuing flood-affected citizens.

**Step 3.** Experts who agreed to participate in the survey are assigned identifiers (also using a random number generator). Suppose that there were 100 people who agreed to participate in the examination. Moreover, it is desirable to perform all steps automatically so that *before the completion of the survey of experts, no one, including the organizers of the examination, knows who specifically participates in the surveys, who justified their decision and how, how groupings of participants arise survey.*

**Step 4.** Each participant of the expert survey is informed about the need to list the operations that are of priority for the process of search and rescue of injured

citizens and is asked to arrange the selected operations in order of importance. This forces the experts to carefully consider the choice of a subset of priority operations.

**Step 5.** For each expert, no more than 15-16 operations are left in the lists of selected and ordered operations.

As a result of step 5, the following table will be generated. Experts whose lists included operations selected by no more than 10-15 percent of those participating in the examination - in the table these are operations  $X_2, X_j, X_{j+k}$  - they are asked to explain the reasons for choosing these particular operations, and all experts are introduced to these explanations, suggesting that they change their rankings if they wish.

Expert	The composition of priority operations to eliminate the negative consequences of the sudden destruction of the dam								
	$x1$	$x2$	...	$X_j$	$X_{j+1}$	...	$X_{j+k}$	...	$X_m$
$Z1$	1	1	...	1	1	...	0	...	1
$Z2$	0	0	...	0	1	...	1	...	0
$Z3$	1	1	...	1	1	...	0	...	1
...	...	...	...	...	...	...	...	...	...
$Z_i$	0	1	...	0	0	...	0	...	0
...	...	...	...	...	...	...	...	...	...
$\sum X_j$	92	eleven	...	3	97	...	2	...	95

**Step 6.** Processing the results of the examination.

Let  $Z = |Z_i|, (i = 1, 2, \dots)$  – a set of experts who are assigned identifiers  $Z_i$  using a table or a random number generator. Initial information is presented in the form of a table  $\{x_{ij}\}$ . Wherein

$$x_{ij} = \begin{cases} 1, & \text{если } i - \text{й эксперт выбрал } j - \text{ю операцию;} \\ 0, & \text{если } j - \text{я операция отсутствует в списке у } i - \text{го эксперта.} \end{cases}$$

Let's single out the experts  $Z_i$  and  $Z_k (i, k = 1, 2, \dots)$  and introduce the following notation:  $P_{ik}^{(11)}$  is the number of operations chosen simultaneously  $Z_i$  and  $Z_k$ , i.e.  $P_{ik}^{(11)} = |Z_i \cap Z_k|$  - power of intersection of sets  $Z_i = \{x_{ij}\}$  и  $Z_k = \{x_{kj}\} (j \in 1, m; x_{ij}, x_{kj} = 1)$ ;  $P_{ik}^{(10)}$  - the number of operations selected by the expert  $Z_i$ , but not in the list  $Z_k$ , i.e.  $P_{ik}^{(10)} = |Z_i / Z_k|$  - power of difference of sets  $Z_i = \{x_{ij}\}$  и  $Z_k = \{x_{kj}\}$ ;  $P_{ik}^{(01)}$  - the number of operations that are not in the list  $Z_i$ , but are selected  $Z_k$ , i.e.  $P_{ik}^{(01)} = |Z_k / Z_i|$ .

As a measure of the discrepancy between the rows  $Z_i$  and  $Z_k$  we choose the value  $S_{ik} = P_{ik}^{(01)} / (P_{ik}^{(11)} + P_{ik}^{(10)})$ , and to assess the degree of absorption by the ex-

part  $Z_k$  of the list of expert operations  $Z_i$  (the degree of inclusion, “inclusion” of the list of expert operations  $Z_i$  in  $Z_k$ ) - the value  $h_{ik} = P_{ik}^{(11)} / (P_{ik}^{(11)} + P_{ik}^{(10)})$ .

Let us construct matrices  $P = \{p_{ik}^{(01)}\}$ ,  $S = \{s_{ik}\}$ ,  $G = \{g_{ik}\}$ ,  $H = \{h_{ik}\}$  ( $i, k \in \overline{1, n}$ ), where  $g_{ik} = P_{ik}^{(11)} / (P_{ik}^{(11)} + P_{ik}^{(10)} + P_{ik}^{(01)})$  is the Jacquard similarity measure.

We transform  $P$ ,  $S$ ,  $G$  and  $H$  into logical matrices of the absorption (inclusion) ratio for the values  $\varepsilon_p, \varepsilon_s, \varepsilon_g, \varepsilon_h$ .

$$P_0 = \{p_{ik}^0\}, S_0 = \{s_{ik}^0\}, G_0 = \{g_{ik}^0\}, H_0 = \{h_{ik}^0\} \quad (i, k \in \overline{1, n}),$$

whose elements are defined as follows:

$$p_{ik}^0 = \begin{cases} 1, \text{если } P_{ik}^{(01)} \leq \varepsilon_p \text{ и } i \neq k, \\ 0, \text{если } P_{ik}^{(01)} > \varepsilon_p \text{ или } i = k; \end{cases} \quad s_{ik}^0 = \begin{cases} 1, \text{если } S_{ik} \leq \varepsilon_s \text{ и } i \neq k, \\ 0, \text{если } S_{ik} > \varepsilon_s \text{ или } i = k; \end{cases}$$

$$g_{ik}^0 = \begin{cases} 1, \text{если } g_{ik} \geq \varepsilon_g \text{ и } i \neq k, \\ 0, \text{если } g_{ik} < \varepsilon_g \text{ или } i = k; \end{cases} \quad h_{ik}^0 = \begin{cases} 1, \text{если } h_{ik} \geq \varepsilon_h \text{ и } i \neq k, \\ 0, \text{если } h_{ik} < \varepsilon_h \text{ или } i = k, \end{cases}$$

where  $\varepsilon$  are the chosen boundary values.

The difference in the composition of the operations selected by the participants in the expert survey can be clearly shown in the graphs built on the matrices  $G_0$  and  $H_0$ . The degree of interconnection of experts in terms of the composition of the operations they have chosen can be assessed by analyzing the matrix  $G = \{g_{ik}\}$ .

Performing the transposition of the original matrix, it is possible to estimate the informational weight of the selected operations and/or each of the experts - by calculating the matrix  $(P_0 + P_0^2)$ . The analysis of the matrix  $(P_0 + P_0^2)$  makes it possible to determine which of the operations, according to the participants of the expert survey, has the highest information “weight” (rank).

**Step 7.** Based on the results of groupings (expert-object relationship graphs and matrix  $G$ ) in each group, a list is formed from the operations selected by experts in a particular group (no more than 15 operations) for further research.

**Step 8.** A common list of 15 operations is formed and its ranking (*in order of execution*) using the PURO method - step-by-step refinement of the ranking of objects [7-10].

**3.2. Ranking (ordering) operations in order of execution.** Such streamlining of operations according to the PURO method is necessary, since, as we noted earlier, even a *negligibly small* delay in the start of *rescue and recovery* operations in the disaster zone can turn out for the country *irreparable* social, economic and environmental losses. And the PURO method for ordering objects, being universal and correct (the theorem on the correctness of calculating the Kemeny median was proved in 1978), has a number of fundamental advantages, in particular, the joint use of both the Delphi procedure and the correct approach to ordering *proposed*

by *Kemeny* makes it possible \*to get meaningful an acceptable *quantitative criterion* for a reasonable completion of the examination - a certain amount of relative (for example, 5% or 10%) change in the total *Kemeny* distance is established; \* to form groups of experts, focusing on the selected ( *depending on the degree of agreement of opinions* ) threshold values of the *Kemeny* distance and to investigate the reasons for the relationship of expert assessments; \* find the ordering of characteristics agreed with the members of each expert group by calculating exactly or approximately the *Kemeny* median.

**Conclusion according to paragraph 3.2.** The use of the PURO method makes it possible to find the composition and sequence of operations to eliminate the consequences of a catastrophe agreed with a team of experts and to identify groups of participants in the examination who hold similar views on the *composition and sequence of the* selected operations

### **3.3. Assessment of the resource intensity of priority operations.**

At the next stage, it is necessary not only to identify the composition of priority decisions (actions, operations) and arrange them in order of implementation, but also to assess their *resource intensity* (time, labor and financial resources for implementation). For this purpose, it is advisable to use the method of process-statistical accounting of resource costs (see [11-13, and also 14, p. 22]).

**4. Determination of the professional composition and number of specialists-liquidators of the consequences of the disaster.** To determine the *composition and number* of specialists-liquidators accidents and disasters, it is advisable to use the method of selecting the desired subset of objects from a set of large power and the method of stepwise refinement of the values of indicators with an assessment of the distribution characteristics (see paragraphs 3.1. and 2).

## **CONCLUSIONS.**

1. Procedures for making *collective* decisions are proposed that allow you to quickly \*assess the magnitude of social, economic and environmental losses from sudden destruction of concrete dams, hydroelectric power stations, nuclear power plants, \*optimize the professional composition and number of liquidators of the consequences of the disaster, \*determine the composition, sequence of execution and resource intensity of process operations to minimize irreparable losses.

2. It is shown that *solutions* related to minimization of social, economic and environmental losses from sudden destruction of dams and other *objects with similar catastrophic consequences* are *unique, operationally implemented, collective and creative.*



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研发成果商业化背景下科学技术产品价格合理化的途径  
**APPROACH TO JUSTIFYING THE PRICES OF SCIENTIFIC  
AND TECHNICAL PRODUCTS IN THE CONTEXT OF THE  
COMMERCIALIZATION OF R&D RESULTS**

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注解。 本文将科学技术产品商业化时价格合理性的现代方法视为研发成果。提出了确定反映科技产品定性和定量特征的主要指标的工具。 提出了适合现代条件和现有创新基础设施的研发成果商业化的新的有效组织和经济机制方案。

关键词：科技产品、研发成果、创新基础设施、工具、集群、互动。

**Annotation.** *The article considers the modern approach to justifying the price of scientific and technical products at their commercialisation as R&D results. The tools for determining the main indicators reflecting qualitative and quantitative characteristics of scientific and technical products are presented. The scheme of new effective organisational and economic mechanisms for the commercialization of R&D results, adequate to modern conditions and the existing innovation infrastructure, is proposed.*

**Keywords:** *scientific and technical products, R&D results, innovation infrastructure, tools, clusters, interaction.*

### **Introduction**

The main prerequisite for successful modernisation and transition of the Russian economy to innovative development should be the emergence of R&D results promising for commercialisation, a significant increase in their quality, as well as the ability to compete in domestic and foreign markets. The process of commercialisation of R&D results consists in bringing new or improved products (services) to the market using the rights to create them [3]. It is no secret that due to the

imperfection of the existing system of intellectual capital management and organisational and economic support of commercialisation at domestic knowledge-intensive enterprises, many promising R&D projects are not brought to the stage of commercial implementation both in the domestic and foreign markets.

The way out of this situation is seen in the need to develop new effective organisational and economic mechanisms and tools for commercialisation of R&D results which are adequate to modern conditions. At the same time, one of the most important problems is the optimization of R&D expenditures [1]. It determines the importance of the task of improving the methodology for calculating the price of scientific and technological products (STP) when concluding contracts for their creation.

### Main part

Since STP is a specific type of product, it can be assumed that, provided that it remains constant throughout its creation and the list of tasks initially agreed in the terms of reference, the price of STP will depend on the following factors:

- demand for STP (its value for potential consumers);
- level of work coordination in the development of STP;
- the degree of importance of the consumer (customer);
- expected inflation rate;
- the number of main tasks to be solved in the process of creating STP.

When determining the price of STP, it is also necessary to take into account the tendency of the technical means used in its development to become more expensive over time.

To take into account the influence of the above factors in the formation of the price of STP it is necessary to use appropriate coefficients. In our view, the expected costs of the customer of STP should be calculated according to the following formula:

$$C_{STP}(t_b, t_e) = C_{STP}^{pl}(t_c, t_b, t_e, \overline{R}_I^C(t_b, t_e)) + \Delta C(t_b, t_e, \overline{R}_I^C(t_b, t_e), \overline{R}_I^F(t_b, t_e)) \quad (1)$$

in which:  $t_b$  - the planned beginning date of work on the creation of STP;

$t_e$  - the planned ending date of works on creation of STP;

$t_c$  - the calculated moment of time;

$C_{STP}^{pl}(t_c, t_b, t_e, \overline{R}_I^C(t_b, t_e))$  - planned (preliminary) STP price (with prices of the calculated moment of time  $t_c$ ), created by the contractor in the period  $(t_b, t_e)$ , with the inflation index agreed between the customer and the contractor in this period at the level of  $\overline{R}_I^C(t_b, t_e)$ ;

$\overline{R}_I^C(t_b, t_e)$  - the weighted average inflation index agreed between the customer and the contractor in the period  $(t_b, t_e)$ , which is relevant to the preliminary price of STP;

$\overline{R}_I^F(t_b, t_e)$ - actual value of weighted average inflation index in the period  $(t_b, t_e)$ .

$\overline{R}_I^F(t_b, t_e)=1$ , if  $t_b = t_e$ , or in the period  $(t_b, t_e)$  prices do not change, or inflationary and deflationary processes balance each other in this period.

$\overline{R}_I^F(t_b, t_e)>1$  if in the period  $(t_b, t_e)$  there is an increase in the inflation index (the result of inflationary processes in the economy).

$\overline{R}_I^F(t_b, t_e)<1$  if in the period  $(t_b, t_e)$  there is a fall in the inflation index (the result of deflationary processes in the economy);

$\Delta C(t_b, t_e, \overline{R}_I^C(t_b, t_e), \overline{R}_I^F(t_b, t_e))$ - the amount of adjustment of the planned (preliminary) price based on the results of the inflation index actually formed in the country in the period

$(t_b, t_e)$ inflation index. индекса инфляции.

While:

$$\Delta C(t_b, t_e, \overline{R}_I^C(t_b, t_e), \overline{R}_I^F(t_b, t_e))=0, \text{ если } \overline{R}_I^F(t_b, t_e) \leq \overline{R}_I^C(t_b, t_e) \quad (2)$$

$$\Delta C(t_b, t_e, \overline{R}_I^C(t_b, t_e), \overline{R}_I^F(t_b, t_e))>0 \text{ при } \overline{R}_I^F(t_b, t_e) > \overline{R}_I^C(t_b, t_e) \quad (3)$$

In this case, the value of the planned price adjustment amount is determined by the following formula:

$$\Delta C(t_b, t_e, \overline{R}_I^C(t_b, t_e), \overline{R}_I^F(t_b, t_e)) = C_{STP}^{pl}(t_c, t_b, t_e, \overline{R}_I^C(t_b, t_e)) \frac{\overline{R}_I^F(t_b, t_e)}{\overline{R}_I^C(t_b, t_e)} \quad (4)$$

In order to obtain the value of the planned (preliminary) price of R&D, it is advisable to use the concept of typical R&D - work on a similar subject for the implementation of which competitions were held in the ministries and agencies of the Russian Federation. In this case, the data available in the catalogue of R&D cost indicators can be used. The minimum price of R&D belonging to the same subclass as the planned R&D is taken as the base price.

The planned (provisional) price of R&D should be determined by the following formula:

$$C_{RW}^{pl}(t_c, t_b, t_e, \overline{R}_{tm}^C(t_b, t_e)) = C_{RW}^T(t_b) \left( \rho_{tm}^T R_{tm}^C(t_b, t_c) + R_v(1 - \rho_{tm}^T) \right) \times \\ \times \frac{R_p}{R_v} \times \frac{R_x}{R_x} \times \frac{R_g}{R_g} \times \frac{R_f}{R_f} \quad (5)$$

in which:  $C_{RW}^T(t_b)$  - the base price of typical R&D calculated in prices at time  $t_b$ ;

$R_{tm}^C(t_b, t_e)$  - the coefficient characterising the degree of increase in the cost of technical means in the period  $(t_b, t_e)$ , purchased for the planned R&D compared to the cost of those purchased for typical R&D;

$\rho_{tm}^T$  - the share of the cost of purchasing technical inputs in the price of typical R&D;;

$t_b$  - the moment of time at which the price of typical R&D is calculated;

$R_v$  - coefficient characterising the value of STP;

$R_v^T$  - coefficient characterising the value of STP obtained in the course of performing typical R&D;

$R_\alpha$  - coefficient characterising the degree of importance of the customer of the planned R&D;

$R_\alpha^T$  - coefficient characterising the degree of importance of the R&D type customer;

$R_o$  - coefficient characterising the role of the performer in organising (coordinating) research and performing the planned R&D;

$R_o^T$  - coefficient characterising the role of the performer in organising (coordinating) research and performing typical R&D;

$R_p$  - a coefficient characterising the number of major tasks that need to be solved in the process of performing the planned R&D;

$R_p^T$  - a coefficient characterising the number of major tasks that have been completed in the process of performing typical R&D.

In the case when the necessary initial data are not available to estimate the value of the coefficient  $R_{\tau m}^C(t_\sigma, t_\rho)$  the necessary initial data are not available, the inflation index is used.

As initial information for determining the values  $C_{RW}^T(t_n)$ ,  $\overline{R}_i^F(t_b, t_e)$ ,  $R_{\tau m}^C(t_\sigma, t_\rho)$ ,  $R_v(t_b, t_c)$  it is advisable to use the data published by the State Statistics Committee of Russia, as well as the planned indicators of price changes established by the Government of the Russian Federation.

When only the annual inflation index is known and the periods of STP creation cover only a part of the  $i$ -th year, then it is necessary to use the following formula to estimate the inflation index:

$$R(t_j, t_{j+1}) = R_i^{\frac{m_i}{12}} \quad (6)$$

where:  $m_i$  - the number of months in the  $i$ -th year that belong to the period  $(t_n, t_{OK})$ ;

$R_i$  - the annual inflation index in the  $i$ -th year.

If the period  $(t_j, t_{j+1})$  covers several years, the inflation index should be determined by the following formula:

$$R(t_j, t_{j+1}) = P_i R_i^{\frac{m_i}{12}} \quad (7)$$

The value of STP is determined by the level of novelty of the research required to solve all the tasks set out in the terms of reference and the level of quality of the results obtained. Therefore, the coefficient of value of STP is determined by the formula:

$$R_v = R_v^n \times R_v^{Q^{PI}} \times R_v^{Q^{RW}} \quad (8)$$

where:  $R_v^n$  - coefficient reflecting the level of novelty of STP;

$R_v^{Q^{PI}}$  - coefficient reflecting the projected level of quality of the results that are expected to be obtained during the development of STP;

$R_v^{Q^{RW}}$  - coefficient reflecting a posteriori level of quality of results, as determined by the results of planned R&D.

The values of the coefficient reflecting the level of novelty of STP, vary from 1 (the work is aimed at clarifying the individual results of previously performed research) to 10 (the work is new, aimed at solving a newly emerged interdepartmental problem, the development of the main provisions of theory, methodology).

The predicted level of research quality depends on the qualifications of R&D performers. An objective assessment of the qualifications of performers is their academic degrees and scientific titles. It is reasonable to use these data as a basis for estimating the value of this coefficient based on the predicted quality of research results. The value of the coefficient reflecting the a priori level of quality of results varies from 1 - work performed without the participation of candidates and doctors of science to 8 - work performed with the participation of doctors of science, professors (more than 10% of the number of performers). The value of the coefficient reflecting the a posteriori level of quality of the results at the stage of price negotiation is assumed to be equal to one. In case of any violations by the R&D contractor related to deviations from the technical specification, the customer has the right to assign a value less than one to the coefficient reflecting the a posteriori level of quality of results.

The value of the coefficient characterising the role of the performer in organising (coordinating) research and performing the planned R&D varies from 1 to 1.75, depending on the number of co-performers and their tasks.

The considered model is the basis for the methodology of calculating the cost of STP and determining the planned level of production profitability for enterprises of innovation clusters [4]. The application of this methodology contributed to the increase in the efficiency of these enterprises. In addition, this model was used in the development of the methodological framework for assessing the competitiveness of STP.

The concept of “competitiveness” of STP reflects two categories of properties: one of them is directly related to the product and reflects its quality and value, and the other depends on market requirements, sales conditions and is reflected in the form of demand and market price. Product quality and cost are determined by the conditions of its development, production and after-sales service, while demand and market price are determined by market requirements and sales conditions. If the quality and cost of products characterise the potentialities of a product, demand and market price characterise the realisation of potentialities in a particular market, in a particular period of time. Therefore, we can distinguish its potential properties as a commodity from the concept of “competitiveness” of STP and

combine them in relation to the export of STP by the general term “export potential”. This approach makes it possible to distinguish more clearly between the potential export opportunities of STP and the actual volumes of its sales in the world market, as well as the mechanisms for ensuring them. The quantitative assessment of export potential and competitiveness of STP is a very important task.

The quality of STP samples is determined by a set of their tactical-technical and operational characteristics (indicators), the number of which often reaches several dozens. In this regard, there is a problem of comparing these indicators and forming a generalised (integral) indicator of product quality. There are several approaches to the assessment of quality indicators of industrial products using the method of parametric indexation. The works of a number of Russian scientists consider the approach to assessing the integral indicator of functional efficiency of STP samples on the basis of building a “quality polygon” of the product under consideration relative to the reference sample and calculating the area of this polygon. As a result, the functional efficiency indicator  $E_f$  of the following form is obtained:

$$E_f(k_1, k_2, \dots, k_n) = \sum_{i=1}^n \alpha_i k_i^2 \quad (9)$$

in which:  $\alpha_i$  - relative value of the  $i$ -th characteristic of the product relative to the reference sample (private parametric index of the product);

$k_i = \frac{x_i}{x_i^E}$  - significance coefficient of  $i$ -th characteristic, determined by expert judgement.

The advantage of such an integral indicator of the quality of STP is simplicity, clarity and good stability of the obtained estimate at inaccurately known data.

The cost of an STP sample  $C_o$  includes the cost of R&D and serial production, as well as the cost of its warranty after-sales service. The cost of a sample is a function of its quality characteristics and technical and economic parameters of production.

The higher the value of the indicator  $E_f$  and the lower the value of the product  $C_o$  relative to the reference sample, the higher the export potential of this STP sample. Therefore, as a quantitative measure of export potential it is advisable to take the value of the coefficient of export potential of the sample  $K_{EP}$ , which is determined by the following formula:

$$K_{EP} = \frac{E_f C_o}{C_o^E} \quad (10)$$

where  $C_o^E$  - the value of the reference sample.

Export potential determines the probable demand (volume of sales) and the value of the market price for STP of a given type. Marketing research and the practice of exporting STP show that with increasing quality  $E_f$  and decreasing cost of the sample  $C_o$ , i.e. with increasing export potential, the volume of sales increases. The selling price of the sample  $C_s$  depends on its cost  $C_o$ , profit margin, volume



$N_{PR}$  and terms of product sale. Thus, the export potential of STP largely determines its competitiveness in a particular market.

The actual assessment of STP competitiveness can be made based on the results of sales in the market. As a quantitative measure of product competitiveness it is proposed to use a coefficient numerically equal to the ratio of the average sales value of the sample under consideration to the average sales value of the reference sample. Its value is determined by the formula:

$$K_{COM} = \frac{N_{PR}^{AV} C_{PR}^{AV}}{N_{PR}^E C_{PR}^E} \quad (11)$$

There is an implicit relationship between the coefficients  $K_{COM}$  and  $K_{EP}$  through the product demand distribution function.

Probable demand can be estimated by constructing forecast distribution functions of sales volume  $N_{PR}$  for different market segments. The logistic function is often used as such distribution functions, the parameters of which depend on the market characteristics and export potential of the product. This dependence can be described by the following function:

$$S_z = \frac{1+\alpha}{1+\alpha \exp\left(\frac{z}{K_{EP}}\right)} \quad (12)$$

in which:  $S(z)$  - the projected probability of demand for STP;

$\alpha > 0$  - a parameter of a certain market;

$z$  - the STP unit;

$K_{EP}$  - export potential of the product.

From this dependence at a given value of  $S$  we find a quantile for the predicted with probability  $Pr$  sales volume of products with export potential coefficient  $K_{EP}$ :

$$Z_s = K_{EP} \times \ln \ln \frac{1+\alpha-S}{\alpha \times S} \quad (13)$$

With  $K_{ЭП} = 1$  we get the sales volume  $Z_S^E$  for the reference product sample. Thus, the predicted sales volume of the product under consideration with any probability  $Z_s$  is proportional to the sales volume of the reference sample  $Z_S^E$ :

$$Z_s = K_{EP} \times Z_S^E \quad (14)$$

Ratio (14) will be true for average values of sales volumes, so the expression for the competitiveness coefficient takes the form:

$$K_{COM} = \frac{K_{EP} \times C_{PR}}{C_{PR}^E} \quad (15)$$

Consequently, given a known distribution function of demand for STP between its competitiveness and export potential, it is possible to establish a dependence that has a monotonic character. Expression (15) can be used to determine the competitiveness of a product if its value obtained with the help of model dependencies is used as the selling price.

$$C_{PR} = \frac{C_0(1+\beta)}{N_{PR}^b} \quad (16)$$

where:  $\beta$  - the planned rate of return;

$b > 1$  - coefficient of dependence of the selling price of the product on the sales volume.

The actual value of coefficient  $K_{COM}$  calculated on the basis of sales results, may differ from the forecasted value determined by expression (15). However, if the forecast adequately reflects the market situation, these values are likely to converge to each other as the number of trade transactions increases. A significant discrepancy between the indicators of export potential and competitiveness of STP indicates low efficiency of marketing and sales organisation. Thus, it is possible to analyse the competitiveness of STP, which allows us to clearly distinguish its potential and real export opportunities.

To assess the potential capabilities of STP it is advisable to use the export potential indicator, depending only on the quality and cost of products, reduced to some basic sample. Real competitiveness can be assessed by the volume and value of product sales in a particular market relative to the basic sample [4]. There is a dependence between the indicators of export potential and product competitiveness through the distribution function of demand for products, which is monotonic for the logistic function.

The organisation of the R&D results commercialisation process should be carried out from a comprehensive perspective, including not only financial, but also organisational and economic aspects. In this case, the system of organisational and economic support of the R&D results commercialisation process should be based on the interaction of such subsystems as: organisational and information support; marketing; financial and economic support; accounting, etc., in accordance with the legislation of the Russian Federation and the norms of international law. These subsystems are designed to solve the main tasks at enterprises engaged in commercialisation of R&D results. They include:

- identification of preferred forms of commercialisation of specific R&D results;
- systematisation of financial flows arising from the use of R&D results and identification of additional sources of income;
- improving the efficiency of accounting and evaluation of R&D results at the enterprise;
- creating conditions for new competitive advantages;
- increasing the efficiency of legal protection of R&D results.

To commercialise R&D results, modern innovation management and innovation marketing offer not only new goods, new forms of organisation of the production process, new production structure, or new technologies, but also other so-

called new tools and production and trade innovations: trade and service methods; socio-economic innovations, new methods of labour organisation; innovations to increase revenue volumes; innovations to reduce production and circulation costs, financial innovations; and innovations to reduce the cost of production and circulation costs. In addition, there are other tools for commercialisation of R&D results that have already proved their effectiveness in practice. These include: vertical and horizontal methods; use of Internet tools; use of transfer networks and innovation centres; use of business incubators and commercial intermediaries (brokers, etc.) [2]. Let us briefly consider the essence of some of them.

The vertical method of commercialisation of R&D results is characteristic of large industrial companies that develop and manufacture a narrow range of specific products that do not contain heterogeneous constituent parts. The horizontal method of commercialisation of R&D results takes advantage of partnerships and cooperation between enterprises, where commercialisation functions are transferred to specialised centres. Traditional tools for the commercialisation of R&D results on the Internet include web-sites, e-mail and search engines.

One of the effective methods of commercialisation of R&D results is access to virtual trading platforms for innovative developments (technology transfer networks), which are active in Europe, China, the USA and other countries. These networks, as a rule, unite regional innovation centres that not only help the company to place information about the development on the Internet, but also accompany it at all stages of technology transfer, providing assistance in finding partners, preparing a business plan, conducting market research, protecting intellectual property, drawing up agreements, etc. [3].

The use in practice of the system of organisational and economic support of the process of commercialisation of R&D results provides not only consideration of the interests of all participants of this process, but also opens new opportunities for obtaining a synergetic effect as a result of the optimal application of generalised resource, personnel, organisational, information and other support within the framework of a unified strategy of innovative development of an economic entity, region and country as a whole. Important advantages of this system are: a high level of its sustainability due to the possibility of controlled flow (diffusion) of various types of resources to the sector with the most effective development of innovations and increased legal protection of all participants of the innovation cycle.

### **Conclusion**

Thus, the technological development of modern economic systems is carried out under the influence of the development and introduction of innovations that can transform the technological, reproductive and institutional structure of the economy. With regard to the market system of economic management, innovation becomes the most important factor of technological modernisation, structural sta-

bility and formation of progressive innovative development of the national economy. Obviously, the scientifically substantiated determination of the price of STP and its competitiveness is a necessary condition for an objective assessment of the innovation potential of both individual innovative enterprises and the innovation cluster as a whole.

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管制新型精神活性物质贩运的国际法律合作  
**INTERNATIONAL LEGAL COOPERATION FOR CONTROLLING  
OF TRAFFICKING IN NEW PSYCHOACTIVE SUBSTANCES**

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抽象的。 本文的目的是分析在监管新型精神活性物质和麻醉药品流通领域的主要超国家和国际监管法律的规定。 相比而言,我们考虑在欧盟、美国、加拿大以及联合国和上海合作组织内部建立对这些物质的控制的法律程序。 制定了改进在法律和刑法打击非法贩运新型精神活性物质领域的超国家和国际禁毒立法的建议。

**关键词:** 新型精神活性物质、麻醉药品、精神药物、超国家和国际药物管制、欧盟、美国、加拿大、联合国、上海合作组织。

**Abstract.** *The purpose of the article was to analyze the provisions of the main supranational and international regulatory legal acts in the field of regulating the circulation of new psychoactive and narcotic substances. In comparative terms, legal procedures for establishing control over these substances in the EU, USA, Canada, as well as within the UN and SCO are considered. Proposals are formulated for improving supranational and international anti-drug legislation in the field of legal and criminal law counteraction to the illicit trafficking of new psychoactive substances.*

**Keywords:** *new psychoactive substances, narcotic drugs, psychotropic substances, supranational and international drug control, European Union, USA, Canada, UN, Shanghai Cooperation Organization.*

In the last two decades, due to a significant increase in the level of development of chemical technologies, automation and computerization of organic synthesis processes, the availability of patents of various pharmaceutical companies, the most serious problem faced by national and international drug control author-

ities is the problem of the so-called. new psychoactive substances, the circulation of which is not regulated or restricted by the relevant UN Conventions [15]. By December 2022, 1182 new chemical compounds had been reported by 139 countries from different regions of the world to the UN Office on Drugs and Crime (UNODC), most of which are psychostimulants of various chemical structures, aminoindanes, tryptamines, synthetic cannabinoids, hallucinogens and synthetic opioids [13].

The pace and scale of synthesizing (manufacturing) and entering the legal and illegal market of new psychoactive substances forced both the EU itself and the member countries of this union to include in their legislation legal and criminal law measures to counteract their illicit trafficking and smuggling.

EU General Action 7/396/JHA of 16.07.1997 concerning new synthetic psychoactive substances not included in the Schedules of the 1971 UN Convention and presenting a serious threat to public health, comparable to substances listed in Schedules I or II of the Convention, defines the mechanism interaction between national police authorities, Europol, the European Monitoring Center for Drugs and Drug Addiction (EMCDDA) and the European Commission to establish control measures for new synthetic psychoactive substances [10].

Framework Decision 2004/757/JHA of the EU Council of 25.10.2004 defines narcotic drugs, psychotropic substances and their precursors identical to the definitions given in the 1961, 1971 and 1988 UN Conventions. and, therefore, in accordance with General Action 7/396/JHA of 16.06.1997 theoretically puts all new psychoactive substances under control within the EU [7]. In the same period, the Council of the EU adopted an important Decision 2005/387/JHA “On the exchange of information, risk assessment and control of new psychoactive substances” dated 10.05.2005 (expired from 22.11.2018), where for the first time the concept of “ new psychoactive substances” and states that their use may be harmful to health [8].

Directive 2017/2103 of the European Parliament and of the Council of 11/15/2017 amending Council Framework Decision 2004/757/JHA to include new psychoactive substances in the definition of drugs and repealing Council Decision 2005/387/JHA defines the term “new psychoactive substance” as a substance or mixture of substances that causes the same effects as narcotic drugs and psychotropic substances specified in the relevant UN Conventions, but not mentioned in them, and, at the same time, causes the same serious consequences for individual and public health, serious social consequences similar to those which can cause substances included in the Convention [9]. In addition, the same Directive defines the procedure and terms for establishing control measures when recognizing a new substance as psychoactive. The Regulation of the European Parliament and the Council of the EU in Directive 2017/2101 of November 15, 2017 provides for the

procedure and procedure for preparing the so-called. The initial report, which is entrusted to the EMCDDA [11]. Thus, at the request of any EU Member State, and also if the EMCDDA has reasonable grounds to believe that a new psychoactive substance may pose a danger to individual and public health, the procedure for the preparation of an Initial Report is initiated, which includes data on the chemical structure, pharmacology, toxicology, as well as the nature, number and scale of incidents demonstrating the potential danger and possible social consequences of the abuse of a new psychoactive substance. EMCDDA, having summarized in a 5-week period in the Report the entire range of available information regarding the chemical and pharmacological characteristics of a new psychoactive substance, operational data on its circulation and the consequences of its use, obtained using the REITOX early warning system, as well as from Europol and national police authorities, is obliged to transmit the Initial Report to the Commission and to all EU Member States.

The European Commission either adopts a by-law (Commission Delegated Directive) to add a new psychoactive substance to the List of Substances to be Controlled, or does not accept it; in such a case, the Commission is obliged to submit a report to the European Parliament and the European Council, setting out the reasons for its position on this issue. EU Member States are obliged for a period not exceeding 6 months. make appropriate changes to its anti-drug legislation.

In the United States, if the Drug Enforcement Administration (DEA) is informed that a new potentially hazardous psychoactive substance is on the legal or illegal market, an emergency procedure is initiated to temporarily add the substance to the relevant Schedules. Paragraph (h) of Controlled Substances Act (CSA) §811, 1970 grants the Attorney General of the United States the power (in order to avert an imminent threat to public safety) to temporarily list a substance in Schedule I for two years, without regard to the requirements of paragraph (b) of the same paragraph [12]. The Attorney General, in turn, delegated this authority to the DEA.

The DEA notifies the US Department of Health and Human Services (HHS) of its intent to bring a new psychoactive substance under control. The Ministry, in turn, instructs the Food and Drug Administration (FDA) to provide data on whether the substance is approved as a drug and whether clinical studies of the substance are being conducted in order to obtain such approval. If both questions submitted to the FDA are answered in the negative, the DEA will review the substance for three of the eight criteria specified in paragraph (b) of §811 CSA, namely:

- history and contemporary forms of harmful use
- the extent, duration and significance of harmful use
- risks to individual and public health and makes the appropriate administrative decision.

Canada's main anti-drug legislation is the Controlled Drugs and Substances Act of 1996, as well as the Cannabis Act of 2018, which legalizes the recreational use and possession of small amounts of cannabis [6].

Cooperation between the United States and Canada in the field of combating the production and smuggling of narcotic drugs and psychotropic substances is carried out within the framework of the Inter-American Commission on Drug Abuse Control (CICAD) in accordance with the Inter-American Program of Action to Combat the Illicit Use, Production and Trafficking of Narcotic Drugs and Psychotropic Substances (Rio -de Janeiro, 1986).

Within the framework of the UN, the problem of establishing control over new psychoactive substances and legal measures to counteract their illicit trafficking is currently the subject of discussions, due to the fact that, for formal legal reasons, these substances are not subject to international control, up to the end of the procedure for introducing them to the convention lists.

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UNODC defines new psychoactive substances as “Substances of abuse, whether pure or in preparation, which are not controlled by the Single Convention on Narcotic Drugs of 1961 or the Convention on Psychotropic Substances of 1971, but which may pose a threat to public health” [14 ].

The authority to enter into the Convention Lists of controlled substances is vested in the Commission on Narcotic Drugs of the United Nations Economic and Social Council (ECOSOC). So, according to the United Nations Single Convention on Narcotic Drugs of 1961, the Commission on Narcotic Drugs, in accordance with the conclusion of the World Health Organization (WHO), may include any substance in any of the convention lists, followed by the application of appro-

priate international and national measures to this substance. control, or exclude it from any of the Lists (part 3, part 4, part 5 and part 6 of Article 3 of the Single Convention of 1961) [1].

According to Parts 5 and Part 6 of Article 2 of the Convention on Psychotropic Substances of 1971, the Commission on Narcotic Drugs, in accordance with the opinion of WHO, may enter any psychotropic substance into the Convention Lists, with subsequent application of conventional control measures to this substance, or move the substance to another List, or exclude it from any of the Lists [2].

The authority to conduct an examination of narcotic drugs and psychotropic substances is vested in the WHO. So, according to Art. 3 of the 1961 Single Convention, WHO, on its own initiative or on behalf of the Secretary-General of the United Nations, examines the substance and makes its recommendations to the Commission on Narcotic Drugs for the inclusion of this substance in Schedules I, II, III or IV of the 1961 Convention, or, provided that the substance has ceased to be the subject of abuse and, accordingly, has lost the ability to cause harmful effects - recommendations for its removal from any of the Schedules. The 1971 Convention on Psychotropic Substances (Article 2: Scope of Control of Substances) clarifies the WHO's prerogatives to a large extent, namely, it clearly articulates the principles and defines the necessary parameters for the peer review of a potential psychoactive substance.

In order to prepare an appropriate expert opinion, the WHO has established an Expert Committee on Drug Dependence (WHO EC). WHO EC is responsible for the preparation of the so-called. A critical review, which determines whether the Director-General of WHO should be asked to recommend the listing of the substance in the Schedules of the UN Conventions or whether to change its status in the Schedules. Upon receipt from the WHO Secretariat of the best information available on a substance, the WHO EC will decide whether to conduct a Critical Review of the substance, which will include an assessment of dependence potential, likelihood of abuse and of creating public health and social problems, and the therapeutic usefulness of each substance. being reviewed; as well as a recommendation for inclusion in the appropriate list under one of the Conventions;

The critical review consists of two successive stages: at the first stage, the issue of listing the substance in the Schedules of the Single Convention of 1961 is decided. terms of the Convention on Psychotropic Substances of 1971 [4]. The findings of the WHO EC are summarized in a Report submitted to the Director-General of WHO, who transmits the WHO recommendation to the UN. The final decision on the inclusion / non-inclusion of a substance in the Convention Schedules remains with the Commission on Narcotic Drugs

The 1988 Convention provides for a slightly different procedural mechanism for inclusion in the Schedules of substances subject to regulation and control. The

role of the expert body that evaluates the substance from the standpoint of its potential use as a precursor of narcotic drugs and psychotropic substances, as well as the current scale of use of this substance, is assigned to the International Narcotics Control Board (part 4, Article 12 of the 1988 Convention) [3].

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The legal basis for interaction in the field of combating drug trafficking within the framework of the Shanghai Cooperation Organization (SCO) was the Agreement on Cooperation in Combating Illicit Trafficking in Narcotic Drugs, Psychotropic Substances and Their Precursors, adopted in Tashkent on June 17, 2004 [5]. The agreement singled out a number of areas in which it was supposed to carry out joint activities of the authorized departments of the SCO member states.

1) cooperation in the field of analytical activities;

2) cooperation in the implementation of practical measures to combat the illicit trafficking in drugs and psychotropic substances;

3) cooperation within the framework of legal support

In their joint Statement dated July 9, 2023, the SCO member states expressed their firm commitment to the line of maintaining and strengthening the existing international drug control system based on the three basic UN conventions, however, to date, a single coordinating center has not been created within the SCO on the collection and compilation of information on the use of narcotic and psychotropic substances, as well as on the emergence of new psychoactive substances in circulation, on the fight against drug trafficking and cross-border drug trafficking.

Thus, it can be concluded that the procedure for supranational and/or international expertise for the inclusion of new psychoactive substances that pose a serious danger to individual and public health in the Controlled Lists is complex, lengthy and time-consuming and clearly does not correspond to the pace of development, synthesis and emergence of these substances. substances on the legal and illegal markets.

Taking into account the above, it seems relevant to discuss the following possible procedure for introducing / deleting new psychoactive substances into the conventional Control Lists: UNODC, using international online monitoring systems, in cooperation with Europol, EMCDDA, national competent authorities, fixes the emergence of new psychoactive substances in circulation. The Commission on Narcotic Drugs, in turn, includes all psychoactive substances that have appeared on the legal or illegal market (with the exception of chemical compounds that are part of medicines that are allowed for use in certain member countries of the Conventions) in a separate UN Special List, for which certain agreed measures are prescribed control. In the future, at the request of any interested party (UN Member States, international and national pharmaceutical companies, etc.), the WHO EC conducts a Critical Review, in which it assesses the relationship between the potential danger and therapeutic utility of a new psychoactive substance, with the possibility, in the future, to include of the substance into the already existing Convention Schedules or deletion of this substance from the Special List.

In addition, from our point of view, it would be expedient to prepare within the framework of the UN a new “Joint Convention on Narcotic Drugs, Psychoactive Substances and Their Precursors”, which could include the proven provisions of the 1961, 1971 and 1988 Conventions. as well as a number of articles devoted to the regulation of the circulation of new psychoactive substances, while updating some outdated conventional requirements and procedures.

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高等教育体系中的意识形态与俄罗斯宪政  
**IDEOLOGY IN THE HIGHER EDUCATION SYSTEM AND  
RUSSIAN CONSTITUTIONALISM**

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注解。 文章证实了在现代条件下在高等教育系统中特别关注意识形态工作的必要性,而这种工作在后苏联时期已大大减少。 这成为导致很大一部分学生世界观出现严重问题的关键因素之一,表现为俄罗斯民族价值和理想的变形。 持续的思想工作成为高等教育机构教育过程的有机组成部分,能够有效影响当前形势的消极方面,激活学生基于国家价值观的世界观的形成和发展。 提议向所有学士和专家引入“俄罗斯立宪主义”学科,作为教育过程意识形态导向的要素之一。 揭示了本学科思想内容的要素。

关键词: 意识形态与民族价值观、学生价值取向、学生世界观变形、高等教育意识形态、俄罗斯宪政。

**Annotation.** *The article substantiates the necessity in modern conditions of special attention to ideological work in the system of higher education, which was largely reduced in the post-Soviet period. This became one of the key factors that led to serious problems in the worldview of a significant part of the student population, manifested in the deformation of Russian national values and ideals. Consistent ideological work, becoming an integral part of the educational process in higher education institutions, is able to effectively influence the negative aspects of the current situation and activate the formation and development of students' worldview based on national values. The introduction of the discipline "Russian*



*Constitutionalism” for all bachelors and specialists is proposed as one of the elements of the ideological orientation of the educational process. The elements of the ideological content of this discipline are revealed.*

**Keywords:** *ideology and national values, value orientations of students, deformations in the worldview of students, ideology in higher education, Russian constitutionalism.*

In the life of Russian society, the value of the national ideology can hardly be exaggerated, because it is through it that the healthy forces of society are consolidated and united for the sake of achieving common goals. National ideology is not a fantasy invented by someone, but something that spiritually unites the majority of people living in one country in the form of common life guidelines, ideals and values recognised by them, stemming from belonging to the history of the nation, its present and future.

Ideology becomes especially important in difficult historical periods, when the unity of the people, including governing structures, primarily the state, becomes a key factor in overcoming difficulties, obstacles and problems. It is in such periods that the deformations in the sphere of ideology are most noticeable, the forces seeking to destroy the national ideology are clearly identified, and the problems in the state of ideological work of society and governing structures are clearly highlighted.

Now, at the level of the Decree of the President of the Russian Federation, the threats in the sphere of ideology, which come from extremist and terrorist organisations, certain mass media and mass communications, unfriendly foreign states, a number of transnational corporations and non-profit organisations, are openly declared.

Attention is drawn to the fact that their activities, through their ideological and psychological influence on citizens, lead “to the planting of a system of ideas and values alien to the Russian people and destructive of Russian society (hereinafter referred to as destructive ideology), including the cultivation of selfishness, permissiveness and immorality, and the denial of the right to freedom of expression, immorality, denial of the ideals of patriotism, service to the Fatherland, the natural continuation of life, the value of a strong family, marriage, many children, creative labour, Russia’s positive contribution to world history and culture, the destruction of the traditional family through the promotion of non-traditional sexual relations” [1]. [1].

The problem is outlined, it exists and may have a tendency to grow. Without considering its content as a whole, we will try to highlight some of the main points of its manifestation in the university student environment and possible ways to overcome it within the framework of this article. Noting that some aspects of this

problem have already been considered by us in a number of previously published works [2, 3].

The problem of formation of values and ideals among Russian students is of particular importance, because students are the most actively developing part of society, with a not yet fully formed and in the stage of formation of the worldview, which is the future of Russian society and the state, and which, as a result, is exposed to a more massive and purposeful impact of the forces that seek to destroy the Russian national ideology.

This impact, which has both internal and external sources, has led to a shift in the value orientations and ideals of a certain part of the Russian student population. Let us note here, first of all, the shift of orientations from high principles and ideals to narrow pragmatism; from the priority of public and collective interests to private and personal ones; from traditional for Russian society and established moral norms to permissiveness and cynicism.

Many Russian students have progressive social and political infantilism, when a person is indifferent to what is happening in his or her collective, society and the state, as long as it does not affect his or her own personal interests. Career advancement, material well-being, personal success without regard to the condition and capabilities of others - these are the predominant orientations of this part of the student population today.

We will not cite here the numerous studies of scientists on the state of the worldview of modern Russian students. They will only confirm the above-mentioned. Let us acquaint the reader with an extract from a serious document prepared on the basis of the results of a recent meeting of the Committee on Science and Higher Education of the State Duma of the Russian Federation.

It notes that “the educational potential of higher education is not used to the fullest extent, including due to the false attitudes that prevailed at a certain historical stage, absolutising tolerance, value relativism and ideological and attitudinal neutrality (indifference) of the state, market-service approach to the understanding of education. Combined with neoliberal ideas about some special rights of young people, designed to liberate them and protect them from oppression and suppression by their elders, this has led to the degradation of patriotic consciousness among a significant number of students, weakening of personal motivation to form patriotic qualities, replacement (displacement) of traditional ideals of the Russian socio-cultural environment by alien value and goal orientations, spread of value pathologies, including the cult of selfishness, permissiveness, self-interest, disregard for the common good, lies, conformism, indifference to immoral acts, immorality, irresponsibility, cynicism [4]”.

Having considerable experience of both teaching and administrative work in higher education institutions, we note that all these things take place and we

believe it is important to focus on analysing the causes of existing problems of worldview in the student environment. Let us make some considerations in this regard, highlighting the main things that prevent us from effectively counteracting the existing destructive elements.

First of all, let us draw attention to the fact that for a certain part of educational system managers and university teachers the issues of ideological work are not an actual task, but rather a reminder of the Soviet past. Indeed, in the Soviet period, where serious efforts were made to form the ideology necessary at that historical stage in the youth environment, university students were not left out. Let us recall, as an example, that in addition to mass ideological events and a block of public organisations that carried out this work, each year of study at a higher education institution in any speciality included in the curriculum subjects, the content of which had a clear and openly expressed ideological orientation.

The history of the CPSU, dialectical and historical materialism, political economy, scientific communism - this is a consistent series of disciplines directly aimed at forming a certain type of worldview of students. Moreover, one of these disciplines was necessarily submitted to the final state examination.

Of course, today we perceive the social world and the processes of its development in a somewhat different way. But if our attitude to the theoretical understanding of social life has changed, it does not mean that there is no need to form or develop a nationally oriented worldview of the younger generation, including students. Patriotism and citizenship, moral axioms and human ideals, collectivism and social responsibility - this is by no means a complete list of values that should be actively produced in higher education.

Let us emphasise here that unlike some other communities, for our country higher education is historically and topically not just a process of pumping knowledge from one head to another in order to endow it with professional knowledge and skills or, as they usually say nowadays, competences. For us, it is an environment in which Russian multinational culture is reproduced, the achievements of previous generations are reproduced, and the product of which is a person endowed with special professional knowledge and skills, actively and in the interests of the individual, collective, society and state.

The worldview of such a person does not appear by itself, it is not given, so to speak, from nature or any higher forces. It is formed and as a result is obtained only in the process of purposeful and systematic ideological work. However, today in Russian universities ideological work is not singled out as an independent area of activity. Here they usually talk about educational work, which does not cover the range of ideological work, and the educational work itself is reduced mainly to extracurricular activities, entertainment, sports, sometimes of volunteer nature or multi-purpose mass gatherings.

The ideological work of universities as an object of research is not honoured by the Russian scientific community as well; there are practically no publications on this topic, as a review of the corresponding rubric in the RSCI database shows. At the same time, researchers from a number of other countries, for example, scientists from Belarus and China, attach serious importance to the study of the problems of ideology of university students and university work in this direction [5, 6]. Such work as ideological work is necessary if we do not want further progressive development of worldview deformations in the student environment. What in terms of activation of ideological work is proposed to do?

Firstly, the Russian university community, including management structures, needs to qualitatively change its attitude to ideology as an element of the spiritual life of society. Ideological work in higher education institutions is nothing but a necessary way and method of forming national Russian value orientations in the worldview of students. These reference points partly coincide with universal values, partly they are unique, as the Russian people and the historical path of the Russian society, state and, by the way, education are unique. Therefore, the ideology should not be taken from somewhere else, but partly borrowed from the positive historical past, partly formed taking into account the new realities as a national Russian ideology.

Secondly, this ideological work should be one of the priority areas in the activities of higher education institutions, especially state universities. It should be identified and singled out as one of the subject forms in the HEI management system and the existing management structures of the HEI should be functionally oriented to it depending on the specialisation. It is important to understand that ideological work with students is the responsibility of the whole complex of university management structures, not of any single unit. Therefore, for example, it would be a mistake to create one managerial ideological unit and forget about ideological work in the organisation of scientific or educational activities.

Thirdly, we do not belittle the importance of all forms of work with students within the framework of educational activities of the university, as each of them contributes to the formation of students' worldview. However, we would like to emphasise that the most productive and effective form of ideological influence on students is the educational process. There are no other options in this process than the introduction of a well-thought-out set of disciplines with clearly defined qualitative and quantitative parameters for each of them, purposefully and consistently introducing the Russian national ideology. Understanding that such a set of worldview disciplines is gradually being formed in the system of higher education and its creation is the work of the entire university community, we would like to emphasise that as far as ideology is concerned, there is no room for amateurism. Here, each discipline included in the ideological complex should be clearly spec-

ified in the didactic elements of the content, the number of hours and its place in the curriculum of the university.

As one of the possible directions to ensure the ideological orientation of the educational process we could offer the inclusion of the discipline “Russian Constitutionalism” for all bachelors and specialists. This discipline is mainly aimed at forming in students the values of citizenship and responsible attitude to the current law. Some foundations of these values are laid already at school, but they do not reach there, as university pedagogical practice shows, the level necessary for understanding the status and necessity of lawful actions as a citizen of a great and in many ways special power.

From an ideological point of view, the discipline “Russian Constitutionalism” is intended to demonstrate the historical significance of the adoption of the Constitution as the basic law for the Russian multinational people, the peculiarities of the constitutional development of Russia, the achievements of Russian constitutionalism, which in a number of parameters surpassed the constitutional development of other countries, the directions of the modern transformation of the Constitution, the responsibility of society, the state and each individual for the preservation and strengthening of the Russian constitution. Such a discipline could be read already in the first year of study as a continuation and deepening of the material learnt at secondary school, in the amount of 72 academic hours at all specialities and areas of training of university students. With the exception of those that already have a course on Constitutional Law of the Russian Federation, which requires only more emphasis on issues of ideological significance.

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运用专门知识克服犯罪侦查的反作用

## THE USING OF SPECIAL KNOWLEDGE IN OVERCOMING THE COUNTERACTION TO THE CRIMES INVESTIGATION

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注解。 本研究的主题是考虑法医检查的任命和制作问题，作为利用特殊知识来识别和克服对犯罪调查的反作用的主要形式。 研究犯罪侦查克服反作用主义的理论和实践概念，分析各种观点和文献来源。 科学新颖性是由克服犯罪调查反作用原则的形成方面决定的，作为一个完整的理论规定和实践建议体系。

关键词：犯罪学、法医检验、专业知识、法医学说、犯罪调查的反作用、克服反作用、关于克服犯罪调查的反作用的法医学说。

**Annotation.** *The subject of this research is the consideration of issues of the appointment and production of forensic examinations, as the main form of using special knowledge in order to identify and overcome counteraction to the investigation of crimes. The study of the theoretical and practical concept of the doctrine of overcoming counteraction to the investigation of crimes, the analysis of various opinions and literary sources. Scientific novelty is determined by the aspect of the formation of the doctrine of overcoming counteraction to the investigation of crimes, as an integral system of theoretical provisions and practical recommendations.*

**Keywords:** *criminalistics, forensic examination, special knowledge, forensic doctrine, counteraction to the crimes investigation, overcoming the counteraction, forensic doctrine about overcoming the counteraction to crimes investigation.*

Special knowledge, as well as its use, is one of the most important and promising areas for expanding and strengthening the evidence base in criminal cases, which objectively contributes to overcoming resistance to investigation. Investigation of crimes with the use of special knowledge in various fields of science and technology and the use of appropriate technical means and methods is the most important element of the activity of the bodies of investigation (investigation), prosecutor's office and court. In criminalistic literature much attention is paid to

the concept and content of special knowledge, forms and means of its use [1; 2;4;5;12]. Problems of crime, growth of its organised nature, more and more active use by its participants of modern scientific and technical means and methods, cause the need to solve the issues involving the use of special knowledge in the conditions of countering the investigation.

The current legislation of the Russian Federation defines the use of special knowledge in procedural and non-procedural form. The procedural form includes participation of a specialist in the production of investigative and other procedural actions according to the art. 58, 168 CCP RF; carrying out inspections and audits according to the p.1 of art. 144 CCP RF; performance of special research and preparation of a conclusion on its results according to the art. 80 CCP RF; assistance in posing questions to the expert; advisory and reference activities of knowledgeable persons; production of forensic examinations according to the art. 195 CCP RF and investigations which according to the p. 3.1 p.2 art. 74 CCP RF are recognised as evidence. The non-procedural form of using special knowledge includes: direct participation of specialists in the implementation of operational and investigative activities; production of special and preliminary studies; performance of audit and audit checks. Some authors refer to this form of consultations with knowledgeable persons, which are carried out outside the framework of investigative actions [10, p.52]. In general, we should agree with the opinion that the possibilities of using special knowledge in non-procedural form are practically limitless.

The current procedural form of using special knowledge allows to obtain evidence in the form of: the conclusion and testimony of an expert; conclusion and testimony of a specialist; consultative testimony of a witness with special knowledge. The results of the study show that special knowledge is used in almost all criminal cases in the form of forensic expertise and research, as well as participation of a specialist in the production of investigative actions.

In accordance with the art.6 of the Federal Law “On operational-search activities in the Russian Federation”, the assistance of a specialist in order to overcome resistance is also used by operational officers, namely, in the process of production of operational-search activities information systems, video and audio recording, photography and other technical means of tracking, surveillance and fixation are used. But it is important to note that with this help it is possible to obtain only orientation information, which can not be used as evidence, but allows you to determine the direction of further operational and investigative work to overcome the resistance to the investigation of crime. According to our research, the use of specialist assistance in the framework of operational and investigative measures to overcome the resistance to investigation is constantly increasing, which is confirmed by other studies. The assistance of a specialist is expedient and often used in cases in the field of economics, construction, IT-technologies, medicine,



pharmacology, etc.: these are specialists of economists, accountants, calculators, production specialists, technologists, specialists in hidden works, specialists in writing and encryption of programmes, etc.

Interaction between the investigator and the specialist in the production of investigative actions and operational-search activities is the most important element of forensic tactics and techniques. The use of special knowledge, scientific and technical means and methods in the process of production of investigative actions allows for more reliable and meaningful recording of verbal forensically significant information, minimising the possibility of countering the investigation of crimes. In such cases, there is a special need for technical assistance of a specialist in connection with the expediency of additional forms of fixation of verbal information in order to prevent and overcome resistance to the investigation. In such cases of distortion of the relevant information to successfully identify and overcome the resistance to the investigation is necessarily necessary with the help of the production of expertise [11, p.161]. The obtained data should be considered exclusively as information of orientation. This information depends on the completeness and reliability of the information submitted by the investigator to the specialist for study, which helps the investigator to determine the direction of actions to overcome the counteraction, in the development of general and private versions of the counteraction to the investigation, the system of measures and tactical features of their implementation for these purposes [6, p.172; 9, p.59-62].

One of the most important means of overcoming resistance to investigation is the appointment and production of forensic examinations. Forensic examinations are carried out practically in every criminal case of the category under consideration. Based on the analysis of forensic practice forensic examinations of forensic direction, namely handwriting, technical examination of documents, ballistic, were conducted more than 70%, forensic medical, forensic psychiatric - more than 40%, examination of physical evidence, namely materials, substances, compositions and products - more than 20%.

When appointing forensic examinations, special importance is attached to taking into account the likelihood of resistance to the investigation and forecasting its possible methods. This makes it possible, in order to avoid the appointment of additional expert examinations and other investigative actions, to put questions to the expert, the conclusions of which will minimise the likelihood of resistance in the future. As a peculiar tactic of actions of the investigator, allowing to work ahead of the curve, this approach has already been proposed by researchers of the problems of overcoming resistance to the investigation of certain types of crimes [14, p.105].

A typical example of countering the investigation of crimes is the application and satisfaction by the court of motions by the defence of the accused to challenge

the expert opinion. As a rule, for these cases, the defence counsel, at the time of the application, provide the already prepared expert opinion of independent expert institutions. Not isolated cases are the conclusions of conducted expert examinations by different state expert institutions, for example, expert forensic subdivisions of the Ministry of Internal Affairs, forensic expert subdivisions of the Investigative Committee, the Forensic Institutions of the Ministry of Justice. In these cases and discrepancies, the court may appoint additional expert examinations, expert examinations in other expert institutions, for example, expert institutions of the federal level, expert institutions of another region of the country, asking additional questions, clarifying questions, etc. In this described case, overcoming the counteraction by providing unreliable, incorrect expert opinion, is the mandatory additional expert examinations excluding the possibility of influence from the prosecution, it is, firstly, and the most correct and proper questioning to obtain a reliable and complete answer to make a decision, secondly.

In the new history of the Russian Federation, in connection with the almost complete change of legislation regulating and regulating the activities of entire and often new industries, the issue of legal expertise has become quite acute and serious. For the most part it concerned and still concerns the compliance of adopted decisions with the current legislation, compliance of normative acts and adopted decisions with the main regulating law. As often due to the lack of appropriate legal regulation of activities or the presence of outdated laws and by-laws, especially in such sectors as construction, economy, international relations, etc., officials made their own managerial decisions, and in the best case this decision was formalised in the form of a collective managerial decision. These decisions due to the lack of legislation or a large number of inconsistencies, discrepancies and gaps, led and lead not only to a frequent violation of the law, but also gives reason to plot, prepare, implement both the criminal activity itself in various sectors of life, and counteraction to the investigation of crimes committed.

Legal expertise allows through the study of a separate area of law to establish the content of legal relations and resolve controversial issues that have arisen as a result of the application of legal norms governing certain areas and spheres of economic activity, to establish facts of evidentiary value in a criminal case [11, p.92].

At the moment, forensic economic expertise is quite in demand within the framework of overcoming resistance to the investigation of crimes due to the significant growth of crimes in the field of economic activity. Within the framework of this expertise has quite a lot of experience and developments forensic accounting expertise, as well as appropriate testing of this methodology, also expertise tax, financial and credit, etc. [7]. [7].

The forgery of documents by criminal elements: agreements, contracts, acceptance certificates, delivery notes, especially signatures of officials, is quite common

in cases of obstruction of investigation. Handwriting expertise remains the most demanded type of forensic expertise appointed in the course of resolving corporate, inheritance disputes, divorce cases, disputes with tax authorities, credit institutions, disputes over notarised documents. It is on such facts that handwriting expertise is appointed and carried out, and in order to achieve the truth, the official selection of signature samples, both free and experimental, is carried out. As the signature is one of the most important requisites of the document, giving it legal force, and signature forgery is one of the most widespread ways of falsification of documents, in the overwhelming majority of cases in the course of court proceedings there is a necessity to establish the executor of signatures in these documents. The fact of signature forgery, i.e. establishment in the course of expert examination of the fact of signature execution by a person other than the one in whose name it is written, is sometimes a decisive argument. The expert's task is to identify in the disputed signature and in the samples complexes of individual features characterising the handwriting of a certain person. The expert bases his conclusion on the results of comparison of the identified features, assessment of coincidence and difference of these features. The scientific validity of the conclusion largely depends on the quantity and quality of the comparative material, namely the signature and handwriting samples submitted for examination.

Handwriting samples (signatures) are divided into free, conditionally free and experimental. Free samples are signatures (records) made by the alleged executor in documents not related to the case within the framework of which the expertise is appointed. When executing these documents, the person did not know and did not assume that they could be used as specimen signatures. These may be various documents: statements, explanations, powers of attorney, business letters, personal correspondence, etc. Conditional free samples - signatures (records) made in various documents after the beginning of the case examination, but not specifically for the examination. Experimental - signatures (records) made by the person being examined specifically for expert examination.

The modern state and development in everyday life of computer, information and communication technologies gives a huge field of activity to criminals to counteract the investigation of crimes through the use of various means and ways to falsify audio and video materials bearing evidentiary and other information component. In these cases, there is an increased need for research to establish the authenticity of such recordings and fixations. In such cases, forensic phonoscopic and video-technical examinations are appointed and carried out, which have both identification and diagnostic tasks, in particular, to identify signs of copying, editing, erasure, selective fixation, to identify signs of other changes introduced into the information. The possibilities of expert examinations to establish the authenticity of copies of audio and video materials, the origin of which has not been

procedurally established, are significantly limited, so it is practically necessary to seize the original recordings. The absence on a copy of a phonogram of signs of editing or changes made during the recording process or after its completion does not necessarily mean that these signs are not present on the original phonogram.

Recently, research on speech synthesis has been intensified, and devices are being developed to «clone» the voice of virtually any person or official. Software sound editors common in everyday life are already capable of performing computer editing and mixing of sound signals with high accuracy, using a variety of means of manipulating sound information. Automated speech systems already control many elements of domestic use of the so-called «smart home», production, etc. Special computer programmes imitate not only the voice, but also produce intonation, manner of speech, etc. Quite a large number of examples of faking the voices of politicians, deputies, ministers, presidents, artists, etc. The professionalism of forgery masters begins to compete with the skill and professionalism of experts. Therefore, the creation of more advanced expert techniques for reliable detection of signs of falsification of phonograms and video recordings is a priority task of improving the methodology of this type of expertise.

Forensic medical, forensic psychiatric and forensic psychological examinations are a separate category in overcoming obstacles to the investigation of offences.

A forensic medical examination is a procedural action consisting of research and the giving of an expert's opinion on matters the resolution of which requires special knowledge in the field of science, technology, art or craft, and which are put before the expert by a court, judge, inquiring authority, person conducting the inquiry, or investigator, for the purpose of establishing the circumstances to be proved in a particular case.

Forensic medical examinations carry out a great deal of work to detect hidden offences by examining the following objects: 1) First of all, such objects include corpses of people who died suddenly in conditions of non-obviousness, without external signs of violent death. In this case, the main task of forensic doctors is to establish the type, category and kind of death; 2) Forensic medical examinations, under certain circumstances, may make it possible to qualify the offence in accordance with one or another article of the CC RF. For example, the examination of living persons in relation to the injuries inflicted on them. In such cases, the forensic physician, based on the examination of the nature of the injuries, decides on the severity of the health damage; 3) Some results of forensic medical examinations allow the investigation to obtain quite individual diagnostic characteristics of the person who committed the offence. By biological objects originating from the perpetrator, it is possible to establish his sex and group affiliation and more individual characteristics; 4) Under certain circumstances, forensic medical research

allows for individual identification of the perpetrator or the instrument of crime, which is valuable evidence for the investigation; 5) Forensic medical research of the victim of a crime is important, especially in cases where the identity of the deceased person is not known. These investigations may make it possible to establish who died and thus make it possible to identify the perpetrator; 6) Through forensic medical investigations very important factual circumstances of the case may be established. For example, the mutual position of the victim and the murderer at the moment of infliction of injuries, the distance of the shot, the viability or postmortem nature of the injuries, etc.

According to our research, forensic medical examinations are resorted to within the framework of investigation of criminal cases in a small number of cases, not more than 5-7 per cent. Basically, investigations are carried out on certain types of objects of biological origin, for example: saliva, urine, semen, sweat marks, etc. There is a certain regularity, most often specialists are involved by lawyers (defence lawyers) and opposite conclusions are given when forensic examinations are conducted using «author's» methods of conducting examinations.

Forensic psychiatric expertise is a type of forensic examination conducted using specialised knowledge in the field of psychiatry. Forensic psychiatric expertise can be outpatient, inpatient and postmortem. Forensic psychiatric expertise is appointed in criminal or civil proceedings when there is a need for a special psychiatric examination of the accused, suspect, witness, victim, civil plaintiff and defendant. Forensic psychological examination is a system of psychological studies of the personality and activities of the person under investigation, convicted person, witness and victim in order to clarify information that helps the investigation, the court, and the re-education of witnesses. Forensic psychological examination is carried out by psychologists.

Forensic psychological examination is a system of psychological studies of the personality and activities of the person under investigation, convicted person, witness and victim to clarify information that helps the investigation, the court, and the re-education of witnesses. Forensic psychological examination is carried out by specialist psychologists. It is one of the types of work of a clinical psychologist and forensic psychologist.

Within the framework of our research, forensic psychological expertise is relatively rare, not more than 5% of criminal cases. There are two diametrically opposed points of view about the scientific validity and, consequently, the expediency of this expertise in science. On the one hand, in the process of investigation of criminal cases there are often difficulties in assessing the relationships of participants of criminal groups and communities, hidden for the investigation and the court, in connection with which serious errors are possible when deciding the question about the actual status of a particular subject of the offence. One should

also take into account the possibility of group members playing out a pre-prepared scenario to counteract the establishment of the real role of each person and the concealment of the leader. On the other hand, the research within the framework of this expertise provides only a probable conclusion about the possible leader of the group, and this nature of the conclusion excludes its use as evidence, which raises doubts about the expediency of expert examination [8].

Based on the above, it should be noted that the use of special knowledge in order to overcome resistance to the investigation of crimes occupies an important, if not central role. The effectiveness of overcoming the resistance to the investigation is predetermined by a skilful and competent combination of a set of investigative actions, operational-search, organisational measures with the indispensable extensive use of special knowledge. Special knowledge should be applied as a system of operations united in the tactical plan, as well as conducted separately, but within the framework of a clear unified developed plan, its management and implementation. Repeated repetition of the process of reflection of information on counteraction to the investigation allows to develop and apply recommendations on typical actions of the subject of its overcoming. Detection and fixation of information on counteraction to investigation of signs of counteraction acts as an initial stage of actions on consideration and subsequent application of already developed typical forensic programmes on its overcoming.

Also as conclusions of the conducted works we consider it necessary to note separately that the use of special knowledge of specialists, forensic experts of various branches of knowledge in the process of investigation of crimes requires a more perfect, orderly order of work, and most importantly, the order of interaction of the organisation of activity of forensic institutions and expert forensic units with the bodies of investigation (investigation) and court; also legislative regulation of the use of special knowledge in criminal proceedings, including the use of special knowledge in criminal proceedings.

These conclusions and proposals will give the most effective condition for the use of special knowledge at various stages of overcoming resistance to the investigation of crimes.

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打击中国犯罪所得合法化的组织措施  
**ORGANISATIONAL MEASURES TO COUNTER THE  
LEGALISATION OF PROCEEDS FROM CRIME IN THE PRC**

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注解。 该文章提请人们注意与洗钱相关的犯罪的区域性和跨境性。 在此基础上, 笔者认为有必要研究我国反洗钱的经验。 通过对反洗钱监管法律文件和其他材料的分析, 形成了中华人民共和国合作机构和组织的四级体系, 其中中国人民银行发挥着关键的执行作用。 结论是, 有必要加强俄罗斯联邦和中华人民共和国咨询机构之间在打击和预防此类犯罪方面的双边合作。

关键词: 洗钱、组织打击、国际执法合作、中华人民共和国、跨境犯罪。

**Annotation.** *The article draws attention to the regional and cross-border nature of crimes related to money laundering. On this basis, the author concludes that it is necessary to study the PRC experience in combating money laundering. The analysis of regulatory legal documents and other materials on combating money laundering allowed to form a four-tier system of cooperating bodies and organisations in the PRC, with the People's Bank of the PRC playing the key executive role. It is concluded that it is necessary to strengthen bilateral cooperation between the advisory bodies of the Russian Federation and the PRC in combating and preventing these types of offences.*

**Keywords:** *money laundering, organisational counteraction, international law enforcement cooperation, PRC, cross-border crime.*

The study of certain areas of combating money laundering in the PRC is of scientific interest and practical necessity for several interrelated reasons.

Firstly, some regions of the Russian Far East and Northeast China are border territories. This political and geographical factor determines the second reason - the development of relations between the two states in economic, cultural, educational and other spheres. The consequence of such development is often criminal activity of citizens of the two states in the border territories, which can be of an organised nature. Money laundering becomes one of its types. When considering



the relationship between migration processes and organised crime in the Far Eastern Federal District, scholars note that Chinese criminal communities offer their Russian partners new markets and opportunities for “criminal trade turnover”, which includes money laundering. For example, illegally obtained profits from smuggling are legalised through an ever-growing network of restaurants owned by representatives of national diasporas. “Financial resources laundered in the service sector are again invested in the “shadow” business” [1, p. 49].

In his study, Zhao Guohui also notes that following the development of Sino-Russian bilateral trade and economic relations, cross-border money laundering activities and money laundering within China and Russia will become more prevalent. Since 2006, when the ruble became a freely convertible currency in the PRC, Chinese criminal elements have been using standardised currency exchange channels to move criminal proceeds into Russia in disguised ways. As a result, these criminal proceeds were laundered in open financial markets in Russia [2, pp. 238-239].

In this regard, the issues of combating money laundering in the two countries do not lose their relevance. Building an effective system to counter money laundering committed by Russian or Chinese citizens as a result of international crimes is impossible without studying and understanding the structure of such a system in the PRC.

It seems that the organisational foundations are of paramount importance in any system, because without any minimal organisation the system cannot emerge. At the same time, taking into account the large developed and complex systems of modern society, to which the state should be attributed, we note the peculiarity of interpenetration and formal subordination of elements of systems. Thus, the organisational foundations of the activity of state bodies, public formations or other legal subjects are first of all fixed in the legal element of the system, i.e. in normative-legal documents.

In order to understand the organisational basis of anti-money laundering in the People’s Republic of China, let us refer to the legal act of the same name - the Anti-Money Laundering Law of the People’s Republic of China (hereinafter - the Law), adopted on the 31st of October, 2006.

Article 4 of the Law assigns responsibility to the State Council of the PRC, namely the General Administration of Anti-Money Laundering of the State Council of the PRC, for the management and supervision of anti-money laundering.

Article 3 of the Law refers to the anti-money laundering obligation imposed on financial institutions and non-financial institutions established in accordance with the established procedure to carry out anti-money laundering work.

Financial institutions, according to Article 34, include financial transaction political banks, commercial banks, credit cooperatives, state postal corporation

institutions, trust companies, securities companies, futures brokerage companies, insurance companies and other institutions established by the General Administration of Anti-Money Laundering of the State Council of the People's Republic of China and openly engaged in financial transaction activities.

Next, we turn to the content of the Regulation on Financial Institutions for Combating Money Laundering (hereinafter - the Regulation).

According to Article 1 of the Regulation, it is designed to prevent money laundering activities, regulate the control and management of money laundering and the work of financial authorities in combating money laundering.

Article 2 establishes a list of national, i.e. domestically established, financial authorities that need to be guided by the Regulation in their activities. Such bodies include:

- 1) Commercial banks, urban credit co-operatives, rural credit unions, post offices (post offices that hold/save money), political banks;
- 2) Securities companies, futures brokerage companies, fund management companies;
- 3) Insurance companies, property insurance management companies;
- 4) Trust investment companies, financial asset management companies, finance companies, finance companies, leasing companies, auto finance companies, foreign exchange brokerage companies;
- 5) Other financial institutions established and promulgated by the People's Bank of China.

Companies engaged in foreign exchange operations, payment clearing operations and fund commercial operations are governed by the Regulation in accordance with the definitions of the financial authorities on anti-money laundering management and control.

The task and role of the People's Bank of China in anti-money laundering activities are set out in Article 3 of the Regulations - "The People's Bank of China is the chief executive body of the State Council of the People's Republic of China in the field of anti-money laundering. In accordance with the law, the People's Bank of China shall supervise and control the activities of the financial authorities in combating money laundering". The same article further establishes the responsibilities of individual government agencies and the requirement to carry out coordinated activities between financial and law agencies - "The State Committee of the People's Republic of China on Banking Regulation and Supervision, the China Securities Regulatory Commission, The China Insurance Regulatory Commission shall, within the limits of their own authority, exercise supervision and control over anti-money laundering. The People's Bank of China shall cooperate with relevant departments and organs of the State Council of the People's Republic of China and the judiciary in the exercise of its anti-money laundering responsibilities".

Let us pay special attention to the regulation of the issue of international cooperation in combating money laundering. Thus, Article 4 of the Regulations stipulates: “The People’s Bank of China, in accordance with the authority granted by the State Council, shall carry out international cooperation on anti-money laundering as a governmental organ of the country. The People’s Bank of China may establish mechanisms for cooperation with foreign state and regional anti-money laundering authorities, and supervise and manage cross-border anti-money laundering”.

The Chinese Anti-Money Laundering Monitoring and Analysis Centre is the anti-money laundering information and analytical support body of the People’s Bank of China.

Let us consider the system of bodies with which the People’s Bank of China interacts in the process of combating money laundering.

The analysis of open sources allows the following system of bodies to be constructed:

1. State bodies of the PRC:
  - 1.1 The State Audit Commission of the People’s Republic of China;
  - 1.2 The Supreme People’s Procuracy of the People’s Republic of China;
  - 1.3 The Ministry of Public Security of the People’s Republic of China;
  - 1.4. General Customs Administration of the People’s Republic of China;
  - 1.5 The State Tax Agency of the PRC;
2. Financial management and control agencies:
  - 2.1 The Banking and Insurance Regulatory Commission;
  - 2.2 The China State Administration of Foreign Exchange;
  - 2.3 The China Securities Regulatory Commission;
3. international organisations;
  - 3.1 Financial Action Task Force on Money Laundering
  - 3.2 Asia/Pacific Group on Money Laundering;
  - 3.3 Caribbean Financial Action Task Force;
  - 3.4 The Eastern and Southern Africa Anti-Money Laundering Group;
  - 3.5 The Anti-Money Laundering and Counter - Terrorist in Latin America;
  - 3.6 The Inter-governmental Action Group against Money Laundering in West Africa;
  - 3.7 Middle East and North Africa Financial Action Task Force;
  - 3.8 The Committee of Experts on the Evaluation of Anti-Money Laundering Measures and the Financing of Terrorism;
  - 3.9 The Egmont Group of Financial Intelligence Units;
4. Foreign anti-money laundering authorities:
  - 4.1 The Financial Crimes Enforcement Network of the U.S. Department of the Treasury;

4.2 Australian Transaction Reporting and Analysis Centre;

4.3 The Financial Transactions and Reports Analysis Centre of Canada[3].

Chinese researchers note that anti-money laundering work is a comprehensive and systematic work, so the establishment of a close inter-agency cooperation and information exchange system between the Anti-Money Laundering Monitoring and Analysis Centre of the People's Bank of China and the anti-corruption departments of procuratorates, anti-smuggling departments of customs authorities, investigation departments of public security authorities and other law enforcement agencies is very important. Joint receipt, accumulation and analysis of relevant information on suspicious transactions by competent employees of the above mentioned bodies, timely exchange of such information will significantly increase the role of the mechanism of information exchange on such transactions in the work on combating money laundering [4, p. 144]. This direction is also relevant for the domestic system of organisation of interaction between law enforcement agencies on combating money laundering. The studies note that certain difficulties in the practice of combating money laundering are caused by the lack of effective and promptly organised two-way communication between the relevant law enforcement agencies and government agencies that store and process financial information on transactions in the banking sector, in particular, it concerns the exchange of information between tax authorities, financial monitoring agencies and law enforcement agencies. In this regard, tax authorities and Rosfinmonitoring bodies, collecting relevant information from banks, but not receiving comprehensive data from law enforcement agencies, cannot improve the efficiency of control of certain subjects of economic activity [5, p. 89]. We emphasise that the operational exchange of information on crimes related to money laundering is of paramount importance in the implementation of interstate cooperation in the investigation of such crimes. Strengthening the information exchange and improving the mechanisms of its implementation between the competent authorities of the states, in particular Russia and China, will certainly increase the effectiveness of the requesting party's work on detection, investigation or prevention of money laundering.

The information provided allows us to conclude that the system of links and relationships of individual anti-money laundering authorities and units in China with other government agencies within the country, and with international organisations and foreign national authorities in the international arena is quite extensive.

It seems that this practice is positive and fully meets the objectives of combating money laundering, since this type of criminal acts often has a cross-border or transnational nature. The study of the system of anti-money laundering bodies in the PRC allows us to identify areas of cooperation between the two countries, which is necessary for the implementation of both general and specific prevention of the commission of this type of crime.

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恐怖活动对俄罗斯现代互联网空间的影响  
**IMPACT OF TERRORIST ACTIVITIES ON THE MODERN  
INTERNET SPACE OF RUSSIA**

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注解。文章介绍了俄罗斯联邦境内恐怖活动领域的研究。文章阐述了“恐怖主义”、“校园枪击事件”和“哥伦拜恩”等概念，指出了俄罗斯恐怖活动的决定因素，提供了俄罗斯和车里雅宾斯克地区恐怖活动活动的统计数据以及调查结果。对学生进行的社会调查。提出了加强打击俄罗斯青年通过互联网空间参与恐怖活动的建议。

关键词：恐怖主义、恐怖活动、招募、校园枪击、哥伦拜恩运动、社交网络“互联网”。

**Annotation.** *The article introduces the research in the field of terrorist activity on the territory of the Russian Federation. The article characterises such concepts as “Terrorism”, “School shooting” and “Columbine”, identifies the determinants of terrorist activity in Russia, presents statistical data on the activity of terrorist activity in Russia and the Chelyabinsk region, as well as the results of a social survey among students. Recommendations to improve the fight against the involvement of Russian youth in terrorist activities through the Internet space are offered.*

**Keywords:** *terrorism, terrorist activity, recruitment, school shooting, Columbine movement, social network “Internet”.*

Terrorism (from Latin terror - fear, dread) is commonly understood as the use of violence or the threat of its use against individuals, groups of individuals or various objects in order to achieve political, economic, ideological and other favourable results.

The Federal Law of the Russian Federation “On Combating Terrorism” of 25/07/1998 No. 130-FL defines terrorism as violence or threat of its use against individuals or organisations, as well as the destruction (damage) or threat of destruction (damage) of property and other material objects, creating a danger of loss of life, significant property damage or other socially dangerous consequences,

carried out with the aim of violating public security, intimidating the population, or exerting influence on the security of the population.

Every year, terrorists find more sophisticated ways to recruit young people into terrorist activities. For terrorist recruiters, the best means of recruitment is the Internet. So, for example, for their recruitment they skilfully use many social networks and messengers: VKontakte, Facebook, WhatsApp, Viber, Telegram[1].

Thus, according to 2022 data of the National Anti-Terrorist Committee of the Russian Federation, in terrorist activities 75% of participants are young people[2].

According to Article 205 of the Criminal Code of the Russian Federation, terrorism is considered the implementation of explosions, arson and other actions that can frighten the population and lead to the death of a person, as well as actions aimed at destabilising state authorities[3].

According to Article 22, Section 2656 of the U.S. Code, terrorism is defined as deliberate politically motivated violence against non-military targets committed by subnational groups or clandestine agents whose purpose is to influence society[4].

So, for example, Mikheev Ivan Rudolfovich, a well-known scholar in the field of criminal law, points out in his scientific work that in our world there are more than two hundred definitions of terrorism. This state of affairs occurred because of the complexity of this phenomenon (terrorism), its factors of subjective perception, which exist both at the domestic and international levels.

Walter Laqueur, a specialist on terrorism, believes that a single concept of terrorism will never happen. This is due to the fact that in our world there is not one, but many forms of terrorism, differing from each other in goals and motivations. Soviet and Russian historian Oleg Vitalievich Budnitsky believes the same opinion, - "It seems to be very difficult (if not impossible) to give some universal definition of terrorism, although it is obvious that its inherent features are indeed a threat to life and safety of people and political motivation for the use of violent actions[5].

There are indeed differences between the terrorism that existed in past centuries and modern terrorism. It is about the mentality, way of thinking and general spirituality of one or more individuals. The differences between modern terrorism and the terrorism that existed in past centuries are: the level of technological equipment; organisation; financing; and the acquisition of an international character.

Let us further disclose the statistics of terrorist offences in Russia (Table 1).

**Table 1**

*Dynamics of terrorist activity. on the territory of Russia in the period from 2019 to 2022*

	2019	2020	2021	2022
Terrorism-related offences were registered	1806	2342	2136	2233
Number of terrorist offences for which criminal cases were brought to court	629	771	905	1027
Unsolved terrorist offences	871	1405	972	872

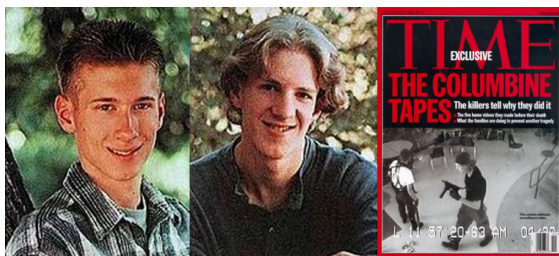
Thus, it is worth noting that it was between 2019 and 2020 that the number of unsolved terrorist offences as a proportion of reported terrorist offences increased from 48% to 60% percent and after that, up to the end of 2022 decreased to 45% in 2021 and at the end of 2022 decreased to 39%[6].

Schoolshooting is the phenomenon of violent mass shootings in educational institutions.

This phenomenon had the name “Columbine”, which appeared in 1999 after the tragic case of mass murder of schoolchildren by two students of Columbine High School (Colorado, USA). Eric Harrison and Dylan Klebold, committed an armed attack on their school, as a result of which the attackers shot and killed 13 people (12 students and 1 teacher) and wounded 23 teenagers. As a result of this murder, the teenagers committed suicide right on the school grounds[7].

After the Columbine High School incident, prominent TV channels such as CNN and Fox News had huge ratings watching news and programmes around the world about the school shooting. The Time newspaper, for 2 weeks, mentioned Columbine on the front pages of their newspaper compilations.

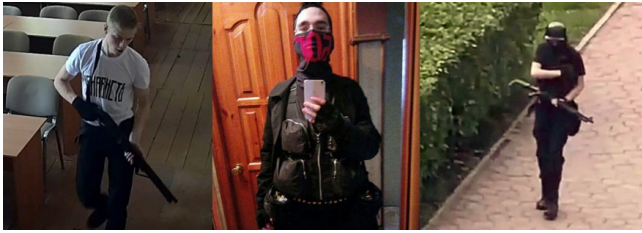
Thus, after the Columbine school shooting and the dissemination of the incident through the media led to the determination of the Columbine movement cult in 49 US states, similar incidents occurred in educational institutions, emulating Eric Harrison and Dylan Clibold (Picture 1).



**Picture 1.** Eric Harrison and Dylan Clibold, the Columbine High School skool-shooters, on the cover of “The Time” magazine



In 2021, there were more than 300 communities on various social media platforms in Russia with publications about intentions to attack educational institutions. By this time, the “Columbine” movement had changed its name to “School shooting”. The young generation in Russia is becoming increasingly interested in the actions of American school shooters Eric Harrison and Dylan Klebold. An example of this is the skulshuter Vladislav Roslyakov (Russia, Republic of Crimea, city of Kerch), who committed a mass murder in his educational institution (Kerch Polytechnic College), using almost the same murder weapon (pump-action shotgun “Hatsan Escort”), killing 23 people and wounding 67 people, as a result of which he finished the act of school shooting in the form of suicide on the top floor in the school library[8].



*Picture 2. Vladislav Roslyakov*

In order to study the problems of spreading the ideology of terrorism, school shooting and Columbine on the young generation of Russia, the results of a social survey created within the framework of a case study on two topics: “Terrorism”; “School shooting” (<https://vk.com/antischoolshooting>) will help.

A total of 770 respondents took part in the anonymous survey “School shooting and terrorism in the youth environment”. The respondents of the social survey were college students of «Ural Regional College» и «The South Ural University of Technology» of Chelyabinsk.

Так, 589 (76% опрошенных) из 770 ответили, что ни при каких обстоятельствах не стали бы поддерживать терроризм, даже если бы им это было выгодно, в то время как 181 (24% опрошенных) ответили да.

2 февраля 2022 года Верховный суд Российской Федерации признал движение «Колумбайн» (school shooting ) террористическим и запретил его на территории России.

According to the reports of the National Anti-Terrorist Committee of the Russian Federation for 2022, the young generation of Russia accounts for 75 per cent of the total number of Russians recruited into terrorist activities.

In the course of the research, five main areas of terrorist activity in the Internet space were identified:

Dissemination of ideology. Terrorists have access to the Internet space by posting video, audio and photo materials of a terrorist nature.

Recruitment of adherents. Studying the social profiles of young people to identify destructive behaviour and the ability to be subjected to ideological or mercantile manipulation;

Sponsorship. Transferring money through online accounts of terrorist organisations;

Communication. Utilising the closed access features of social media and messengers to create covert terrorist activity. Creation of web-sites via foreign platforms with the functionality of changing IP-addresses and address strings;

Terrorising society and the state. Public posts or private messages warning of the commission of a terrorist act.

To carry out their activities, terrorist recruiters use various platforms: social networks and messengers (VKontakte, Facebook, WhatsApp, Viber, Telegram, etc.). Target terrorists - age group from 16 to 35 years old with destructive consciousness.

The mechanism of recruitment of youth into terrorist activities starts by selecting candidates. Basically, this recruitment is aimed at the young generation that has destructive behaviour in society. Often, such destructive behaviour is expressed in a commitment to withdrawn behaviour, isolation from the whole world. After the selection of candidates, motivation of the committed by means of ideological processing is applied. In cases of difficulties with ideological processing, the fact of attraction by means of mercantilism is not excluded. A recruited person who subsequently becomes a terrorist has the greatest threat because of his or her ability to recruit the next younger generation into terrorist organisations in the future.

Damir Usmanov will serve as an example. In 2016, as a sixteen-year-old teenager, he became acquainted through the social network «Internet» with the recruiters of the terrorist organisation «Islamic State of Iraq and the Levant». In the same year, he travelled to Istanbul, Turkey, to meet Islamic terrorists. After the acquaintance travelled to Syria to a military camp to receive special military training for Syrian militants. He participated in military actions against The Russian Federation Armed Forces on the territory of Syria, after which he fled to the territory of Turkey, where he was engaged in recruiting Russians into terrorist cells of Islamic terrorists[9].

In 2020, Damir Usmanov was detained by officers of the Federal Security Service Directorate. Damir Usmanov was sentenced to life imprisonment (Picture 3).



*Picture 3. Damir Usmanov in the terrorist organisation ISIL*

Terrorist activity in the Internet space is often disseminated on terrorist web-sites. The main problem is that such web-sites do not meet technological barriers to deter their appearance, change or disappear addresses on the Internet.

Often, the problem is that the detection of terrorist web-sites lies precisely in their address lines, which have the ability to change unlimited times.

The second important problem is the Internet sites of foreign companies. For example, for a long period of time the Russian Federation demanded that the Lithuanian company ELNETA immediately block the terrorist web-site Kavkaz-Centre (banned in the Russian Federation). The web-site is linked to the terrorist organisation Caucasian Emirate (a terrorist organisation banned in the Russian Federation). It contains materials of extremist nature, namely incitement of interethnic, racial or religious hatred and hostility, published by militants[10].

Thus, it is understood that nowadays the Internet space is faced with a serious problem of deterring and eliminating terrorist activities in social networks and messengers. Lack of knowledge among the youth about understanding what terrorism is makes it easier to recruit terrorists to terrorist organisations such as ISIL.

Law enforcement officials do not have the access that terrorists have. Closed groups on social media and private chats on messengers only complicate the law enforcement process. It is obvious that law enforcement agencies need to develop in the field of IT technologies to an appropriate level, modernise current capabilities to a new level with access to track the threat of terrorist activity on the vastness of the Internet.

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打击犯罪的宪法和法律基础  
CONSTITUTIONAL AND LEGAL FOUNDATIONS OF THE FIGHT  
AGAINST CRIME

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注解。 本文专门讨论打击犯罪的宪法和法律基础。 宪法条款一方面为打击犯罪提供了法律框架，另一方面为保护受害人、犯罪嫌疑人、被告人的权利提供了法律框架。 文章详细讨论了打击犯罪的宪法原则。 该书分析了《阿布哈兹共和国宪法》第二章条款的内容，其中载有打击犯罪的基本依据，符合第 3 条至第 7 条和《阿布哈兹刑法典》规定的刑事立法原则。 阿布哈兹共和国。 该书还特别关注这样一个事实，即只有在宪法法律的基础上并在宪法的范围内，才可能对人权和公民权利和自由进行限制。 同时，值得注意的是，如果有政治意愿来实施打击犯罪，那么打击犯罪就会取得成功。

关键词：宪法、原则、打击犯罪、人权、法律。

***Annotation.** The article is devoted to the constitutional and legal basis of the fight against crime. It is the provisions of the Constitution that provide the legal framework for combating crime on the one hand and protecting the rights of victims, suspects and accused on the other. The article discusses in detail the constitutional principles of combating crime. The work analyses the content of the provisions of the second chapter of the Constitution of the Republic of Abkhazia, which contains the fundamental bases for combating crime, corresponding to the principles of criminal legislation provided for in articles 3-7 and the Criminal Code of the Republic of Abkhazia. The work also pays special attention to the fact that restrictions of human and civil rights and freedoms are possible only on the basis of constitutional law and within the limits of the Constitution. At the same time, it is noted that the fight against crime is successful when there is political will to implement it.*

***Keywords:** constitution, principles, fight against crime, human rights, law.*

The fight against crime is known for the activities of State and public bodies to combat crime and prevent it. Recidivism. It has a sufficient legal basis in the Republic of Abkhazia. Fundamental are the norms of the Constitution and the legislation of the

Republic of Abkhazia, as well as the rules of the international treaty, the universally recognized principles and norms of international law in the Republic of Abkhazia. Pursuant to article 11 The Constitution, Republic of Abkhazia recognizes and guarantees the rights and freedoms enshrined in the Universal Declaration of Human Rights, the International Covenants on Economic, Social and Cultural Rights, Civil and Political Rights and other universally recognized international legal instruments [1, p.4]. The traditional for the Republic of Abkhazia is the sectoral principle of legislation: criminal, criminal procedure, corrective labour, etc. The laws of the Republic of Abkhazia «On militia», «On prosecutor's office in the Republic of Abkhazia» and others were adopted and are currently in force.

When it comes to combating crime, it should be borne in mind that:

First, more general issues (law and order, protection of human and civil rights and freedoms) and security;

Secondly, on individual components of the fight against crime (criminal, criminal procedure legislation, etc.);

Third, the bodies involved in the struggle and their activities.

Thus, the Constitution of the Republic of Abkhazia<sup>1</sup> places the fight against crime within a certain legal framework. The situation of the accused, the procedure for bringing a person to criminal responsibility and various restrictions on his or her rights and freedoms are regulated in particular in detail.

Chapter 2 of the Constitution of the Republic of Abkhazia: Fundamental human and civil rights and freedoms contains the following important provisions:

1. Article 12 - Fundamental rights and freedoms belong to man from birth. Every man is born free. All are equal before the law and the courts regardless of race, nationality, sex, language, origin, property and official status, place of residence, attitude to religion, beliefs, ideologies and other circumstances;
2. Article 15 - No one may be subjected to torture, violence, other cruel or degrading treatment or punishment;
3. Article 14 - Every person has the right to privacy, personal and family privacy, protection of honour and dignity;
4. Article 16 - Every person has the right to freedom of movement and choice of residence, secrecy of correspondence and other communications; The collection, storage, use and dissemination of information on a person's privacy without his or her consent is not permitted.
5. Article 20 - The house of a person is inviolable. No one may enter a dwelling against the will of the occupant except in the cases prescribed by law or on the basis of a court decision.

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<sup>1</sup> The Constitution of the Republic of Abkhazia was adopted at the 12th convocation of the Supreme Council of the Republic of Abkhazia on 26 November 1994, approved by popular vote on 3 October 1999, as amended on 3 October 1999 and 30 April 2014.

6. Every person is guaranteed State and judicial protection of his rights and freedoms.
7. Article 23 - Every person detained or remanded in custody has the right to be assisted by a lawyer from the moment of arrest or detention and may not give evidence in the absence of a lawyer. Every detainee, remand prisoner or accused person has the right to be assisted by a lawyer (defence counsel) from the moment of arrest, detention or indictment, as appropriate;
8. Article 22 - The presumption of innocence applies in the Republic of Abkhazia. The accused shall be presumed innocent until proven guilty and established by a final judgement. The accused is not obliged to prove his innocence;
9. Article 24 - No person shall be tried again for an act for which he or she has already been convicted under a final judgement;
10. Article 25 - The law establishing or aggravating liability shall not have retroactive force. No one may be held responsible for an act which was not recognized as an offence at the time of its commission. If, after committing an offence, liability for it has been removed or reduced, the new law shall apply.

The most important provision is Article. 35 that No law abolishing or diminishing human rights and freedoms shall be adopted or issued in the Republic of Abkhazia.

Certain restrictions of rights and freedoms may be imposed only by constitutional laws when necessary to protect the constitutional order, ensure security and public order, protect health and morals, and in cases of natural disasters, emergency or martial law» [1 p.7].

It follows from this rule that, firstly, it is possible to restrict human and civil rights and freedoms; secondly, this can be done only by constitutional law; thirdly, only in the cases and boundaries specified in article 35 of the Constitution.

The State shall provide victims with access to justice and compensation for harm suffered;

article 26 - Everyone has the right to compensation by the State for harm caused by unlawful actions of State bodies and officials.

Scholars have drawn attention to much weaker protection of the rights of victims than of suspects and defendants. In general, the issue of balancing the rights of victims and defendants is a key issue in the fight against crime. The position of the legislator on the primacy of human and civil rights and freedoms in the formation of criminal law is enshrined in the Constitution. 2 The Criminal Code of the Republic of Abkhazia<sup>2</sup> (hereinafter referred to as the Criminal Code of the

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<sup>2</sup> Criminal Code of the Republic of Abkhazia (№ 1798-c-IX, 27 April 2009 r. № 2348-c-IV, 21

Republic of Abkhazia), which stipulates that human and civil rights and freedoms, property, public order and public security, the environment, the constitutional order are protected under the rules of criminal law; peace and security of mankind from criminal encroachment.

Part of the provisions of chapter 2 of the Constitution of the Republic of Abkhazia was reaffirmed as priorities in the formation of criminal policy and principles of criminal legislation. All right, Article 3-7 of the Criminal Code enshrine such principles of criminal law as the principle of equality before the law, the principle of legality, the principle of guilt, the principle of justice, the principle of humanism. The formulations of some of the principles proclaimed by the Criminal Code of the Republic of Abkhazia are almost identical to those of the Constitution of the Republic of Abkhazia. For example, Article 4 The Criminal Code of the Republic of Armenia, which establishes the equality of citizens before the law, almost completely copies article 12 of the Constitution of the Republic of Abkhazia. Article 5 of the Criminal Code of the Republic of Armenia, which establishes liability only if there is fault, corresponds to article. 22 The Constitution of the Republic of Abkhazia establishes the presumption of innocence. Article 6, paragraph 2, of the Criminal Code, which enshrines the principle of justice, fully complies with article 24 of the Constitution of the Republic of Abkhazia.

Experts have noted that the media play a significant role in combating crime. Finnish criminologist Matti Linee writes: The media are an increasingly important factor in the fight against crime. For example, the tabloid press can strongly express its views on crime issues and thus influence... public opinion. Politicians are sometimes very receptive to public opinion and therefore the importance of the media is even greater» [3].

In the fight against crime, the development of international cooperation is essential, and the issue of extradition is particularly important in the context of the development of transnational crime, including trafficking in arms, drugs, etc. The United States Government has taken the lead in this regard.

In conclusion, the fight against crime can only be successful and science-based when there is political will to implement it.

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July 2009 г. № 2426-c-IV, 30 July 2009 г. № 2450-c-IV, 4 august 2009 г. № 2472-c-IV, 10 march 2011 г. № 2863-c-IV, 15 June 2011 г. № 2937-c-IV, 7 august 2012 г. № 3187-c-V, 29 November 2012 г. № 3227-c-V, 15 June 2015 г. № 3793-c-V, 18 November 2015 г. № 3910-c-V, 9 June 2016 г. № 4135-c-V).



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2. *Criminal Code of the Republic of Abkhazia dated 12/28/2006 Criminal Code of the Republic of Abkhazia (with amendments and additions dated July 18, 2007 No. 1798-c-IX, April 27, 2009 No. 2348-c-CM, July 21, 2009 No. 2426-c-CM, July 30, 2009 No. 2450-c-CMM, August 4, 2009 No. 2472-c-CMM, March 10, 2011 No. 2863-c-CMM, June 15, 2011 No. 2937-c-CMM, August 7, 2012 No. 3187-c-M, November 29, 2012 No. 3227-c-M, June 15 2015 No. 3793-s-M, November 18, 2015 No. 3910-s-M, June 9, 2016 No. 4135-s-M)*.
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未来教育硕士数字能力的发展  
**DEVELOPMENT OF DIGITAL COMPETENCE OF FUTURE  
MASTERS OF PEDAGOGICAL EDUCATION**

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抽象的。当前，俄罗斯高等教育向科技化、数字化方向转型具有重要意义。尤其紧迫的是培养现代高等教育教师的问题，他们必须熟练掌握计算机技术和数字工具，以便在教学实践中实施。本文介绍了作者对未来教育硕士数字能力发展过程的方法，其特点是：知识、对数字工具在教学活动中的使用的理解；拥有数字能力，决定解决与专业教学活动、信息和通信技术（ICT）手段相关的问题的准备和能力。这种方法使“教育学”方向的硕士课程毕业生能够在高等教育技术和数字化转型的现代条件下成功工作。

关键词：高等师范教育、“师范教育”方向硕士课程、数字能力、数字工具、信息和通信技术。

**Abstract.** *Currently, the transformation of higher education in Russia in the direction of technologization and digitalization is relevant. Particularly acute is the problem of training modern teachers of higher education, who must be fluent in computer technology and digital tools for their implementation in teaching practice. The article presents the author's approach to the process of developing digital competence of future masters of pedagogical education, characterized by: knowledge, understanding of digital tools for their use in pedagogical activity; possession of digital competencies that determine the readiness and ability to solve problems associated with professional pedagogical activity, means of information and communication technologies (ICT). This approach allows graduates of the master's program in the direction of "Pedagogical education" to successfully work in modern conditions of technological and digital transformation of higher education.*

**Keywords:** *higher pedagogical education, master's program in the direction "Pedagogical education", digital competence, digital tools, information and communication technologies.*

According to the federal state educational standard of higher education, the professional activities of a graduate of the master's program in the direction "Pedagogical education" include such areas as education and science [8]. Working in a higher professional school, the activity of the Master of Pedagogical Education - a teacher is aimed at organizing the process of teaching various disciplines in accordance with the scientific research of the Master. From his professionalism, ability to see and formulate pedagogical tasks, design stages of education, select the content of education taking into account the cognitive abilities of students, involve them in scientific research using modern teaching methods, build innovative learning technologies, focusing on the active introduction of digitalization in higher education, notes N .M. Akhmerov, the formation of the creative potential of specialists of the new generation depends [1].

That is, a modern master of pedagogical education should be prepared for successful work in modern conditions of technological and digital transformation of secondary and higher education.

Considering the problems of computerization and digitalization of modern higher education, it should be noted that many works are devoted to them in pedagogical research. In the developments of the authors, it is mainly:

- about the formation of information literacy of students (the use of information resources and digital content and their management; analysis and evaluation of information; database management) [2; 14];
- on the organization of communication and cooperation activities (interaction through digital technologies; exchange through digital technologies; cooperation using digital technologies; ethics in the network) [3; 9];
- on the creation of digital content (creation and development of digital content; its integration and processing; copyrights and licenses; programming) [4];
- on security when working with digital resources (protection of the device; protection of personal data and confidentiality; protection of health and well-being; protection of the environment) [5];
- about the problem of digital competence of a university graduate (solving technical problems; identifying needs and technological solutions; creative application of digital technologies, etc.) [10; 11; 13].

Since the Master of Pedagogical Education works with students of various areas of training, it is important for him to master digital competence in the process of studying in the magistracy.

A large number of works are devoted to the study of the formation and development of the phenomenon of digital competence of a teacher. Under the digital competence of a teacher, many authors understand the set of competencies that are constantly updated in the context of improving digital technologies to carry out professional activities in a digital educational environment [10; 12; 14].

O. McGarr and A. McDonagh, for example, identified four components of such competence:

- 1) knowledge and skills in the field of digital technologies;
- 2) pedagogical and technological knowledge and skills;
- 3) awareness and understanding of cyber ethics;
- 4) positive attitude and openness to new digital technologies [13].

According to scientists, a master's digital competence should be characterized by:

- knowledge, understanding of digital tools for their use in pedagogical activity;
- possession of digital competencies that determine the readiness and ability to solve problems related to mathematical activity, means of information and communication technologies (ICT).

Combining the presented approaches to understanding the main types of professional competence of the master of pedagogical education, we come to the conclusion that in the magistracy, when preparing a teacher of higher education and a research master, it is necessary to form digital competence (DC).

Under the *digital competence* of the master of pedagogical education, we mean competence, which is characterized by knowledge, understanding of digital tools for their use in pedagogical activity, possession of digital competencies that determine the readiness and ability to solve problems associated with educational activities, means of information and communication technologies.

The concept of “*formation of digital competence of future masters of pedagogical education*” is interpreted as the achievement by undergraduates in the process of teaching psychological, pedagogical and methodological disciplines, as well as disciplines of the computer science block, when passing all types of practices, new educational results in the form of mastered technologies, teaching methods and digital tools those who implement them, develop the skills to act meaningfully in a situation of choosing digital content, competently set and achieve educational goals, act productively in the process of teaching various disciplines using digital resources.

We take the European model of teacher competencies (Digital Competence of Educators (DIGCOMPEDU)) as the basis for the formation of digital competence of a future teacher of higher education [13].

**The first block of the model** is digital professional competencies. These are the skills that any modern specialist should have (organization of communication, professional cooperation, development of digital skills and reflective practices).

**The second block of the model** is digital pedagogical competencies. These include: digital resources (their selection, creation and modification, management, protection and sharing); learning and teaching (teaching, mentoring, reflective practices, self-managed learning); assessment (assessment strategies, evidence analysis, feedback and planning); empowerment of learners (accessibility and inclusiveness, personalization, engagement).

**The third block of the model** is the digital competencies of the teacher, aimed at the formation of digital competencies of students.

It is possible to master such competencies only in conditions of improving the quality of fundamental and vocational education. For this we consider it necessary:

- creation of open educational resources and digital learning environment;
- intellectualization of interactive interaction between the learner and the educator with the means of informatization in the information and educational space;
- availability of a constantly updated bank of new (including digital) methods and technologies for teaching disciplines of compulsory and optional blocks;
- the development of digital competencies, both among teachers working in the master's program of pedagogical education, and students - future teachers of higher education [6; 7].

Let us dwell on the technology of formation of future masters of pedagogical education of digital competence, developed by us at the Donetsk State University.

The technological process was designed within the framework of the integration of fundamental, psychological, pedagogical and methodological disciplines. It goes through three stages.

**Stage 1:** *the introduction of digital application programs into the fundamental block of basic and variable disciplines.* At this stage, there is not only a deepening of the professional knowledge of undergraduates, but also the development of digital competencies for the implementation of pedagogical activities using application packages: MathCAD, Maple, MatLab, AutoCAD, Matematica, etc. For example, in the master's program "Mathematical Education" in the preparation of a future teacher mathematical disciplines, we use universal mathematical packages not only to provide computing processes, but also as a learning environment: Mathematica in solving geometric problems, in complex analysis, in solving problems of mathematical statistics. The Wolfram Mathematica system is used to solve differential equations, visualize mathematical objects not only in mathematics, but also in other scientific fields, etc.

In the discipline "Logic and Methodology of Modeling" students master the ways of mathematical modeling in professional activities using digital tools such

as, for example, the AnyLogic platform, designed for simulation in business and logistics. At the same time, computer visual models are created that allow undergraduates to apply the acquired knowledge and digital skills for research in master's theses, computer experiments are carried out to model various technical, pedagogical, philological, psychological systems, and laboratory work on computer modeling is performed.

**Stage II:** *the introduction of ICT and digital tools in the psychological and pedagogical disciplines.* The master's program provides for the study of such psychological and pedagogical disciplines as: "Pedagogy of higher education"; "Pedagogical measurements"; "Electronic resources and digital technologies in education"; "Interactive means of remote interaction with students". When studying psychological and pedagogical disciplines, undergraduates develop professional and pedagogical thinking, pedagogical culture, professionally important qualities of a future teacher, but at the same time, their study is also aimed at the formation and development of digital competence. Thus, undergraduates study learning organization models using LMS (Learning Management System) - learning management systems, such as the Suport Open Learning (SOL) Model used at the Open University (Open University); ADDIE Model ; backward model. The Moodle distance learning organization system, which is most often used in higher education, is studied in detail. In addition, students get acquainted with e-learning (e-Learning) platforms Claroline LMS, CoreApp, We.Study, Course Editor, Nethouse.Academy, Tilda Publishing, iSpring Suite e-learning course builder based on Microsoft PowerPoint, etc.

**Stage III:** *mastering the ability to choose effective software for use in teaching activities.* When studying methodological disciplines ("Methodology of teaching in higher education"; "Methodology and methods of scientific research"; "Management of project activities of students"), software is selected that is used in various disciplines of higher education; modern network resources are analyzed; mobile technologies are studied in teaching how to work with simulation programs; social networks and digital platforms are being studied to develop online classes with students; chat conferences, video conferences, video tutorials, etc. are being developed. Students design lectures, practical classes and laboratory work using innovative technologies based on blended, hybrid learning, flipped classroom learning, create interactive web tests, multimedia simulators for students, etc.

Thus, undergraduates - future teachers of higher education master the skills and digital skills: to navigate the range of the main problems associated with the application of computer programs in professional pedagogical activity; use application software to solve professional problems; determine the most effective software for use in teaching activities; apply various software to create educational projects and their implementation in higher education.

The presented approach to the formation of digital competence of future teachers of higher education allows them to master the competencies of “tomorrow”: key professional competencies; over-subject competencies (soft skills); meta competencies.

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学生体育作为公共服务大学教育工作的一种概念方法  
**STUDENT SPORTS AS A CONCEPTUAL APPROACH TO  
EDUCATIONAL WORK IN A PUBLIC SERVICE UNIVERSITY**

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注解。大学教育工作理念框架内的学生体育发展问题在我国困难时期变得尤为重要。工作目的：以公立大学高等教育工作中的学生体育俱乐部“涅夫斯基泰坦尼”为例，从教育工作的角度思考学生体育的方向和功能。教学研究过程中发现，高等教育机构中的群众性体育活动是现代学生形成教育、爱国和交际功能的彻底而富有成效的工具。

关键词：体育群众活动、学生体育俱乐部、学生体育、爱国主义教育、普及、动机、运动素质、主动娱乐。

***Annotation.** The issues of student sports development within the framework of the concept of educational work at the university have become relevant in a difficult period for our country. The purpose of the work: consideration of directions and functions of student sport in the perspective of educational work in the higher educational work in a public service university on the example of the student sport club “Nevskiye Titany”. In the course of pedagogical research it was established that sport mass activity in higher education institutions is a thorough and productive tool in the formation of educational, patriotic and communicative functions of a modern student.*

***Keywords:** sport mass activity, student sport club, student sport, patriotic education, popularisation, motivation, motor qualities, active recreation.*

### **Introduction**

Studentship is a wonderful time that opens up prospects and opportunities for realising one’s ambitions and reaching heights in the chosen field of activity. The core direction of physical culture and sports education at the university in a difficult period for our country has become the uobringing of socially active and patriotic youth. The development of sports, physical and patriotic education of

the nation is the main vector of the internal state policy of our country, which is reflected in the federal educational programmes for youth development, for example, the State Programme of the Russian Federation “Development of Physical Culture and Sports” (as amended by the Government of the Russian Federation from 24.12.2021 № 2440) [6]. [6]. In this regard, student sports among young people is the main direction in the preparation of a resilient and comprehensively developed younger generation and a fundamental vector in the concept of educational work in the university.

Young people aiming to improve their physical and motor qualities, strengthen and preserve their health and prolong their creative longevity are interested in participating in and organising student and public sports events. Unfortunately, during the pandemic period restrictive measures thoroughly reduced the motor activity of the population, but the society slowly but surely returns to the usual way of life: fitness clubs and gyms are opened, athletes are restoring their sports regime, mass sports festivals are organised, etc. And student life with new forces and ideas has been in full swing: sports sections are created and opened, national teams are preparing for championships among universities in various sports, sports mass activities are held to pass qualification standards within the framework of the “Ready for Labour and Defence” program [1; 2; 3, 4].

**Purpose of the work:** to analyse the directions and functions of student sports in the perspective of the implementation of a unified educational process in the university of public service.

In 2013, the student initiative to create the “Association of Student Sports Clubs of Russia” (ASSC) was approved by Russian President V.V. Putin. And already more than 670 student sports clubs from different regions of the country have joined the ASSC youth sports organisation, which since 2018 has become a permanent partner of the Ministry of Sports of the Russian Federation and the Ministry of Science and Higher Education of the Russian Federation. The Association of Student Sports Clubs of Russia is responsible for the implementation of the Concept for the Development of Student Sports in the Russian Federation for the period up to 2025 and the Intersectoral Program for the Development of Student Sports [5].

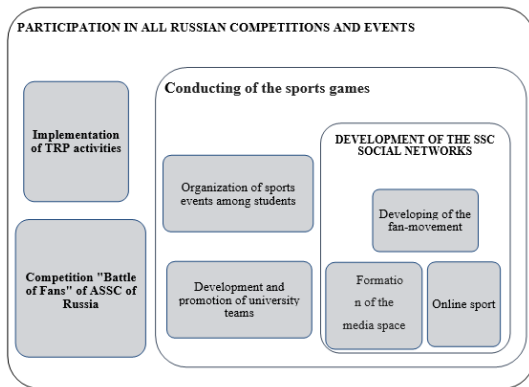
The variety of ASSC projects provides an opportunity for active and interested young people to participate in sports battles, to realise their organisational skills, skills as a sports referee or sports volunteer (pic. 1).



*Picture 1. Projects of ASSC of Russia*

On the basis of North-West Institute of Management (NWIM) there is a student sports club “Nevskiye Titany” (SSC), which became a full-fledged member of ASSC on 6 November 2018. The university management supported the initiative of students to go to the All-Russian level, and on its part makes every effort to create conditions for the development of university sports. NWIM is a non-core university, but there are a lot of student-athletes in the university with the highest achievements and sports titles, who defend the honour of the university and the country, demonstrating the results of their daily work: Alexandra Boikova and Dmitry Kozlovsky - figure skating; Mikhail Artamonov (bronze medallist at the Tokyo 2020 Olympic Games) - taekwondo; Ivan Pozdyshev - freestyle; Elizaveta Ilyushina - taekwondo; Olga Matveeva (six-time champion of Russia) - karate; Adam Yusupov - freestyle wrestling; Daniil Kalashnikov - cybersport; Veronika Pershina - beach tennis; Stepan Lomakin and Maxim Lobanov - curling and many others. Also, the university receives a large number of students who have initial sports training or are physically well-coordinated, who are ready to further improve and conquer the sporting Olympiads. Therefore, the development of mass sports, and in particular, student sports is simply necessary.

The main goal of SSC “Nevskiye Titany” is to organise leisure time and encourage university students to engage in systematic physical training and sports. The functioning of SSC “Nevskiye Titany” is to introduce young people to a healthy lifestyle, to organise and conduct sport mass activities, to strengthen friendly relations between educational organisations and clubs and to reach the regional and All-Russian level (Pic.2).

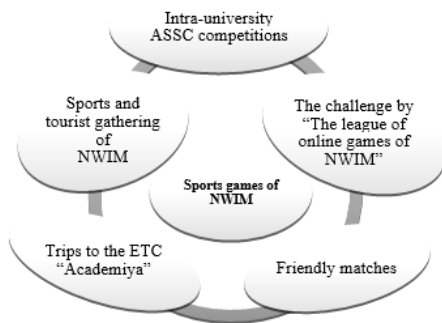


Picture 2. Organisation of activities of SSC

The SSC “Nevskiye Titany” team unites active and creative students who prove to be responsible organisers and performers, capable of infecting many students of different nationalities and ages with their enthusiasm and personal example:

- the team of organisers (PR managers, fan movement, selection work, development of TRP programmes, development of cyber sports space);
- sports organisers at faculties;
- managers of teams of faculties in different sports;
- members of teams of the university;
- communities in the media space.

The main mission of the club is to develop mass student sports, uniting a multinational team, and to promote high-performance sports in competitions at the city and all-Russian levels (Pic.3).



Picture 3. Sport mass activities of NWIM

In NWIM 31 sections and national teams operate and function on a permanent basis. A fundamental aspect in the organisation of sectional activities in higher education institutions has become the unification of students on the basis of promoting healthy lifestyles (HLS) and encouraging young people to engage in regular sports and physical education [2, p. 319]. It is difficult to think of a more effective form of university sports organisation than competitions between universities/students. Events of this format are designed to popularise mass sports through accessible sports. SSC “Nevskiye Titany” organises events not only on sports grounds, but also successfully implements the project “Conversation on Equals”, the essence of which is to organise live broadcasts with famous personalities related to sports. Within the framework of such meetings, students become more familiar with sports and the peculiarities of competitive struggle.

**Conclusion.** The development of student sport should have a strategic orientation for the long term. Sports and about sports activities unite and unite young people, forming communicative functions, responsibility, initiative, ability to work in multitasking mode, to defend the honour of their university on sports grounds.

Having analysed the directions and functions of student sport, the author found that the interaction of all participants and organisers of SSC is based on the rights of equal partners.

Inclusion of student sport in the educational process of youth has a stimulating effect on the growth of students’ conscious attitude not only to their own improvement, but also to the achievements of the whole team of the student sports club, providing an opportunity for each student to become part of sports culture, to join physical recreation, to meet champions, to feel part of a large sports community.

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外语交流环境中非语言交流的特殊性

**THE SPECIFICITY OF NON-VERBAL COMMUNICATION IN A  
FOREIGN-LANGUAGE COMMUNICATION ENVIRONMENT**

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注解。本文分析了外语交际环境中非语言交际的具体情况。考虑了非语言交流在交流情境中信息传递中的作用以及非语言符号学的方向。指出了使用非语言交流手段时的语境及其文化条件的重要性。考虑了成功的外语交流所必需的交流能力。

关键词：外语交际环境、交际、非语言交际、非语言交际手段、交际能力。

**Annotation.** *The article analyzes the specifics of non-verbal communication in a foreign language communicative environment. The role of non-verbal communication in the transfer of information in situations of communication and the direction of non-verbal semiotics are considered. The importance of the context in the use of non-verbal communication means and its cultural conditioning are noted. The communicative competencies that are necessary for successful foreign language communication are considered.*

**Keywords:** *foreign language communicative environment, communication, non-verbal communication, means of non-verbal communication, communicative competence.*

Non-verbal communication includes all forms of human self-expression that are not based on words. According to statistics, the recognition of non-verbal signals is the most important condition for effective communication, since gestures and postures reveal about 55% of the meaning of the message, sounds and intonations - 38%, while words - only 7% [1]. Since non-verbal communication is the prevailing component in the transfer of information, in the process of communication in a foreign language communicative environment, it contributes to the knowledge of this field, the development of communication skills with representatives of another culture and personality, the development of certain personality traits, the transfer of cultural experience, the formation of theoretical and practical

readiness for meaningful and productive intercultural interaction [2]. The high role of non-verbal communication skills in successful integration into a foreign language communicative space determines the relevance of their study.

The aim of the work is to study the specifics of non-verbal communication in a foreign language communicative environment. To achieve it, analytical, synthetic, inductive and deductive methods of processing case studies, scientific publications and relevant literary sources were used.

The following directions of non-verbal semiotics can be distinguished [3]:

- paralinguistics - the science of sound codes of non-verbal communication;
- oculusics - the science of visual behavior in the process of communication;
- kinesics - the science of gestures and gestural movements that accompany communication;
- haptics - the science of tactile communication;
- auscultation - the science of auditory behavior in the process of communication;
- gastika - the science of communicative and symbolic functions of food and drinks;
- olfaction - the science of the role of smells in communication;
- proxemics is the science of communication space, its structure and functions.

In formal interpersonal communication in a foreign language communicative environment, the main directions of non-verbal semiotics are kinesics and proxemics.

Proxemics studies the structure of a natural and specially built communication environment, the functions and meanings of various characteristics of a communicative environment, the construction of a typology of communicative spaces, verbal and non-verbal dialogic behavior, cultural functions and meanings of spaces related to a person. The culturally specific rules of proxemic behavior include the choice of distance and place: a person chooses a suitable distance for a conversation, taking into account the meeting place, age, gender and social status of the interlocutor. Also the range of interests of proxemics includes the rules of spatial orientation and position of bodies in the process of communication, based on the types of social interaction and ways of perceiving the space of communication.

Kinesics studies sign language, which is a natural form of expression of individual social and social processes. Gestures can duplicate speech information, replace or contradict a speech statement, enhance or emphasize any components of speech and act as a regulator of speech communication [4]. Their functions in communication are diverse: gestures can control and regulate the verbal behavior of the speaker and listener, convey semantic information to the addressee, display actual speech actions in a communicative act, represent the psychological state of the speaker and perform a deictic function - depict the parameters of an object,



indicate the position of an object or person. Additionally, gestures can perform a rhetorical function, in addition to conveying meaning, participating in the processing of the execution of the message.

Postures can act as gesture signs - correlative positions of body parts, which are usually more static than hand and foot gestures. In all cultures, there are typical postures for different genders, ages and social strata, expressing status, attitude towards another person, the degree of involvement in the dialogue, mental and physical state, the search for participation, individual and social relationships. All peoples and cultures have their own set of gestures, and only a small part of the signs is universal.

When using means of non-verbal communication, the context is of great importance [5]. In particular, the role of context increases in high-context cultures (Korean, Chinese, Japanese, Filipino, Brazilian), in which part of the information remains unsaid and is transmitted non-verbally. This specificity should be taken into account when intercultural interaction with representatives of low-context cultures (Australian, American, German, Canadian, Danish, English), in which the interlocutors are straightforward, pronounce messages full, express themselves clearly and give maximum information in the form of words.

Since intercultural communication occurs during the dialogic interaction of cultures, the participants in the dialogue, in order to achieve their communicative goals, need to know and observe certain communicative-pragmatic principles of constructing speech, the means and functions of non-verbal communication. Despite some universality of non-verbal means of communication (a smile, a nod of the head in agreement), the features of non-verbal communication are determined by culture and represent “codes” of communication - stereotypes of non-verbal communication that are used by representatives of a particular cultural community [6]. The basis of the cognitive component of non-verbal competence is the ability to find a balance between the interpretation of non-verbal signals of a communicant based on stereotypes which allows saving cognitive resources and situational context. The behavioral component of non-verbal communicative competence includes the skills of non-verbal behavior which are based on knowledge of the specifics of the perception of non-verbal signals by the interlocutor.

Non-verbal communication is a part of communicative competencies and can be successfully carried out only if other competencies are developed, such as [7]:

- knowledge in the field of communicative disciplines;
- organizational and communication skills - the ability to accurately and quickly establish business contacts, take the initiative, exert psychological influence based on an adequate understanding and perception of the uniqueness of a particular person, actively influence in joint activities with participants in communication;

- the ability to empathize - the ability to feel the state of another person and empathize;
- the ability to self-control - the ability to regulate one's own behavior and the behavior of a communication partner, find productive ways to resolve conflict situations, predict the development of interpersonal relationships and form a favorable psychological climate;
- culture of verbal and non-verbal communication - observance of etiquette, possession of rhetorical techniques, speech technique and argumentation of the dispute, compliance with speech discipline, appropriate use of the conceptual and categorical apparatus and non-verbal means.

At the same time, communicative competencies are not limited to specific knowledge, skills and abilities [8]. The development of competencies implies the presence of not only skills that are tied to the situation of their development, but the ability to go beyond the boundaries of these situations, allowing you to experience the value of self-expanding your own knowledge and skills, showing initiative and activity in a new communicative situation. A positive result of communication in a foreign language environment can be considered the presence of all components of communicative competence in a communication situation: mutual information, the specifics of relationships, mutual understanding, interaction and mutual correction [9].

Thus, the possession of non-verbal communication skills, together with the verbal system and the norms of speech behavior of specific social groups within society, allows the individual to adapt more easily and successfully in a foreign language environment. Since non-verbal means make a predominant contribution to the representation of communication, successful adaptation in a foreign language communicative environment requires the presence of basic cognitive structures, knowledge of foreign cultural scripts, understanding of foreign concepts and the ability to draw analogies with one's own value orientations, which constitutes the cognitive base of socio-cultural communicative-behavioral skills and abilities.

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关于西伯利亚和西伯利亚人作为传统区域语言文化标志的陈述

## STATEMENTS ABOUT SIBERIA AND SIBERIANS AS A MARKER OF TRADITIONAL REGIONAL LINGUOCULTURE

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注解。 本文的目的是确定叶尼塞西伯利亚居民关于他们自己的民族文化空间的口头陈述的文化含义，以及这些陈述的俄罗斯真实意图类型的特征。 用于研究有关西伯利亚和西伯利亚人的口头陈述密度的材料，这些材料是在 2018 年至 2023 年克拉斯诺亚尔斯克边疆区各个地区复杂的民俗和方言学考察中磨砺出来的。 揭示解释性、评价性、论证性和指导性的陈述； 考虑神话和隐喻作为一种罕见的语言文化。

关键词：传统地域语言文化、口头文本、话语内容意向类型、西伯利亚、西伯利亚人。

**Annotation.** *The aim of the article is to identify the cultural meanings of the oral statements of the inhabitants of the Yenisei Siberia about their and their own ethno-cultural spaces, as well as the characteristics of Russian true-intentional types of these statements. The material for the study of the density of oral statements about Siberia and Siberians, grinding during the complex folklore and dialectological expeditions of 2018-2023 in various regions of the Krasnoyarsk Krai. Explicative, evaluative, argumentative and instructive statements are revealed; consideration of mythologeme and metaphor as a rare linguoculture.*

**Keywords:** *traditional regional linguistic culture, oral text, content-intentional type of utterance, Siberia, Siberians.*

An urgent task of modern Russian studies is to expand the empirical base and improve the theoretical and methodological apparatus of linguocultural and communicative dialectology. The main object of the study of these scientific areas are cultural-bearing oral texts of different genres. Currently, a number of Russian universities and many linguistic centers of the Russian Federation are actively working to fix and study the texts of linguo-linguistic culture. Linguistic culture is understood as a special semiotic subsystem, which professor Krasnykh V.V. metaphorically designated as “culture in the clothes of language”, noting that this

linguo-cognitive phenomenon is formed “not by linguistic units, but primarily by cultural meanings and images of consciousness that are interconnected with them” [Krasnykh, 2016, p. 115]. For Siberian Russianists, of particular interest is such a form of linguistic culture as regional traditional (folk) linguistic culture, which was formed in the conditions of close interaction of Russian national culture with the cultures of the indigenous peoples of Siberia and the diasporic cultures of the settlers of the Siberian region.

The oral texts of Russian old-timers of Siberia about their own and others' space, about their own and others, began to be studied by linguists only in the 21st century, when the problems of cognitive-communicative and communicative-pragmatic paradigms came to the fore. Initially, such texts were recorded along the way as illustrative material for large lexicographic projects: “Dictionary of Russian dialects of the old-timers of Baikal Siberia” by G.V. Afanasyeva-Medvedeva [2007-2021] and the multimedia “Angara Dictionary” by O.V.Felde. At present, a corpus of oral texts has been created at the Siberian Federal University and continues to be replenished as part of a program for studying the discursive space and linguistic culture of the Northern Angara region [Electronic resource – URL: <http://angara.sfu-kras.ru/> (free access)]

The empirical material of this study is the records of oral statements about Siberia and the Siberians made by the author in different regions of the Krasnoyarsk Krai, the largest administrative-territorial unit of the Yenisei Siberia. When selecting the material, territorial and social factors were taken into account. The texts recorded from the indigenous Siberians, i.e. born in Siberia, the descendants of the first Russian-speaking settlers of the Siberian lands (XVII - XVIII centuries) and the descendants of immigrants from the western and central provinces of the Russian Empire of the XIX century, who are united by a “double ethnic consciousness”: the consciousness of belonging to the Russian ethnos and the Siberian sub-ethnos at the same time.

The theoretical and methodological basis of the study is the postulate about the specificity of the traditional Siberian linguistic culture, which is determined by cultural codes and subcodes, as well as value dominants, historical and social experience of the local community (See more about this: [Felde, 2019, p. 56]). Following V.N. Teliya, we understand the codes of culture as “the taxonomic substratum of its texts, the totality of cultivated ideas about the picture of the world of a particular society - about its natural objects, artifacts, phenomena, actions and events distinguished in it, mentofacts and inherent these entities in their spatio-temporal or qualitative-quantitative dimensions” [Teliya, 1999, p. 20-21]. At the stage of collecting material, the guided interview method was used. The respondents were asked questions: What does Siberia mean to you? Within what boundaries do you feel it as “your” space? Who can be called a Siberian? Do the

Siberians differ from the Russians living in other regions of the Russian Federation. If yes, what are the differences? At the research stage the interpretation method of the obtained data was used.

The materials and conclusions of the article can be used in the further study of the normative-value system of Siberians as one of the ethno-territorial groups of the Russian people, as well as in the description of oral regional texts as macro-units of traditional linguistic culture. The results of the study are also significant for expanding ideas about the regional variability of the triad of linguocultural concepts “one’s own” - “foreign” - “other”. This determines the relevance of the undertaken research.

In the process of analysis, it was revealed that, in terms of their content-intentional features, statements about Siberia and Siberians have a pronounced world-modeling and influencing orientation. Respondents try to explain, argue their point of view, influence the consciousness and feelings of the collector, as if inviting them to share their own point of view on Siberia and Siberians. The database we collected revealed explicative, evaluative, argumentative statements about Siberia and Siberians, as well as texts of an evaluative and instructive nature, which contain directive statements about the need to remain faithful to the traditions of Siberians and love “Sibir-matushka”.

An analysis of the data obtained showed that for the majority of respondents, the territory of Siberia does not coincide with its official geographical boundaries. Many of the natives of the Yenisei Siberia associate the “real” Siberia with their place of birth, with the usual cold climate, primarily with the place of residence of relatives and countrymen:

*«Для меня Сибирь, как раз вот Красноярский край. Не Новосибирск. Потому что у меня нет такого ощущения, что здесь у меня «своя Сибирь», несмотря на то, что у меня и семья здесь, и всё. А осталось у меня, что там корни, в Кежме, в Красноярском крае. Поэтому Сибирь для меня – это всё-таки там. Здесь уже, почему-то мне кажется Сибирь не настоящая. Потому что здесь климат помягче, здесь же потеплее. Алтай, на который мы ездим отдыхать, дак это вообще, как бы там очень тёплое место, и поэтому это не Сибирь. Нет, для меня, Дальний Восток – это не своё место, совершенно не своё. Я служил в армии, я служил, значит, за Уралом, в Курганской области я служил. И меня удивило, что они уже себя сибиряками называют. Для меня это было, извините, говорю, какие же вы сибиряки. Для меня это не воспринималось. Но они называют себя сибиряками, а для меня – нет. Для меня вот Сибирь настоящая – это Красноярский край, Средняя Сибирь, Енисей. Может быть, ещё туда, к Байкалу ещё, там, где Иркутская область. Вот это для меня Сибирь. Потом, я же всё время и в Красноярск езжу, туда меня тянет, на родину.*

*То есть для меня настоящая Сибирь – это именно Красноярский край. И немножко Иркутска там и Иркутская область. Вот это для меня. Средняя Сибирь, ну географическая, вот она – Сибирь. Даже Дудинка для меня более родной воспринимается. А почему Дудинка, почему Крайний Север? Потому что немало родственников моих туда уехало. И земляки мои там, на Севере, жили. Ну и потом, всё время же я читаю про Красноярский край и у меня это, в общем, в голове и в сердце» (2019 interview with a native of the village of Kezhma Of Krasnoyarsk Krai who currently lives in Western Siberia in Novosibirsk). Here is another typical example of an assessment text in which Siberia is presented as a space of “ours”: «Для меня Сибирь – это прежде всего моя родина. Это мои родные, мои друзья, мои коллеги. Мы все живём на этой прекрасной земле» (Krasnoyarsk, 2022). The dominant aesthetic experience of the homeland is usually a sense of the beauty of Siberian nature which is conveyed by emotionally colored linguistic means: «Утром встала, вышла на улицу. А у меня трава зелёнькая. И роса. И вот, представьте, как босичком пройти по этой росе. Какая красота! А если туманчик ещё небольшой... А воздух какой чистый! А петухи поют! Это ж вот, представьте, душа поёт, с утра загорается жизнью. И жизнь вот прям расцветает!» (Motyginiski district of the Krasnoyarsk Kria, the village of Motyginino, 2018).*

Estimated attitude to Siberia is conveyed by anthropomorphic metaphors Siberia-Matushka, Mother Siberia, Angara-matushka, Yenisei-batushka: «Почему мы называем Сибирь матушкой? Сибирь. Она нас родила. Она нас воспитала. Она нас бросила в эту жизнь. Я считаю, что мало сибиряков, которые родились и живут здесь, не любят её. Это наше. Это наше. Это родина. А родина – это мать. В любом случае» (Boguchansky district of the KrasnoyarskKria, the village of Taezhny, 2021).

In the value picture of the world of Siberians the native land is positioned as the most precious thing in life. The stereotypical ideas about Siberia as a rich region to which the “power of Russia grows” are frequent, the mythologeme of the “golden bottom” is broadcast: «Сщас всё у нас на Сибири держится! Вся Россия на Сибири-матушке держится! А какие у нас площадь! Вон у нас скоко всего: и лес, и газ, и нефть, и уран - да всё! Не зря же говорят, Сибирь – золотое дно» (Kezhemsky district, Yarkino village, 2018). Talking about Siberia, its indigenous people invariably demonstrate patriotism, including Siberia in the space of a great homeland: «Что для меня значит Сибирь? Я родился в Сибири в 1953 году. Сибирь для меня – Россия. Россия – это Родина. Я люблю Сибирь. Всю свою жизнь в основном я живу в Сибири. .... Россия – есть наша родина. И Сибирь принадлежит России. Сибирь, в которой я проживаю, – это речка Мана. Речка Мана, на которой прошло мое детство. Здесь всё связано с моим детством. Поэтому Сибирь для

*меня – всё! Поэтому даже разговора быть не может, чтоб мы не любили свою Сибирь!»* (Divnogorsk, 2021).

Popular consciousness ascribes to the Siberians a special mission of saving the Fatherland, the statements that in 1941 “Siberians saved Moscow” are frequent. A semantic analysis of the statements we collected about Siberians showed that Siberian identity is determined not by nationality, but by the place of birth and “moral settled way of life” (D.S. Likhachev), attachment to the native land. The factor of nationality for a resident of Siberia does not really matter. *«Сибиряки – все, кто родился и живёт в Сибири»; «Сибиряки – все, кто давно живёт в Сибири и любит её»; «Я приехал, хохол, 42 года назад. И осибирячился. А дети мои и внук и подавно сибиряки. Тут родились. [What does “osibiryachilsya” mean? – Собир.]. Ну, полюбил Сибирь. Прикипел к ней. Нравятся люди. Суровость природы нравится. Бодрит морозец. Жизнь у нас – это жизнь в тонусе. Всё время нужно силу, опыт, изобретательность применять. Люди в Сибири живут на адреналине, а не существуют. Да, уезжают в Питер наши, в Краснодар уезжают некоторые. Но все по Сибири скучают! Вот друг у меня из Ачинска уехал в Анапу. Говорит, снег прямо снится. Вот, говорит, снится, как белый снег лопатой разгребает»* (Красноярск, 2021). When discussing who Siberians are and how they differ from other residents of Russia, the respondents draw an ideal image that has absorbed part of the historical and ethno-social experience of their ancestors. Let us give one of the examples of the translation of the autostereotype “Siberians” in the speech of a student, a native of Divnogorsk: *«Сибиряки – это жители Сибири различных национальностей. Стойкие, предприимчивые и волевые люди. Вот так я думаю. От других россиян нас отличает то, что сибиряки альтруистичные и, ну, такие тёплые люди. И семьянины»* (Divnogorsk, 2020). Along with the concept of “ours”, in statements about the inhabitants of Siberia, the concepts of “foreigners” and “others” are also explicated. It should be noted that the factor of the nationality of the “others” for the Siberian - the bearer of the traditional (folk) linguistic culture - also does not matter, he evaluates only the business and moral qualities of fellow countrymen. Often this is a rather high assessment, which is conveyed by various axiological means of the language: *«Кто свои и чужие? К «чужим», во-первых, наши предки, они долго присматривались. Я вот приведу маленький пример: когда в 42-м году пригнали, как дед говорил, немцев, долго к ним присматривались. А когда увидели, что это **работящие**, вот я за другие деревни не могу считать, что их сразу приняли к себе, а у нас в Пашино, в Проспихино увидели, что это **настоящие, работящие мужики. По работоспособности, по порядочности считай, что принимали»*** (Kezhemskiy district, Kodinsk, 2019).



In conclusion, we note that oral texts about Siberia and Siberians have a high linguocultural information content, because explicate the images of consciousness inherent in the mentality of Russian old-timers in Siberia. In the considered statements, value dominants, ideals of Siberians, lofty ideas about the native land, about their own and “others” are integrated. A significant role of the evaluative, associative and figurative-symbolic components of the spatial and ethno-territorial codes of the traditional regional linguistic culture has been established. The prospect of further research is to conduct a survey about Siberia and Siberians among the inhabitants of central Russia and different regions of Siberia, as well as a comparative analysis of the national and regionally specific in the content of the data obtained.

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莫言小说《青蛙》中母亲原型的具体体现

## THE SPECIFICS OF THE EMBODIMENT OF THE MOTHER ARCHETYPE IN THE NOVEL “FROG” BY MO YAN

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抽象的。本文从神话学的角度分析中国“寻根”文学代表人物莫言的小说《青蛙》中的万馨阿姨形象，以发现和揭示文化的本质。作品中的母亲原型。

关键词：神话诗法、神话、象征、原型、“寻根”文学、莫言。

**Abstract.** *This article analyzes the image of Aunt Wan Xin in the novel “The Frogs” by Mo Yan, a representative of the “search for the roots” literature of China, from the position of a mythopoetic approach that allows to discover and reveal the essence of the mother archetype in the work.*

**Keywords:** *mythopoetic approach, myth, symbol, archetype, literature of “search for roots”, Mo Yan.*

The mythopoetic approach has found wide use in modern literary criticism. This approach is based on the idea that the myths and symbols present in literary works are the expression of universal archetypal images and ideas. Archetypes as structural schemes and structural prerequisites of images reflect the basic patterns of thinking, perception and behavior innate for a person, being a kind of concentrated expression of psychic energy.

Thus, myths and fairy tales, which have been passed down from generation to generation for centuries, are a common representation of archetypes. In a similar vein, mythological symbols, plots, characters and events embody not only logical meanings, but also emotional ones, therefore, mythology objectifies sensory data. E. Ya. Rezhbek in his work “Myth thinking (cognitive analysis)” (2003) writes: “Mythical reality begins where an individual does not control his own actions, but ascribes his subjective sensations to reality, without even knowing it” [5, p. .217]. A person extrapolates his own material and spiritual essence to the external world, identifying himself with the surrounding reality.

In his research on archetypes and the collective unconscious, C. G. Jung calls myth primarily a mental phenomenon, however, the archetype represents only

those elements of mental content that have not yet had time to fall under the influence of conscious comprehension. Amenable to mythopoetic rethinking, natural phenomena are not so much a rephrasing of the conscious content as the release of an internal unconscious drama through a symbol [6, p.11]. Mythological images and plots enter into a dialogue with the subconscious of a person who tries to give his experiences a more or less understandable form, which C. G. Jung calls the “elaboration” of a symbol.

According to E. M. Meletinsky, the subject of mythopoetic imagination is not only the ratio of the conscious and unconscious principles in the soul, but also the relationship of the inner world of a person with the reality surrounding him, thus “a person’s life path is reflected in myths and fairy tales to a greater extent in terms of the relationship of personality and society than in terms of confrontation or harmonization of the conscious and the unconscious” [1, p.5]. Since the myth as a dynamic system of symbols and archetypes becomes directly the narrative of the work.

First of all, C. G. Jung singled out the archetypes of “mother”, “child”, “shadow”, “animus” (“anima”), “wise old man” (“wise old woman”) as the most important mythological mythologemes. This article discusses the archetype of the mother in Mo Yan’s novel “The Frogs” (2009), to a greater extent, concentrated in the main character of the work - Aunt Wan Xin. The relevance of this study is justified by the insufficiently studied myth-making of Mo Yan, which requires a mythopoetic approach and, in particular, an analysis of archetypes, symbols and schemes that contribute to the identification of hidden structures of a literary text. Literature of the “search for the roots” of China in the late 70s - early 80s. The twentieth century, inheriting the traditions of Latin American magical realism, rethinks the methods of restoring ties with the tradition of bygone eras. Rethinking the legacy of the “cultural revolution” and, at the same time, pursuing a policy of reform and openness, China inevitably borrowed many Western trends, which led to a reflection on a national scale, aimed at searching for its own social history and cultural sources, including myths and legends. and legends of the small homelands of the authors, which allows us to consider the mythopoetic approach as the most productive in this context. Scientific novelty lies in the application of the psychoanalytic and archetypal approach of C. G. Jung to the study of the writer’s work.

It is necessary to emphasize the fact that for Mo Yan, one of the representatives of the “search for roots” literature, the figure of the mother has a sacred meaning - he almost completely devotes his Nobel lecture to her. Expressing gratitude for his own upbringing, Mo Yan elevates the image of the mother to a new level, mythologising the very memory of her: “It was then that I felt that my mother became one with the earth and that, turning to my native land, I turn to her” [3, p.254]. The archetype of the Great Mother is of fundamental importance in the life of the author, since the phenomenon of motherhood itself is immeasurably important.

In the novel “The Frogs”, Mo Yan built a specific architectonics of the novel, through the prism of which the question of the national identity of the Chinese at the end of the 20th century is considered in the realities of the policy of one child per family - China’s demographic policy, carried out in 1979-2015. The work is divided into five parts, the narrative of which is built around and through the correspondence of the playwright Cadow and the Japanese sensei Yoshihito Sugitani. Sensei is the person who opened for Cadow his own interpretation of the plays by the French writer Sartre, thereby inspiring him to write his own, which would become a biography of Cadow’s own aunt, who worked as an obstetrician-gynecologist for more than fifty years. Introduced restrictions associated with a well-harvested sweet potato in the 1960s. and the subsequent rise in the birth rate, led to the fact that Aunt Wan Xin was forced to retrain and begin to perform sterilization operations and abortions herself. The inhabitants of Gaomi oppose such a course, arguing that the birth of children is an immutable law of heaven and earth.

The “mother”, who contains in her image the immortal unconscious element, can be found by us in almost everything that evokes love and a sense of reverence. However, the symbols of the Great Mother can have both positive and negative meanings: “Evil symbols are the witch, the dragon (or any other gluttonous animal such as a big fish or snake), the tomb of the sarcophagus, deep waters, death, maras and ghosts (Empusa, Lilith and others) [6, p.163]. Aunt Wan Xin harmoniously combines both connotations. The very first mention of the aunt in the text of the work is accompanied by the image of “frogs swarming around”, she “takes the child with her blood-stained hands with ringing laughter” [2, p.6]. According to Kadow, Yoshihito Sugitani greatly admires her image, using it as an example to illustrate his literary views and inspire literature lovers to write “an exhilarating work” based on the life of an aunt.

Auntie claims to have helped ten thousand babies to be born: “At that time I was a living bodhisattva, I gave children to mothers, the scent of hundreds of flowers came from me, swarms of bees circled around me, many butterflies flew. And now only flies, his children, are buzzing...” [2, p.31]. With equal ease of giving and taking life, Wan Xin becomes a bearer of ambivalent qualities, suitable for the term “loving and terrible mother” proposed by C. G. Jung [6, p.164]. On the one hand, the mother strives to be life-giving and loving, on the other hand, she is destructive and filled with hatred. Exploring the archetype on mythological material, C. G. Jung comes to the conclusion that the “mother” can be activated in completely different contexts.

So the women who gave birth to Aunt Wan Xin had reverent respect for her. According to them, the aunt’s hands were different from the others, they were soft and cold: “As soon as she runs her hand over the body of the patient, the disease goes away by seven tenths. In our area, women almost idolized their aunt” [2,

p.25]. Next to her, the minds of the women in childbirth cleared up, which allowed them to be filled with courage. Here one of the symbols of the mother archetype is manifested - the magical power of a woman, wisdom that surpasses reason. However, with the adoption of a new birth policy, the attitude towards Wan Xin is changing: "Today, some aunty is called a monster, "living Yan-wang" (lord of hell), so, for me, this is an honor!" [2, p.112]. In a similar way, the reverse side of the mother archetype is manifested, containing the symbol of the kingdom of the dead: something dark and hidden, devouring and poisoning; all that is inevitably like fate.

The more the aunt takes root in her adherence to party politics and everything progressive, the more absurd her consciousness, devoid of individual perception of the world, appears. In pursuit of Geng Xiulian, who is pregnant with her fourth child, the aunt leads her to certain death. Geng Xiulian jumps off the boat on which she is being transported to the hospital to prevent a forced abortion. As a result of the chase, a woman heroically sailing a race with a boat in cold water has a miscarriage: "Aunty and the others used the best means, made every effort, but Geng Xiulian still died" [2, p.143]. Wan Xin donates five hundred blood cubes to her, sincerely considering this the highest manifestation of kindness and generosity. Describing the aunt's dedication to the matter, Kadow says that she "burns incense and takes baths" for those who give birth according to the plan, however, those who oppose the course of the party will "quickly slam - no one will be able to escape" [2, p.112]. Regardless of whether the aunt's actions were approved or condemned, the surrounding people, in their own subjective perception, deprived her of human characteristics, comparing her with a celestial, an evil spirit, because she takes upon herself the right to decide other people's destinies.

Only having met old age, Wang Xin begins to repent: "In my whole life, with my own hands, against my will, I killed more than two thousand babies" [2, p.259]. Having married Master Hao, she helps him in the craft of making clay dolls. The choice of just such an occupation refers to the Chinese myth about the goddess Nuwa, who created people from clay and repaired the sky. The comparison with Nu Wa brings Wan Xin back to her starting point, the Mother Goddess archetype. This transformation is clearly seen in the aunt's story about how, returning home through the swamp lowland, she was pursued by hordes of frogs: "The frogs fell off me like clods of clay. But many clung to clothes, hair, two even hung on their ears, like terrible earrings" [2, p.263]. In Chinese, the word "frog" (蛙, wā) is phonetically consonant with the cry of a child, thus the croaking of frogs for Wan Xin sounds like the cry of tens of thousands of newborn babies. The frogs tear her clothes, practically naked, she is saved by meeting Mr. Hao, and loses consciousness. The aunt's body is covered with lichen, her fever rises and delirium begins, only thanks to Mr. Hao's decoction, Wan Xin manages to survive the critical mo-

ment. “I heard in fairy tales about how they shed their skin and change bones, and I realized that this is happening to me” [2, p.265]. Thus, we discover a compositional element characteristic of myth-making - the crossing. V. Ya. Propp in his work “The Historical Roots of a Fairy Tale” refers to the crossing as the transition of the deceased to another kingdom, the afterlife, as well as his subsequent rebirth [4, p.402-419]. Auntie Wang Xin, questioning her former ideals, sets off on a “path”, during which she must undergo a kind of initiation rite: overcome her fears, die and be reborn in a new status.

Summing up, we can note that despite the obvious influence of Latin American magical realism in literature, Mo Yan demonstrates his own unique mythopoetic approach. In his unique subjective attitude, he reflects various aspects of the mentality and social life of Chinese women. The archetypal interpretation of the mythology of the mother in its multiple manifestations and symbolic content in the novel “The Frogs” leads to the identification of the archetype of the Great Mother, embodying the psychological sensation of generational change, a certain form of immortality. Containing the image of the goddess of fertility, Aunt Wan Xin also has a symbolic relationship with death, which in turn leads to resurrection and rebirth. Such a reflection of objective reality through myth and archetype allows us to comprehensively approach the experience of the whole nation, its rethinking of the period of the “one family - one child” policy, which proves the effectiveness of the mythopoetic approach as a means of revealing hidden meanings and structures in works of art.

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现代科学和哲学问题背景下的苏赫拉瓦迪思想  
**SUHRAWARDI IDEAS IN THE CONTEXT OF MODERN SCIENCE  
AND PHILOSOPHY ISSUES**

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注解。 苏赫拉瓦迪的思想与解决思维与大脑的关系问题、人格的发展有关。它们有助于证实思想和记忆的无形基础的观念，以及精神原则高于物质原则的首要性。 这篇文章展示了现代科学和哲学在什么背景下可以要求这些想法。

关键词：光、灵魂、心灵、身体、认知。

**Annotation.** *Suhrawardi's ideas are relevant to the solution of the problem of the relationship of thinking and brain, the development of personality. They serve to substantiate the idea of the intangible substrate of thought and memory, the primacy of the spiritual principle over the physical. The article shows in what contexts these ideas can be demanded by modern science and philosophy.*

**Keywords:** *light, soul, mind, body, cognition.*

We appeal to Suhrawardi in view of the ideological, methodological and ideological relevance of his ideas for solving the problem of thinking and brain, development of personality. In accordance with the historical method<sup>1</sup>, let us take into account that in Suhrawardi's works, the formulation and method of solving these problems correspond to the thinking style of a particular culture and era. Let's try to understand which ideas of the thinker can serve as an ideological or methodological basis of the modern philosophical, scientific solution of these problems. The task of the work, therefore, is to highlight and study the content of ideas relevant to the solution of the modern problem of the relationship of mind and brain, the development of the personality; an attempt to rethink and generalize their content in the context of a number of scientific results, including the achievements of ontology and the theory of cognition 19-21 centuries.

It is known that in addition to the style of thinking, the solution of the problem determines the goal, method and criteria of truth. What goals does Suhrawardi set?

<sup>1</sup> Podkorytov G.A. «Historism as a method of scientific knowledge» (1967).

His goals are concrete and practical. For example, explaining to the rulers of their age what is necessary to know about the beginning and the end, according to how their deified philosophers and the excellent pillars of learning see<sup>2</sup>.

Suhrawardi's main goal throughout his life was to grasp the supreme unchanging wisdom. Wisdom is expressed through symbols, it is beyond criticism. The criticism touches only the superficial meaning, remaining unable, according to Suhrawardi, to reach the true meaning<sup>3</sup>. The journey, the search for a worthy mentor, the study of various teachings and beliefs were conditioned precisely by this goal: «...I have not found anyone who possesses the highest (noble) sciences, and no one who believes in them»<sup>4</sup>.

Among those who have already gained wisdom, and those who only aspire to it, Suhrawardi distinguishes several groups. To the first are the sages who have grasped rational knowledge and gnosis. The second group includes the sages who have mastered only rational knowledge. The third are those who have found gnosis. In the fourth group he refers to the sages who have fully understood gnosis, but have not sufficiently understood rational knowledge, and to the fifth – strong in rational knowledge and weak in gnosis. Those who are at the initial stage of cognition may aspire to both rational knowledge and gnosis, or only gnosis, or only rational knowledge<sup>5</sup>.

Assessing the methodological significance of the goal and levels of knowledge, we see that this classification is empirical, based on observation, comparison and experience, the substantiation of the existence of interrelated, but not convergent with each other levels and methods of knowledge. It implies that there are limits to the extrapolation of conclusions from one level to another. It also leads to the conclusion that there exists a hierarchy of goals of cognition, levels of thinking and cognition, conditioned by the difference of ontologies of objects of cognition. This approach is consistent with the orthodox worldview<sup>6</sup> and dialectical method.

The criterion of truth, the main criterion of the solution of the problem of personality development and thinking is the practical result - the revelation of the faculties of cognition and self-knowledge, the correct attitude to the world, which is the consequence of the correct attitude towards God, the priority of spiritual qualities, treating death as a transition to another being, not its absence.

The above criteria have one of the key reasons of the problem of realizing

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<sup>2</sup> Shihab ad-Din Suhrawardi. Imadov Tablets /<https://iphras.ru/uplfile/smirnov/ishraq/2/17sukhrav.pdf>. P.204.

<sup>3</sup> V. N. Putoyagina - FOUNDER «PHILOSOPHY OF ENLIGHTENMENT» SHIHAB AD-DIN AS-SUHRWARDI/ Vestnik NGU series: Philosophy. - 2008. - P. 54.

<sup>4</sup> «Majmu 'a musannafat sheikh al-'ishrak». P. 505.

<sup>5</sup> «Majmu 'a musannafat sheikh al-'ishrak». P. 11-12.

<sup>6</sup> Nesteruk A.V. «Logos and Cosmos: Theology and Orthodox Tradition»/

<https://azbyka.ru/otechnik/bogoslovie/logos-kosmos-bogoslovienuka-pravoslavnopredanie/>



oneself as something separate from the Creator. Man as the creation of God is the personification of Light and Good. Suhrawardi asserts the need to «restore the consciousness of the right situation»<sup>7</sup>. A way to restore the consciousness of the right state of things - the development of the «inner vision», allowing one to look at oneself as possible existence, «necessity of which is borrowed from the Necessary-Eternal». Similar ideas in the context of the philosophical fact of soul immortality have Plotinus.

This problem was also posed, for example, by A.S. Posov, ep. Nikanor (Brovkovich), N.N. Stelletsy, V.Y. Katasonov, P.A. Florensky, A.F. Losev, N.O. Lossky, A.S. Khomyakov, V.N. Trostnikov, G.M. Shimanov, J. Lennox et al. The recognition of the Creator or the denial of his being serves as a boundary between the types of worldviews and, by consequence of the conclusions of the research of the problem of man and consciousness.

Suhrawardi's method is «affirmation of the meaning of the whole principles one by one», which is then accompanied by the evidence of the Qur'an, considered as proof. Cognition, «comprehension of things» is «obtaining by you its form and similarity», imprinting it in the mind (we compare: in feelings). Where the form is considered absolute, unlimited in the sense is common to all members of the family (for example, the image of a lion in general). It is emphasized that each thing has a self, to which the thing corresponds. Form and similarity are not identical «the self of things» (205).

The question is open about Suhrawardi's view on the limits of cognition. Did he consider the essence of things to be knowable if the self is not imprinted in the mind? That Suhrawardi's teachings roughly correspond to the category of essence inextricably connected in the *diamat* with the concept and criteria of the scientific method<sup>8</sup>?

Egoism of things, as opposed to form and likeness, includes not only necessary, but also random, possible traits (action), i.e. such that things differ from each other, the presence and absence of which is not necessary. Perhaps the concept of selfhood roughly corresponds to the notion of hierarchy of structures of phenomenon, and the concept of form and likeness - hierarchy of structures of essence in their interrelation in *diamat*<sup>9</sup>.

In general, this view deserves special attention, as the categories of system and structure, including the increasing extrapolation of ideas and methods of synergy and graph theory, make up the world view methodological basis of hypotheses and

<sup>7</sup> «Gabriel's wing noise» /<https://iphras.ru/uplfile/smirnov/ishraq/1/suhraw.pdf> P.517.

<sup>8</sup> The system of these empirical-specific techniques proved to be helpless when conducting research under slightly changed conditions... because it was not based on the essential knowledge of the objects under study»/ Sub-rytov G.A. Historism as a method of scientific knowledge (196). - p.10-19.

<sup>9</sup> Egorov A.A. Possibility and structure /Modern problems of materialistic dialectics (1971). - P.121-134;

theories in the field of brain, consciousness, personality. This is important for the correct interpretation and evaluation of the results and possibilities of this kind of research.

The key concept in Suhrawardi's teaching is light, the world is light-bearing and in this sense the dark substance of «nonfinite», is not true light», not self-sufficient (its «self» depends on another)<sup>10</sup>. Light is the cause of (gloomy) substances, bodies that do not exist as such. The bodies can hold back the Light and are therefore carriers of actiential light. Light can leave the body. If light leaves the body, it becomes a dark, dark substance. Darkness is the absence of light. The body is a barrier (a substance upon which one can point). The dark substance (that which does not need a receptacle) and the dark figures.

So, the light is m.b. pure (free) and actiential (figure for another). There is a difference between pure and actant light: pure, free light devoid of direction, it is light for itself, it is not transposed into the body, it exists for another<sup>11</sup>.

In Suhrawardi's teachings, there is a concept of two types of figures: dark and excitable light. The question arises, what category of modern philosophy and methodology do they approximate? Most likely, the structure, since the idea of their relationship roughly corresponds to the idea of a hierarchy of structures in the diamate and a system approach. Abstracting the real body to a collection of figures (in the diamate - structures), Suhrawardi comes to the conclusion that the substantial forms are unrealistic.

If it is assumed that the consciousness, the mind exists in an inextricable connection with God-Light, then the body, the brain are not their substrate, and they, respectively, are not a function of the brain. God is the Supreme Light of heaven and earth. Similar concept is present in works of Plotinus and St. Fathers - Gregory Palama and Gregory Theologian. Light is the cause of (gloomy) substances, bodies that do not exist as such.

The action light is possible. It needs substance, a dark figure, but «higher and nobler» it. The substance (the body) is not its cause, does not cause it.

Suhrawardi refers to the fact that it is possible to separate the actional light from the substance, it is not always where it is. Accordingly, the substance, the dark (latent) figure, is a consequence of the excitant light. Here is an empirical argument: what is «more hidden», cannot be a consequence of what is «less hidden».

What do these ideas tell us about solving the brain-mind problem, which is the subject of constant presentations, for example, by the neuroscientist K.V. Anokhin? Since substances need figures and figures depend on others, free light is the only reason for everything. What we perceive are figures, the effects of light. Where the

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<sup>10</sup> Shihab ad-Din Yahya al-Suhrawardi. Wisdom of illumination (passage). Translation from Arabic and comment A.V. Smirnov /<https://istina.msu.ru/publications/article/8131842/>

<sup>11</sup> Same as [10]

pure light «is not introduced into the body», there it is not perceived (it cannot be pointed to), it is deprived of direction, corporeality.

Suhrawardi's ideas lead to the conclusion that the brain is a consequence of the soul, in the sense of a subordinate entity of a lower order. The existence of essences of different order and their hierarchy, the absence of their isomorphism, is grounded in materialistic dialectics<sup>12</sup>.

Another important idea of Suhrawardi relates to the attributes of the substance, a category that in modern scientific research is usually replaced by the categories of structure and element. The substance is accompanied by three dimensions (length, width, height), on it can indicate «external feeling». The substance, or the body, is «perhaps existent», it is independent in motion and independent in being, can take place but exists outside the vessel. The receptacle is a substrate, something from which do not move, it is, that in which the random signs reside, they are - action, figures.

In the question of the origin of things<sup>13</sup>, Suhrawardi relies on the method of intuition and logical reasoning: if not A, then B. Suhrawardi's ideas call into question the ontological foundations of the evolutionary idea of the origin of species: «One barrier (i.e. the real body - my note - O.A) does not produce another», «dark substances do not exist one from the other» due to their non-selfvoluntality: the thing cannot precede itself, «depend on what depends on it itself. In other words, one body cannot be the cause of another, «in the body as such one cannot find grounds to build a mutual causation in the chain of bodies».

In explaining the origin of things, Suhrawardi divides bodies into elemental (with changing forms) and etheric (with strong forms)<sup>14</sup>. The substance, in terms of measurements, is a body, in relation to random signs - a receptacle, in relation to the form - matter (primordial matter). The primordial matter of the elemental bodies is common. The substance (primordial matter) is one but in the process of development can take different forms (human seed), when some random traits disappear, others - appear. These ideas receive direct and indirect development in the modern hypothesis of design, ancient ecclesiastical and modern Christian anthropology and ontology, the teachings of Plotin, Lossky, Brovkovich, Losev and other prominent representatives of domestic thought of the 19-20 centuries.

The soul category is naturally one of the key ones in Suhrawardi's teachings. The soul is an intangible receptacle of the forms of things (in the modern knowledge of called logical images, general concepts - note me - O.A), free from distances and directions, indivisible. For example, the form «animal», which char-

<sup>12</sup> Modern Problems of Materialistic Dialectics (1971).

<sup>13</sup> Shihab ad-Din Suhrawardi. Imadov Tablets /<https://iphras.ru/uplfile/smironov-ishraq/2/2/17sukhrav.pdf>.

<sup>14</sup> Same as [13] p. 213-214.

acterizes the common for all their species, is not in the body but in the soul. In Orthodox ontology of this kind have the name logos.

Form is the intelligible thing, what is separated by the mind from the extraneous acts as opposed to the senses and imagination. Form does not reside in the body<sup>15</sup>. It has no «private position» and no «private value», in which individual individuals would not coincide. Form is what coincide individual individuals. Suhrawardi uses experience facts and reasoning with the principle of contradiction.

The soul as the «command of God» and as the light of God is separated from matter and «connected with Domination»: «my self (i.e. soul - O.A.) is manifested where there is no «where», it is not in the created worlds. As such, the soul is the basis of the superpowers: «I have removed them not by my own power», but «by the power of the angelic and soul illuminated by the light of her Lord» (Ali about the gates of the port, which have subsequently been able to return only 9 people).

Unlike Orthodox anthropology, however, Suhrawardi identifies the self, soul, and spirit of man; he also lacks the ideas of the inner and outer man and, accordingly, the types of memory and the subconscious. Memory is synonymous with the capacity of imagination as the properties of the soul.

The concept of human nature concretizes the idea of «I»: the feeling of «self» in the absence of memory about the body, its parts - the criterion that the human «I»<sup>16</sup> is not «part of the body world, can exist separately from the body. Arguments:

The impossibility to specify one's self as something separate from oneself (rationale);

Unlike the body, the self does not change (it is obviously a physical change) and is not replaced (personality unity throughout life).

This implies the necessity of distinguishing between the Self (associated with the categories of the soul, spirit, and body in ancient Church anthropology) having a complete memory, and the personality whose alteration may be is the result of a purposeful influence on the physiological mechanisms of access to memory<sup>17</sup>.

St. Fathers undoubtedly look beyond Suhrawardi in the study of the Self. Self and personality are not identical, but interrelated. Depending on the spiritual state of the person, it is possible to substitute the Self with another entity, that the personality becomes subordinate, controlled from the outside under certain conditions, for example, the state of obsession, «zombie», numbing, whirling, sleep-walking, ISS, hypnosis, etc.

The next idea - is the idea of the inner and outer senses. Suhrawardi asserts that they are located in the body. He refers to the empirical fact that their distress is

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<sup>15</sup> Same as [13] p. 220.

<sup>16</sup> Same as [13] p. 217-219.

<sup>17</sup> Smirnov I.V. «Psychoecology» (2003).

inevitable due to the disruption of their location. These are typical cases of which exceptions are known.

There are five outer senses (sense of touch, taste, smell, hearing, sight) and five inner senses (general sense, imagination (memory), illusory representation, forming sense and memory. «The difference of these feelings is known by the [observed] disorder of some while maintaining others, and the places of their location are known by the fact that a feeling with necessity and inevitability comes into disorder due to the disturbance of its location».

«Lords of feelings» are in certain parts of the brain. Human senses are used by the mind. The word «used» indicates the essential independence of the mind from the senses, which is important for the modern assessment of the relationship between the senses and the mind in relation to the capabilities of man.

The common sense is the first acceptance of the similarity of all sensual [things] and the imagination is its repository. An illusory representation (vahm) is something that in animals imparts sensually perceptible [things] insensitive meanings - such as a cat's grasp of [a definite] meaning in a mouse that encourages it to attack. In man, this feeling comes into dispute with the mind, because it is a bodily feeling that does not recognize what the mind recognizes.

Form-forming feeling (al-mutahayil) «makes similarities and definitions». If it is used by the mind, it is called the thinking sense (al-mufakkira), and through it is created [as a deduction from the general to the particular] of science and art. This feeling is «different from imagination - because the imagination does not control [forms], but [only] preserves them, as they came [to it], and the shaping feeling makes the animal from different parts (eg, the head of a person, the neck of a camel, the back of a tiger, and so on) ». Both of these feelings are 30 in the middle [brain] cavity, with the formative feeling located in the back.

The fifth [inner feeling] is the memory (a) 31, which preserves all judgments of the illusory representation and the forming feeling, as well as [all] events, in their details and according to their correlations. And its lord is in the back of the brain»<sup>18</sup>. We see that Suhrawardi equates the memory of the consciousness and the subconscious.

Suhrawardi's solution to the problem of the relationship between soul and body, mind (mind) and brain also concretizes the following ideas. In addition to the material body, there is a subtle body (animal spirit), which is the carrier of all forces in the material body and «emanates from the left side of the heart». The subtle body due to the quality of «subtlety» can penetrate the nervous network. The cause of illnesses (death of body parts), death - the appearance of interference preventing the subtle body from penetrating into one or another part of the mate-

<sup>18</sup> Shihab ad-Din Suhrawardi. Imadov Tablets/<https://iphras.ru/uplfile/smironov/ishraq/2/17sukhrav.pdf>. P. 218-221.

rial body. This finding is relevant in determining the causes and mechanisms of disease.

The idea of the existence of several human bodies is also known in Indian ancient teachings and in ancient church anthropology, for example, astral and etheric bodies. It still provides the basis for the explanation of perception and interaction at a distance and in time in non-materialistic world-view systems.

The subtle body consists of two parts: the spiritual spirit, «rising into the brain and settling in it», acquiring to itself a «the sovereign of light» (i.e. the soul) and the natural spirit, «going from the heart to the veins of the liver», through which the actions of vegetable, that give rise to, nourish, etc. forces.

The spirit of the soul is a means of movement and understanding, and the natural is a means of action of plant forces. «The Sovereign of Comprehension resides in the brain», and «the Sovereign of Motor Impulses resides in the heart», besides them there is also a nourishing force (acting in the matter of food), producing and vegetable. The driving force, including the «lusting» and the «angry» obeys imagination and comprehension and aspiring force. Animal spirit and verbal soul are qualitatively excellent. The verbal soul emerges with the body, it is a bodiless substance which can comprehend the intelligible [things] and dispose of the bodies. And it is a light from the number of God's light existing outside the place»<sup>19</sup>.

These ideas suggest that the substratum of consciousness, reason, thinking, is not the brain, but something qualitatively different from it, - the «soul spirit», subject to other laws. The close-knit idea of cognitom originated in modern neuroscience (K.V. Anokhin), but cognite is still understood as a specific material superscript. These ideas are important for solving the problem of managing a person's condition<sup>20</sup>, especially under conditions of information and other stress, manipulative influence. They allow to substantiate objectivity of spiritual laws and causes of boomerang effect when violation of spiritual, moral laws leads to weakening, damage, deformation of mind and will.

In conclusion, we note the ideological significance of Suhrawardi's ideas. Suhrawardi draws practical conclusions from the discourse about the world and man, which, as a consequence, cannot but have an ideological significance: who has forgotten God, that God has made forget themselves. «Human success» depends on purification and perfection of the soul - the key element of human existence. One can never know the soul, one can seduce or destroy it. These conclusions are important in assessing the possibilities and limits of manipulation and falsehood in information war. They indicate, first, that such limits exist. Secondly, that these limits are connected with the spiritual plane of human existence, the

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<sup>19</sup> Same as [18]. P. 219-221.

<sup>20</sup> See, for example, the materialistic solution in: Grimak L.P. «Reserves of the human psyche» (1989).

possibility of accounting for which in scientific knowledge has subjective and objective limitations.

With regard to the question of the role of the individual in history and the relationship between the individual and the State, these conclusions lead, in the final analysis, to the reality of the individual's spiritual freedom<sup>21</sup>, the priority of self-knowledge, the individual and the general level of which determine social conditions. Suhrawardi's ideas are generally consistent, for example, with many ideas of Slavophilia and Russian religious philosophy (A.S. Khomyakov, P. Nikanor (Brovkovich), P.A. Florensky, etc.), with modern conservative and socialist ideologies in their Orthodox sense (Somin N.V., Katasonov V.Y., Trostnikov V.N., Shimanov G.M.)<sup>22</sup>. They also correspond to the words of St. Seraphim (Sarovsky): «Save yourself and thousands will be saved around you».

Suhrawardi's ideas also do not contradict Nesteruk's conclusion that monistic epistemology (and ideology - my comment - O.A.) based on discursive reason (dianoia) confined to this world can be effectively applied only within that world. Dualistic ideology and epistemology have the main basis of spiritual mind (nous) without which it is impossible to understand the essence of events and phenomena, the meaning of history, their correct estimation.

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<sup>21</sup> Today, particularly in philosophical studies of consciousness, the existence of individual freedom is often called into question.

<sup>22</sup> History as Providence of God/ Under Ed. O.A. Platonov (2014).

哲学作为唯物主义历史理解中的一种社会意识形态：热点问题  
**PHILOSOPHY AS A FORM OF SOCIAL CONSCIOUSNESS IN THE  
MATERIALISTIC UNDERSTANDING OF HISTORY: TOPICAL  
ISSUES**

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注解。 该主题的相关性与混合战争背景下政治和意识形态对人文、哲学影响力日益增强的趋势有关。 文章考虑了问题的热点问题。 结果表明，“公共意识”和“作为公共意识的一种形式的哲学”范畴保留了方法论意义，并在唯物主义历史理解中具有科学依据。

关键词：社会意识、哲学、社会意识形态、系统。

**Annotation.** *The relevance of the topic is connected with the trend of increasing influence of politics and ideology on the humanities, philosophy in the context of hybrid wars. The article considers topical issues of problems. It is shown that the categories «public consciousness» and «philosophy as a form of public consciousness» retain methodological significance and have scientific substantiation within materialistic understanding of history.*

**Keywords:** *social consciousness, philosophy, form of social consciousness, system.*

Each person is only to a certain extent a social person - to the extent that he has become involved in the content of the public consciousness. There is hardly a denial in domestic studies that the public consciousness reflects the general<sup>1</sup>. However, the generally accepted answer to the question «what is common?» is missing. «General» may have the following meanings: general in relation to the public being, that is in the public consciousness, that is due to the public being, when the public consciousness is opposed to the public consciousness, the individual consciousness (A.K. Uledov, Yu.K. Pletnikov). The general may be understood in the sense of needs based on the public interest, in the sense of reflecting the results of specialized and non-specialized knowledge underlying the practice.

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<sup>1</sup> Fofanov V.P. Social activity and theoretical reflection. Novosibirsk, 1986. pp.143, 166.



In the monograph of V.P. Fofanov «Social Activity and Theoretical Reflection» (1986), the content of the concept of public consciousness is revealed in connection with the concept of social relations and the system of activities. Social relations are systems of different kinds of social activity, including consciousness as a subordinate moment. The active role of consciousness is its own activity of the social system, the activity of living activity<sup>2</sup>. Historically, the possible limits of consciousness activity are determined by the level of development of the social system.

What are these limits to philosophy as an element of social consciousness? Philosophy as a common is the self-consciousness of society. It reflects social life through the le## of a system of ideological relations. Its form (alienated or not) depends on the formative features of society, the features of existing antagonisms in it. The activity of consciousness is realized through the social activity of the subjects - carriers of the historical process. Hence, the limits of philosophy can be studied on the basis of the study of social activity of subjects<sup>3</sup>. The author's concept of the essence of philosophy is revealed through the definition of its object. The subject of philosophy is practice and on its basis is spiritual activity, social activity in its universal definitions. Philosophy is a comprehensive reflection on the method<sup>4</sup>.

In materialistic philosophy there is a division of philosophy into scientific, unscientific and anti-scientific (Yu.K. Pletnikov). Obviously, the above applies only to scientific philosophy. Ideally, the consciousness (and philosophy as one of its elements)<sup>5</sup> should reflect the laws of the development of social being, anticipate its development (ahead of the social being)<sup>6</sup>. On the other hand, the primacy of social existence is grounded: social existence determines the content, structure and functions of public consciousness. In this statement V.P. Fofanov requires the word «defines». In the special literature there is no generally accepted interpretation.

According to the dialectical concept of content and form, philosophy is an element of social consciousness in terms of its content. Philosophy is a form of social consciousness in terms of the features of the structure and functions of social consciousness. Since the content and form are opposites<sup>7</sup>, philosophy as a system can only be investigated on the basis of the synthesis of these parties.

How does a change in philosophy relate to its structure? Development is connected with the transformation of the structure of an object as a result of accu-

<sup>2</sup> Same as [1] pp. 167-168

<sup>3</sup> Consequently, the fundamental function of philosophy is the reflection of human activity in universal definitions.

<sup>4</sup> Same as [1] p. 143

<sup>5</sup> Fofanov V.P. Social activity and theoretical reflection. Novosibirsk, 1986. p.166.

<sup>6</sup> Materialistic Dialectics as a scientific system /Edited by A.P. Sheptulin. – M., 1983. – pp.196-197

<sup>7</sup> Same as [6] pp. 194-195

mulation of changes of functions of its elements<sup>8</sup>. How have the functions of the elements of philosophy changed in relation to the public consciousness? And what are these elements? Given that the substance of social consciousness is knowledge, does the content of philosophy, an element of social consciousness, correspond to the content of philosophical knowledge? Modern studies do not provide answers to these questions.

The basic premise of dialectic-materialistic philosophy regarding the relationship of matter and consciousness is known. It is a statement of the primacy of matter. The question is topical, first, in connection with the study of the dialectics of the relationship of philosophy as a form of social consciousness and social life. Secondly, in connection with the treatment of this category to such categories as the consciousness of society, the spiritual sphere of society, spiritual production, etc.

Reading the relevant philosophical works shows that the concept of primacy can be different. Primordially can be associated with the substance of matter, with the causal condition of consciousness by matter<sup>9</sup>.

In accordance with the principles of interrelation of structure and function<sup>10</sup>, stability and variability require taking into account not only cause and effect, structural, but also functional, ensuring the stability of the system, maintaining its quality in relation to the world around. Therefore, in relation to consciousness and matter, two opposites must be distinguished: causal and functional.

The importance of functional connections in the study of social consciousness has until recently been underestimated. In general, their importance and prospects of research in this field is stated in the works of V.S. Barulin. Their insufficient study is emphasized. What will be the functional relationship of matter and consciousness? As the highest form of reflection, consciousness conditions matter functionally. Otherwise, for example, the existence of people whose worldviews, including scientific ones, far outweigh time, and the possibility of anticipation and action far beyond the level of everyday practice and development of society as a whole, are inexplicable.

So we come to the question: what in philosophy depends on the philosopher himself, on the philosophical community, and what does not? What are the limits of philosophy besides its specificity? It is impossible to define these boundaries by viewing philosophy apart from such categories as spiritual life of society, spiritual production, consciousness of society, etc.

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<sup>8</sup> Same as [1] p. 203

<sup>9</sup> With the attributive approach (A.S. Karmin), matter is defined as a set of its attributes. The question arises, how do these attributes change in causal and functional relationships in society, what is their hierarchy depending on the conditions? On the other hand, the question arises about consciousness and matter as opposites, their difference.

<sup>10</sup> In accordance with this principle, it is proposed to classify laws into, respectively, laws of development and functional laws.

The appeal to the definition of philosophy as a form of social consciousness characterizing the relationship of philosophy with life is relevant in connection with the assessment of the potential of philosophical knowledge in specific conditions. The next question is how to realize this potential and the criteria for its optimum. In this context, questions about the relationship of philosophy as a form of social consciousness to the regularities of social life, its ideological and methodological function are also of interest.

It is known that the concept of social consciousness is developed by dialectic-materialistic philosophy based on the teachings of K. Marx and F. Engels. Without denying the significance of such principles of this doctrine as the principle of philosophical materialism, the principle of systematism and the principle of historicism, development, we note the following. In the well-known Soviet studies on public consciousness (J.V. Kelle, M.Y. Kovalzon, A.K. Uledov, B.A. Grushin, G.E. Koryavko), these principles are not considered critical or accepted by default. Their concretization and development as means of justification tend to be subordinated to the ideas of socialism and/or communist formation. Since the beginning of the 90s. The research of philosophy itself as a form of public consciousness was practically not conducted.

Philosophy remains the least studied form of social consciousness. What is its place in the social consciousness in modern conditions? What determines its change? These questions remain open. We admit that philosophy as a form of public consciousness is appropriate to consider both as a dynamic structure, as an open system, and as an abstraction (the term M.M. Novoselov). The principle of criticality (term G. Struve) is considered necessary in such research, which implies a well-known autonomy and independence of research, system and interval approaches, principles of dialectic-materialistic philosophy developed in the works of Alekseev P.V., Barulin V.S., Vinogray E.G., Petrov Y.A. and others. metaphilosophical analysis.

The modern type of scientific rationality is characterized by the recognition of the need to change fundamental concepts and laws in accordance with the changes in the objects themselves, the discovery of contradictions, paradoxes and the emergence of new theories. The content of the modern concept of social consciousness, both in philosophy and in other humanitarian disciplines, often differs significantly from its content in Marxist doctrine, the materialistic understanding of history. However, it is within the limits of the materialistic understanding of history that this category has a scientifically sound theoretical and methodological significance.

Is the content of this category really to be revised and of scientific significance outside of the other categories of the theory? Is there a reason for these changes? That quantitative and qualitative changes in social consciousness are taking place

- without a doubt. But of course they cannot be the basis for arbitrary interpretation and extrapolation of this philosophical order. Recent fundamental research on the topic (Yu.K. Pletnikov «Materialistic understanding of history», 2008; Yu.I. Semenov «Philosophy of history», 2003) proves that the grounds for revision of the essence and the basic content of social consciousness, defined in Marxist social philosophy, absent: their development is necessary.

From the point of view of the post-non-classical type of rationality (the term V.S. Stepin) in modern philosophy, social consciousness is a special type of object: a complex historically developing system, where there is a tendency to increase the subjective factor. Hence, one of the directions of research of changes in the public consciousness is connected with the study of changes in the subject of consciousness of society (term A.K. Uledov), consciousness of different types of communities (term V.S. Barulin); changes in the systems of social activity (term V.P. Fofanov) different level. In accordance with the attitude of public consciousness towards social life, it is relevant to study the national and class specificity of the structure of public consciousness.

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教学理念问题：热点问题

## THE PROBLEM OF TEACHING PHILOSOPHY: TOPICAL ISSUES

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注解。 文章思考了哲学学习和教学中的一些实际问题。 本文对哲学作为一门学科的现状和社会意识的形式进行了简要评估。 它提供了解决所考虑问题的方法。

关键词：教学理念、世界观、认知、理解。

**Annotation.** *The article considers a number of actual problems of studying and teaching philosophy. The article provides a brief assessment of the state of philosophy as a discipline and forms of social consciousness. It offers approaches to solution of considered problems.*

**Keywords:** *teaching philosophy, world view, cognition, understanding.*

Attitude to philosophy in modern education and public opinion of Russia and the corresponding low level of philosophical preparation, subjective need in philosophical knowledge make the question more and more urgent: why philosophy is needed in universities and what philosophy is possible and necessary there? Existing forms of testing are typical in this respect. For example, the form and content of the residual knowledge test may be such that long-term memory is tested, but not the ability to use philosophical knowledge in action.

What is the test to be an indicator of ability and willingness to apply philosophical knowledge? This requires testing the level of spiritual needs (which is one of the most difficult tasks of the course of philosophy), as well as the ability to philosophically assess events, situations. The natural payback for the existing formal approach in the teaching of philosophy and assessment of knowledge is the insufficient ability of graduates to apply philosophical knowledge in a variety of systems of activity (the term V.P. Fofanov<sup>1</sup>), including the area of their competence.

The consequence is the inability to realize the peculiarities of one's scientific, everyday, etc. worldview; the inability to realize what its content depends on;

<sup>1</sup> Fofanov V.P. Social activity and theoretical reflection. Novosibirsk, 1986. – 187 p.

the inability to critically evaluate one's worldview, and, consequently, to form it correctly. Another consequence is a decrease in the level of spiritual needs and a lack of understanding of the need to increase it, an inability to take advantage of existing opportunities to increase it; a lack of understanding of the importance of spiritual needs in the life of the individual. The third consequence is a situational, simplified understanding of such categories as matter, time, personality, consciousness, development, contradiction, law, freedom, morality, state, law, etc.

These consequences create the ground for manipulation, lead to the inability to critically evaluate information. A person becomes incapable of meaningful discussion of problems that go beyond ordinary, situational or narrow professional experience; problems related to the protection of public interests. He is unable to distinguish the real interests of society from what is being presented for them, he lacks the skill of thinking in the public interest. His goals and thinking, reflecting social psychology and the spirit of monetary civilization (the term Katasonova V.Y.), lag behind the advanced ideas, norms and ideals of scientific rationality of his time. A person does not know that such rationality exists at all. For him, this is an empty abstraction, like other concepts related to the existence of society as a whole, such as value, historical law, social consciousness, the law of the relation of productive forces and production relations. It is obvious how strongly such an attitude affects the freedom of the individual, his ability to create and develop, manage his condition; on his social health (the term of R.A. Zobov), depending on the degree of involvement of a person in a variety of social structures.

These facts lead us to the following conclusions regarding the teaching of philosophy:

1. 2nd year students cannot adequately assess the value of philosophy. It is more expedient to teach philosophy at senior courses.

2. Philosophy cannot be a discipline of choice, it must be mandatory.

3. The reduction of hours for philosophy should have limits in accordance with the socio-economic conditions and the state of the spiritual sphere, the ability and ability of students to assimilate the subject of philosophy with low motivation.

A critical trait must be defined<sup>2</sup>, before which "the fire is not lit", a new quality of knowledge and skills does not arise (Oblomov effect), solid knowledge is not acquired<sup>3</sup>. In accordance with the above, the tests should, first of all, reveal the understanding of the material, the ability to solve non-standard tasks, the ability to understand the limits of their competence<sup>4</sup>.

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<sup>2</sup> A critical feature is associated with the minimum necessary social time, which is a condition for training a specialist. See: S.P. Kapitsa, S. P. Kurdyumov, G.G. Malinetsky Synergetics and forecasts of the future. – M., 2001. – pp.143, 146.

<sup>3</sup> S.P. Kapitsa, S. P. Kurdyumov, G.G. Malinetsky Synergetics and forecasts of the future. – M., 2001. – p.125.

<sup>4</sup> Same as [3]. P. 149.

In reforming education, one should not forget that its tasks and the tasks of teaching specific disciplines are connected by a causal relationship. The requirements for the volume of work and the timing of its implementation should be brought into line with the specifics of the discipline<sup>5</sup>, the actual time for science classes and the need for proper rest; they should take into account the academic and various types of extracurricular workload.

The criterion of professionalism should be the ability to represent the current state in their field, trends in its development, the ability to correctly understand, explain and systematize facts. Otherwise, the emergence of “dead zones” is natural - communities that reject outstanding people, professionals, progressive innovations<sup>6</sup>.

In teaching, preference should be given to philosophical concepts and topics relevant to solving current problems of our time. In the presentation of the history of philosophy, it is necessary to reveal the logic of its historical development, its necessary connection with the development of society; the influence of the specifics of the philosophical foundations of science on the development of science. The presentation of the main topics should be combined with a problem approach, an illustration of their importance in the life of the individual and society.

In social philosophy, it is necessary to teach a philosophical view of issues on the understanding of which the ability to think independently and the ability to navigate the world directly depends. Among them: politics, law, the state, freedom, the role of the individual, sociological laws, spontaneous and planned in public life, NTR, public opinion, mass consciousness, social health, alienation, private property, etc.

In epistemology and ontology, it is necessary to compare in various ideological variants of the content of such philosophical categories as matter, consciousness, development, space and time, contradiction, system, (universal) law, cognition, truth, cause and effect, possibility and reality, necessity and chance, etc. This is necessary for a meaningful attitude and rational justification, objective assessment, and the development of scientific thinking.

The peculiarities of the modern state of society<sup>7</sup> are such that the formation of the needs for the study of philosophy and the improvement of the spiritual level of the individual, the ability to form a meaningful worldview should be the fundamental task of the philosophy course<sup>8</sup>. So far, we have to state that there

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<sup>5</sup> The specifics of the functions of philosophy at non-humanitarian faculties are primarily related to the “transmission of the genetic code of the nation” and the training of the elite capable of solving strategic tasks. S.P. Kapitsa, S. P. Kurdyumov, G.G. Malinetsky Synergetics and forecasts of the future. – M., 2001. – p.119.

<sup>6</sup> Same as [5]. P. 128.

<sup>7</sup> Katasonov V.Y. Kapitalizm. M., 2013. – 1072 p.

<sup>8</sup> See: History and Philosophy of Science /Edited by A.S. Mamzin. – St. Petersburg, 2008. –

is a tendency to increase the number of students of non-humanitarian specialties who find it difficult to read textbooks on philosophy, especially philosophical texts (literal reading, lack of understanding of the general meaning, meaning). Many people do not know the general content of fundamental general scientific concepts (law, reason, contradictions, etc.), do not have a meaningful idea of the degree of influence of modern ideology and science on society and personality in the conditions of hybrid wars, about the types of modern scientific rationality. It is difficult for students to distinguish scientific statements and facts from unscientific and pseudoscientific, they do not understand the specifics of scientific criteria; it is difficult for them to explain about the peculiarities of modern society as a whole and critically evaluate their worldview. Finally, they do not feel the need for this kind of knowledge, they do not understand what the possibilities and limits of human thinking are connected with.

How does this problem characterize the state of philosophy – a form of social consciousness? The state of philosophy as a form of public consciousness (the term of A.K. Uledov) is associated with a crisis of worldview, the discrepancy of the spiritual atmosphere to the functions of philosophy (interpretation by I.A. Ilyin), inadequate to the essence of philosophy in public opinion about it. What depends, and what does not in this situation, on the philosopher, the teacher of philosophy? The fact that it depends, in general terms, has already been said above. What doesn't depend? At a minimum, the existing spiritual state of the people (the term I.A. Ilyina) as a whole, due to historically developed civilizational (V.Y. Katasonov's interpretation<sup>9</sup>), spiritual factors. In relation to them, philosophy has a subordinate, secondary character, as evidenced by the existence of civilizational, cultural differences in philosophical concepts.

Since social consciousness and philosophy as its form are complex open developing systems, it is necessary to study the trends of their change. These trends are connected, on the one hand, with the patterns of their own development. On the other hand, with the laws of the development of the systems in which they are inextricably linked. This is the social being, the spiritual sphere of society, the political and social spheres of society and society as a whole.

In general, these patterns have already been established in Marxist social philosophy. The patterns of world-historical development (Yu.I. Semenov), sociological patterns (A.K. Uledov), patterns of social systems of activity (V.P. Fofanov), structural and statistical patterns of functioning and development of social systems (Y.K. Pletnikov) are highlighted. These are the laws of the development of materi-

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pp.170-175, 228-235. Sagatovsky V.N. Philosophy of developing harmony (philosophical foundations of the worldview). Part 2. – St. Petersburg, 1999. – pp. 4-25; S.P. Kapitsa, S. P. Kurdyumov, G.G. Malinetsky Synergetics and forecasts of the future. – M., 2001. – pp. 117-205.

<sup>9</sup> Katasonov V.Yu. Kapitalizm. M., 2013. – 1072 p.



al production, the law of population, the law of the elevation of needs<sup>10</sup>, the law of the correspondence of production relations to productive forces, the possibility of forming material social relations regardless of people's consciousness.

Philosophy emerges as the first theoretical form of social consciousness<sup>11</sup>. The main thing in the development of philosophy is connected with the reflection of the fundamental principles of human activity, ideological and methodological foundations of scientific research<sup>12</sup>. The relevance of philosophy in the public consciousness objectively exists as a dependence of management on knowledge of laws and goal-setting activities. The effectiveness of activity depends on knowledge of laws and the ability to organize actions in accordance with the essence of things and trends in changes in objective conditions (Yu.K. Pletnikov).

Overcoming the spontaneity of social processes is associated with the development of society, the individual, and, as a consequence, with the awareness of the dialectic of the interests of the individual and society as a whole, corresponding to the development of civilization and economic structure. Manipulation of spiritual production while ignoring social laws for the sake of profit, although a strong weapon, but double-edged.

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<sup>10</sup> Pletnikov Yu.K. Materialistic understanding of the history and problems of the theory of socialism. M., 2008. p. 58.

<sup>11</sup> Same as [10]. P. 147.

<sup>12</sup> Same as [19]. P. 144, 149.

基于单义的历史过程分期作为并行性问题的可能解决方案

**PERIODIZATION OF THE HISTORICAL PROCESS BASED ON  
THE MONOMYPH AS A POSSIBLE SOLUTION TO THE PROBLEM  
OF PARALLELISMS**

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抽象的。以中国、伊朗和欧洲2500年的历史为例，基于卡罗尔·S·皮尔逊 (Carol S. Pearson) 的12个原型体系 (英雄之旅的概念) 构建历史进程分期的可能性是显示。已确定了 17 个时期，最后一个属于“小丑时代”。

关键词: 历史平行性、历史分期、中国、伊朗、欧洲、皮尔逊十二原型体系。

**Abstract.** *On the example of the history of China, Iran and Europe for a period of 2500 years, the possibility of constructing a periodization of the historical process based on the system of 12 archetypes of Carol S. Pearson (the concept of the hero's journey) is shown. 17 periods have been identified, the last of which falls on the "Jester's era".*

**Keywords:** *historical parallelisms, periodization of history, China, Iran, Europe, Pearson's 12-archetype system.*

**Evolutionary parallelisms**

Back in the 19th century (E. Lazo, W. Strauss), a similar course of socio-evolutionary processes was noted in unrelated human communities. Parallelism was observed in the independent emergence of various types of crafts and crafts; creation of similar types of mythology, religious systems, etc. [4, p. 123-124].

In this paper, we are primarily interested in synchronous parallelisms (synchronisms). Their widely known example is the period of "axial time" (K. Jaspers), which was characterized by a simultaneous spiritual surge in China, India, Iran, Palestine, Ancient Greece in the 6th-4th centuries BC. [10, p. 205]. No less remarkable is the synchronicity of the growth/decline rhythms of the Roman Empire and the Chinese Han Empire, recorded by F. Teggart [14, p. 162].

Next, we intend to show a curious similarity between world dynamics and that version of the monomyth, which is known as the system of 12 archetypes by

C. Pearson. It covers historical synchronisms already known, as a rule, and at the same time, in an unexpected way, links them into a single system.

**Monomyth**

The monomyth theory was formulated in 1949 by the American philologist J. Campbell. He proposed a typical path of the hero’s mythological journey: solitude, initiation, return [12, p. 37]. Subsequently, on its basis, another American philologist, Carol S. Pearson, created an extended scheme of the hero’s journey, consisting of 12 stages, which were called archetypes [17, p. 57-61].

Pearson’s concept is used in psychology as a personality typology, where each archetype plays the role of an independent type. In Table 1, we briefly characterized each archetype using the work of T.V. Kapustina [9, p. 78-80] and the results of our own research [11].

**Table 1**

*A brief description of the archetypes in the Pearson’s typology of personality*

	<b>Archetype</b>	<b>Description</b>
1	Idealist (former Innocent)	Due to his naivete, he is very susceptible to ideology. A sincere patriot of the idea, to the point of fanaticism. A man with principles. Excellent propagandist.
2	Realist (former Orphan)	Victim archetype. Appreciates safety, therefore prefers collective action, is devoted to the interests of a small team. He does not like to stand out, he tries to be «like everyone else.»
3	Warrior	Likes to compete. He considers courage, rage and excitement to be valor. Struggle and sacrifice must be rewarded financially.
4	Caregiver	He is often confused with a caring servant. However, this is a more status figure - a patron, like a Maecenas or even God.
5	Seeker	Likes new, unusual, changes, movement. The search can be not only a movement in space, but also a spiritual search - scientific, mystical.
6	Lover	In the first place aesthetics and harmony. He loves and knows how to impress, win over. Opinion leader.
7	Revolutionary (former Destroyer)	Corresponds to the archetype of “death-and-rebirth” according to S. Grof. Unlike the Realist, he is an unfriendly individualist. He likes to criticize, constantly conflicts with someone - just for the sake of the process. Knows how to break barriers, «hack the system.»
8	Creator	If the previous archetype resembles Lucifer, then the Creator is a common synonym for God in Christianity. An undisciplined, inspiration-addicted genius.
9	Ruler	Master of political combinations and system building. Even the post of secretary can be turned into a power resource.
10	Magician	Trouble shooter, master of the impossible. His life does not obey logical laws, everything is “not like people’s.” Often closed.

11	Sage	The priority of reason, logic, knowledge, technology. Likes to create complex systems.
12	Jester (former Fool)	Corresponds to the puer aeternus archetype. In the first place is entertainment, a game. Ridiculous, irresponsible, spontaneous.

**Periodization of history based on Pearson archetypes**

In Table 2, we grouped historical synchronisms for three macroregions in chronological order (from west to east - China, Iran, Europe), starting from the “axial time”. The principle of grouping: the presence in the era of signs of certain archetypes of the hero’s journey. “1.8” was chosen as the initial value, because Creator is the eighth archetype in order in the C. Pearson system.

**Table 2**  
*Correspondence of historical synchronisms with the archetypes of the hero’s journey*

№	Period	China [8]	Iran [5; 6; 7]	Europe [2; 5; 6]
1.8	Age of Creator	The flourishing of culture, arts, crafts during the Zhangguo period (480-221 BC).	From the heyday of Assyrian culture under Ashurbanipal to the completion of the apadana at Persepolis (669-465 BC). Scythian animal style	Greek culture of the classical period (6th-4th centuries BC): Myron, Phidias, Apollodorus, Epicetus, Aeschylus, Heraclitus, Pythagoras, Aristotle
1.9	Age of Ruler	The first unification of the country: from the reforms of Shang Yang to the Han emperor Wu-di (356-140 BC)	Achaeminid state, starting from Cyrus II (556-334 BC) - an empire from Egypt and Macedonia to Pakistan	Building empires: the campaigns of Alexander the Great, the Roman Republic (4th-2nd centuries BC)
1.10	Age of Magician	Appearance of Fangxian Dao (4th-3rd centuries BC), Xu Fu’s expedition for the elixir of immortality (219-210 BC), execution of Gongsun He’s son for witchcraft (92 BC)	Early Hellenism (late 4th - early 2nd centuries BC): mystical cults, syncretic deities, Seleucid royal cult	School of Astrology Berosa on about. Kos [1]. “Sorceresses” by Theocritus, skepticism of Arcesilaus. Villa of the Mysteries in Pompeii, Bacchanalia (3-2 centuries BC).
1.11	Age of Sage	From the establishment of Taixue University	Parthian kingdom from Mithridates I (171 BC). Growth	Roman science: compilations of Varro, Roman

		to the victory of the eunuchs (136 BC - 169). Invention of paper, Confucian rank examinations	in the number of settlements, development of crafts: Borsippa fabrics, «Margian iron», aivan	law, literary Latin (language of science), Roman concrete, dome, aqueduct (2nd century BC - 1st century)
1.12	Age of Jester	Erosion of power: from He-di to Xiang-di (89-220): corruption, harem power, the nominal role of emperors. The first collection of jokes «Forest of laughter»	Loss of authority by the Arsacids, starting with the Parthian Muse (2 BC - 4 AD): conspiracies, revolts of the aristocracy, interference of Rome in internal affairs	The depraved Milesian Tales. Circus performances. 3.500 books by Didim Halkenter. “New Style”: Ovid, Seneca. Juvenal (1st century BC - 2nd century)
2.1	Age of Idealist	Revival of Taoism: Zhang Daoling, Neo-Taoism (Xuan Xue). The emergence of Zhiguai xiaoshuo stories (142-300). Buddhism	The first codification of the Avesta under Vologases I (51-78). State status of Zoroastrianism under Ardashir I (224-240)	Mithraism [1, p. 163-169]. Neo-Pythagoreanism, Stoicism of Marcus Aurelius, Neo-Platonism (1st-4th centuries)
2.2	Age of Realist (Orphan)	Depopulation: From the Yellow Turban Rebellion to the Reforms of Tuoba Hong II and Xiao Ze (184-485).	Manichaeism - the preaching of property equality (3-5 centuries). Mazdakism: «taking from the rich to give to the poor» (488-529)	Depopulation: Antonine plague and Plague of Cyprian [13], crisis of the 3rd century. Victory of Christianity (all are equal and all servants of God) (3rd-5th centuries)
2.3	Age of Warrior	The Age of Legendary Heroes (Guan Yu, d. 219). The Time of the «Thin Upstarts»: From the Barbarian Invasion to the Tang Empire (311-618)	Byzantine-Sasanian wars and the Arab (“barbarian”) conquest of Persia (420-654). Legendary hero Bahram Chubin	Barbarian invasion of Rome and Byzantium. Legendary heroes: Attila, Theodoric the Great, Radegast (4th-8th centuries)
2.4	Age of Caregiver	Sui and Tang empires (581-907); population peak for the 1st millennium AD	The revival of Persian identity (shuubiya). Great irrigation work (9th-10th centuries)	Carolingian and Ottonian Renaissance: educational reform, Charles Academy (8th-10th centuries)

2.5	Age of Seeker	Development of maritime trade. Exodus of the population to the south, campaigns of the Mongols to the West (1127-1260). 3 of 4 «great inventions», Leishu edition of encyclopedias (932-1204). Creation of the Four Great Academies.	Campaigns of the Turks (1021-1055). Development of science: Ferdowsi, Biruni, ibn Sina (940-1209). Mysticism: Karmatians, Sufism (Nasir Khosrov, Attar, Ghazali), Nizari state (since 1090)	Vikings, internal colonization, the beginning of the Reconquista, the Crusades, Marco Polo. Religion: «Papal Revolution», heresies, spiritual orders. Science: scholasticism, the emergence of universities (11th-13th centuries)
2.6	Age of Lover	Lyrical comedies (The West Wing by Wang Shifu, d. 1307) and tragedies («Rain in Plane Trees» by Bai Pu, d. 1306; «Pipa Ji» by Gao Ming, d. 1359). Lyric poetry of the sanqu genre. The rise of calligraphy.	The love poem “Vis and Ramin”, the lyrics of Omar Khayyam and Nizami, the ghazal classics of Saadi and Hafiz, sublimated erotic images of Rumi (11-14 centuries). Decorative trends in architecture of the 12th-14th centuries.	Gothic art, courtly lyricism, chivalric romance, «sweet new style» Trecento: Dante, Petrarch, Boccaccio (12th-14th centuries)
2.7	Age of Revolutionary (Destroyer)	Reducing the population by half over the period 1200-1393: the Black Death pandemic, the uprising of the «Red Turbans» [13, p. 238].	“General massacre”: the Mongol conquest (1220-1237), Timur’s wars (1381-1401), sarbadars. The abundance of mausoleums in the 13th-14th centuries.	Pandemic of the Black Death, Hundred Years’ War, bankruptcy of Bardi and Peruzzi, onslaught of the Ottoman Empire (14th-15th centuries)
2.8	Age of Creator	The Four Classical Novels (1494-1610) are the most famous Chinese novels. A new style of porcelain painting (end of the 16th century), export of products to Europe, the appearance of the chinoiserie style there	The culmination of the development of literature in Herat: Jami, Navoi; historian Mirkhond (15th century). Monuments of architecture in Isfahan and Samarkand. The heyday of the art of miniatures, fabrics, carpets, ceramics in the 16-17 centuries.	Renaissance and Baroque art (15th-17th centuries): painting - Leonardo da Vinci, Dürer, Bosch, Rembrandt; theater - Shakespeare, Moliere; prose - Cervantes, Rabelais. «Military revolution» 16-17 centuries.

2.9	Age of Ruler	The most powerful state of Asia of the “period of three reigns”: from the “Kangxi era” to the end of Qian-long (1679-1799). Literary fashion to imitate classical models	Safavid state from Abbas I, Nadir Shah (1588-1747). Centralization of the state, absolute monarchy. External expansion, up to an attempt to conquer India	Creation of colonial empires. Reformation: movement for the independence of political power from the church. Absolute monarchy. In art, classicism (16-18 centuries)
2.10	Age of Magician	“Yuan Mei’s New Records of Qi Xie” (1796) is a collection of stories about miracles and the supernatural. Taiping Heavenly State (1851-1864)	Ta’zieh Mystery Theater (18th century). Religious uprisings of the Babis (1848-1852), Bahaism	Hypnosis, spiritualism. Romanticism in culture and philosophy [16, p. 83-303]. Theosophical Society. Freemasonry (18th - early 20th centuries)
2.11	Age of Sage	From the Xinhai Revolution (1911) to the present day. Universal secondary education, growth in the number of universities, industrialization	From the opening of schools “Dar ol-fonun” (1851) to the present day. Also industrialization, etc.	Spread of literacy [10, p. 95-100]. Industrial Revolution, «Prussian socialism», Keynesianism (19th–20th centuries)
2.12	Age of Jester	Creation of TikTok (2016)	-	Postmodernism (from 1967-1969) [15, p. 441-442]

## Conclusions

L.E. Grinin and A.V. Korotaev formulated six rules for the periodization of history: identical grounds; hierarchies; equality of periods of one division stage; close connection with theory; additional basis; the need for coincidence, at least to some acceptable degree, of the theoretical construction and empirical facts [3, p. 101-103]. We believe that the resulting periodization corresponds to five of the six indicated rules (the only exception was the rule of additional reason).

Among those proposed by L.E. Grinin, A.V. Markov and A.V. Korotaev reasons for evolutionary parallelisms [4, p. 124-129] the channeling role of the structure of the body seems to be the most suitable for explaining the result obtained, based on the idea that archetypes, as phenomena of the collective psyche, are part of a system called “humanity”.

The resulting periodization is far from universalism, because a significant amount of events like wars and uprisings do not fit into it. However, the number of parallelisms covered by it is too large to call such a coincidence random. In order to find a place for this periodization among other options for the periodization of history, further research is needed.

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上海合作组织的扩大作为该地区战略发展的地缘经济阶段  
**EXPANSION OF THE SHANGHAI COOPERATION  
ORGANIZATION AS A GEOECONOMIC STAGE OF THE  
STRATEGIC DEVELOPMENT OF THE REGION**

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注解。 文章分析了最近举行的上合组织第二十三次峰会上伊朗伊斯兰共和国作为正式成员加入上海合作组织的情况。 作者概述了伊斯兰共和国加入该组织的主要优势。 作者阐述了白俄罗斯作为 2024 年候选成员国在上合组织内活动的优先领域,以及在西方集体全球主导地位下降的情况下该组织在该地区的作用。

关键词。 上海合作组织、伊朗、白俄罗斯、区域合作、地缘经济。

*Annotation.* The article analyses the The Islamic Republic of Iran's entry into the Shanghai Cooperation Organisation as a full-fledged member as a result of the recent 23rd SCO Summit. The author outlines the main advantages of the participation of the Islamic Republic in the Organisation. The author elaborates on the priority areas of Belarus' activities within the SCO as a candidate for membership in 2024, as well as on the role of the Organisation in the region amid the declining global dominance of the collective West.

*Keywords:* Shanghai Cooperation Organisation, Iran, Belarus, regional cooperation, geoeconomics.

The regular 23rd meeting of the Council of Heads of State of the Shanghai Cooperation Organisation chaired by India resulted in the official admission of Iran as a full-fledged member of the Organisation, the signing of a memorandum of commitment by Belarus to join the SCO, as well as numerous statements on economic and political cooperation in the structure .

It is significant that the Summit was of a global nature — in addition to all the member states of the organisation, Belarus, Iran and Mongolia attended the meeting as observers; Turkmenistan participated as a guest. Representatives of the UN, heads of regional structures such as ASEAN , CICA , EAEU , CSTO , CIS were also invited .

The process of Iran's accession to the SCO has more than 15 years-old history, starting from obtaining the observer statutes in 2005. The discussion about Iran's membership at the SCO first took place under the President Khatami, however, it was instantly curtailed, firstly, in connection with the expiring presidential term and the subsequent coming to power of Mahmoud Ahmadinejad, who initially supported the idea of joining the SCO, what was afterwards paled into insignificance. Secondly, due to the imposed US sanctions, the SCO looked at Iran with suspicion and waiting attitude .

Over time, talks about Iran's entry into the organisation resumed. Iran is a country with a rapidly growing population with an annual increase of 2 to 4% (according to various sources), which claims to be a regional power in the Middle East .

With the victory of the conservatives in the presidential elections in August 2021, led by Ibrahim Raisi, the discussion about the possibility of gaining membership in the SCO intensified. Compared to the attempt of the reformers to "sit on two chairs" — to benefit from the nuclear deal with the United States, improve relations with the West, and not to interfere in the Russian — Chinese tandem in the SCO format, the policy of the reformers was based on the idea of finding alternative options to find the way to the economic development and social prosperity in one or another civilisation eliminating hopes in the obsolete Joint Comprehensive Plan of Action. In this regard, at the beginning of 2022, the Iranian Parliament ratified the relevant document, what implied the further application for joining the SCO.

Symbolically, Iran, using a political tool and an economic mechanism, became a member of the SCO on July 4, 2023, on the Independence Day of the United States, demonstrating its choice in favour of the East.

In its turn, Iran possesses rich oil and gas reserves and occupies an advantageous geographical position providing access to the Persian Gulf, which is crucial for the evolution of energy and infrastructure cooperation between the SCO members. Iran's accession to the organisation would freely assist in the implementation of regional infrastructure projects, including the Chabahar transport corridor.

On the other hand, the SCO provides an opportunity for Iran to ease sanctions isolation and related economic difficulties, as well as a platform for more active and large-scale foreign policy maneuvers.

Moreover, Iran, like all SCO countries, is interested in settling and controlling the situation in Afghanistan. The Afghan issue, it is important to emphasise, was one of the key reasons that prompted the SCO countries to approve Iran's entry into the organisation, due to the fact that the withdrawal of US troops from Afghanistan and the coming to power of the Taliban largely influenced the weakening of the US position in the region and led to the conclusion that emerging security problems must be solved by joint efforts.

It is reasonable to believe that Iran's entry into the SCO is also of an image nature, since one of Tehran's mission is to ease the burden of international isolation and legitimise the state in the region and the world as well. As President Raisi noted, "membership in this organisation will provide Iran with an opportunity for sustainable economic development" [ 2 ].

Moreover, the goal of expanding the consumer market, ensuring stable imports of oil and other goods, obtaining the necessary technologies and material resources for the development of industry are serious factors of Iran's interest in the SCO, which opens up additional opportunities for the Islamic Republic to diversify its exports, which becomes extremely important during the sanctions pressure.

With the acquisition of a new member state, the SCO is limited by its geography not only to the countries of the Central Asian region, Russia, China and South Asia represented by India and Pakistan, now the structure covers the Middle East, opening up opportunities for entry into the organisation of the Gulf monarchy — Turkey, the countries of the Maghreb (Algeria, Egypt). With the expansion of the membership, the number of priority areas for development increases. The SCO is not an exclusive solution to priority political and security issues, but also the creation of a future geo-economic platform. From now on, the SCO is about the formation of a new ideological civilisation .

Today Belarus demonstrates itself as a serious, significant, consistent and important actor in the system of international relations, including in the Eurasian region . The process of accession of a new member to the SCO, Belarus, would be completed by 2024, according to the statement of the First Deputy Foreign Minister of India during the Summit [3].

Within the framework of the Summit a memorandum on the obligations of the Republic of Belarus in the process of organisation as a full-fledged member state was signed. The document was signed by all the member states without exception, by the Secretary General of the organisation, and now the further process will be connected with the ratification of this memorandum and the entire package of obligations of the Republic of Belarus to all member countries. As soon as the process is completed by all the member states, it can be stated that Belarus would fully join the organisation. On the part of Belarus, all the legislative work has been done, what remains is the simultaneous ratification of the memorandum and 47 agreements to be signed within the framework of the SCO by member states, to which Belarus is joining as part of this process.

Belarus' accession to the Shanghai Cooperation Organisation opens up new areas of cooperation :

- Experience exchange with participating countries in countering new challenges and threats: destructive cyber attacks, digital theft, targeted dissemination of fakes in the information space, terrorism and extremism;

- Support and promotion of the idea of global development against the backdrop of the declining dominance of the collective West in the economy and finance, as well as attempts to retain geopolitical influence by imposing sanctions;
- Continuous technological development based on mutually beneficial partnership. It can not be denied that the central role in the creation and export of technologies is occupied by China, while Belarus is keen to provide a platform for its implementation (Chinese — Belarusian Industrial Park “Great Stone”, High-Tech Park, Minsk City Technopark);
- Participation of Belarus, as one of the largest exporters of potash fertilizers, foodstuffs and equipment, directly with the SCO states in solving the problem of global food security;
- Minsk remains interested in transforming the common transport and logistics space of the SCO, including through the intensification of international transportation, acceleration and digitalisation of control procedures, arrangement and operation of the North — South transport corridor;
- For a closer acquaintance with the diversity of cultures of the member states of the organisation, Belarus proposes to consider the possibility of implementing a large-scale humanitarian project — the Festival of Cultures of the SCO [ 1 ].

Undoubtedly, the SCO today is presented as an interstate complex of cooperation at the level of the continent. With the growing influence and expansion of its geography, pressure from the West is not excluded, since the SCO is able to counter the relevance of the existence of NATO or the G20, creating its own vision of the future world order .

The Shanghai Cooperation Organisation is a regional organisation, it needs to be strengthened and improved precisely in this capacity, especially with quantitative expansion at the heart of transport, logistics and economic projects that will ensure the connectivity of the whole continent.

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中俄壁画的使用特点  
**FEATURES OF THE USE OF WALL PAINTING IN CHINA AND  
RUSSIA**

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注解。壁画是人类最早用来传达有意义的信息的美术类型之一，它是在墙壁本身不存在时出现的。然而，组织、形式化和使用空间的愿望不仅出于功利目的，而且从考古证据来看，也作为掌握世界的一种手段——固定、解释、建模等，大约始于旧石器时代晚期。

本文分析了20世纪和21世纪中俄两国城市壁画的特点，揭示了壁画作为一种造型艺术在不同国家公共空间中的作用，以便通过壁画图像所反映的视觉代码更好地了解城市的社会文化。

关键词和短语：壁画、公共空间、涂鸦、壁画、视觉代码。

**Annotation.** *Wall painting, one of the earliest types of fine art used by mankind to convey meaningful information, arose when walls as such did not exist. However, the desire to organize, formalize, use space not only for utilitarian purposes, but also as a means of mastering the world - fixation, interpretation, modeling, etc. judging by archaeological evidence, approximately began in the Upper Paleolithic.*

*Analyzing the characteristics of wall painting in the cities of China and Russia in the 20th and 21st centuries, this article reveals the role of wall painting as a plastic art in public spaces of different countries in order to better understand the social culture of the city through the visual code reflected in the images of wall painting.*

**Keywords and phrases:** *wall painting, public spaces, graffiti, mural, visual code.*

As one of the forms of artistic expression, wall painting has a long history. In the Paleolithic era, before the advent of writing, rock carvings were a tool used by

primitive people to transmit information. If we take Chinese rock art as an example, then Chinese rock art can be traced back to the earliest Neolithic period. This is a series of recorded images, symbols, and sometimes even complete hunting scenes, carved and painted by primitive people on stone walls. Rock carvings are equivalent to the primary text of primitive people and are of practical importance for recording, transmitting and communicating information. Since the ancient Egyptian period and ending with the 19th century, wall painting has always played the role of propaganda of religion and imperial power. It was only with the advent of street art in the mid-20th century that wall painting appeared in the public life of people in the form of pure aesthetics.

The paintings on the wall, using a symbolic visual code, demonstrate a direct and close connection between the applied images and the social life of people. In other words, the content of wall painting is an intuitive and visual expression of society and culture. Thus, the study of wall paintings in public spaces from the point of view of socio-cultural visual codes can reveal the characteristics and development process of the city in order to more effectively understand urban society and culture.

Based on the theme of wall paintings in public places of Chinese and Russian cities, the analysis of the characteristics of society and culture is of sufficient importance for contemporaries to understand human society, inherit cultural traditions and create a culture corresponding to modern society and national characteristics.

Thus, the **object of this study** is wall painting in public spaces in China and Russia.

**The subject** is wall painting in public spaces of China and Russia from the point of view of the socio-cultural visual code.

**The aim** is to analyze wall paintings in China and Russia from the point of view of socio-cultural visual.

To achieve this goal, the following tasks were **defined**:

- to determine the theoretical and methodological basis of the study;
- to identify the essential concepts of “wall painting”, “street art”, “graffiti”, “visual code”, etc.;
- to consider the use of wall painting as a decoration of public spaces in Chinese and Russian culture from a historical perspective.

The definition of the peculiarities of the design of Chinese and Russian public spaces through wall paintings by historical review is based on a combination of both art criticism and culturological scientific approaches such as: historical, semiotic, hermeneutic, constructivist and iconographic.

The study of wall paintings within the framework of the historical and cultural approach defines the basis for understanding the artistic “vision” of a certain era

and taking into account the national characteristics of the cultures studied, especially from the point of view of the development of two opposing cultures (East and West).

Norman Bryson in his book “Vision and Painting - The Logic of the Gaze” mentioned that “Painting is the art of the sign, but the specific signs that it uses, and above all its images of the body, mean that this art is in constant contact with significant forces beyond painting, forces that cannot be explained by “structuralist” explanations”[7].

Wall painting as a work of art can be considered as a communicative and linguistic system, and therefore, the semiotic approach is the main one for understanding this (Yu.M. Lotman, H.-G. Gadameer, M.M. Bakhtin). Hermeneutics makes it possible to explore wall painting through the systemic nature of understanding (as an author’s text, a work of art, the personality of the perceiver and cultural traditions). The established iconographic canons allow us to analyze the disclosure of the historically conditioned figurative and symbolic content of wall paintings (A. Warburg, E. Cassirer, E. Panofsky) [2].

Street art is a tool thanks to which any city acquires identity, and constructivist buildings of the XX century get a new life. Various obstacles lie in the way of the embodiment of urban murals: communication with the owners, approval of the sketch, search for materials.

Street art helps not only to form the visual appearance of the space, but also to express ideas and values floating in society[5].

The original definition of graffiti was an act of vandalism in which people used spray paint to paint in public places without the permission of the responsible person of the relevant department. As a translation term, “graffiti” first appeared from the poem “Shi Tianning” by the Tang dynasty poet Lu Tong: “The ink on the table suddenly tipped over, and the ink smeared across the collection of poems like a crow”[11].

Later, Chinese writers used “graffiti” as a metaphor for the immaturity of calligraphy and painting or writing to show self-deprecation.

Chinese graffiti appeared relatively late compared to Western countries, and their content is focused on aesthetics and interesting expressions.

Before we directly study the use of wall paintings in Russian and Chinese culture from the point of view of the socio-cultural visual code, we also need to consider the concept of “socio-cultural code”.

Lian Fu in his article “Let’s talk about the cultural code” mentioned that “A code can be a set of numbers, a set of words, a set of letters, a set of symbols or a set of actions, and so on. In more detail, it represents a legal system, and it defines a method of interpreting symbols. The meaning of the code is completely set artificially, and there is an arbitrariness of all characters in it” [4].



Culture is the sum of material and spiritual wealth created by people as a result of the practice of productive labor. The social attributes that people possess determine that culture should rely on society as a carrier of inheritance and development. At the same time, culture also reflects the characteristics of the society to which they belong, and they are complementary relationships. A sociocultural code is a humanistic symbol that includes history, traditions, race, customs, habits, religion, beliefs, region, religion, environment and other factors. It has ethnic, unique, regional and traditional characteristics and will change as society develops.

All types of human social behavior are subject to a certain structure. If we want to discover a certain order or a certain structure in various disordered social phenomena; if we want to better understand all kinds of human behavior; if we want to be accepted by the society in which we live; if we want to make the entire environment a carrier for ensuring good sustainable human development, then we must discover, understand social and cultural code and follow it.

A similar theory is put forward in the work of the Russian philosopher G.V. Plekhanov "Letters without an address. Art and social life", "I think that art begins when a person again evokes the feelings and thoughts he experienced under the influence of the surrounding reality, and gives them a certain figurative expression. It goes without saying, of course, that in the vast majority of cases he does this in order to convey what he has changed his mind and what he has felt to other people. Art is a social phenomenon" [1].

The Russian culturologist M.S. Kagan in his book "Philosophy of Culture Textbook" mentioned that "thus, the basis of culture is the freedom acquired by a person to continuously change his behavioral program for the sake of improving it, increasing the efficiency, adapting to changing environmental conditions. This is expressed both on the material, spiritual, and artistic levels of activity (which very clearly shows their unity in the real course of cultural development), leading to a change in their content and methods of implementation, and to a change in their relationship, which determines the structure of each historical type of culture" [6].

Peng Jixiang in his book "Introduction to Art Criticism" mentioned that "Culture can see itself and know itself in the mirror of art. It is obvious that the status of art in human culture is primarily manifested in the participation and popularization of art reflecting the historical development of human culture" [8].

Ulyana Sergeevna Schwindt Urban in her article "Street Art: trips to the study of the phenomenon in the social sciences and humanities" mentioned that "Urban surfaces affect how we see and perceive ourselves, the city, which, in turn, contains imprints of its perception by other people and their personal experience. Therefore, the city is a complex space of interpersonal interactions and communication" [9].

Therefore, outstanding artists are often able to visualize the aesthetic ideals and worldview of a nation or society in visual works of art and present them to the public. Wall painting is a means for displaying social life and expressing the thoughts and emotions of the artist by forming a static visual image. From primitive society to modernity, wall painting gradually shifted from practical functions to aesthetic ones. In addition to the frescoes in the tomb, the wall painting uses the artistic language of openness and intuitiveness to directly and closely connect the social life of people. In other words, the content of the wall painting is an intuitive visual manifestation of society and culture. The analysis of the social and cultural characteristics of the epoch based on the characteristics of the visual image embodied in the frescoes is essential for our understanding and inheritance of human material and spiritual civilization and the creation of an excellent culture corresponding to modern society and regional characteristics. Zhang Yuanming in his article “The study of the active role of graffiti in urban Construction” mentioned that “The color theory of urban construction planning shows that urban color is one of the important factors, reflecting the individual characteristics of the city. Positioning culture and art in the development of the city, creating an artistic atmosphere of the city and focusing on the aesthetic value of mass culture reflect the cultural taste of the city” [10].

Compared to written language, the first thing that affects human vision is the language of images. The color impact of the wall paintings themselves affects the visual perception of the audience, fully revealing the personalized, people-friendly, interactive and other characteristics of wall paintings in public places, as well as using the language of images to visualize representative cultural symbols of local features. It is an effective means of promoting regional social and cultural development, raising the aesthetic level of the entire people and stimulating the development of the surrounding commercial spheres.

Next, we will take graffiti and street art in the public spaces of Chinese and Russian cities as an example to analyze the social and cultural phenomena reflected in the images on the walls from the point of view of the visual code.

First of all, let's take as an example a wall painting in the city of Nanning, Guangxi Zhuang Autonomous Region. There is a giant graffiti wall 30 meters long in the Neijie Culture and Creativity Park, which can make people feel the changes of the Nanning times. The images of the Dragon-Elephant Tower, the Nanning International Convention and Exhibition Center, the Fusan Flower and the Zhuang Bronze Drum totem on the wall paintings are all classic buildings and objects that can represent the city of Nanning. The Nanning International Convention and Exhibition Center with the image of the Fusan Flower as an architectural form is a permanent venue for the China-Asean exhibition. The Fusang flower is the city

flower of Nanning City. The petal structure in the building symbolizes the ethnic minorities of Guangxi. If we consider these classic images as the cultural code of the city, then the creators use modern painting to visualize the characteristic cultural code of the city in front of the public. In other words, wall painting in public spaces is a visual presentation of social and cultural codes.

Secondly, let's take as an example the mural "Millionki" in Vladivostok, Russia, the facade of one of the buildings "Millionki" is painted by artists – characters who once lived in old Vladivostok and stayed in the city appear on the wall. "For about ten years we have been waiting for the opportunity to paint this wall. We were waiting for sponsors, and just when all the stars would come together. The wall that we paint is a firewall, that is, a deaf fire-fighting wall. During its existence, several windows were randomly broken, which did not add to the beauty of the building. But in world practice, the decoration of such facades is a frequent phenomenon," says Pavel Shugurov. Nearby cafes and restaurants became sponsors of the art. The process when old abandoned corners are gentrified and given a new life is called gentrification – this is exactly what has been happening to the "Millionaires" in recent years. Since the building is located in the heart of the old city, the plot of the drawings is predictable. The facade depicts the period of the late XIX – early XX century. The characters and objects decorating the wall are taken from real photographs of that time. People who could have been guests and residents of "Millionka" look down at passers-by [3].

Thus, from the moment of the appearance of street art in the 20th century to the present, various ethnic cultures that have survived different eras have given different characteristics and connotations to the visual language. For example, street art in the Russian seaside city of Vladivostok mainly depicts local marine animals, tigers and representative historical buildings, as well as the aforementioned Nanning International Convention and Exhibition Center, totemic images of the Fusan flower and the Zhuang bronze drum - all this fully reflects the dissemination of cultural characteristics and the spirit of the city in public places through visual images. In general, wall painting in urban public spaces is not only a kind of propaganda of fashion and individuality, but also a call to people to inherit and protect material and spiritual civilization.

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国家“形象”与“样子”概念界定的理论方法研究(比较分析)  
**RESEARCH OF THEORETICAL APPROACHES TO DEFINING  
THE CONCEPTS OF “IMAGE” OF A COUNTRY (COMPARATIVE  
ANALYSIS)**

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注解。 领土形象研究在现代科学中占据领先地位, 不仅对国内, 而且对国外也具有重要意义。 特别令人感兴趣的是通过艺术作品对国家形象的认知。 文章分析了定义“形像”和“样子”概念的主要方法, 并找出了它们的异同。

关键词: 形象、领土形象、国家形象、样子、艺术样子、定位、创造力、城市景观。

**Annotation.** *Research of territorial image in modern science occupies a leading position, and is important, not only for domestic, but also for foreign audiences. Of particular interest is the perception of the **country's image** through works of art. The article analyzes the main approaches to defining the concepts of “image” and identifies their similarities and differences.*

**Keywords:** *image, territorial image, country image, image, artistic image, positioning, creativity, urban landscape.*

The relevance of the research topic is dictated by the need for time. Today's cultural environment, saturated with so-called information “garbage” from the Internet and other popular communication channels, tends to move to a different level of perception of reality. That is why in the modern world there is an increasing interest in other sources of information, especially with regard to the perception of the image of one's country in the aspect of the perception of literary, pictorial, musical works, as well as art in the film industry.

The subject of this study is the concepts of “image”, “image”, used in modern science, especially in foreign science as synonyms, but this is not entirely true. In our research, we will rely on two areas of research of these concepts: “ – image,

image), the purpose of which is to study the laws of creation, functioning and interpretation of images of “other”, “alien”, foreign to the perceiving person objects and “imagology”, according to the author of the encyclopedia according to the image of Panasyuk A. Yu., - the science of forming an opinion of a person or group of people (audience image) about an object (person, product, organization, country) based on the image of this object formed by them[7].

The object of research is territorial image.

The subject of the research is approaches to defining the concepts of “image” and “image” of a country.

The purpose of the research is to study theoretical and methodological approaches to the definition of the concepts of “image” and “image” of the country in the context of scientific research: “Image of Russia in the works of Russian and Chinese artists”.

Objectives of this research paper:

1. Analyze theoretical approaches to defining the main concepts of the research topic.
2. Conduct a comparative analysis of the concepts of” image “and” image “ of the country from the point of view of different sciences.

Research methodology.

The research is based on a structural and functional approach. Method of analysis and synthesis: analysis of domestic and foreign scientific papers, literature, and research sites.

At the beginning of this study, it is necessary to emphasize that fairly young field, especially in cultural studies, which is poorly. Although the fact that never before in the development of human history have people attached such importance and interest to the image as today (in social interaction, personal image is important to participants, in the activity of an enterprise, a corporate image, an image of a product and service is needed, and the image of the government is also necessary.

Along with this, with the acceleration of informatization and globalization, people have begun to pay more attention to the image of the city, regional image, country image, national image), which explains the emergence in recent years of interest in scientific research related to image issues.

The concept of “image”, which originated in Russia in the 90s of the last century, and in France much earlier, is most often used in such sciences as political science, economics, and it would seem that it has nothing to do with cultural studies, but this is only at first glance, because the concept of “image” in the literal sense translated from English, it means “image”, is a key word in cultural studies.

The article attempts to separate the concepts of “ image “and” image “ in the context of studying the perception of the country’s image through the eyes of artists.

According to the conducted etymological studies, it was revealed that the term “image” can be defined as a picture of an object that has appeared in the human mind and reflects objects and phenomena of the surrounding reality. Authors Qin Qiwen and Zhou Yongkang, in their book *Introduction to Image Theory*, consider the concept of “image” in three ways: first, as the appearance and shape of a person and objects, and secondly, it is a substance that can act on a person’s senses, generating impressions, ideas, thoughts and emotional activity. Finally, it is the unity of the concrete and the abstract, as well as the material and the spiritual. [14].

In English, there are several meanings that correspond to the concept of “image”, this is the literal translation of “image”, as well as “figure”, “form”, “identity”. According to Lian Xiaoming, research on the country’s image, which originated in Europe in the 1990s, has now developed into a mature system. Although these studies are primarily based on the image aspect, they cover a complex range of factors, such as time, psychological space, ways of seeing, attitudes, cognitive schemas, the collective unconscious, ideology, utopia, the history of ideas, hierarchical relationships, thinking, language, fiction, projection, and even theory. They also provide additional references to elements related to specific image-making, such as the relationship between image and illusion, and even when applied to the image of the state [12].

The scientific direction “imagology” appeared in France in the 50s, but more interest in it began to develop in China in the works of Meng Hua, the subject of the study of imagology was the images of “other”, “other”, “foreign” countries, cultures, and nationalities. In the context of imagology, the following dimensions of the “image” can be distinguished: internal and external, general and local, static and dynamic, real and false, material and spiritual. The complexity of these factors and the setting of these dimensions in imagology provides a useful analytical tool for understanding the image of the State.

In literature and art, an image is defined as a specific, vivid and artistically attractive picture with a certain ideological content and aesthetic meaning, created by an artist (writer) who selects, refines, transforms and processes material from real life. In psychology, the concept of “image”, called representation, refers to the mental reproduction of external stimuli of the perceptual process by people. Since the individual is a “perceiver” of images, any objective image is reflected through human perception, so the image becomes a concrete impression of a certain object.

Along with this, in the psychology of creativity, the term “image” correlates with the concepts: “imagery” or “representation” and is a reflection of the image of something previously perceived, which was not in front of us at that moment. In other words, an image of something that was perceived in the past and stored in memory is defined as a representation.

Sensation, perception, and representation are all part of perceptual consciousness, but representation is a step forward from sensation and perception, since it has the characteristics of an intuitive image and an initial generalization.

In the definition of the concept of “image”, we are close to the definition of O. A. Stein, who believes that “...image as a construct of consciousness, a way of perceiving the world, a way of passing mental life determines the system of meanings in which thinking and seeing phenomena occur. Images have the ability to encode events, transforming them into symbols that are open for reading”[15].

Along with this, we share the point of view of Y. R. Gorelova, who presents the image as “a way of interaction between a person and the world, an intermediary between a person’s consciousness and external reality. According to the author, the image is in some sense a visual declaration of reality. On the one hand, it is always based on real phenomena, things and events. There can be no image at all, but only an image of something (a person, event, phenomenon, place). On the other hand, the image shows not so much how this event (phenomenon, person, object) exists in reality, but how it was reflected in the consciousness of a particular person, social group, people, or even the whole of humanity”[3].

Many researchers in the field of art believe that the formation of an image begins with the level of sensations. When a person receives signals from the perceiving senses, the shape, color, sound, or even smell is read. On this basis, a bank of sensations is formed. If something from the past experience of similar fragments of reality influencing the recipient’s feelings is added to this information, and thinking in the forms of categorization, analysis, generalization, and imagination processes are connected, then the image fabric is formed. Therefore, according to researchers, in the formation of an image there are stages of primary sensory perception, logical comprehension, and the processes of memory and imagination are activated. And what is also important to note, the image is not a blurry picture, on the contrary, the image always assumes the integrity of the picture.

Thus, when forming a holistic image, a person always relies on their immediate feelings and experiences, as well as on the totality of all previous experience and attitudes. There is a structuring of information about reality and giving meaning to the experience of direct perception. Once formed, the image begins to limit the range of what is perceived, emphasize something, retouch something.

While speaking about the artistic image (in the context of our research, it is very important to focus on the definition of this concept), it is necessary to emphasize that this is the result of creative transformation, the transformation of the surrounding world. However, if an artistic image cannot be placed within a certain framework, then it can be presented in the form of an artistic idea, positioned to the world in the form of an artistic representation, as the embodiment of a certain aesthetic experience.

Studying the theoretical approaches to the definition of the concept of “artistic image”, we found that many researchers (V. E. Khalizev, T. G. Gorelova, V. A. Maslova, etc.) agree that this is an image of reality in the refraction of the author’s (artist’s, writer’s) perception of this reality. Along with this, it is also the author’s



form of thinking, but it is also important that this is a sensory perception of reality. Thus, they agree on the understanding of the artistic image as a special form of aesthetic human cognition of the world, the constructive nature of which is revealed in the dialectical relationship of the individual and the general, subjective and objective, sensual and rational.

At the same time, when studying the peculiarities of perception of the image of a city, region, or country, it is important to interpret this concept as a “picture of the world”. Thus, according to T. G. Goranskaya, “the picture of the world appears as a subjective view of the objective world. The correlation of the “image of the country” with the concept of” world view “allows you to connect many interpretations of the country together”[2]. The perception of the country’s image is both individual and socio-cultural.

Ryabkova T. V. asserts that the concept of “image of a city, country” is the object of research in a number of humanities. In his research, using a historical and cultural approach, the author considers the city as a combination of spiritual and material culture, as a geographical space united by a cultural community, a place of residence [10].

A number of authors of the semiotic direction (Yu. M. Lotman, Z. G. Mints) consider the city as a “text”, the basis of such research is urban culture, urban space. This text, according to researchers, can be laid down in the artistic manifestation, and in everyday life, and in folklore. A large role in the consideration of this approach is assigned to the visual arts, namely the urban landscape. “Depending on the nature of the landscape motif, it is possible to distinguish industrial, urban and architectural landscape, often “veduta” (seen, view, picture, point of view) is mentioned as a separate subgenre” [10, p. 207]

We agree with the point of view of T. V. Ryabkova that image of the city as a cultural category differs from the image of a particular city, which is associated with an emphasis on its originality. Yu. V. Lobanova writes about this in more detail, suggesting the following origin of the artistic image of the city: “The city initiates artistic images associated with its life; at the same time, the focus of artistic culture turns out to be the city’s inherent features of originality, which are manifested in different ways in works of art of different cultural eras and stylistic trends. The uniqueness of the urban environment exists and is found in the images of art on three interrelated levels (specific, typical, individual)” [6].

The urban environment occupies an important place in the work of every artist who has dedicated it to landscape art. Creatively perceiving the space around him, the artist reflects it in his paintings, transforming it in accordance with his artistic worldview. Thus, Zhang Huan in his article “The image of Moscow in the eyes of Russians”, analyzing the role of fine arts in shaping the image of the city, writes that numerous artists depicted Moscow, both during its historical heyday and at

the time when it ceased to be the capital of the Russian state. The paintings show not only well-known urban landscapes that have survived to this day, but also unique, now lost architectural ensembles. [13]. Moscow was captured by both Russian artists and foreign masters, and their canvases can still represent the most important milestones in the historical development of Russian cities. Along with this, it is thanks to the works of artists, famous and unknown at all, that today we can tell about the life of peoples, their activities, and culture in general.

When forming the image of a country, artists most often draw individual fragments of life, nature, architectural monuments, cultural heritage objects, and other elements that form an idea of the object being depicted (1 picture)



*Painting 1. Liu Xiao, Ode to Russia*

For example, a painting by artist Sun Yumin depicts architectural details and a monument on Victory Square in Vladivostok, Russia. (Second picture)



*Painting 2. Sun Yumin, Victory Square, Vladivostok, Russia*

The high mountains in the background are made in the way of traditional Chinese ink painting. The monument in the picture is a visual symbol embodying the image of the city. Lighting effects are depicted on buildings in close-up. People walking around the square represent the real atmosphere of urban life, however, the nearby hills and mountains create a gloomy picture of the gloomy autumn nature of Primorye

The painting gives a unique visual representation of the nature of this work of art, on the one hand it is the image of a hero, on the other hand it is a symbol of the country that won socialism in the civil war.

And the Vladivostok artist Igor Obukhov has a completely different view of this hero (picture 3) – for him it is not just a monument, but a symbol of Vladivostok, as a young traveler setting off on a long journey to Moscow, a road 9288 km long.



*Painting 1. By Igor Obukhov*

However, exploring the images of another country, many artists see it from their own angle. So, in the painting by the artist Sun Yumin, the square for the Power Fighters of the Soviets is depicted against the background of dark hills that are not in Vladivostok, but they are found in the paintings of Chinese artists, as the personification of the specifics of the nature of China

A completely different interpretation of the concept of “image”, in which many researchers agree, and here the point of view of A.Y. Panasyuk is close to us, that this is an artificial image formed by the mass media, psychological and partly manipulative influence in order to form the necessary attitude to the image object. At the same time, the image can combine both real properties of the object and non-existent, attributed, ideal [8]

Along with this, a number of researchers (G.G. Pocheptsov, E.A. Petrova, A.P. Pankrukhin) agree that the image of the territory (city, region, country) this is a complex imaginative representation, most often emotionally colored, about the perceived object and it is formed both in the individual and in the mass consciousness. And another important factor is that the image is a universal education and can be applied to any object. And how does N.S. Biken view it? "... the image of a territory is a set of emotional and rational ideas, beliefs and impressions of people in relation to a given place that arise as a result of comparing all the characteristics of the territory, personal experience of visiting the territory and rumors, as unofficial, but very important information that influences the creation of a certain image. The basis of the image of the territory is its external and internal characteristics (territorial individuality), some of which cannot be changed: natural, geographical features, cultural values, history" [1].

A.E. Kiryunin identifies cultural as one of the main components of the territorial image, as a set of reflection of not only material, but most importantly spiritual values of the territory. In this connection, it can be stated that the target audience associates the country or region with the culture of a certain people, its history, traditions, etc. [4].

Most often, the image of the region, like any other image, is divided into internal and external. The internal image is formed in the representation of its population living in this territory, they are the main carriers of this information for an external audience. Whereas the external image is formed by representatives of another territory. In both cases, the image must meet the expectations of these social groups. And since many image researchers agree, it should be emotionally colored.

In the process of forming the image of the territory, a very important aspect is the search for the correct and unique positioning. One of the key experts in the field of territory marketing, A.P. Pankrukhin, believes that the positioning of the territory is the first strategic decision based on the results of research on target markets and the use of other tools for processing marketing information about the state of the surrounding market environment and factors affecting the prospects for the development of the territory [9]. The purpose of positioning, in his opinion, is to select profitable target market segments and determine the directions of development from the current to the necessary competitive positions of goods and services of the territory both inside and outside it.

According to T.V. Sachuk, positioning in territorial marketing is "... an activity undertaken to help consumers distinguish, recognize, and prefer a particular territory against the background of others" [11]. In his works, this author proves that the positioning of the territory is aimed at maintaining the attractiveness and prestige of the territory, and its recognition occurs through official and unofficial

symbols of the territory (coats of arms, flags, anthems of the territory), thanks to which, most often, the consumer builds associative links with it.

Unofficial symbols also help to evoke associations associated with a given territory. Such objects are: monuments of nature and architecture, famous personalities, goods (for example, Tula gingerbread, Orenburg shawl), events (WEF, Pacific Meridian), etc. Associations are not always positive, they can also have a negative character (for example, Tambov wolf, bandit Petersburg).

The recognition of the territory is related to the geographical location of the region. The territory is described through the associations associated with it. Therefore, an important element of the recognition of the territory is its name, which can also cause both negative and positive emotions.

All these elements (official and unofficial symbols) form a certain image of the territory in the human mind. Y.P. Zinchenko believes that the leading role in the formation of the image is played by different levels of communication between citizens, government officials, subjects of spiritual creativity, journalists, various communities.

Among them are the following:

- traditional media (radio, television) using news and analytical materials, entertainment programs (“The Life of others”, “Let’s Go, Let’s eat”) as the main tool for creating the image of an individual (politician), groups of people and entire states and territories;
- An Internet communication channel that opens up great prospects for creating the desired image of a certain territory (city, region, region, state) by means of Internet media, social platforms, websites, video hosting and other online tools;
- special events aimed at transmitting the specifics of the culture of the region, its national characteristics and achievements (the Dymovskaya Toy Festival, the Scarlet Sails Alumni Evening, the Olonkho National Epic Festival, the City of Masters Festival-exhibition, festivals, contests and exhibitions of various kinds, such as the Vladivostok International Biennale of Visual Arts arts);
- the work of intermediaries, which include travel agencies, diplomatic embassies, foreign representative offices of companies, etc.;
- getting personal experience by visiting the territory and communicating with its residents.

To solve these problems, according to the theory of F. Kotler, the following tools are traditionally used:

- a slogan that creates a platform based on which the image of the region can be further enhanced (“St. Petersburg” is the city of white nights”, “The sun smiles on Gelendzhik”);

- themes and positioning carried out at the regional, national and international levels (for example, “Armenia is an open-air museum”, “Ivanovo is the city of brides”, “Japan is the land of the rising sun”). The branding of the territory may be based on its positioning as a historical, cultural, religious, tourist or industrial center;
- Visual symbols (Big Ben in London, Eiffel Tower in Paris, Red Square in Moscow);
- events and actions taking place on or in connection with the territory (holding a major event, for example, an international exhibition or the Olympic Games).

The tools for forming the image of the territory can also include the search for existing or the creation of new legends associated with this region.

Thus, having considered theoretical approaches to the definition of basic concepts on the topic of research, we came to the conclusion that an image is a spontaneously emerging idea of a country, whereas an image is a purposefully formed image in the minds of the target audience.

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中国水彩画艺术史  
**HISTORY OF THE ART OF WATERCOLOR IN CHINA**

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注解。 本文讲述了水彩画艺术在中国出现以来的发展历程,按时间顺序概述了20世纪中国水彩画艺术发展的各个时期。 在所有教授水彩画技法的艺术学校、学院和机构中,学院占据着特殊的地位,主要是广州美术学院。 由此,在水彩画方面,中国形成了自己的传统,水彩画进入了中国现代艺术。

关键词: 土山湾画派、上海印艺学院、国立北京艺术学院、南京中央大学艺术系、广州美术学院。

**Annotation.** *This article talks about the development of watercolor art since its appearance in China, gives a chronological overview of various periods of development of watercolor art in China in the 20th century. Among all the art schools, colleges and institutes that taught watercolor techniques, a special place is occupied by academies, primarily the Guangzhou Academy of Fine Arts. As a result, in watercolor painting, China formed its own tradition, and watercolor painting entered modern Chinese art.*

**Keywords:** *Tushanwan School of Painting, Shanghai Academy of Graphic Arts, National Beijing Art College, Art Faculty of Nanjing National Central University, Guangzhou Academy of Fine Arts.*

Watercolor technique, like oil painting technique, was not originally formed in China and is an external borrowing. The study of the history of watercolor technology in China is interesting because of its limited knowledge. On the one hand, the similarity of watercolors and gohua techniques creates some difficulties in distinguishing them, on the other hand, due to the appearance of similarities it is possible to identify and study the internal features of Chinese understanding of art.

In 1715, the Italian missionary painter Lang Shining came to Beijing to paint for the Emperor, and he was able to paint both oil and watercolor, but the watercolor was not distributed for various reasons. Although some of the earliest Western artists in China (including watercolors) studied at the Tushanwan School of Painting, watercolors were still largely absent from Chinese painting until 1911.



It was only in the 20th century, when Chinese students returned to China, and the teaching of Western painting gradually progressed, that watercolor painting developed, and it was only a century later. Unlike other types of painting that have been involved in the history of China, watercolor has not been very active in all periods of Chinese history». [1]

For example, the Chinese engraving during all periods of the Civil War was closely related to its events and actively expressed the mood of the time, which led to a large number of engravings. Oil Chinese painting, from the time of Western learning to the present, was closely linked to every historical era. The great artists working in the technique of oil painting, beginning with the “art revolution”, became more involved in the expression of society’s aspirations, creating many works.

In contrast, watercolors remained a chamber art and did not take an active part in public life. However, watercolor painting is constantly developing in China and is closely related to Chinese art academies. Academies represent the most fundamental artistic environment of Chinese watercolors in modern times. Each individual watercolor artist is almost forced to have an implicit connection with this medium. The interaction between watercolors and academies led to the development of Chinese art academies, which had a profound impact on the creation and presentation of watercolors.

In the early years of the People’s Republic, as the spirit and desire to transform society were supported by Liang Qichao, Cai Yuanpei and other intellectual elites, there was a massive boom in founding art schools in Jiang, Zhejiang, Suzhou, Linnan, Beijing, Tianjin and Shanghai, who were relatively economically and culturally active. Shanghai Academy of Graphic Arts (founded in 1912 by Liu Haisu and Zhang Yuguang, later transformed into Shanghai College of Visual Arts), National Beijing Art College (founded in 1918 with Zheng Jin as first director, later transformed into the National Peking Art College), art faculty of Nanjing National Central University (founded in 1927 with chairman Xu Beihong) Hangzhou National Art Institute (founded in 1928 with Lin Fenmyang as president, later transformed into Hangzhou National Art College) and National Art Institute (founded in 1928 with Lin Feng Myang as president, later transformed into the Hangzhou National Art Institute). (founded in 1928, President Lin Fenmyan, later transformed into the Hangzhou National Art College and the Chinese Academy of Fine Arts) and the Guangzhou College of Fine Arts (founded in 1922, President Xu Chongqing, Director of Academic Affairs Hu Gantian and Director of General Affairs Feng Ganbai) prepared the ground for the spread of watercolor painting. [2]

During this period, the Chinese desire for science reached almost unbearable proportions, and in the eyes of the Chinese at the time Western education was

undoubtedly the equivalent of science. With the influx of large numbers of international students to Europe, the United States, and Japan, Western learning has become more integrated in China. Of course, it involved watercolors. At the beginning of the 20th century, watercolors were viewed as part of Western education and were a direction of artistic modernization that haunted China. Artists who returned to China after studying abroad, such as Li Shutun, Feng Ganbai and Li Ishi, were well-trained in watercolor, and they tended to teach students at the Academy the knowledge of Western realistic painting (including perspective, *kyaroskuro*, color, etc.), which they believed was a scientific and progressive development. This corresponded to the society that promoted the idea of “Master Science”. It was this desire for science and modernity that led these nascent art academies to produce a large number of watercolors for China, which objectively constituted the majority of Chinese watercolors.

As a result, Chinese watercolor painting entered a phase of growth in the 1930s, when watercolor became more professional when students returned after studying abroad. This period was accompanied by several ideological movements, and watercolors entered a completely new period of development. This was manifested in the consistent establishment of art academies and a more authoritative form of the diffusion of watercolor art. A large number of educated people joined watercolors, expanding the way of watercolors.

Even though a large number of artists were engaged in watercolor and made their mark, the status of watercolors at the Academy during this period remained auxiliary as a means of learning plastic arts. This role continued throughout the republican, anti-Japanese, and civil periods of Chinese watercolor development.

After the formation of New China, a certain institutional guarantee of the “Chinese process” of watercolors was created, and after 1949 most of the best artists were concentrated in art academies, which became units for collecting artists. The combination of the revolutionary Yanan model and the academy model, with its emphasis on basic training and creative work, formed the basis of the new Chinese artistic education system. So many artists were willing to heed the call of the times and do their utmost to express the combination of “revolutionary realism and revolutionary romanticism” and the abundance of construction scenes in Chinese watercolors is clear evidence of the state’s desire to change the trajectory of artists through the distinctive nature of its political position. “Within the framework of the “state-academic” model of watercolor art, she was impressed into the amber of realism as a struggling being. The Academy, in an atmosphere of “responsiveness” to the State, also shaped the direction of artistic expression.

Until the 1980s, watercolor was taught in the architectural faculties of universities and even in the faculties of oil painting, sculpture and engraving of major art colleges, but was considered only as a basic course of teaching color, This was

also true in the art faculties of teacher training colleges. In 1981, the Faculty of Art Education of the Guangzhou Academy of Fine Arts took the initiative and proposed watercolor as a major subject, which was a decisive step from the beginning of the “independence” of watercolors. After all, the “basic” nature of the subject was a prerequisite for the Watercolor Academy to be named. The Guangzhou Academy of Fine Arts was very strict about teaching watercolors, and not only that, she also made drawing, oil painting and Chinese painting basic courses for watercolors. This model of linking professional courses with further training has given Chinese watercolors a really solid foundation, from which the “independent” Watercolor Academy was born and from which it has benefited. [3]

Since 1978, modern Chinese academic watercolors and their institutes have been reconstructed and expanded, creating objective conditions for the establishment of order at the physical level. By this time, the Chinese watercolor arts were gradually moving out of the basic color framework and gradually becoming bold and innovative, as watercolors began experimenting with different materials to express different textures. But “the beauty of water separation, the beauty of color, the beauty of the brush and the beauty of transparency presented in the painting, are the main attributes of the aesthetics of watercolor painting, defined by materials, and are the basic connotation of the concept of watercolor painting as a genre, and therefore, artistic bottom line of watercolor painting, which we must adhere to for the moment.” This focus on the work of the brush largely connects watercolor with the technique of Chinese painting. At the same time, this creative philosophy retains a strong unity with the mainstream culture, and therefore the development of Eastern color in Chinese watercolors has become a breakthrough trend for many Chinese watercolors.

Modern Chinese watercolor painting is essentially an artistic style, derived from traditional Western aesthetics, classical Chinese aesthetics, and teaching life drawing and realistic techniques taught at the academy. The participation of watercolor painting in the modernization of China was inextricably linked to modern thinking and art education. Before and after the “Fourth of May” movement, art education was spread, colleges were established, and watercolor art became popular; during the period of reforms and openness, watercolor art became even more colorful. In watercolor painting, China formed its own tradition, and watercolor painting entered modern Chinese art as a free and elegant means of emotional expression for Chinese artists.

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婴儿急性肾功能衰竭无尿期血肌酐、尿素、钾的相关性  
**CORRELATION OF CREATININE, UREA, POTASSIUM IN BLOOD  
IN THE PHASE OF ANURIA AT ACUTE RENAL FAILURE IN  
INFANTS**

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注解。 通过研究急性肾衰竭第一天复合强化治疗期间的监测数据,发现44名幼儿(3岁以下)血液中尿素浓度增加了2.5-4倍。 第一组包括在ICU接受长达10天重症监护的患者(15例),第二组(16例)经过11-65天重症监护后结果良好,第三组(13例)预后不良。 血肌酐指数在1天内升高1组4倍,2组3倍,3组5倍。 三组均在一日内出现中度高钾血症。 第三组最重儿童的肌酐水平高于第一组和第二组儿童。 在第一组中,血液中的肌酐浓度与镇静量(0.8)直接相关,与抗炎(-0.76)、抗菌(-0.84)、血管舒张(-0.84)、每日引入液体量呈负相关(-0.82)和释放尿液量(-0.91)。 第2组和第3组的儿童完全没有相关性。 3岁以下儿童急性肾衰竭中增加输液治疗和刺激肾功能导致血浆钾下降。

关键词: 肌酐, 尿素, 钾, 急性肾功能衰竭, 儿童。

**Annotation.** *An increase of 2.5-4 times in the concentration of urea in the blood of 44 young children (up to 3 years of age) was detected by studying the monitoring data of complex intensive therapy during the period of acute kidney failure during the first day. The first group consisted of patients receiving intensive care under ICU for up to 10 days (15), the second group (16) with a favourable outcome after intensive care for 11-65 days, the third group with an adverse outcome (13). Blood creatinine index was increased in 1 day 4 times in 1 group, 3 times in 2, and 5 times in 3 groups of children. Moderate hyperkalemia in one day was found in all three groups. The level of creatinine in the heaviest children in the third group was higher than in the first and second groups of children. In group 1, there was*

*a direct correlation of creatinine concentration in the blood with sedation volume (0.8), negative with anti-inflammatory (-0.76), antibacterial (-0.84), vasodilatory (-0.84), daily volume of introduced fluid (-0.82), and volume of released urine (-0.91). Children in groups 2 and 3 had no correlation at all. Increased infusion therapy and stimulation of kidney function in acute renal failure in children under 3 years of age contributed to the decrease in plasma potassium.*

**Key words:** *creatinine, urea, potassium, acute renal failure, children.*

**Relevance.** The most common causes of intermittent acute renal failure (ARF) in children are dehydration against the background of acute gastroenteritis, accompanied by fluid loss through the gastrointestinal tract (vomiting, diarrhoea), exogenous (poisoning) and endogenous (sepsis) intoxications, and so-called «loss to the third space» (in case of burns, nephrotic syndrome, liver diseases). Oliguria/Anuria have serious consequences. Criteria for Acute Renal Failure (ARF) are: creatinine, urea, potassium in the blood. Creatinine is a chemical compound that occurs in humans as a result of the breakdown of protein molecules. At the beginning of the creatinine formation chain there is creatine (nitrogenous carboxylic acid), this substance, entering the muscles, is converted into creatine phosphate, and then breaks down into creatinine and phosphate, giving the muscles the energy to contract. Creatinine is easily excreted from the body with urine. Urea is one of the end products of protein metabolism containing nitrogen. It's produced in the liver, transferred by the blood to the kidneys, filtered through the vascular ball, and then released. The result of the urea test in the blood is an indicator of globular production and urine excretion. The level of urea should be interpreted in the same way as creatinine. Potassium is involved in the transmission of nerve impulses, muscle contraction, and kidney function. Kidney diseases and the use of certain medications can cause excessive levels of potassium in the blood serum (above 5.0 mmol/liter). Severe hyperkalemia (>6.5 mmol/litre) is a life-threatening emergency requiring immediate care and treatment. The purpose of intensive CKD therapy is to prevent potentially lethal complications and kidney ischemia, such as pulmonary and brain edema, hypervolemia (volume overload), hyperkalemia, acidosis, and drug toxicity. The authors consider that the addition of potassium to infusion solutions and the use of drugs that can increase potassium levels (angiotensin-transforming enzyme inhibitors) are unacceptable. Early onset of in-vitro detoxification prevents the development of multiple organ failure. Numerous studies have confirmed the concept that antihypertensive therapy slows the progression rate of HPN [1-4]. However, there is insufficient data to assess the effectiveness of integrated intensive care in early childhood, leading to the study.

**Work objective.** Study and determine the correlation of the correlation of creatinine, urea and potassium and the severity of the condition in the phase of anuria at acute renal failure in infants.

**Material and methods of research.** The monitoring data of 44 ARF children admitted to Republican Science Center for Emergency Medical Care. with anuria from 1 to 5 days at the age of 10 months to 3 years 4 months from the Republican Science Center for Emergency Medical Care of the Regional Children’s Hospitals and Branches were studied. Prior to admission to the clinic, all patients received anti-inflammatory therapy, directed at the treatment of ARI-2, pneumonia 32, glomerulonephritis 16, AII-6 patients. Patients were given invasive mechanical respiratory support from the first day in connection with severe progressive respiratory failure. All patients underwent hemodialysis, 4 - in combination with plasmapheresis under the control of hemodynamics, acid-alkaline state (AAS), respiratory system ,supporting, antibacterial, anti-inflammatory, syndromic corrective intensive therapy according to the recommendations in the literature. A favorable outcome with full renal functional activity and discharge from hospital was observed in 31 children (1 and 2 groups), an unfavorable outcome - in 13 children (3 groups). The first group consisted of patients who received intensive care under Republican Science Center for Emergency Medical Care for up to 10 days (15), the second group was children (16) with a favorable outcome after intensive care for 11-65 days.

As shown in table 1, the duration of intensive care in children in groups 2 and 3 was reliably significantly longer than the duration of treatment in group 1 by 20 days or more ( $p < 0.05$ , respectively). In Group 2, mechanical respiratory support (MRS) was 18.6 7.5 days, in Group 3 - longer MRS, unfortunately, did not improve the outcome of the disease.

**Table 1.**  
*Patient record*

Groups	Age (months)	Mechanical ventilation (days)	MRS (days)	In hospital (days)
1	29±2,8	0	0	7,8±1,5
2	19±7,7	4,3±3,5	18,6±7,5	27,8±4,3*
3	30,5±6,5	5,5±0,5	25,5±6,7	30,7±6,8*

\*-difference is valid against the indicator in 1 group.

**Results And discussion.**

**Table 2.**  
*Trends in acute renal failure of children under 3 years*

days	Urea, mmol/l			Creatinine, cmol/l			Plasma potassium, mmol/l		
	1 group	2 group	3 group	1 group	2 group	3 group	1 group	2 group	3 group
1	32,5±6,6	20,5±5,8	33,8±6,2	0,4±0,1	0,3±0,1	0,5±0,2	5,0±0,2	4,4±1,1	5,6±0,8
2	26,4±5,8	26,6±10,3	36,9±11,6	0,4±0,02	0,3±0,1	0,4±0,1	4,4±0,5	4,1±1,3	4,8±0,6

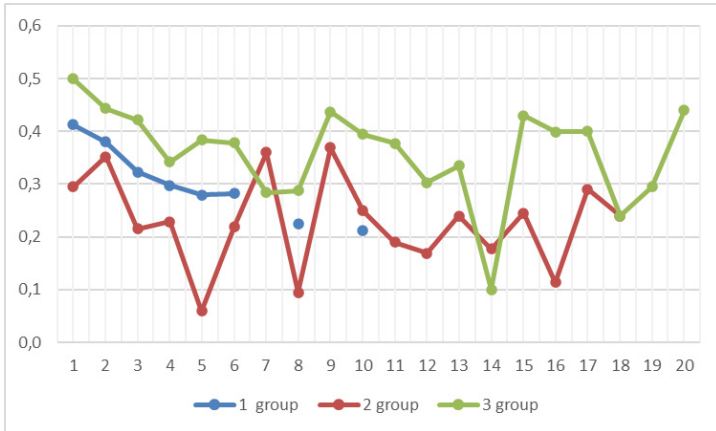
3	26,8±5,6	18,2±5,0	22,5±4,6	0,3±0,1	0,2±0,1	0,4±0,1	4,6±0,5	4,4±0,8	4,2±0,9
4	20,5±5,8	15,8±6,0	23,2±6,4	0,3±0,1	0,2±0,1	0,4±0,1	4,6±0,3	4,3±1,1	4,7±0,5
5	18,9±3,9	8,9±3,8	22,5±6,7	0,3±0,1	0,2±0,1	0,4±0,1	4,3±0,9	4,0±0,7	4,8±0,5
6	20,8±7,1	13,2±5,9	20,8±6,1	0,3±0,1	0,2±0,1	0,4±0,1	3,3±0,6	3,1±0,5	5,1±0,3
7		17,7±4,6	22,9±8,3		0,3±0,1	0,4±0,1		4,2±0,7	4,6±1,3
8	13,7±1,6	11,9±4,1	24,5±7,5	0,2±0,1	0,2±0,1	0,4±0,1	3,7±0,6	3,3±0,4	4,7±1,1
9		17,7±9,2	24,9±3,3		0,3±0,3	0,4±0,2		4,6±2,5	4,4±0,7
10	20,3±5,9	18,6±8,9	21,8±1,9	0,2±0,02	0,2±0,1	0,4±0,1	3,8±0,7	2,9±0,3	4,0±0,1
11		17,4±7,1	20,7±1,5		0,2±0,1	0,4±0,1		3,4±0,6	4,3±0,5
12		10,4±4,7	24,9±12,4		0,2±0,1	0,3±0,1		3,4±0,4	4,7±0,7
13		11,9±7,3	21,8±8,7		0,2±0,1	0,4±0,1		3,8±0,5	4,7±0,5
14		13,4±5,1	15,4±4,4		0,2±0,1	0,2±0,1		3,3±0,7	2,9±0,5
15		12,4±5,4	24,3±7,0		0,2±0,1	0,4±0,0		3,9±0,6	4,5±0,7
16		11,6±6,2	24,6±5,1		0,2±0,1	0,4±0,1		3,7±0,4	4,6±1,3
17		14,8±7,8	21,9±6,2		0,2±0,1	0,3±0,1		3,1±0,9	3,9±1,1
18		14,8±6,3	22,8±5,8		0,2±0,01	0,3±0,1		2,5±0,7	3,3±0,3
19			22,8±5,8			0,3±0,1			3,3±0,3
20			22,4±6,8			0,3±0,1			3,1±0,8

In the first day of treatment in group 1, an increase in the concentration of urea in the blood was found to be 4 times relative to the generally accepted norm, in group 2 2 by 2.5 times and in group 3 by 4.2 times. In the process of almost daily hemodialysis swans, the level of urea in the plasma U was only reduced by 8 days to 13.7 1.6 mmol/l (table.2). However, the tendency to increase the indicator to 20.3 5.9 mmol/l on the 10th day of treatment under conditions of positive clinical indicators, hemodynamics, respiration, excretory activity of kidneys remained. The latter can be explained by high catabolism caused by the main disease (severe foetal pneumonia, secondary damage to the parenchymatous organs). Blood creatinine index was increased in 1 day 4 times in 1 group, 3 times in 2, and 5 times in 3 groups of children. The extracorporeal method of blood purification managed to reliably significantly reduce the level of creatinine concentration in the blood in 1 group for only 8 days to 0.2 0.1  $\mu\text{mol/l}$ , in 2 group for 3 days the indicator decreased to 0.2 0.1  $\mu\text{mol/l}$ , remaining at this level during observation. In the 3 heaviest group, where the indicator was initially the highest level of blood creatinine, the trend was found to decrease to 0.2 0.1  $\mu\text{mol/l}$  only on the 14th day with some tendency to increase in the following days.

Moderate hyperkalemia in one day was found in all three groups. The decrease in potassium concentration to 3.3 0.6  $\mu\text{mol/l}$  was observed in 1 group for 6 days, in 2 group the decrease trend was noted for 6 days, before hypokalemia - for 18 days. In children of group 3 a reliable significant decrease in the concentration of potassium in the plasma was observed only on 14 days to 2.5 0.5 mmol/l, which

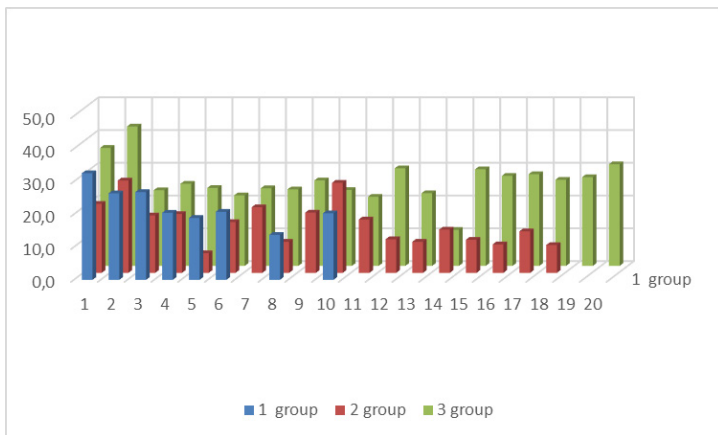


is not an indicator of effective correction of electrolytic imbalance, corresponded to the severity of patients



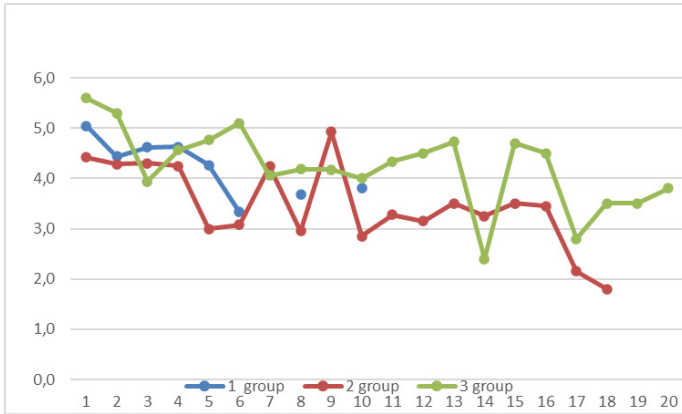
**Picture 1.** Plasma creatinine dynamics up to 3 years

In general, the level of creatinine in the heaviest children in 3 groups fluctuated at the highest figures than in 1 and 2 groups of children (Pic.1).



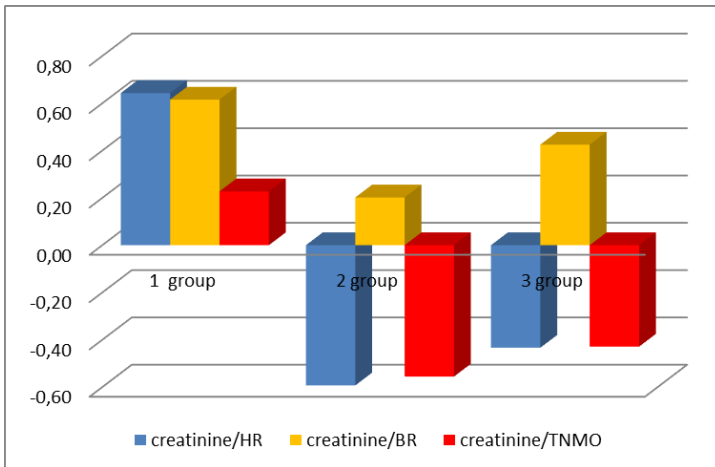
**Picture 2.** Development of urea by severity of acute renal failure up to 3 years.

It is noteworthy that the level of urea in the blood also fluctuated at a higher level than in groups 1 and 2



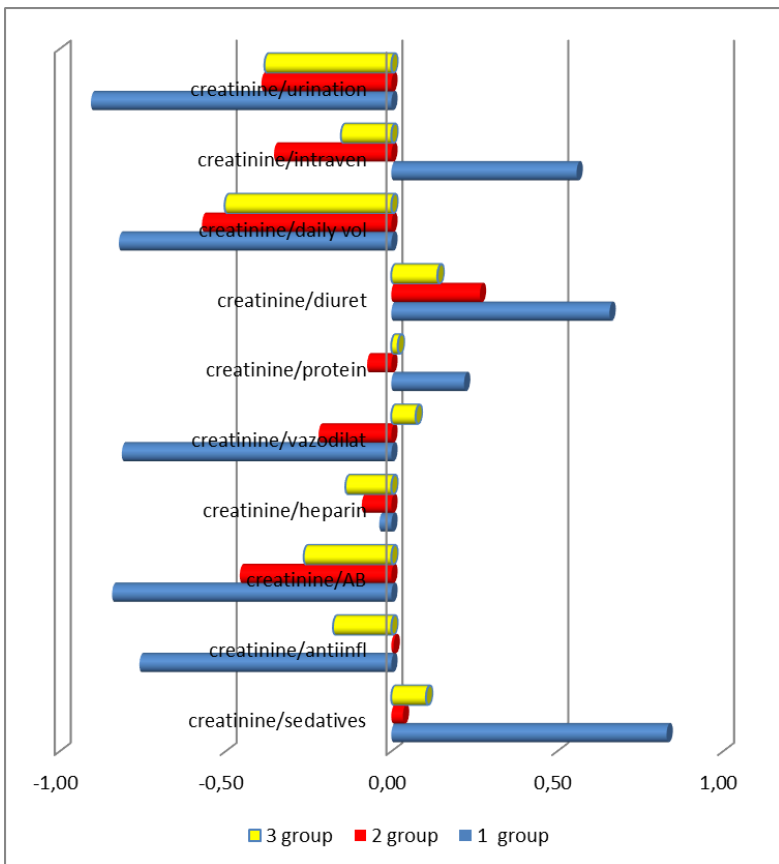
**Picture 3.** Development of plasma potassium by severity of acute renal failure up to 3 years.

The concentration of potassium in the blood during the period of anuria in group 1 ranged from 5 to 3.3 mmol/l, in group 2 from 4.4 to 1.8 mmol/l, in group 3 from 5.6 mmol/l in the first day to 2.8 mmol/l for 17 days. The cause of death of patients in 3 groups was pneumonia, in 10 - multi-organ insufficiency syndrome against the background of relatively restored excretory kidney function.

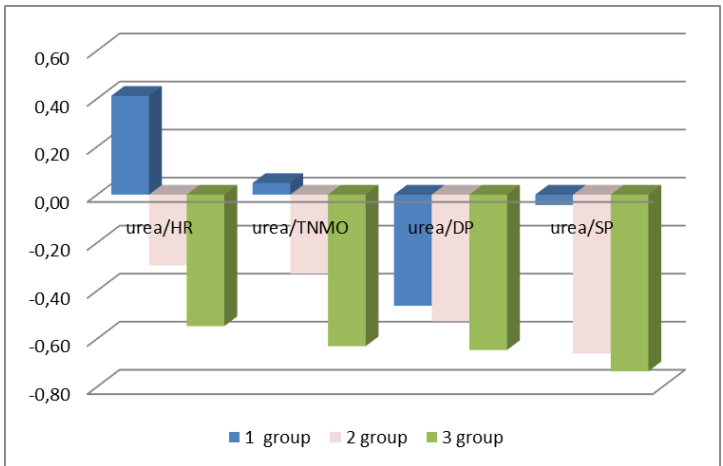


**Picture 4.** Correlation of blood creatinine with hemodynamics.

There is a tendency of direct correlation of creatinine change in the blood with the heart rate (0.64) and breathing rate (0.62) in 1 group, and negative correlation with the heart rate (-0.59) and mitral valve prolapse (-0.56) in 2 group. The largest number of correlations in 1 group is evidence of preservation of compensatory mechanisms of reaction of organs and systems in conditions of independent breathing, minimal sedative therapy. For example, there was a direct correlation between creatinine concentration in the blood with sedation volume (0.8), negative with anti-inflammatory (-0.76), antibacterial (-0.84), vasodilatory (-0.84), daily volume of introduced fluid (-0.82), and volume of released urine (-0.91). While children of groups 2 and 3 had no correlation at all (Pic.5).

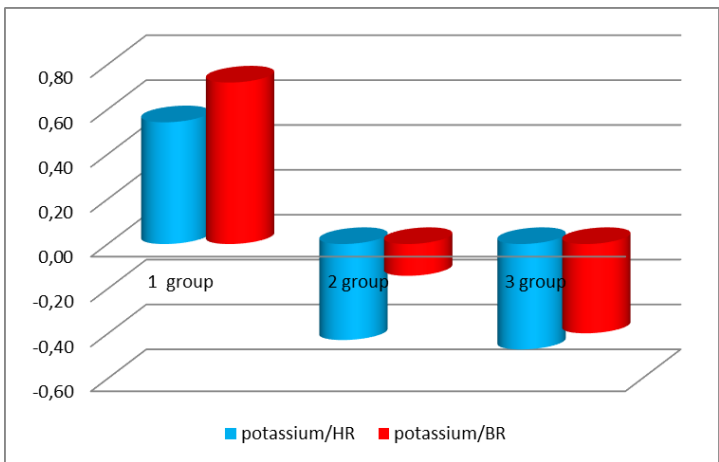


*Picture 5. Blood creatinine correlation with treatment*



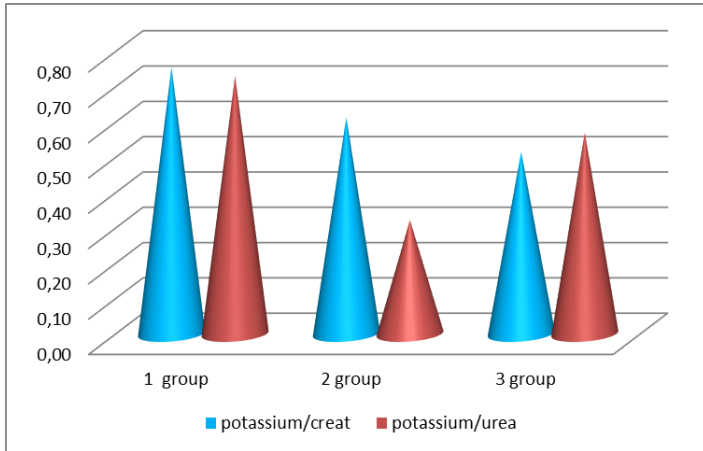
**Picture 6.** Correlation of urea with hemodynamia and respiration.

Reverse trends in blood urea correlation in the 2 and 3 groups were noted, which corresponded to the negative influence of urea growth on heart rate, myocardial oxygen demand, systolic blood pressure and diastolic blood pressure levels in the phase of acute kidney failure up to 3 years (pic.6).



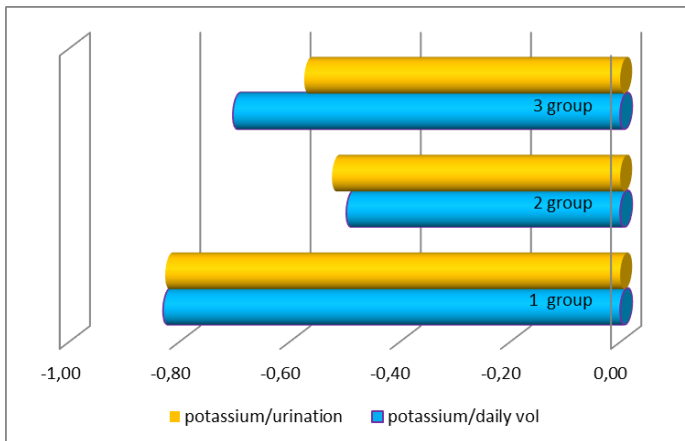
**Picture 7.** Correlation of potassium plasma changes with hemodynamics, respiration parameters.

The toxic effect of potassium on heart function is known. In Group 1, there is an inclination to tachycardia in the growth of potassium plasma. However, in 2 and 3 groups of children, only the tendency to reduce heart rate and respiration in hyperkalemia is noted, which corresponds to the existing representation of hyperkalemia toxicity.



**Picture 8.** Correlation of potassium with creatinine and urea blood.

All children have a direct correlation between changes in potassium, creatinine and urea levels, most pronounced in group 1 patients (pic. 8).



**Picture 9.** Correlation of potassium plasma with water balance parameters.

The closest inverse dependence of the blood potassium level on the volume of daily infusion and excretory activity of kidneys is found in children of group 1, and inclination - in groups 2 and 3 (pic.9). In other words, increased infusion therapy and stimulation of kidney functional activity in open opiates in children up to 3 years of age contributed to a decrease in plasma potassium.

**Conclusion.** In the first day, an increase in the concentration of urea in the blood was found to be 2.5-4 times. Blood creatinine index was increased in 1 day 4 times in 1 group, 3 times in 2, and 5 times in 3 groups of children. Moderate hyperkalemia in one day was found in all three groups. The level of creatinine in the heaviest children in the third group was higher than in the first and second groups of children. In group 1, there was a direct correlation of creatinine concentration in the blood with sedation volume (0.8), negative with anti-inflammatory (-0.76), antibacterial (-0.84), vasodilatory (-0.84), daily volume of introduced fluid (-0.82), and volume of released urine (-0.91). Children in groups 2 and 3 had no correlation at all. Increased infusion therapy and stimulation of kidney function in acute renal failure in children under 3 years of age contributed to the decrease in plasma potassium.

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唾液腺病合并幽门螺杆菌感染患者腮腺唾液细胞因子浓度  
**CONCENTRATION OF CYTOKINES IN PAROTID SALIVA  
IN PATIENTS WITH SIALADENOSIS AND HELICOBACTER  
PYLORI-INFECTION**

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抽象的。本文分析了唾液腺病和幽门螺杆菌感染患者腮腺唾液腺的功能活动以及促炎和抗炎细胞因子的浓度。在研究过程中，监测了唾液分泌不足的表现程度以及IL-1 $\beta$ 和TNF $\alpha$ 的浓度，根据文献，这表明幽门螺杆菌的毒力特性的表现。同时，腮腺分泌物中IL-6的增加和IL-10的减少表明这是一个慢性过程。

关键词：唾液腺、唾液腺病、白细胞介素、幽门螺杆菌。

**Abstract.** *This article analyzes the functional activity of the parotid salivary glands and the concentration of pro- and anti-inflammatory cytokines in patients with sialadenosis and Helicobacter pylori infection. During the study, the degree of manifestation of hyposalivation and the concentration of IL-1 $\beta$  and TNF $\alpha$  were monitored, which, according to the literature, indicates the manifestation of the virulent properties of H. pylori. At the same time, an increase in IL-6 and a decrease in IL-10 in parotid secretions indicate a chronic process.*

**Keywords:** *salivary glands, sialadenosis, interleukins, Helicobacter pylori.*

### **Relevance**

Sialadenosis (sialosis) is a non-inflammatory functional-dystrophic process in the salivary glands (SG), which occurs with metabolic disorders against the background of general somatic diseases, including the pathology of the gastrointestinal tract (GIT) [1].

The frequency of occurrence of sialadenosis, according to statistical studies, is 10-18%, while the parotid salivary glands (PSG) are mainly involved in the pathological process [2].

According to the World Gastroenterological Association (2021), one of the significant medical and social problems of the 21st century is infection caused by *Helicobacter pylori* (HP), which in turn is the leading etiological factor in the development of gastric ulcer (GU) [3].

It has been proven that a significant increase in the concentration of pro-inflammatory IL-1 $\beta$  and TNF $\alpha$  in the blood serves as a marker of the persistence of pathogenic strains of HP [4], while a decrease in anti-inflammatory interleukins (IL-10, etc.) indicates the development of immunosuppression of the body [5].

Despite the effectiveness of various schemes of eradication therapy in the gastrointestinal tract, HP is determined in the oral cavity (in mixed saliva, plaque, periodontal and periodontal pockets, gum biopsies), which allows us to consider it a secondary reservoir of infection [6, 7].

As a result of the scientific work of T. B. Sultimova et al. (2022) found that in parotid saliva, the concentration of pro-inflammatory interleukins significantly increases and anti-inflammatory interleukins decrease in parotid saliva in sialosis of PG with concomitant pathology of the thyroid gland [8]. Thus, it seems possible to assess the local cytokine status of SG secretion [9].

In addition, in recent years, salivary diagnostics has been of increasing scientific interest to gastroenterologists, due to the recretory ability performed by the salivary glands, due to the diffusion of endo- and exogenous substances from the blood stream through the hematosalivary barrier into saliva (HSB) [10]. It has been established that chronic infection of the gastrointestinal tract reduces the permeability coefficient (PC<1) of GSB, resulting in the activation of acid phosphatase and a change in the buffer capacity of mixed saliva [11].

According to research by I. N. Antonova et al. (2021), inhibition of SG secretory activity in gastrointestinal pathology contributes to the development of hyposalivation [12]. Clinically, it is manifested by dry, insufficiently moistened, easily vulnerable oral mucosa (VOM) and recurrent pathomorphological elements, as well as multiple defects in hard dental tissues, due to demineralization processes [12]. In addition, a number of scientific works demonstrate the relationship of gastrointestinal pathology with an increased risk of development and severe course of periodontal diseases, which in turn contribute to the body's immunosuppression [13, 14].

In connection with the foregoing, the study of the concentration of pro- and anti-inflammatory interleukins in the secretion of PG is an important prognostic criterion for the pathogenetic mechanisms of *H. pylori* in the development of sialosis.

The aim of the study was to evaluate the effect of the level of the parotid saliva cytokine profile on the course of sialadenosis PSG in patients with GU associated with HP infection.



## Materials and methods

In 2020-2023 46 people were examined at the clinical base of the Department of Dentistry of the FSBI DPD “Central State Medical Academy” and the Department of Gastroenterology and Hepatology of the FSBI “Polyclinic No. 1” 46 people were examined: women - 37 (80.4%), men - 9 (19.6%). The average age of the subjects was  $45.6 \pm 10.8$  years.

The criterion for inclusion in the study was patients with sialadenitis PSG and GU associated with HP infection (enzyme-linked immunosorbent assay of blood serum Anti-H. pylori IgG), before eradication therapy at the age of 35-55 years.

Exclusion criteria – persons after eradication, HP negative, with sialadenitis, recently suffered infectious and viral diseases, pathology of the cardiovascular, endocrine and nervous systems in the stage of decompensation, oncology, Sjögren’s syndrome and disease.

Due to the absence of reference values of pro- and anti-inflammatory cytokines in parotid saliva, patients without clinical signs of SG pathology and with a negative result for HP-infection were included. Based on this, the following groups were formed:

I (control) — 20 practically healthy people aged 22-29 years: female — 14 (70%), male — 6 (30%).

II – 46 people with sialadenitis PSG and GU, associated with HP, before the eradication of 35-55 years: women — 37 (80.4%), men — 9 (19.6%).

All subjects underwent a comprehensive dental examination using the following methods: general (collection of complaints and medical history, examination of the external and oral cavity), specific (sialometry, sialography) and special - determination of the levels of pro- and anti-inflammatory cytokines in the parotid secretion.

The collection of complaints was carried out with the help of a questionnaire, which included questions:

- dryness and its manifestations: insufficient amount of saliva, impossibility of chewing dry food (sandwich, dry food) without drinking water, poor fixation of removable prostheses, burning and relapses of COPD diseases;
- presence of one-sided or two-sided increase in SG.

Sialometry PSG according to the method of M. B. Simonova (1982) performed on an empty stomach in the morning, using the Leshly-Yushchenko-Krasnogorsky capsule.

Saliva was collected in a graduated test tube. After the appearance of the first drop, salivation was stimulated by introducing a 3% solution of ascorbic acid into the oral cavity every 30 seconds for 5 minutes. The received volume of saliva was evaluated: quantity and transparency.

The test tubes with the secretion of PSG were frozen ( $t = -20^{\circ}\text{C}$ ) and transferred in a special transport refrigerator to the laboratory of “Scientific Center EFiS”

LLC to determine the concentration of IL-1 $\beta$ , 6, 10 and TNF $\alpha$  (pg/ml) by enzyme immunoassay (EI). (set "Vector Best", Russia).

For the assessment of organic changes in the structure of PSG, according to the method of I. F. Romacheva and co-authors. (1987), performed sialography on the orthopantomograph Planmeca ProMax (Finland) with pre-filling of the ductal system with water-soluble iodinated radiocontrast drug "Omnipak" 350 mg.

The data received during the work were processed with the help of the software "Statistica 13.3". Values with  $p < 0.05$  were considered statistically significant.

### **The results**

Patients from the control group did not complain of dryness in the mouth, the ENT was not palpated. The mucous membrane of the oral cavity is pale pink, moderately moistened, without pathological elements.

4.55 $\pm$ 0.07 ml of clear, transparent parotid saliva was obtained during the sialometry of the PSG, which corresponded to the normal level of salivation (according to the classification of M. V. Simonova, 1982).

In the laboratory diagnosis of parotid secretion by the IFA method, the limits of the control values of the investigated cytokines were determined: IL-1 $\beta$  4.87 $\pm$ 0.56 pg/ml, IL-6 was 7.96 $\pm$ 0.78 pg/ml, while only insignificant concentration was noted

TNF $\alpha$  0.21 $\pm$ 0.016 pg/ml and the level of anti-inflammatory IL-10 19.23 $\pm$ 0.38 pg/ml exceeding the above figures, providing local immune protection.

On the sialograms, the main and ducts of the I, II, III, IV orders were visualized in the form of a "tree-like" pattern, homogeneously filled with radiopaque material, no changes in the structure of the glands were detected.

In patients of the II group with IBD associated with HP, in 69.6% of cases, complaints of dryness of COPD, burning of the tongue in 54.3%, and burning of the tongue in 34.7% were noted. presence of erosions and ulcers in the anamnesis. On external examination, there was a bilateral enlargement of the ENT, painless on palpation, with a soft-elastic consistency. In 73.9%, weakly hyperemic, insufficiently moistened COPD was determined with the presence of foamy viscous saliva in the oral cavity, as well as multiple defects of the hard tissues of the teeth. The dental status was characteristic for the manifestation of a clinically expressed stage of hyposalivation.

These sialometry data of PSG amounted to 1.23 $\pm$ 0.35 ml and corresponded to the II degree of xerostomia (according to the classification of M. V. Simonova, 1982).

When studying the cytokine profile, a significant increase in the concentration of pro-inflammatory

TNF $\alpha$  in 2 times, IL-1 $\beta$  in 1.6 times, IL-6 almost in 3 times, with a simultaneous sharp decrease in anti-inflammatory IL-10.

On the sialogram of the PSG, the ductal system was homogeneously filled with radiopaque, there was a narrowing of the ducts of the main and I, II order, while the ducts of the II, III, IV order were barely visible, which was interpreted as interstitial sialadenosis.

### Conclusion

The obtained results of a significant increase in the index of pro-inflammatory IL-1 $\beta$  in saliva in patients with GU confirm the literature data on the presence of high virulence and the manifestation of pathogenic properties of *H. pylori* [15]. At the same time, the synthesis of pro-inflammatory TNF $\alpha$  and IL-1 $\beta$  is enhanced in the parotid secretion, leading to the launch of immune cell chemotaxis, activating lipid peroxidation processes and the development of aseptic inflammation in the PSG [5, 15, 16].

At the same time, the reverse dynamics of an increase in the concentration of IL-6 and a decrease in the anti-inflammatory IL-10 in the parotid secretion indicates a chronic process in the PSG [5, 15].

These indicators reflect an objective decrease in function and organ disorders in the structure of the PSG, which is diagnosed as sialadenosis in patients with GU before eradication.

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抽动样疾病的脑电图诊断特点

## FEATURES OF EEG DIAGNOSTICS IN TIC-LIKE DISORDERS

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注解。 本文介绍了脑电图 (EEG) 检查在抽动样疾病诊断中的重要性。 抽动样疾病患者脑生物电活动 (BEA) 最常见的特征被认为是: 背景节律紊乱、额叶-中央-顶叶导联中  $\delta$  和  $\theta$  节律功率谱增加、额叶导联中的  $\beta$ -1 和  $\beta$ -2 节律, 枕叶导联中的  $\alpha$ -节律减少。 抽动秽语综合征患者的脑电图特点是: 心律失常、不对称、非粗尖波。 显示了  $\alpha$  节律不对称表达与运动过度严重程度的相关性。

关键词: 脑电图、抽动样障碍、抽动秽语综合征。

**Annotation.** *The paper presents the importance of electroencephalographic (EEG) examination in tic-like disorders diagnosis. The most frequently occurring features of brain bioelectrical activity (BEA) in patients with tic-like disorders are considered: disorganisation of the background rhythm, increase of power spectra of delta and theta rhythms in frontal-central-parietal leads, increase of power spectra of beta-1- and beta-2-rhythms in frontal leads, decrease of alpha-rhythm in occipital leads. The features of EEG in patients with Tourette syndrome are described: dysrhythmias, asymmetry, non-coarse sharp waves. The correlation of alpha rhythm asymmetry expression depending on the severity of hyperkinesis is shown.*

**Keywords:** *electroencephalography, tic-like disorders, Tourette's syndrome.*

Tic-like disorders, F-95 according to ICD-10, 8A05 according to ICD-11, are one of the most common types of motor disorders in children. In childhood, the disease most often runs in a “wave-like” manner, with periodic relapses and subse-

quent remissions. The issue of qualitative and timely diagnosis is becoming more and more relevant due to the increasing number of patients with various forms of tics. According to various estimates, the prevalence of tics among children ranges from 1.6% to 24%, and the prevalence of Tourette's syndrome is up to 0.1%. Tourette syndrome is thought to be more common than diagnosed due to the fact that mild and non-disabling manifestations of the disorder predominate in this syndrome [1]. The diagnosis of generalised tics is made on the basis of clinical manifestations, but clinical evaluation should be supplemented with instrumental diagnostic methods. For differential diagnosis of neurosis-like and neurotic ticotic hyperkinesis, it is recommended to include in the clinical examination electroencephalography, ultrasound Doppler ultrasonography of cerebral and neck vessels.

Ultrasound Doppler ultrasonography of cerebral and neck vessels in patients with tic disorders reveals moderate cerebral angiodystonia (asymmetry of blood flow in the main vessels of the brain) [2]. During EEG examination in patients with tics, changes were observed in 8-44% of cases in the form of disorganisation of the background rhythm, excessive slow-wave activity was registered, which was regarded as residual-organic changes in the brain and subcortical structures. EEG data revealed a pronounced increase in the power spectra of delta and theta rhythms in frontal-central-parietal leads, an increase in the power spectra of beta-1- and beta-2-rhythms in frontal leads, and a decrease in alpha rhythm in occipital leads [3]. Visual analysis of EEG in patients with Tourette syndrome revealed a variety of disorders: dysrhythmias in the form of bilateral bursts of theta- and alpha-like waves and low-frequency beta oscillations of high amplitude with disorganisation of the basic rhythm, as well as diffuse sharp waves. Non-coarse sharp waves predominate, as a rule, in one of the hemispheres, more often in the left hemisphere, there is a marked asymmetry in the theta or alpha rhythm. Dysrhythmias are registered in the high and middle amplitude ranges, and the EEG recording contains an equal number of delta-, theta-, and alpha-band waves, among which it is impossible to identify the dominant rhythm.

The intensification of slow-wave activity with subsequent involuntary movements registered in the form of artefacts may indicate a delay in the formation of inhibitory structures of cortical biorhythmics in patients with tics, as indicated by the maximum expression of slow waves in patients with Tourette's syndrome, compared to patients with local and widespread tics. The analysis of spectral power registered in occipital leads (sensory cortex) and frontal leads (motor cortex), where the most stable rhythms are determined, allowed to reveal in tics patients a tendency to asymmetry and reduction of alpha rhythm power in occipital regions, especially in patients with Tourette's syndrome. The severity of alpha rhythm asymmetry depended on the severity of hyperkinesis. The coefficient of asymmetry in alpha-rhythm in patients with local tics averaged 10%, in patients with

widespread tics - 67%, in patients with Tourette's syndrome - 52%. It should be noted that in norm a certain functional asymmetry is registered, which can be 10-15% on average.

In patients with localised and widespread tics, the EEG showed variants of age normal, discharges of slow-wave activity on the background of dysrhythmia without hyperkinesia, dysrhythmia, asymmetry of alpha rhythm, single sharp waves. In patients with Tourette's syndrome who had status tics in the exacerbation stage, the following EEG signs were observed: Hyperkinesia pattern - bursts of slow-wave tics, followed by involuntary movements registered as artefacts (blinking, eye turning, shoulder twitching), decrease in spectral power of alpha rhythm in occipital region, predominance of slow-wave activity in motor cortex, asymmetry in amplitude of alpha and theta rhythms more than 20%. The frequency of discharges is an objective sign of hyperkinesia, as it depends on the severity of the tic. Evaluation of electroencephalographic parameters using computer analysis methods will help to further improve objective diagnostic criteria, as well as to assess the effectiveness of treatment [4].

Visual analysis of EEG showed that the absolute majority of patients with tics had a large number of slow waves, predominantly in the theta range, weak or absent regular alpha rhythm, and changes in the shape of alpha oscillations (deformed, sharpened or bifurcated peaks). Quantitative analysis of the EEG indicated that the bioelectrical activity of the brain in children with tics was characterised by increased slow-wave activity and decreased beta activity in frontal leads. Thus, the electroencephalogram in children with chronic tics is characterised by higher values of theta-rhythm and beta-1-rhythm ratios compared to healthy children and children with transient tics. Also, the electroencephalogram of children with tics is characterised by lower values of alpha-rhythm power in occipital leads compared to healthy children. In turn, the electroencephalogram of children with chronic tics is characterised by lower values of alpha-rhythm power in occipital leads compared to children suffering from transient tics. There is a pronounced functional immaturity of the brain underlying the occurrence of chronic tics. Thus, the literature data accumulated to date and the results of our own research suggest that tico-tic hyperkinesia may be associated with impaired functioning of cortico-strio-pallido-thalamic circles and monoaminergic systems modulating their activity [5].

It is known that the degree of severity and age dynamics of the alpha rhythm index reflects the process of brain maturation, the revealed reduction of the alpha rhythm indicates a decrease in the functional state of the cerebral cortex, possibly due to a delay in its morphofunctional maturation. EEG changes during ontogenesis reflect not only the maturation of the cortical neuronal apparatus, but also the dynamics of cortical-subcortical interactions in different age periods.

Taking into account that the alpha rhythm is the main rhythm of relaxed wakefulness, the increase in the beta rhythm index and its amplitude, detected in 48.7% of cases, against the background of alpha rhythm reduction can be considered as a sign of predominance of excitation processes in the cortex of the large hemispheres.

The decrease in the registration of high-amplitude beta-rhythm as patients with ticotic hyperkinesia grow older reflects the influence of the processes of age-related morpho-functional maturation of the cortex on the course of this disease and, in general, on the role of slowing the rate of maturation of cortical activity in the pathogenesis of ticotic hyperkinesia. The majority of examined children with ticotic hyperkinesia (71.7%) showed disorganisation of brain bioelectrical activity manifested in the following variants: dominance of high-amplitude beta rhythm with reduction of alpha rhythm, reduction of alpha rhythm index with increased theta activity, epileptic activity, as well as combinations of the above variants.

The most significant and frequently recorded EEG pattern in children with tics is a high-amplitude beta rhythm dominating in the recording. The frequency of detection of high-amplitude beta rhythm in children with tics decreases with age and is in direct correlation with the degree of prevalence of ticotic hyperkinesia, both in boys and girls. The changes in brain bioelectrical activity detected in children with tics indicate a delay in the maturation of the main cortical rhythms and allow us to consider the deficit of the controlling influence of the cerebral cortex on subcortical structures as one of the factors in the pathogenesis of tic disorders [6].

### **Conclusion**

Thus, it can be concluded that in the differential diagnosis of tic-like disorders, including Tourette's syndrome, an objective, clinically justified method of electroencephalography is relevant. There are typical patterns characteristic of tic-like disorders, such as disorganisation of the background rhythm, increased power spectra of delta and theta rhythms in frontal-central-parietal leads, increased power spectra of beta-1- and beta-2-rhythms in frontal leads, decreased alpha rhythm in occipital leads. Tourette syndrome is characterised by the following features: dysrhythmias, asymmetry, and sharp waves. There is also a correlation between the severity of alpha rhythm asymmetry and the severity of hyperkinesia. Electroencephalographic examination is a rather effective method of diagnosing tic-like disorders, as EEG changes are manifested, depending on the severity of the disorder, in 8-44% of patients with tic-like disorders.



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肱骨近端骨折的手术治疗

**SURGICAL TREATMENT OF FRACTURES OF THE PROXIMAL HUMERUS**

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抽象的。 本文向读者介绍了一种有效的肱骨近端骨折手术治疗技术。

关键词: 肱骨近端骨折, 肱骨外科颈骨折, 肱骨接骨术, 骨移植, 腓骨干皮质冻干移植术移植。

**Abstract.** *The article introduces the reader to an effective technique for the surgical treatment of fractures of the proximal humerus.*

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**Keywords:** *fracture of the proximal humerus, fracture of the surgical neck of the humerus, osteosynthesis of the humerus, bone grafting, grafting with a cortical freeze-dried graft from the fibula shaft.*

**Relevance.** Fractures of the proximal humerus account for about 5-7% of all fractures in adult patients and rank third in frequency among fractures in elderly patients. Currently, there are no unambiguous recommendations on the choice of tactics for the treatment of patients with fractures of the proximal humerus. This is due to a large number of possible treatment options: conservative and surgical, a large number of modifications of the surgical method of treatment.

**Goal of the work.** To develop a technique for surgical treatment of fractures of the proximal humerus and evaluate its effectiveness.

**Materials and methods.** We have developed a method for osteosynthesis of fractures of the proximal humerus. In 2020, osteosynthesis with a plate was performed in 70 patients with fractures of the proximal humerus (according to AO: B1-25, B2 - 17, C1 - 6, C2 - 15, C3 - 7). Men - 14, women - 56, average age - 64.3. Preoperative examination of patients included the obligatory performance of radiographs in standard projections and computed tomography of the shoulder joint. The purpose of computed tomography was to assess the nature of the fracture and assess the bone density of the proximal humerus. Therefore, CT was performed simultaneously for all patients of 2 shoulder joints. Based on CT slices, bone density was assessed in nine zones of interest with an area of 0.5 cm<sup>2</sup> at three levels with a step of 10 mm (indicating zones 1\_1, 1\_2, 1\_3; 2\_1, 2\_2, 2\_3; 3\_1, 3\_2, 3\_3, where the first digit indicates the level of measurement, the second – area of interest in the medial-lateral direction). When processing CT data, 5 areas of interest were developed, where bone density was variable (1\_2, 1\_3, 2-1, 2\_2, 3\_1). In zone 1\_1 bone density was always high, in zones 2\_3, 3\_2 and 3\_3 there was always a deficit of bone mass. We determined the average values of bone density for each of the 5 zones (Hounsfield units, uN). The assessment of bone density on the injured arm was recognized by us as unreliable due to the variety of displacement of fragments, so the measurement was performed on a healthy shoulder. A decrease in bone density in 3 or more zones by more than 30% of the average value obtained for each zone in young patients was regarded by us as an indication for bone grafting. The type of fracture was determined by Neer. Attention was paid to the integrity of the medial calcar margin (the so-called MC+/MC- fracture types). Surgical treatment was performed in the first 4-5 days after injury, through a standard deltopectoral approach, the fracture was fixed with lockable plates for the proximal shoulder. A feature of the proposed surgical technique was the mandatory intraoperative suture of the tendons of the supraspinatus, subscapularis and infraspinatus muscles with non-absorbable sutures (Terylen 5),

with which we started the surgical intervention. The suture of the tendons made it possible to navigate in the wound and use the threads as joysticks for repositioning bone fragments. After repositioning of the fragments of the head of the humerus, the threads were passed through the holes in the plate intended for this purpose, the plate was centered along the proximal fragment and fixed first with a central pin and then with 2 screws. After fixation to the proximal part, the diaphysis was repositioned, the plate was positioned in the center of the diaphysis, and the cortical screw was inserted into the oval hole in the plate. With a satisfactory position of the fixators according to the X-ray data, the rest of the screws were installed proximally and distally. At the same time, we did not install more than 5 screws in the proximal part. The threads were fixed to the plate with interrupted sutures, which improved the quality of fixation in conditions of low bone density in aged patients and prevented the loss of fixation and varus deformity in the early postoperative period. In our work we use allogeneic bone grafts. We have developed a decision-making algorithm for osteoplastic surgery. In the presence of bone mass deficiency (according to CT data) and the destruction of the calcar layer (MC-), plastic surgery was performed with a combined allogeneic graft from the head of the fibula. With sufficient bone density, but MC-fracture, plasty was performed with a cortical freeze-dried graft from the diaphysis of the fibula. In MC+ fractures and bone deficiency, only spongy grafts were used for plasty to restore the volume of the humeral head. Determining the indications and performing bone grafting is considered a mandatory option for surgical treatment. After osteosynthesis of the humerus, the axis of the limb, the position of the metal fixator, and the cervical-diaphyseal angle were evaluated. In the postoperative period, after the pain syndrome decreased, active therapeutic exercises were prescribed, in which the intensity and complexity of the exercises were increased as the pain syndrome decreased. After the reduction of postoperative edema, the condition of the tendons of the muscles of the upper urinary tract was monitored using ultrasound, which was performed through standard ECHO-locating points on a MyLab Class C device (Esaote, Italy) with a multifrequency linear transducer (5–13 MHz). Dynamic examination of patients (examination, radiography, ultrasound) was carried out at terms of 1.5; 3 and 6 months from the moment of operation. The results of treatment were assessed 1-1.5 years after the operation. The Simple Shoulder Test (SST), Oxford Shoulder Score (OSS), and the Constant scale were used for evaluation. The SST test recorded the number of “yes” answers as 1 point. When assessing OSS (12 questions), the maximum answer was rated as 4 points, the minimum as 0. The maximum total OSS score was 48.

The result. Satisfactory reposition and correct cervical-diaphyseal angle were achieved intraoperatively in all patients. A dynamic assessment of the tendons of the VMP muscles revealed a gradual decrease in edema and a lack of response to

the installed threads. Long-term results were evaluated in 48 (68.6%) people (B1 - 19, B2-12, C1 - 3, C2 - 10, C3 - 4). For B1 SST fractures, the average score is 10.4 (max 11, min 8), OSS average - 44.2 (max - 48 min - 34) Constant average 63 (max - 71 min - 40). For fractures B2 SST average score - 9.4 (max 12, min 4), OSS average - 40.6 (max - 48 min - 23) Constant average 54.1 (max - 70 min - 40). With C1 SST fractures, the average score is 10.6 (max 11, min 10), OSS average - 44.2 (max - 48 min - 42) Constant average 63.3 (max - 66 min - 61). For fractures C2 SST average score - 10 (max 11, min 9), OSS average - 43.8 (max - 45 min - 42) Constant average 62.5 (max - 65 min - 58). With C3 SST fractures, the average score is 5 (max 11, min 3), OSS average - 23.8 (max - 48 min - 12) Constant average 33.75 (max - 62 min - 14). One patient developed superficial suppuration, which was cured conservatively. In 1 patient, the fracture did not heal and a reverse endoprosthesis was placed. In 4 patients, a cut-out effect occurred, which was associated with partial avascular necrosis of the head of the humerus and required the removal of migrated screws. Plates were removed in 3 people due to discomfort. Moderate pain worries 3 of the interviewed patients. Satisfied with the function of the hand 39 patients (81.3%). A large number of unsatisfactory results in patients with type C3 fractures is associated with axillary nerve paresis, which was diagnosed in 3 out of 4 patients surveyed.

**Conclusion.** The developed method of surgical treatment made it possible to achieve positive results in 81.3% of cases in patients with severe fractures of the proximal humerus.

局部破坏与化疗方法对肝胆区不可切除肿瘤患者疗效的比较评价  
**COMPARATIVE EVALUATION OF THE EFFECTIVENESS OF  
METHODS OF LOCAL DESTRUCTION AND CHEMOTHERAPY  
IN PATIENTS WITH UNRESECTABLE TUMORS OF THE  
HEPATOPANCREATOBILIARY ZONE**

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注解。理由。约80%的肝转移患者存在无法手术切除的病灶。未接受手术的肝转移患者的中位生存率为 14 个月。转移性病变的化疗作为唯一的治疗方法可导致总生存率略有增加。局部破坏方法是提高肝前区不可切除肿瘤患者生存率的一种有前途的方法。

目的。比较评价局部破坏方法联合化疗治疗肝胆区不可切除肿瘤的疗效。

方法。该研究纳入了 240 名患有非复发性原发性和转移性肝脏和胰腺肿瘤的患者。患者被分为4组：第一组接受化疗和射频消融联合治疗（49例）；第二组联合化疗饱和微球选择性肝动脉化疗栓塞（30例）。第三组联合不可逆电穿孔胰头（32例）、肝脏（1例）；第四组：128名患者接受化疗作为唯一的治疗选择。使用 Kruskal-Wallis 标准进行统计分析。使用 Dunn 方法进行合同跨组比较。使用 Kaplan-Meyer 方法进行生存性分析。

结果。射频消融肝不可切除转移瘤联合化疗的总生存率：1年生存率 80.6±3.7%；3 年 33.9 5%；5岁儿童 6.5 3.8%；（我25.6个月）。药物饱和微球肝动脉（HEP）化疗栓塞：原发肿瘤诊断后一年生存率为90%，两年生存率为65.7%

, 三年生存率为56.7%, 四年生存率为43%, 5岁儿童占33%, 6岁儿童占20%, 7岁儿童占20% (我38.2个月)。与化疗相比, 不可切除胰腺癌的不可逆电穿孔辅助化疗可将患者的中位总生存率从 11 至 18 个月 ( $p = 0.03$ ) 延长至 6 至 12 个月 ( $p = 0.01$ )。化疗作为唯一的治疗选择: 1 年 77.6 2.5%; 3 年期 5.36 1.2%; 5 年中位数 0.0% 17 个月 RAC/化疗  $p=0.002$ ; HAPA/化疗  $p=0.011$ 。

结论。局部破坏不可切除的肝脏和胰腺肿瘤的方法, 如果与全身药物治疗相结合, 是一种有效的抗肿瘤治疗方法。

关键词: 非复发性肝脏肿瘤, 射频消融, 不可逆电穿孔, 化疗栓塞。

**Annotation. Justification.** *About 80% of patients with metastases to the liver have inoperable lesion. The median survival rate of patients not operated with liver metastases is 14 months. Chemotherapy in metastatic lesions as the only treatment method leads to a slight increase in overall survival. Methods of local destruction are a promising way of increasing the survival rate in patients with non-resectable tumors of the hepatoprotectoral zone.*

**Purpose.** *To make a comparative evaluation of the effectiveness of local destruction methods in combination with chemotherapy in patients with non-resectable tumors of the hepatoprotectoral zone.*

**Methods.** *The study included 240 patients with non-recurrent primary and metastatic liver and pancreatic tumors. The patients are divided into 4 groups: 1st group received a combination of chemotherapy and radiofrequency ablation (49 patients); 2nd group combined with selective chemoembolization of hepatic arteries by microspheres saturated with chemotherapy (30 patients) Group 3 combined with irreversible electroporation of pancreatic head (32 patients), liver (1 patient); group 4: 128 patients received chemotherapy as the only treatment option. Statistical analysis was carried out using the Kruskal-Wallis criterion. Contract cross-group comparisons were made using the Dunn method. The survivability analysis was done using the Kaplan-Meyer method.*

**Results.** *Overall survival rate of radiofrequency ablation of non-resectable metastases in liver combined with chemotherapy: 1-year survival rate of 80.6 3.7%; 3 years 33.9 5%; 5-year-olds 6.5 3.8%; (Me 25.6 months). Hepatic artery (HEP) chemoembolization by drug-saturated microspheres: One-year survival rate since diagnosis of primary tumor was 90%, two-year survival rate 65.7%, three-year survival rate 56.7%, four-year survival rate 43%, Five-year-olds account for 33%, six-year-olds 20%, seven-year-olds 20% (Me 38.2 months). Irreversible electroporation of non-resectable pancreatic cancer supplementing chemotherapy increases the median total survival rate of patients from 11 to 18 months ( $p = 0.03$ ) of the median to a progression from 6 to 12 months ( $p=0.01$ ) compared to chemotherapy. Chemotherapy as the only treatment option: 1 year 77.6 2.5%; 3-year 5.36 1.2%; 5-year median 0.0% 17 months RAC/chemotherapy  $p=0.002$ ; HAPA/chemotherapy  $p=0.011$ .*

**Conclusion.** *Methods of local destruction of non-resectable tumors of the liver and pancreas, if combined with systemic drug treatment, is an effective method of antitumor treatment.*

**Keywords:** *non-recurrent liver tumors, radio frequency ablation, irreversible electroporation, chemoembolization.*

### **Justification**

Many retrospective and prospectus studies of the problem of surgical treatment of metastases in the liver and local forms of malignant neoplasms of the hepatopancreatoduodenal zone were conducted. The results obtained allow to count on a 5-year survival of 27-37% of patients. Despite careful selection of candidates for calcium liver resection, 50-60% of patients later develop recurrent metastatic organ failure [1-3]. Repeated surgical interventions on the liver due to recurrent metastasis at CRE are possible in 10-33% of patients (provided that the objective condition and the liver function are satisfied). The reason for refusing surgical treatment can be considered not only the multiplicity of metastatic lesions of both lobes of the liver, but also the high postoperative mortality associated with both technical difficulties of surgery and the general condition of the patient. With technical progress, well-known and new techniques are being developed to influence the disseminated tumor process and its complications. Great success is achieved in combining and improving physical-chemical and delivery means: radioembolization, chemoembolization medicinal saturated microspheres. There are a number of works showing a significant increase in the median survival rate of patients with non-resectable tumors of the hepatopancreatoduodenal zone: chemoembolization of liver arteries [4-7]. The role and place of local destruction methods in different clinical situations in patients with non-resectable process have not yet been determined.

**Purpose.** To make a comparative evaluation of the effectiveness of local destruction methods in combination with chemotherapy in patients with non-resectable tumors of the hepatopancreatoduodenal zone.

**Methods.** 240 patients with non-resectable primary and metastatic liver and pancreatic tumors were included in the study. Patients are divided into two groups. The 1st Group received a combination of chemotherapy and radiofrequency ablation (49 patients); 2nd Group combined with selective chemoembolization of hepatic arteries by microspheres saturated with chemotherapy (30 patients) Group 3 combined with irreversible electroporation of pancreatic head tumors (32 patients) group 4: 110 patients received chemotherapy as the only treatment option. Patients who underwent radiofrequency ablation and chemoembolization with medically saturated microspheres for non-resectable liver tumors were divided into subgroups by the number of foci per unit and multiple, and by the stage of treatment at the time of inclusion in the study: Primary (previously untreated) and



end-of-line (discernible surgical options). The statistical analysis was carried out using the Kruskal-Wallis criterion. The analysis of survival was carried out using the Kaplan-Meyer method.

### Results

Overall survival rate of radiofrequency ablation of non-recetable metastases in liver combined with chemotherapy: 1-year survival rate of 80.6 3.7%; 3 years 33.9 5%; 5-year-olds 6.5 3.8%; (Me 25.6 months). Subgroup analysis showed the worst survival results in patients with multiple foci having previously received various types of surgical and systemic treatment. In a comparative assessment of patients' survival, depending on the volume of tumor liver lesions in single and multiple metastases of colorectal cancer after ANC, Statistically significant increase of median of total survival in the group of patients with solitary liver lesion ( $p=0.031$ ). Hepatic artery (HEPA) chemoembolization by microspheres saturated with doxorubicin / irinotecan: one-year survival rate since diagnosis of primary tumor was 90%, two-year survival rate 65.7%, three-year survival rate 56.7%, four-year survival rate 43%, Five-year-olds account for 33%, six-year-olds 20%, seven-year-olds 20% (Me 38.2 months). Irreversible electroporation of non-recetable pancreatic cancer supplementing chemotherapy increases the median total survival rate of patients from 11 to 18 months ( $p = 0.03$ ) of the median to a progression from 6 to 12 months ( $p=0.01$ ) compared to chemotherapy. Annual mortality in the NE+PCT group:

Year 1 - 7 (21.9%) patients; year 2 - 21 (65.6%) patients; year 3 - 4 (12.5%) patients

Annual mortality in the PCT group: Year 1 - 7 (38.9%); Year 2 - 11 (61.1%); Year 3 - 0.

Chemotherapy as the only treatment option: 1 year 77.6 2.5%; 3-year 5.36 1.2%; 5-year median 0.0% 17 months RAC/chemotherapy  $p=0.002$ ; HAPA/chemotherapy  $p=0.011$ .

**Conclusion.** Thus, methods of local destruction of non-recetable tumors of the liver and pancreas, if combined with systemic drug treatment, are effective in antitumor treatment. At the current level of development, the methods of local destruction combined with chemotherapy make it possible to increase life expectancy and improve its quality in patients with non-recevable tumors of the hepatothelial zone.

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早期静脉-静脉血液透析滤过治疗严重复合创伤。 临床观察  
**EARLY ONSET OF VENO-VENOUS HEMODIAFILTRATION  
IN THE TREATMENT OF SEVERE COMBINED TRAUMA.  
CLINICAL OBSERVATION**

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摘要。严重复合创伤的特点是年轻人死亡率高(>20%)，老年人死亡率高——约45%。纠正代谢紊乱是最困难的任务，尤其是在受伤后的最初几个小时内。

目的: 以成功治疗严重复合创伤患者 (ISS 57 分) 为例, 证明早期开始静脉-静脉血液透析滤过的有效性。

临床观察: 患者A, 19岁, 因酒后从6楼高处坠落, 被救护队送往外科重症监护室, 定向诊断为“严重综合伤”。 中毒。 考虑到通过保守方法不可能纠正水电解质和代谢紊乱, 决定在柠檬酸钙抗凝长期静脉-静脉血液透析滤过 (Ci-Ca CVVHD) 的早期开始体外治疗。 此外, 患者在当前严重联合创伤治疗建议的框架内接受了治疗。 在正在进行的治疗的背景下, 出现了明显的积极趋势。 第 3 天停止升压药物支持, 第 15 天患者转为独立呼吸。 总共进行了 1 次 CVVHD 疗程, 总持续时间为 62 小时。 患者在重症监护室住了 29 天, 从资料来看, 出院时间为 4 天。

结论: 对早期未出现急性肾损伤现象的严重复合创伤患者采用CVVHD方法, 有助于缓解代谢紊乱, 稳定体内平衡系统。 然而, 为了得出结论并扩大严重复合创伤患者使用体外排毒方法的适应症, 有必要对此问题进行进一步的研究。

关键词: 多发伤; 代谢性酸中毒; 肾脏替代治疗; 重症监护室。

**Abstracts.** *Severe combined trauma is characterized by high mortality both among young people (>20%) and among the older age group – about 45%. Correction of metabolic disorders is the most difficult task, especially in the first hours after injury.*

**Objective:** *To demonstrate the effectiveness of early initiation of veno-venous hemodiafiltration on the example of successful treatment of a patient with severe combined trauma (ISS 57 points).*

**Clinical observation:** *Patient A., 19years old, was taken to the surgical intensive care unit by an ambulance team with a directional diagnosis of “severe combined injury” as a result of falling from a height of the 6th floor in a state of alcoholic intoxication. Considering the impossibility of correcting water-electrolyte and metabolic disorders by conservative methods, it was decided to start extracorporeal treatment early in the volume of prolonged veno-venous hemodiafiltration with citrate-calcium anticoagulation (Ci-Ca CVVHD). In addition, the patient received therapy within the framework of the current recommendations for the treatment of severe combined trauma. Against the background of the ongoing treatment, there was a distinct positive trend. Vasopressor support was discontinued on day 3, and on day 15 the patient was transferred to independent breathing. In total, one CVVHD session was conducted, with a total duration of 62 hours. The patient’s stay in the intensive care unit was 29 days, in the profile distance – 4 days with subsequent discharge.*

**Conclusion:** *The use of the CVVHD method in a patient with severe combined trauma in the early period without the phenomena of acute kidney injury contributed to the relief of metabolic disorders with the stabilization of the homeostasis system. However, in order to form conclusions and expand indications for the use of extracorporeal detoxification methods in patients with severe combined trauma, further study of this issue is necessary.*

**Keywords:** *Polytrauma; metabolic acidosis; renal replacement therapy; intensive care.*

### **Intro**

When assessing the causes of death in victims with severe combined injury, acute blood loss with the development of haemorrhagic shock [1], the second - multiple mechanical injuries of organs and tissues, incompatible with their normal functioning [2,3]. Acute Respiratory Distress Syndrome [4,5] and severe cerebral insufficiency on the background of both isolated and combined brain damage rank 3rd and 4th [6]. The rest of the deaths are usually caused by secondary purulent septic complications [7,8], haemostatic disorders with thrombosis and other causes, which occur after the end of the acute period [9,10,11].

In addition to the factors directly leading to death, each reanimatologist perfectly presents the danger of persistent acidosis, developing against the background of massive damage to organs and tissues [12]. Knaybolerooproprastration of the metabolic metabolic correction of the risk of the introduction of the buffer crystals - bicarbonatanthatrium [13,14] and Tromethamol [15,16]. However, each of these drugs, though partially stabilizes homeostasis rates due to the prosthetic buffer systems, but has a fairly short period of action [15]. Processes leading to the development of acidosis can continue for a long time, while the introduction of buffer solutions is strictly limited both in volume and in time [17]. In many works, the authors advise «as soon as possible to stabilize the patient's condition», which should lead to the prevalence of mechanisms of endogenous compensation and independent resolution of metabolic disorders.

However, it is not uncommon for the scope of the injury and the comorbid background of the patient to make it impossible even to estimate, especially in the first hours of the injury. As a rule, the reanimatologist has to form an opinion on the seriousness of the patient's condition, having on hand a limited amount of data. These may include instrumental research data, which can be performed with weight, laboratory indicators and results of a number of integrative scales. Of course, given such limited data, it is extremely difficult to conclude that there is a predominance of various pathogenetic pathways in the formation of haemostatic disorders. In this case, earlier the beginning of extracorporeal detoxification methods may be the universal method of treatment that will allow to move to a targeted approach based on the results of the pre-test.

### **Clinical observation:**

A 19-year-old woman, BMI 26 was taken by the ambulance team to the department of surgical resuscitation with the diagnosis of «severe combined trauma». According to the ambulance workers, the injury was caused by a fall from a height of 6 floors under the influence of alcohol. When examined at the scene, the patient's level of consciousness on the Glasgow scale is 6. Sol. Ketamini 100 mg.

At the time of receipt, the condition was considered terminal. The severity of the condition was due to severe respiratory failure, which required the start of artificial ventilation at the pre-hospital stage through the tracheoesophageal two-way intubation tube Combitube, Cerebral insufficiency of severe degree of suppressing the consciousness to the level of moderate coma (glasgow coma scale 6 points), as well as severe cardiovascular insufficiency, not corrected by infusion therapy.

In order to prosthetic vital functions of the organism, the patient had an orthotracheic intubation performed against the background of the introduction: Sol. Morphini 10 mgv with further start of artificial ventilation with parameters: BPAP mode:  $f=18/\text{min}$ ,  $VC = 500-550 \text{ ml}$ ,  $MV = 9-10 \text{ l/min}$ ,  $Pinsp 18 \text{ mbar}$ ,  $PEEP 8\text{mbar}$ ,  $Pasb10 \text{ mbar}$ , In order to ensure intravascular access, the internal jugular vein was punctured and catheterized. Taking into account the initial AD level - 47/21 mm.rt. and the impossibility of correcting hemodynamic violations of infusion therapy in the amount of 2000 ml of crystalloids was decided to start vasopressor support p-rom norepinephrine at a dose of 0.8  $\mu\text{g/kg/min}$ . For the purpose of medicinal sedation and analgesia, the patient was given an infusion of propofol at a rate of 3  $\text{mg/kg/h}$  and in/into bolus Morphine p-re 1% at a volume of 0.1  $\text{mg/kg}$ .

Immediately after the central vein was catheterized, the acid-basic composition of the blood was determined by express method on the apparatus RadiometerABL 800 Basic The results showed a pronounced acidosis with progressive tissue hypoxia:  $\text{pH}-7.026$ ,  $\text{pCO}_2 53.9 \text{ mmHg}$ ,  $\text{pO}_2 30.0 \text{ mmHg}$ ,  $\text{ctHb } 125 \text{ g/L}$ ,  $\text{sO}_2 35.2\%$ ,  $\text{cNa } 143 \text{ mmol/L}$ ,  $\text{cCl } 115 \text{ mmol/L}$ ,  $\text{cLac } 9.3 \text{ mmol/L}$ ,  $\text{SBE } -15.4 \text{ mmol/L}$ .

In total clinical blood test:  $\text{Hb } 120 \text{ g/l}$ ,  $\text{WBW } 10.70*10^9/\text{l}$ ,  $\text{PLT } 166*10^9/\text{l}$ .

In the biochemical analysis of the blood: Alanine Aminotransferase 447.0 ED/L, Aspartate Aminotransferase 437.0 ED/L. Increased creatine kinase 713.0 ED/L, creatine kinase-MB 485.4 IU/L, increased creatinine 91  $\mu\text{mol/L}$ , Troponin 7.1  $\mu\text{g/L}$ .

There was also a coagulogram violation: a decrease in fibrinogen concentration of 1.64, g/l, Activated partial thromboplastin time 39.3 s, Prothrombin index 55%, an increase of 1.41 Prothrombin time.

Following the completion of the clinical and instrumental tests required by the protocol of diagnosis of patients with severe combined trauma, the diagnosis was made:

Main: Cataract. Severe combined injury. Severe Closed craniocerebral injury. Comminuted fracture to the public, sciatic and iliac bones, spinal cavity to the left with the displacement of the fractures. Rupture of the sacroiliac articulation on the left.

Complication of the main one: Severe brain injury. Diffuse axonal injury? Intra-ventricular hemorrhage. Abrasion of the soft tissues of the head. Bilateral lung

injury, left-sided hemopneumothorax, right-sided pneumothorax. Severe contusion of the left lobe of the liver. Damage to the left kidney. Traumatic shock 3st.

When calculating the integrative scales, the following values were obtained:

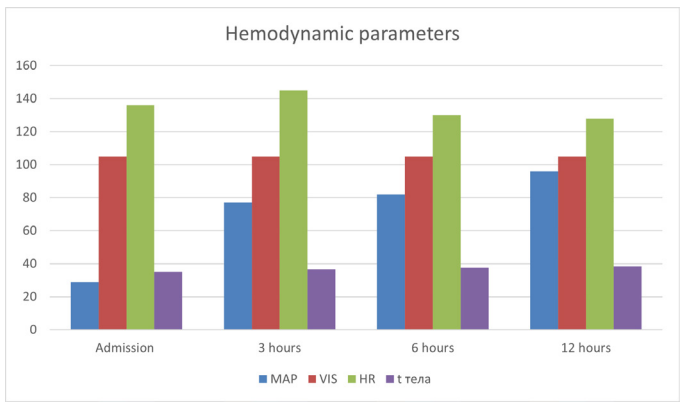
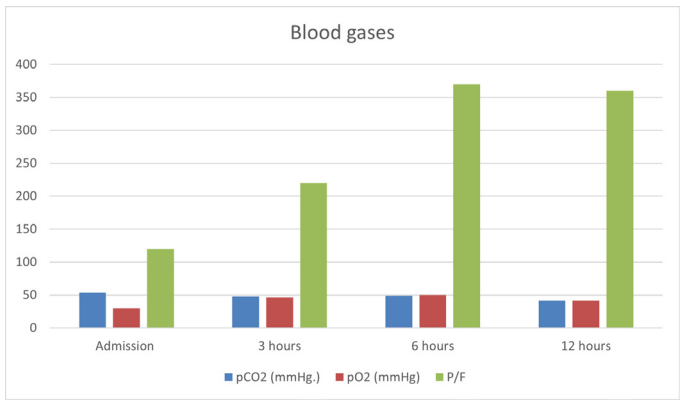
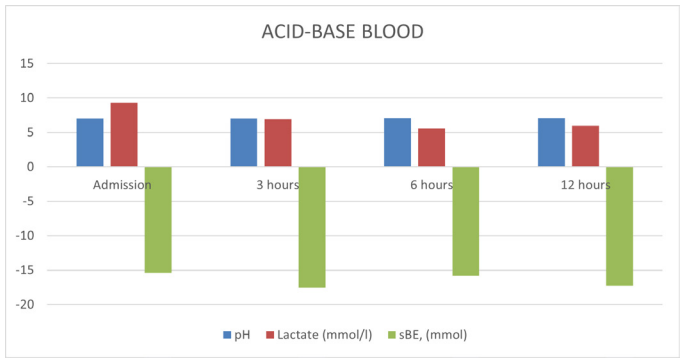
- APACHE II - 28 (the probability of death is 55%),
- ISS - 57 points,
- TRISS (mortality in closed injury 95.91%),
- RTS 2,83
- SOFA – 9 points ethanol 1,4 г/л

Taking into account the nature and extent of the injuries, in the first hours from the moment of admission, the patient underwent surgical interventions in the amount of drainage of both pleural cavities with the installation of an active aspiration system, as well as the imposition of a rod device for external fixation of the pelvis-left thigh.

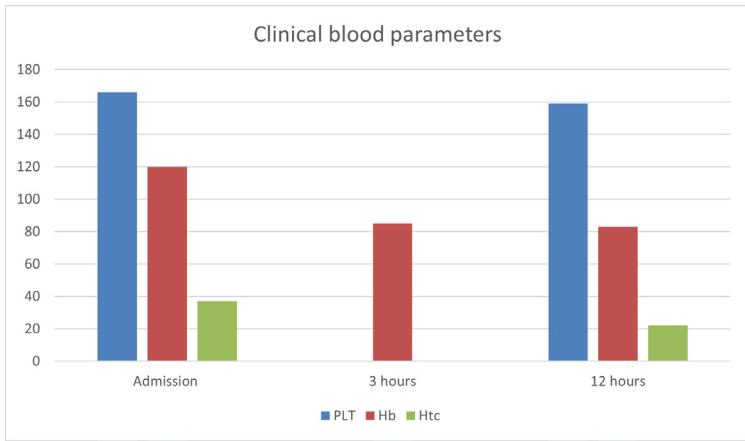
During 6 hours of being in the intensive care unit against the background of adequate venting of the pleural cavities and the patient's introduction in protective modes of ventilation, we got a positive dynamic in the blood gas composition, while serious metabolic disorders persisted. There was also a tendency to reduce diuresis, from 0.5 ml/kg/h to 0.3 ml/kg/h. This indicated the progression of kidney failure. Creatinine has also increased.

While progressing renal failure from the introduction of sodium bicarbonate and tromethamol, it was decided to abstain. Taking into account the remaining lactate acidosis (pH 7.009, cLac 6.9 mmol/L, BE- 17.5 mmol/L) it was decided to start the Ci-Ca CVHD session with parameters of blood flow rate 150 ml/h, dialysis 2000 ml/h, ultrafiltration 0 ml/h. In view of the extremely high risk of bleeding and the current recommendations for renal replacement therapy [23], it was decided to apply citrate-calcium anticoagulation as the safest method.

The patient had a right femoral vein catheterized by a Braun 20g catheter. For CVVHD the multiFiltratel with Ultraflux AV 1000 Sc membrane permeability of substances up to 30 kDa was used. The procedure of veno-venous hemodialysis with cyto-calcium anticoagulation was carried out during 3 days (62 hours). The dynamics of the patient's condition during the first 24 hours are shown in the graphs below.







As we can see from the charts provided, the patient suffered from hyperthermia after 24 hours. Given the patient's short-term stay in hospital, the presence of diffuse axonal injury and subarachnoid hemorrhage according to computer tomography, hyperthermia was central genesis. [25]. It was decided to maintain the norm term by the ArticSun37 0C. Which enabled us to stop drug-induced hyperthermic correction, thereby reducing the drug load on the liver. Normalization of the body temperature and complete rejection of the ArticSun device, we managed to reach the 8-day stay in the intensive care unit.

The change in the clinical blood test, the reduction of platelets, is considered as a manifestation of internal combustion engine syndrome. On the scale of ISTH7. Which was corrected according to clinical guidelines. Transfusion of freshly frozen plasma, Cryopresipitate, washed red blood cells.

According to the analysis of the gaseous composition of the blood, we can see that we managed to reach the reference values within the first day. Further significant changes in the gaseous composition of the blood were not noted.

Given the abundant amount of serous hemorrhagic sputum and the understanding of the patient's long-term stay in the ventilator, for 2 days in the intensive care department it was decided to apply an early puncture-dilatation tracheostoma Portex 8.0. Taking into account the coagulogram indicators and the minimal risk of developing a bleed while carrying out cystic-calcium hemodialysis, the surgery was performed without interruption of the hemodialysis procedure.

Against the background of the therapy, a moderate positive trend was observed with the withdrawal of vasopressor support after 4 days of administration.

For 3 days in intensive care it was decided to wake-up the test. The 24-hour deactivation of the sedation showed that the coma (GCS-6) remained, the pair of

eyes was on the top, the double-sided medriase, D=S. Taking into account the positive dynamics of metabolic and electrolytic disorders for 3 days the cytno-calcium hemodialysis stopped.

On the 5th day: the appearance of consciousness is noted, the patient is disoriented, aggressive to the honey. staff, answering questions with nods or gestures, constantly trying to remove catheters, electrodes, multiple attempts to get out of bed.

For 8 days it was possible to establish verbal contact with the patient through letters and gestures. Retrograde amnesia was noted, and the patient quickly forgot what she had to say, asked the same question several times in a short period of time.

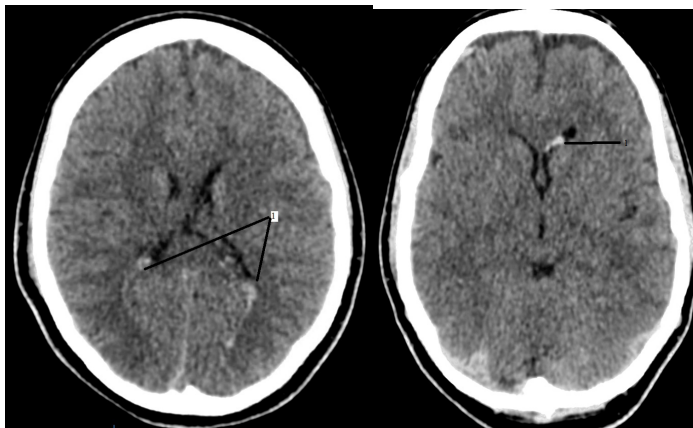
It was then decided, taking into account the patient's condition and the trauma suffered, to carry out surgery in several stages, which gave time for recovery. After each stage of surgical treatment, the early postoperative period is relatively calm.

On the neurological side, there has been an improvement in the patient's cognitive, spatial and temporal orientation. In order to prevent secondary contractures early activation of the patient was carried out with the help of a doctor LFK.

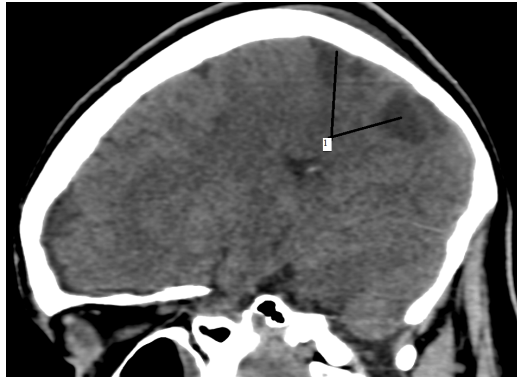
The patient subsequently decannulated the tracheostomy tube, without complications.

The dynamics of brain damage at admission, 4 days, 12 days and 24 days is presented. Fig 1, 2, 3, 4.

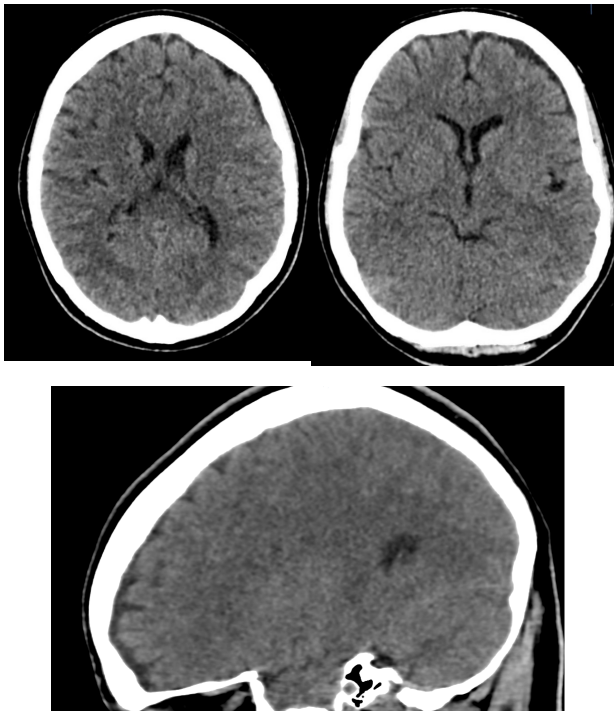
29 days transferred to the main department, total time in which was 4 days. The patient was discharged in a satisfactory condition for recovery treatment.



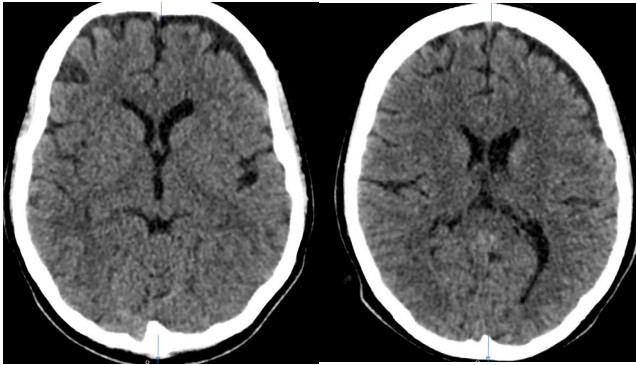
**Figure 1.** CT scan of the brain upon arrival  
1- Pockets of hemorrhaging.



*Figure 2. Brain CT scan for 3 days  
2- Lesions of the brain.*



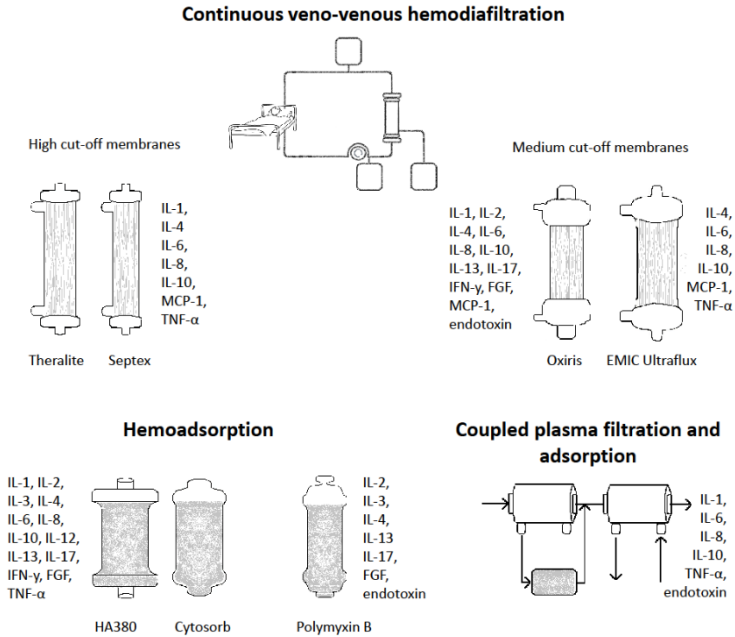
*Figure 3. 12 day brain CT*



*Figure 4 brain CT for 24 hours.*

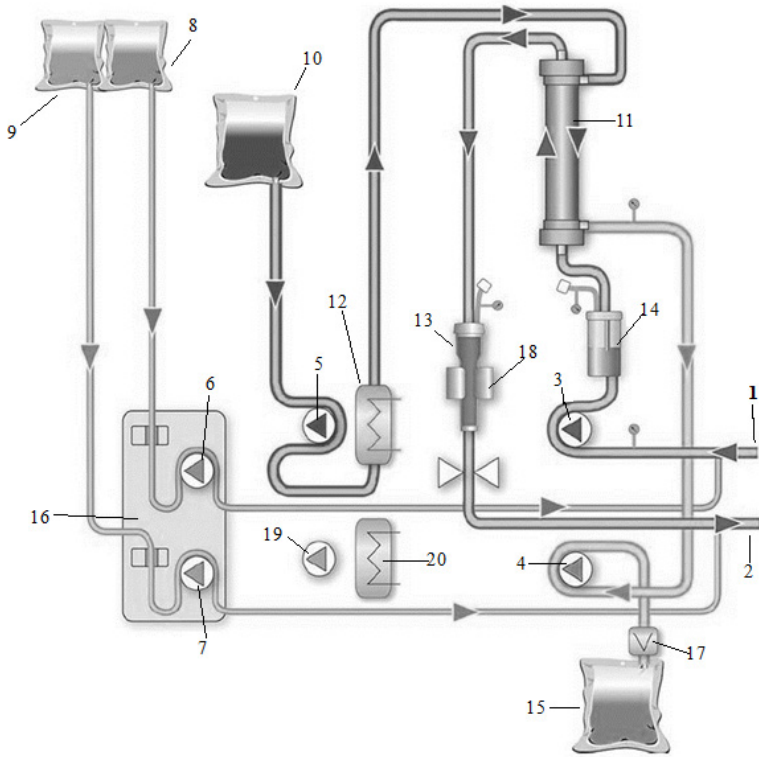
**Discussion:**

Since the introduction of routine methods of extracorporeal homeostasis correction, there has been a debate about the relative benefits and risks of these procedures. If in relation to kidney damage the criteria are formed [18], in case of «extrarenal» pathologies, accompanied by massive rhabdomyolysis with myoglobinemia attachment, lactic acidosis, as well as intense inflammation with the production of such proinflammatory factors, IL-1, IL-6, IL-17 and Tumor Necrosis Factor  $\alpha$  (TNF- $\alpha$ )[19], the decision on early prescription of extracorporeal treatments (EML) is more subjective and based on treatment tactics adopted in a particular medical institution. However, it is worth noting that the possibilities of this treatment method, since the introduction into routine practice, have significantly expanded, partly due to the emergence of fundamentally new filtration and sorption technologies[20] (Figure 1)



**Figure 1.** Current data on cytokine and endotoxin clearance and adsorption using various detoxification agents (Hellman T. et al, 2021)

The partial similarity of the inflammatory cascade in severe combined trauma and sepsis [21,22] suggests that extracorporeal methods of treatment may be used in patients with extensive organ and tissue damage. From the point of view of safety, the use of cystic-calcium anticoagulation is the preferred method at high risk of bleeding (which is especially relevant for victims with severe combined trauma). In the clinical recommendations for the treatment of acute kidney damage in 2020 it is noted that «it is recommended in patients with high risk of bleeding, who do not receive systemic anticoagulation therapy, to use regional anticoagulation solution of citrate» [23]. Thus, the decision to conduct an extended session of CVVH was made taking into account the main indications (uncorrectable lactate-acidosis) of the purpose of treatment of inflammatory cascade. The selected anticoagulation method is the safest when there is a high risk of bleeding in the patient, as the process of anticoagulation occurs inside the contour and does not affect the patient's hemostasis (Figure 2), as confirmed by [24]and existing guidance [23].



**Figure 2.** Scheme of low-flow hemodialysis with citrate-calcium anticoagulation on the multiFiltrate device

- 1 Blood collection line
- 2 Blood return line
- 3 Blood pump
- 4 Filtration pump
- 5 Dialysis pump
- 6 Citrate pump
- 7 Calcium pump
- 8 Bag of citrate
- 9 Bag of calcium
- 10 Solution for renal replacement therapy
- 11 Hemofilter
- 12 Dialysate heater
- 13 Venous air trap

- 14 Arterial air trap
- 15 Bag for collecting effluent
- 16 Module for CiCa anticoagulation.
- 17 Blood leak detector
- 18 Air detector
- 19 Replacement solution pump
- 20 Replacement solution heater

### Conclusion:

Replacement renal therapy in patients with severe combined trauma without signs of acute renal damage is able to solve metabolic disorders that occur in the first hours. The world's experience of early EML in patients with critical conditions suggests that this direction is extremely promising within the framework of complex therapy of patients with severe combined trauma. However, given the variability of the method and the rather frequent inability to accurately assess the extent and nature of the injuries in patients with severe combined trauma, Each case requires a case-by-case approach with a comprehensive assessment of the intended benefits and risks of the procedure.

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### List of abbreviations

- cCl – concentration of chlorine in the blood
- Ci-CaCVVHD – Continuous veno-venous hemodialysis with calcium citrate anticoagulant
- cLac - lactate concentration in the blood.

cNa - the concentration of sodium in the blood

ctHb- hemoglobin

CVVHD - Continuous veno-venous hemodialysis

f – respiratory rate

Hb - Hemoglobin

ISS - Injury Severity Scale

ISTH assessment of the risk of bleeding according to the ISTH recommendation

Mbar – millibars

MV – minute ventilation of the lungs

pCO<sub>2</sub> partial pressure of carbon dioxide in the blood

pH – indicator of blood acidity

PLT- platelets

pO<sub>2</sub> - partial pressure of oxygen in the blood

REER - MPCV - positive pressure of the end of exhalation

LOB – lack of bases.

sO<sub>2</sub> - blood saturation

RV – respiratory volume

WBC - white blood cells

Blood pressure – blood pressure

ALT - Alanine Aminotransferase

AST - Aspartate Aminotransferase

APTT -Activated Partial Thromboplastin Time

VIRAR – ventilator mode Two-phase positive airway pressure

BMI is the body mass index.

CPK - Creatine Kinase

INR - International Normalized Attitude

PTI - prothrombin index

SHKG – scale com Glasgow.

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超声辅助竖脊肌阻滞筋膜面神经阻滞治疗急性胰腺炎的体会  
**EXPERIENCE OF THE ULTRASOUND-ASSISTED NERVE  
BLOCKADE OF THE FASCIAL PLANE BY ERECTOR SPINE  
BLOCK IN ACUTE PANCREATITIS**

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抽象的。重症监护室的疼痛是各种病因的急性胰腺炎患者的常见问题。鉴于疼痛综合征的严重性，以及非甾体类抗炎药（NSAID）或解痉治疗的有效性较低，通常需要使用阿片类镇痛药（OA）或硬膜外镇痛（EA）。这些疼痛管理方法均存在一定的缺点和禁忌症，因此迫切需要寻找一种安全有效的方法来缓解胰腺炎或胰腺坏死患者的疼痛。

目标：确定急性胰腺炎中竖脊肌筋膜间隙封锁的有效性。

临床观察：患者 X, 58 岁，在 V.M. 手术后被送往 SBHI “国立临床医院” 急诊室。Buyanov” MHD, 主诉上腹部剧烈疼痛（根据视觉模拟量表（VAS）10 分，满分 10 分）。在院前阶段，尝试通过静脉注射非甾体类抗炎药（NSAID）和 OA（Sol Ketoprofeni 100 mg, Sol Tramadoli 100 mg）来控制疼痛综合征，然而，这并没有导致疼痛达到所需的疼痛感减轻。根据临床和实验室检查数据，做出以下诊断：主要：K85.1 急性胆源性胰腺炎。并发症：K86.8.1 胰腺坏死。相关：K80 胆结石病。由于持续疼痛，入院时患者接受了静脉注射 Sol. 吗啡 10 毫克，仅将疼痛综合征的强度轻微降低至 VAS 评分中的 8 分（满分 10 分）。考虑到病情严重，患者被送往外科重症监护室住院治疗。实验室检查显示血小板减少（PLT (83\*10<sup>9</sup>），因此决定放弃硬膜外置管。或者在签署自愿知情同意后，患者接受超声辅助竖脊肌筋膜间隙阻断术 左侧第 5 胸椎横突水平处的肌肉（ESPB）。使用的麻醉剂为 Sol. Ropivacaini 0.5%，体积 25 ml。封锁后 20 分钟，患者注意到明显的疼痛。疼痛综合征消退（VAS 评分最高 2 分，满分 10 分），持续 12 小时。麻醉结束后，患者再次主诉疼痛强度增加（VAS 评分 10 分，6 分），通过静脉注射 Sol. Ketopropheni 100 mg 和静脉注射 Sol Tramadoli 100 mg 来控制。在进一步随访期间，疼痛综合征的强度在 VAS 量表上不超过 2-3 分。患者在医院的总住院时间为 12 天，在重症监护室的总住院时间为 2 天。

结论。对患有急性胆源性胰腺炎并发胰腺坏死的患者进行 ESPB 可以快速安全地停止疼痛综合征

关键词: ESPB, 竖脊肌平面阻滞, 胰腺炎, 临床观察。

**Abstract.** *Pain in the intensive care unit is a common problem in patients with acute pancreatitis of various etiologies. Given the severity of the pain syndrome, as well as the low effectiveness of nonsteroidal anti-inflammatory drugs (NSAIDs) or antispasmodic therapy, it is often necessary to resort to the administration of opioid analgesics (OA) or epidural analgesia (EA). Each of these pain management methods has certain disadvantages and contraindications, which makes it urgent to search for a safe and effective method of relieving pain in patients with pancreatitis or pancreonecrosis.*

**Goal:** *To determine the effectiveness of blockade of the fascial space of the spinal erector spinae muscle in acute pancreatitis.*

**Clinical observation:** *Patient X, 58 years old, was brought to the emergency room of the SBHI "State Clinical Hospital after V.M. Buyanov" MHD with complaints of severe pain in the epigastric region (according to the visual analogue scale (VAS) 10 points out of 10). At the pre-hospital stage an attempt was made to control the pain syndrome by intravenous administration of non-steroidal anti-inflammatory drugs (NSAIDs) and OA (Sol Ketoprofeni 100 mg, Sol Tramadoli 100 mg), which, however, did not lead to the desired reduction of pain sensations. According to the data of clinical and laboratory examination the following diagnosis was made: Main: K85.1 Acute biliary pancreatitis. Complication: K86.8.1 Pancreonecrosis. Associated: K80 Gallstone disease. Given the persisting pain, at the stage of admission the patient was given an intravenous injection of Sol. Morphini 10 mg, which only slightly reduced the intensity of the pain syndrome to 8 points out of 10 on the VAS scale. Taking into account the severity of the condition, the patient was hospitalised in the intensive care unit for surgical patients. Laboratory tests showed thrombocytopenia (PLT (83\*10<sup>9</sup>) and therefore it was decided to abstain from epidural catheter placement. Alternatively, after signing a voluntary informed consent, the patient underwent ultrasound-assisted blockade of the fascial space of the erector spinae muscle (ESPB) at the level of the transverse process of the 5th thoracic vertebra on the left side. The anaesthetic used was Sol. Ropivacaini 0.5% in a volume of 25 ml. Twenty minutes after the blockade was performed, the patient noted a marked regression of pain syndrome (up to 2 points out of 10 on the VAS scale), which persisted for 12 hours. After expiry of the anaesthetic, the patient again complained of an increase in pain intensity (6 points out of 10 on the VAS scale), which was controlled by intravenous injection of Sol. Ketoprofeni 100 mg and intravenous administration of Sol Tramadoli 100 mg. During further follow-up the intensity of the pain syndrome did not exceed 2-3 points on the VAS scale.*

*The total time of the patient's stay in the hospital was 12 days, and in the intensive care unit - 2 days.*

**Conclusion.** *Performing ESPB in a patient with acute biliary pancreatitis complicated by pancreatic necrosis made it possible to quickly and safely stop the pain syndrome*

**Keywords:** *ESPB, erector spinae plane block, pancreatitis, clinical observation.*

**List of abbreviations:**

NSAIDs - Non-steroidal anti-inflammatory drugs

OA - Opioid analgesics

EA - Epidural analgesia.

VAS - Visual Analogue Scale

ESPB - Erector spinae plane block

Th - Thoracic vertebrae

EMS - Emergency Medical Services

MHR - Maximum Heart Rate

AP - Blood pressure

AST - Aspartataminotransferase

ALT - Alanine aminotransferase

CT - Computer tomography

MDP - Major Duodenal Papilla

EGDS - Esophagogastroduodenoscopy

qSOFA - Quick sequential organ failure assessment

Ultrasound - Ultrasound examination

Endo ultrasound - Endoscopic ultrasound examination

TAPB - Sequential Organ Failure Assessment

LAST - Local Anesthetic Systemic Toxicity

**Introduction**

Acute pancreatitis is one of the most common diseases among patients in the surgical intensive care unit [1,2]. The genesis of pain syndrome accompanying acute edematous pancreatitis suggests basic therapy in the form of administration of antispasmodics in order to correct pancreatic enzyme outflow disturbance, as well as the use of drugs capable of preventing the development of autolysis as a result of acinar cell damage. However, in case of the most unfavourable course of the inflammatory process, it is often necessary to include OA or regional methods of anaesthesia to the standard therapy. This carries a whole range of unfavourable factors - from side effects of opiates to excessive load on enzyme systems due to the use of local anaesthetics [3]. Also, catheterisation of the epidural space results in the formation of communication of the epidural space with the external environ-

ment, which is undesirable to a certain extent in patients whose activity is limited to the limits of the bed, and care - by sanitary measures of medical personnel [4]. It is also worth considering the fact that the use of epidural anaesthesia with unstable haemodynamics in patients with abdominal sepsis correlates well with increased mortality, aggravation of haemodynamic parameters [5]. In addition, opioid analgesics can cause a whole range of complications - respiratory depression [6], impaired level of consciousness (up to the development of deliriosis) [7], as well as the formation of persistent hypotension, and, finally, the development of tachyphylaxis and dependence [6,9,10]. Given the widely known adverse effects of OA administration, regional anaesthetic techniques are increasingly favoured [8]. In a setting with increased hospitalisation times, opioids have not shown an advantage over other anaesthetic techniques [3]. According to numerous studies, the use of epidural analgesia (EA) has been shown to reduce the need for narcotic analgesics, improving the course of acute pancreatitis due to the redistribution of blood flow in the system of the prural trunk in non-perfused areas of the pancreas through sympathetic blockade and correction of tissue hypoxia [9]. In turn, the ESPB method was initially developed as an additional method of anaesthesia for patients undergoing thoracic or abdominal surgery [10,12,13,14]. In case of complete or partial ineffectiveness of EA, as well as in the presence of contraindications to catheterisation of the epidural space, ESPB quickly entered the routine practice of postoperative analgesia in intensive care units [10,12,13,14,15,16,17,18]. The most effective application of this method should be recognised in patients suffering from pronounced pain syndrome on the background of chest traumas accompanied by fracture of several ribs, as well as in intercostal nerve damage of viral genesis, cardiac surgery [10,12,13,15,15,17,17,19,20]. When ESPB is performed at the level of Th5 - Th6, blockade of dorsal and ventral branches of spinal nerves occurs and, more importantly, visceral analgesia is achieved by blockade of sympathetic fibres [20,21]. Taking into account the peculiarities of sympathetic innervation of the pancreas, adequate EA often requires catheterisation of the epidural space at Th5-Th6 levels, which is associated with certain risks of complications during the manipulation [22]. Also, one should not forget about technical difficulties associated with increased intra-abdominal pressure, pronounced pain syndrome and accompanying general discomfort, feeling that does not always allow the patient to fully fulfil the requirements of adequate positioning [23]. ESPB is much safer, possessing sympathetic blockade, which can be as an alternative to EA.

#### **Clinical case**

Patient H., 58 years old, was admitted to the emergency department of the SBHI "State Clinical Hospital after V.M. Buyanov" MHD with complaints of acute abdominal pain, nausea and vomiting. The referral diagnosis of the emergency medical team (EMS) was "acute pancreatitis". At the prehospital stage, an

attempt was made to control the pain syndrome by intravenous administration of NSAIDs and OA (Sol Ketoprofeni 100 mg, Sol Tramadoli 100 mg). On examination in the emergency room, the patient still had severe pain syndrome in the epigastric region (according to the visual analogue scale (VAS) 10 points out of 10), increasing on palpation and movement. Forced position on the left side. Superficial respiration 22-25 per minute, MHT-113 per min, BP-155/95 mmHg.



*Picture 1. CT scan - picture of pancreatic damage*

According to the results of general and biochemical blood analysis at the stage of admission department, there was an increase in AST (822.0 units/l), ALT (685.0 units/l), alkaline phosphatase (533 units/l), as well as moderate leukocytosis (WBC  $11.8 \times 10^9/l$ ) and thrombocytopenia (PLT  $83 \times 10^9$ ). Taking into account the clinical and laboratory data obtained, a computed tomography (CT) scan of the abdomen with intravenous contrast enhancement was performed to clarify the diagnosis. According to the data of the study the diagnosis “acute destructive pancreatitis of biliary genesis on the background of chronic cholecystitis Balthazar E 7” was made (Figure 1). According to the data of clinical and laboratory examination the patient was diagnosed as follows: Main: K85.1 Acute biliary pancreatitis. Complication: K86.8.1 Pancreonecrosis. Background: K80 Gallstone disease.

In order to exclude the block of the Major Duodenal Papilla (MDP) the patient underwent EGDS, according to the results of which the diagnosis was made: Choledocholithiasis (K80.3). Taking into account the severity of the condition, high qSOFA score (2 points), as well as uncontrollable pain syndrome, the patient was hospitalised in the intensive care unit. At the pre-hospital stage, as well as at the examination stage, in the admission department, the patient was treated with analgesic therapy using NSAIDs and OA (Sol Ketoprofeni 100 mg, Sol Tramadoli 100 mg). In the absence of analgesic effect during 2 hours, a decision was made to anaesthetise with opioid analgesics (Sol. Morphini 10 mg). Against the background of the therapy, the patient did not improve her condition, still com-

plaining of a pronounced pain syndrome - according to the visual analogue scale (VAS) from 8/10 to 10/10 points. Taking into account the low platelet count, high pain syndrome, and ineffectiveness of OA, the decision was made to refrain from epidural anaesthesia and to perform ESPB blockade using an interstitial catheterisation kit (Picture 2).



**Picture 2.** *Interstitial catheterisation kit*

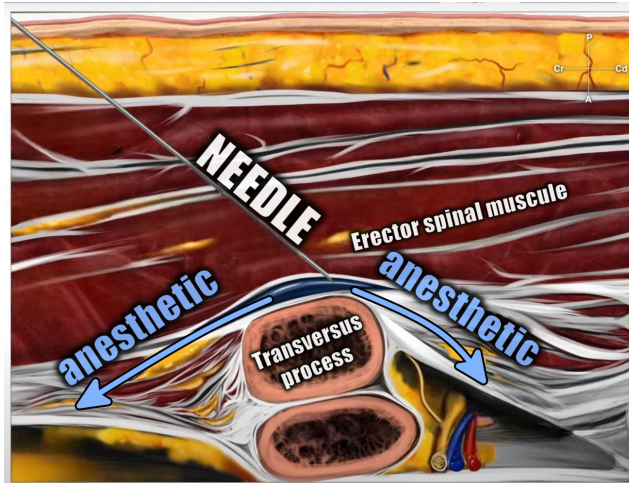
Sol. Ropivacaini 0.5% due to the optimal ratio of the speed of onset and duration of action of the drug. ESPB was performed in the right side position at the level of the Th 5 vertebra (Picture 3).



**Picture 3.** *Technique of performing the blockade under ultrasound navigation.*



Under ultrasound guidance, using a 10-5 MHz high-frequency linear transducer, a 3.5-inch (90 mm) long 20-gauge Quincke tip needle was advanced in the cranio-caudal plane until the tip of the needle reached the dorsal surface of the right transverse process at the level of the Th5 vertebra (Picture 3,4).



**Picture 4.** Schematic representation of a fascial plane block of the spinal erector spinae muscle with anaesthetic direction.

After a negative aspiration test, Sol. Ropivacaini 0.5% without additional dilution for 90 to 100 seconds. The injection volume in the interfascial plane promotes a smoother and more voluminous distribution of the local anaesthetic to several levels above and below in order to obtain adequate analgesia [24, 25]. Ten to 30 minutes after manipulation, the patient noted a marked reduction in pain intensity to 2/10 points on the VAS scale both at rest and on activation. Ten hours after the blockade, the patient reported a partial increase in pain syndrome on activation (up to 6/10 points on the VAS scale). After that, the patient reported no pain for the next 18-20 hours, with a VAS score of 0/10. After 22 hours there was an increase in peristalsis. No complications during anaesthesia were observed. On the next day after hospitalisation, an endoscopic ultrasound examination of the upper abdominal cavity, retroperitoneum transgastrally and transabdominally (endoscopic ultrasound (Endo-ultrasound)) was performed, which showed endoscopic signs of chronic calculous cholecystitis and “passed” choledochal stone without bile passage disturbance. Laparoscopic cholecystectomy was performed urgently. The patient was discharged from the hospital with improvement. The total time in the intensive care unit was 46 hours, in hospital 8 days.

## Discussion

ESPB blockade has been well established as an effective, safe and simple method for pain management in patients with thoracic and abdominal pain [10,11,12,13,14,15,19,24]. However, the effectiveness of using this type of blockade in patients with severe pain syndrome on the background of acute oedematous pancreatitis of alimentary or biliary genesis remains a poorly studied issue.

Opioid analgesics are the gold standard for analgesia of patients with acute pancreatitis [22], as well as EA - it has proved to be an excellent component of analgesia in acute pancreatitis, but it is accompanied by a high risk of haemorrhagic complications, it is demanding to master the technique [19,22]. Ultrasound-guided anaesthesia is increasingly used as a component of multimodal analgesia in the intensive care unit to reduce the use of parenteral opioids. Transverse Abdominal Plane Blockade (TAPB) is another interfascial blockade that has been described as an adjunct to analgesia for biliary colic and pancreatitis; however, TAPB affects somatic peripheral nerves that should not affect pain of visceral origin, reducing the relevance of TAPB for analgesia in acute pancreatitis [16,25]. In our experience, the use of TAPB in patients with biliary colic and acute appendicitis reduces pain well but does not completely remove it [26]. ESPB blockade at the thoracic level - on the contrary - has shown to be effective in sympathetic nerve fibre block in addition to the dorsal and ventral branches, extending into the paravertebral space to provide both visceral and somatic analgesia [21]. According to several reports, it is known that ESPB can successfully manage pain in acute pancreatitis [27,28,29]. The blockade is not without complications, there are described cases associated with ESPB such as pneumothorax, lower limb weakness due to redistribution to the lumbar plexus, systemic toxicity of local anaesthetics (LAST) [28]. It is also necessary to have bedside monitoring of haemodynamics and fat emulsion when using long-acting anaesthetics (Bupivacaine/Ropivacaine) in large volumes [30,31]. But even taking into account all the disadvantages, peculiarities and requirements for the blockade, it is a promising method that has proved itself as a monoanaesthesia for acute pancreatitis as well as a component for multimodal anaesthesia.

Since the blockade was developed and implemented in 2018 and it is relatively new and there are few studies on its efficacy in patients with pancreatitis, further studies are needed. It is necessary to determine the efficacy, safety, degree of sympathetic and visceral blockade, which may reduce the time in intensive care, the duration of artificial ventilation, the consumption of opioid analgesics and improve clinical outcome, reducing mortality.

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头臂动脉粥样硬化患者 Barthel 指数的研究  
**THE STUDY THE BARTEL INDEX IN PATIENTS WITH  
ATHEROSCLEROSIS OF BRACHIOCEPHALIC ARTERIES**

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介绍。 心血管疾病是一个包括中风、心肌梗塞和外周动脉疾病等疾病的术语。缺血性中风仍然是最致残的脑血管疾病。颈动脉很容易在颈内动脉的起始处形成动脉粥样硬化斑块。尽管人们努力通过消除传统危险因素来减轻心血管疾病的负担,但并没有导致血管意外的急剧减少。

研究目的: 评估老年人短头动脉粥样硬化患者的基本功能活动。

材料和方法。 该研究纳入了 2020 年至 2021 年期间住院的 99 名 65 岁及以上患者。圣乔萨夫别尔哥罗德地区医院血管外科。检查的患者的头臂干有不同部位的明显病变。通过复制病历中的必要数据来收集有关患者健康状况的信息。此外,在检查过程中还测定了患者的巴塞耳指数,该指数表征了患者的基本功能活动。结果进行统计学处理,均值比较采用 Fisher F 检验,差异有统计学意义,第一类误差概率小于 5% ( $p > 0.05$ )。

结果。 研究发现,动脉粥样硬化对基本功能活动的影响是不明确的,并且取决于其他伴随因素。评估了动脉粥样硬化的个体形式对基本功能活动和整体活动的各个方面的影响。

结论。 研究表明,头臂干病变患者的基本功能活动是矛盾的。由于在穿衣过程中限制在平坦表面上的活动,患有这种形式的动脉粥样硬化的患者平均感觉比其他患者更容易。这可能是由于神经退行性变导致循环障碍性脑病的发生,这反过来又扰乱了患者对其病情的充分认知,并可能导致对其功能能力的自我评估发生扭曲。在急性脑缺血或短暂性脑缺血发作的患者中,情况发生了根本性的变化。

关键词: 动脉粥样硬化, 基本功能活动, 老年, 老年检查。

**Introduction.** *Cardiovascular disease is a term that includes diseases such as stroke, myocardial infarction and peripheral arterial disease. Ischemic stroke remains the most disabling cerebrovascular disease. The carotid arteries are very prone to developing atherosclerotic plaques at the origin of the internal carotid artery. Despite efforts to reduce the burden of cardiovascular disease by eliminating traditional risk factors, it has not led to a sharp decrease in vascular accidents.*

**The purpose of the study:** *to estimate the basic functional activity of patients with atherosclerosis of the brachycephalic arteries of elderly people.*

**Materials and methods.** *The study included 99 patients aged 65 years and over who were hospitalized in 2020-2021. to the Department of Vascular Surgery of the Belgorod Regional Hospital of St. Joasaph. The examined patients had a significant lesion of the brachiocephalic trunk of various localization. The collection of information about the state of health of patients was carried out by copying the necessary data from medical records. In addition, during the examination, the Barthel index was determined in patients, which characterizes the basic functional activity of the patient. The results were processed statistically, Fisher's F-test was used to compare the mean values, the differences were considered statistically significant, with the probability of error of the first kind less than 5% ( $p > 0.05$ ).*

**Results.** *As a result of the study, it was found that the effect of atherosclerosis on basic functional activity is ambiguous and depends on other concomitant factors. An assessment of the influence of individual forms of atherosclerosis on various aspects of basic functional activity and overall activity as a whole is given.*

**Conclusion.** *As a result of the study, it was shown that the basic functional activity of patients with lesions of the brachiocephalic trunk is contradictory. Restriction of movement on a flat surface during dressing, patients with this form of atherosclerosis, on average, felt less difficulty than other patients. It is possible that this may be due to neurodegeneration leading to the development of dyscirculatory encephalopathy, which in turn disrupted the patients' adequate perception of their condition and could lead to a distorted self-assessment of their functional capabilities. The situation changed radically in patients with acute brain ischemia or transient ischemic attack.*

**Keywords:** *atherosclerosis, basic functional activity, old age, geriatric examination.*

## **Introduction**

Cardiovascular disease is a term that includes diseases such as stroke, myocardial infarction (MI), and peripheral arterial disease. [13] They continue to be the leading causes of premature death, disability and health care costs worldwide.



[12] According to the World Health Organization, atherosclerosis is a variable combination of changes in the internal intima, including the accumulation of lipids, complex carbohydrates, fibrous tissue, blood components, calcification, and associated media changes.[3]

Ischemic stroke remains the most disabling cerebrovascular disease, accounting for more than 5 million deaths worldwide, and the global burden of cerebral infarction is growing at an alarming rate [5,10]. Atherosclerotic plaque instability due to hyperlipidemia in the carotid arteries is a major risk factor leading to ischemic stroke [9]. The degree of atherosclerotic lesions of the common carotid, internal carotid branch or bifurcation of the carotid artery determines the degree of cerebrovascular pathology [4].

The carotid arteries are very prone to developing atherosclerotic plaques at the origin of the internal carotid artery. Studies have shown that atherosclerosis causes hemodynamic disturbances in brain structures, which leads to neurodegeneration even in asymptomatic patients [2,6,7,8]. One of the traditional non-modifiable risk factors for atherosclerosis are age and male gender. Despite efforts to reduce the burden of cardiovascular disease by eliminating traditional risk factors such as smoking cessation, control of blood pressure and total cholesterol, obesity and diabetes, there has not been a dramatic reduction in vascular accidents. [1].

Currently there are more than 200 scales for assessing vital activity. In neurological practice the Barthel scale of daily life is the most common. The scale does not test social and intellectual abilities, but it can be used as a screening method. It is convenient to use the scale both to determine the patient's initial level of activity and to monitor the effectiveness of rehabilitation for the patient's adaptation in society, assessing his quality of life and the need for care. [11]

**The purpose of the study:** to assess the basic functional activity of patients with atherosclerosis of the brachycephalic arteries of elderly people.

#### **Materials and methods**

The study included 99 patients aged 65 years and over who were hospitalized in 2020-2021. to the Department of Vascular Surgery of the Belgorod Regional Hospital of St. Joasaph. The surveyed revealed multifocal atherosclerosis, in particular, lesions of the brachiocephalic trunk of various localization.

All patients were divided into two groups matched by sex and age. The first consisted of 66 patients without atherosclerotic lesions of the carotid arteries, the second - of 33 people with this pathology.

The collection of information about the health status of patients was carried out by copying the necessary data from medical records. In addition, during the examination, the Barthel index was determined in patients, which characterizes the basic functional activity of the patient.

The Barthel index was determined using an appropriate questionnaire. In the process of data analysis, in addition to the general value of the index, its average

values were assessed, characterizing certain types of basic functional activity (the ability to eat independently, observe personal hygiene rules, dress, take a bath, perform physiological needs (urination, defecation), get out of bed, walking on level ground and climbing stairs).

The results were processed statistically, Fisher's F-test was used to compare the mean values, the differences were considered statistically significant, with a probability of error of the first kind less than 5% ( $p > 0.05$ ).

### **Research results**

As a result of the study, it was shown that the basic functional activity of patients with lesions of the brachiocephalic trunk is contradictory.

When moving on a flat surface ( $13.79 \pm 0.53$  and  $12.35 \pm 0.38$  points;  $p < 0.05$ ), in the process of dressing ( $9.39 \pm 0.40$  and  $8.33 \pm 0.28$  points;  $p < 0.05$ ), patients with this form of atherosclerosis, on average, felt less difficulty than other patients. It is possible that this may be due to neurodegeneration leading to the development of dyscirculatory encephalopathy, which, in turn, disrupted the patients' adequate perception of their condition and could lead to a distorted self-assessment of their functional capabilities.

In relation to the overall values of the Barthel index, in groups of elderly patients with and without signs of atherosclerosis of the brachiocephalic arteries, no significant differences were found ( $p > 0.05$ ).

The situation changed radically in patients with acute cerebral ischemia or transient ischemic attack.

More expressed limitations of basic functional activity in the process of eating ( $9.17 \pm 0.28$  and  $9.89 \pm 0.10$  points;  $p < 0.05$ ), as well as when trying to take a bath on their own ( $3.75 \pm 0.26$  and  $4.94 \pm 0.10$  points;  $p < 0.05$ ) had patients who had previously had a cerebral infarction in comparison with other patients.

### **Conclusions**

1. Developing a strategy for the treatment of such patients, measures should be included in the complex of treatment and rehabilitation measures to compensate for the limitation of mobility of this cohort of patients.

2. The use of the Barthel index of activity of daily life, especially in patients after a cerebral infarction makes it possible to predict the duration and outcome of rehabilitation.

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评估现代城市绿地质量的新方法和研究成果

**A NEW APPROACH TO ASSESSING THE QUALITY OF GREEN AREAS AND THE RESULTS OF RESEARCH IN A MODERN CITY**

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抽象的。发达国家的人口正在走向更加城市化的社会。舒适的城市环境是形成高生活水平的重要因素。作为研究的一部分,分析了秋明市中心绿地状况对交通基础设施影响程度的依赖性。本研究是根据已制定的景观美化质量评估方法和景观美化密度评估规模进行的。研究表明,由于城市地区的景观美化程度较低,植物无法应对负荷,绿地也无法保护城市人口免受有害环境因素的影响。技术负荷的高低主要表现为干旱、污染和坏死。道路交通数量与绿地总体状况之间的直接关系已被揭示。

关键词: 居住区、技术影响、交通基础设施、植物指示的物候方法、绿色空间。

**Abstract.** *The population of developed countries is moving towards a more urbanized society. A comfortable urban environment is an important factor for the formation of a high standard of living. As part of the study, an analysis was made of the dependence of the state of green areas on the level of impact of transport infrastructure in the central part of the city of Tyumen. The study was conducted on the basis of the developed methodology for assessing the quality of landscaping and the scale for assessing the density of landscaping. Studies have shown that with a low degree of landscaping of the urban area, plants cannot cope with the load and green areas become unable to protect the population of the city from harmful environmental factors. The level of technogenic load is manifested in the form of drying out, pollution and necrosis. A direct relationship between the number of road transport and the general condition of green spaces has been revealed.*

**Keywords:** *residential area, technogenic impact, transport infrastructure, phenological methods of phytoindication, green spaces.*

## Introduction

Scientifically proved that the main trend of modern human existence is urbanization. Already, more than 50 per cent of the world's population lives in cities and urban settlements, and experts predict that in just seven to eight years it will reach 60 per cent of the world's population.

And this prospect can cause serious problems, foremost among which is environmental security. In fact, the amount of toxic emissions to the atmosphere from densely populated cities accounts for about 70% of the total amount of such pollution. Also, growing cities are constantly demanding different resources, which also leads to environmental degradation. Now, urban residents consume about 60% of the planet's total resources, and this figure will only increase in the future.

Consequently, careful social, economic and environmental preparation is needed to address the problem of further urbanization of the population without causing significant environmental damage. In particular, very often there are cities where the population simply lacks social facilities - schools, kindergartens, health institutions, etc. Also in large cities there are problems of monitoring the status of sanitation systems, sewerage, waste collection, etc., which leads to accidents and increased emissions into the environment. [1]

Today's society should strive for stable development, both in the economic and environmental spheres. In order to achieve this goal, the concept of openness, security, resilience and environmental sustainability of human settlements was introduced within the framework of the United Nations concept. [2]

Cities have an adverse impact on the environment, and they do so through a combination of factors. The main sources of pollution are transport modes and industrial production. They affect water and air resources, soil, flora, fauna, etc. [3]

It should be noted that many natural objects have the capacity to regenerate themselves, but this requires a fairly long time and a balance between negative impacts and the capacity. Unfortunately, in the context of urbanization, the amount of man-made impact on natural objects is only increasing, so many natural objects simply do not have time to recover. In addition, negative impacts have a cumulative effect, resulting in degradation and loss of life.

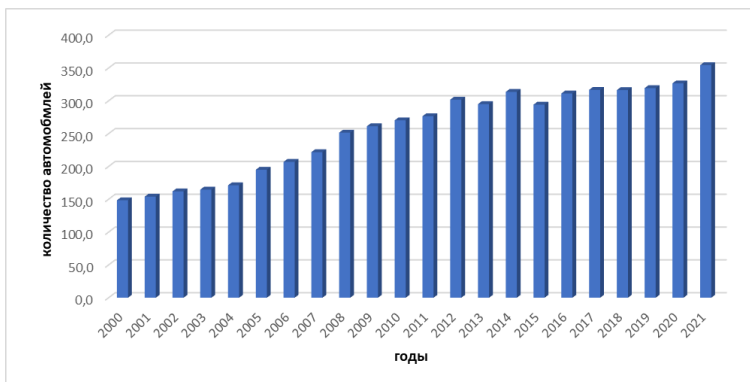
This phenomenon can often be observed when assessing the degree and state of urban landscaping, both historical and modern. In order to minimize the negative effects of technogenic factors on the environment, it is necessary to systematically and systematically assess the state of green areas and the factors that affect them. In addition, there is a need to expand green space in large cities by continuously caring for existing vegetation. [4.5]

**The purpose of the study:** to study the impact of transport infrastructure in the central part of the city of Tyumen on the state of green areas.

**Materials and research methods:** analytical and statistical materials became sources of information for our research; we used analysis, comparison and mathematical methods as research methods.

**Results of the study their discussion**

The dependence of the state of the environment on negative man-made factors was studied on the example of the city of Tyumen. Statistics show that over the past few decades, the city’s population has grown significantly. This is due to the fact that citizens from nearby villages and villages, as well as residents of neighbouring (more northern) regions come to Tyumen for permanent residence. In this connection, the number of urban cars is growing. For example, according to the Federal State Statistics Service, the number of cars in the city has more than doubled over the past 20 years. In particular, while in 2000 there were 148.5 cars per 1,000 people, in 2021 there were 354.4 cars per 1,000 people. The clear growth in the amount of passenger transport in the city is presented in Figure 1. Accordingly, the volume of emissions into the environment has increased significantly. Currently, it is about 92 thousand. tons annually.



*Figure 1. Number of vehicles per 1,000 people.*

Analysis of the state of the green areas of the city of Tyumen has now shown that the urban area is not sufficiently green. Despite the fact that there is a lot of development and expansion of the city, most of the attention in the design and planning of new neighbourhoods is given to transport infrastructure and residential development, while green areas are given a minimum area. It should be noted that the area of greening of the urban area is gradually increasing, but the growth rate is minimal.

To analyze the condition of woody plants, we chose the central section of the city, as it is there that the green areas are subjected to the most intense influence of

technogenic factors. We chose a site where at rush hour there is a maximum traffic load (data received from the City Administration). In particular, the following objects are located in the study area:

- the railway,
- major interchanges,
- busy downtown streets.

The area of the plot is 2,880,000 m<sup>2</sup> and is limited to the streets of Melnikaite, 50 years VLKSM, 50 years October and Permyakov. For a more accurate and convenient assessment, we have divided the area into 49 equal squares (segments).

The study was carried out in summer and winter for 4 years. As part of the study, the density of landscaping on selected segments was estimated taking into account the grassy vegetation.

To determine the extent of greening, we have developed a scale to estimate the density of greening. The analysis found a relationship between the total area of the site and the area occupied by infrastructure, industry and residential buildings. We measured the density of landscaping on the basis of our rating scale. Table 1 shows the levels at which the density of greenery was differentiated.

**Table 1.**  
*Landscaping intensity scale*

%landscaping density	landscaping density	Density characteristic
0 - 30	low	Landscaping completely missing or a small lawn or flower bed
30-70	medium	Landscaping is presented in the form of squares, but most of the road and playgrounds
70-100	high	Greening area dominates the paving area

As part of the study, we studied the condition of deciduous plants, including grass, and conifers in each square of the selected area. To do this, we used a special method, the development of which lasted almost three years. The methodology is based on domestic and international experience. Preliminary additional studies and tests were carried out, which confirmed that the developed methodology is working. Thanks to our methodology we can analyze the state of green spaces in the city and plan landscaping in order to reduce the impact of technogenic factors and minimize the negative impact on the environment.

The technique is based on the plant phytoidization method. The data to be taken into account in the analysis of plants have been compiled in a separate table. The main indicators for the assessment were:

- a plant species,
- the age of plants,

- the presence of drying out and damage,
- the presence of dust,
- projective coating,
- average distance between trees,
- degree of contamination,
- the presence of necrosis.

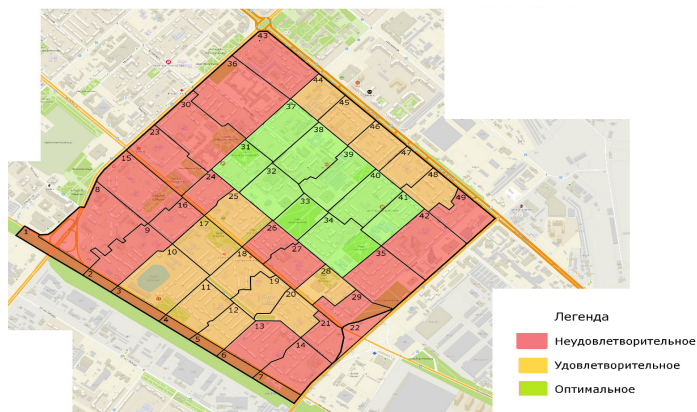
After estimating each indicator, a general conclusion was drawn on the state of plants in each square. For each square of the study area, the average of the indicators analysed was derived.

For deciduous and coniferous plants the analysis was carried out separately. In particular, the following plants were analyzed:

- Norway spruce (*Picea abies*),
- Scotch pine (*Pinus sylvestris*),
- Poplar (*Populus nigra*),
- White birch (*Betula pubescens*).

Conifers were sampled in winter and deciduous plants in summer. To correct the study and eliminate the influence of weather factors, the selection was carried out about 3 times by the method of envelope. Each sample is represented as a tree branch from 7 to 15 cm in length. It is important to note that an average value was derived for each segment of the plot. Samples were taken from about 50 per cent of the trees in the plots studied.

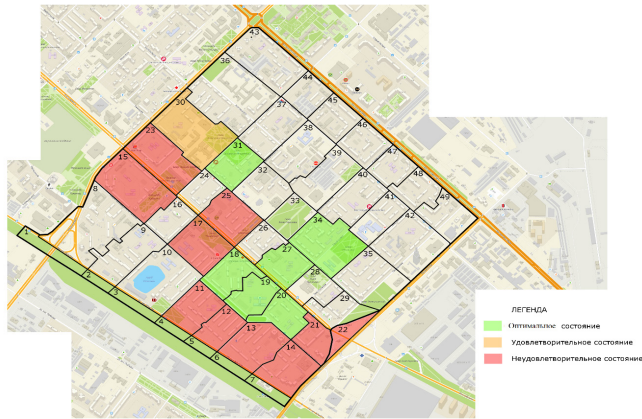
Based on the results of the data obtained, maps of the general condition of deciduous trees (fig. 2) and coniferous trees (fig.3) were drawn up, which made it possible to establish the relationship between man-made effects and the general state of plants.



**Figure 2.** General condition of deciduous plants



According to the results and color visualization of deciduous plants, the following conclusions are noted: in areas dominated by streets with high traffic load and long traffic lights, there are more segments with a general unsatisfactory condition. The causes are found to be leaf necrosis and the presence of dust and poor grass cover. It should be noted that in those segments where there was a higher density of landscaping, its condition was satisfactory. In the railway area, hardwood plants were found to be in poor condition due to abundant soot and dust, with necrosis in minimal quantities. In the middle of the plot, in the area of residential neighborhoods there was an optimal condition of plants (signs of necrosis and dust presence were minimal or completely absent).



*Figure 3. General condition of conifers*

According to the results and color visualization of coniferous plants, the following was observed: in areas dominated by streets with increased traffic load and long traffic lights, The most commonly observed segments are those with a general unsatisfactory plant and grass cover, with obvious signs of necrosis and desiccation. At the same time, in segments 1 - 10, 16, 24, 26, 28, 29, 32, 35 - 49, conifers were practically absent.

### Conclusion

1. The results of the research showed that the greenery in the selected area of Tyumen city, for the most part, are in poor condition. This is due not only to the negative impact of anthropogenic and technological factors, but also to the selection of crops without consideration for their biological characteristics.

2. The level of man-made load is manifested in the form of dried branches and leaves, soiling and necrosis.

3. With low density of greening plants cannot cope with the man-made load.

4. Transport infrastructure and increasing motorization of the population have the greatest impact on urban tree crops.

5. A well-planned process of urban greening, taking into account the biological characteristics of plants, can solve the problem of increased man-made load of cities and will save the urban ecosystem at a high level for future generations.

6. The methodology developed makes it possible to assess the quality of greenery in different cities and to take appropriate measures to improve the components of the urban environment.

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中国绿色建筑的特点

中国绿色建筑的特点

**PECULARITIES OF GREEN BUILDING IN CHINA  
FEATURES OF CHINA'S GREEN BUILDING**

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注解。中国经济的快速发展对其环境产生了强烈影响。水、空气和土壤这三个栖息地都受到了污染，这对人们产生了强烈的影响，也违背了中国历来强调人与自然和谐共处的传统文化。然而，随着习近平总书记的上任，情况开始迅速发生变化。建立了严格的反腐败审计制度，对环境监测虚假报告进行了严厉的处罚，通过建立国家公园和自然保护区制度建立了生物多样性保护体系，国家正在迅速迈向低碳可持续发展，这将对未来气候变化的有利解决产生重大影响，同时也对地球的生活条件产生重大影响。中国正在其中许多问题上与国际社会积极合作。

这篇文章专门讨论了中国生态建设的特点，特别是2023年上半年的情况，同时也谈到了中国共产党第十九次全国代表大会的未来几年。清洁能源生产问题与气候密切相关，涉及最重要的生存问题，政府、中国最大的氢气生产商中国石化的行动以及宗教组织的活动都值得考虑。在可持续生态发展建设中，作为中国传统对待自然态度的代表，在笔者看来，这应该是最完整的中国版图景。

关键词：可持续绿色发展、气候变化、污染治理、生物多样性保护、环境监测、清洁能源、生态系统恢复

*Annotation. The rapid development of China's economy has had a strong impact on its environment. All three habitats - water, air and soil - have been polluted, which has had a strong impact on people and goes against China's traditional culture, which has always emphasised the harmonious coexistence of man and nature. However, with the beginning of the reign of General Secretary Xi Jinping, the situation began to change rapidly. Serious anti-corruption auditing systems have been established, severe penalties have been imposed for false reporting of environmental monitoring, a system of biodiversity protection has been established through the creation of a system of national parks and nature reserves, and the country is rapidly moving towards low-carbon sustainable development,*

*which should have a major impact on the future favourable resolution of climate change, which is also having a major impact on living conditions on Earth. China is actively co-operating with the world community on many of these issues.*

*The article is devoted to the peculiarities of Chinese ecological construction especially for the 1st half of 2023, but also touches upon the preceding coming years by the 19th National Congress of the Communist Party of China. The actions of the government, the largest hydrogen producer in China - Sinopec company - are considered, as the issue of clean energy production is closely related to the climate and refers to the most important issue of survival, as well as the activities of religious organisations in the construction of sustainable ecological development, as representatives of the traditional Chinese attitude to nature, which should, in the author's opinion, present the most complete picture of what is happening in the Chinese version.*

**Keywords:** *sustainable green development, climate change, tackling pollution, biodiversity preservation, environmental monitoring, clean energy, ecosystem restoration*

China's rapid economic growth has also been accompanied by intense pressure on the environment. Water, air and soil were heavily polluted. However, since the 19th National Congress of the Communist Party of China, the situation has changed rapidly, and a course towards sustainable green development has been set. General Secretary Xi Jinping emphasised that «green mountains and emerald waters are priceless treasures» and their preservation is the way to the endless sustainable existence of the Chinese nation. He identified following the green development path as a priority for the economy and one of the essential human needs<sup>1</sup>. Besides, the destruction of nature, Xi Jinping emphasised, will inevitably lead to a natural disaster and the worst consequences, which must also be taken into account. And if the level of the economy is reduced, people will be left with green mountains and clean water - the basis for further existence. But still the standard of living of people, the Secretary General emphasises, should be high. He has set the goal of making green waters and green mountains golden mountains and silver mountains.

The main areas of sustainable environmental development in China are air pollution control, climate change control, water pollution control and soil pollution control. Other areas include combating desertification and land degradation, and closely related to these processes is the restoration of forests on the territory of China. As a result, it is the care of biodiversity, and in particular, the creation of a system of national parks and specially protected natural areas.

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<sup>1</sup> Xi Jinping. Carrying high the banner of socialism with Chinese characteristics, unitedly struggle to comprehensively build a modernised socialist state. Report to the 20th National Congress of the Communist Party of China on the 16th of October, 2022.

It should be noted that already in the first half of 2023, a huge amount of work has been done to combat climate change, reduce carbon emissions, introduced strict inspection of enterprises and other sources of pollution, identified violations in the provision of facts, introduced penalties for such actions, improved monitoring system, which is also the merit of Xi Jinping.

In addition, the country actively participates in international environmental processes. It initiated and contributed significantly to the preparation of the Kunming-Montreal Declaration on Biodiversity Conservation. Several private meetings on the same issue were held with representatives of other countries parties to the biodiversity convention, including two meetings with representatives of Brazil - Brazilian Ambassador to China Gao Wang<sup>2</sup>, as well as meetings with representatives of Australia, France, New Zealand and the Chairman of the UN General Assembly at its 77th Session, Chaba Körösi, with whom the topics of biodiversity conservation, climate change and sustainable development until 2030 were discussed<sup>3</sup>.

Serious action is underway in the PRC to counter climate change. China has made a commitment to peak carbon emissions by 2035, to «drastically improve the ecological environment, basically achieve the goal of building a beautiful

China»<sup>4</sup>, after which it must also achieve carbon neutrality by 2050. In this regard, tremendous work is being done in the science and technology field. As a result, China has become a leader in the production of solar panels, including ultra-thin solar panels, which, moreover, are made of environmentally friendly materials and are easy to disassemble, without damaging the environment when disposed of.

It can also be stated that the number of coal-fired plants in the country is indeed declining. while in 2015, 515 GW of coal-fired power plants were planned, already in 2019 this figure is 70 GW, which is 86 per cent less than the planned amount<sup>5</sup>.

Nevertheless, in 2022, 56.2 per cent of China's electricity was generated by coal, and an additional 106 GW of coal-fired power plants have been approved,

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<sup>2</sup> Minister of Ecology and Environment Huang Rongqiu met with Brazilian Ambassador to the PRC Gao Wang // 生态环境部部长黄润秋会见巴西驻华大使高望\_中华人民共和国生态环境部(mee.gov.cn)

<sup>3</sup> Minister of Ecology and Environment Huang Junqiu met with the President of the United Nations General Assembly Chaba Körösi // 生态环境部部长黄润秋会见联合国大会主席克勒希·乔鲍\_中华人民共和国生态环境部(mee.gov.cn)

<sup>4</sup> Xi Jinping. Carrying high the banner of socialism with Chinese characteristics, unitedly struggle to comprehensively build a modernised socialist state. Report to the 20th National Congress of the Communist Party of China on the 16th of October, 2022.

<sup>5</sup> Energy company RWE abandons plans to build coal-fired power plants // Энергетическая компания RWE отказывается от планов строительства угольных электростанций (energy.media)

despite the fact that the country ranks No. 1 in the world in solar and wind power generation. However, this approach is due to the fact that most of the clean renewable energy is produced in the Xinjiang Uygur Autonomous Region (XUAR), and its capacity is not yet sufficient for all of China's energy consumption. In addition, due to the dependence of some energy sources on weather, such as hydroelectric power plants, power outages can occur, as was the case in 2021 due to drought in southern China<sup>6</sup>. Therefore, coal-fired plants are a safety net, although they are being phased out and replaced with more environmentally friendly plants. Nevertheless, China not only produces solar energy, but also successfully builds storage facilities to distribute it when there are fluctuations in the system. In addition, powerful transmission lines have been built just for this type of energy and it is even delivered to Shanghai, on the opposite side of the country. Wind power is also being actively utilised, and more and more hydroelectric power plants are being put into operation, as well as hydrothermal energy where possible, as in Gansu province<sup>7</sup>, Sichuan and others, and even dry hot rocks, which is also considered a clean energy source.

As a result of the consistent move towards renewable energy, carbon emissions have already been reduced by more than 2 billion tonnes in 2021.

Moreover, China's largest energy company Sinopec commissioned a solar-powered green hydrogen project in Kucha, XUAR, on 3 July this year. The planned capacity is 20,000 tonnes, with a throughput capacity of 28,000 tonnes per hour, and a storage capacity of 210,000 tonnes. All this, according to experts, will reduce carbon emissions by 485,000 tonnes per year<sup>8</sup>. This is Sinopec's first project of this scale, but the company plans to develop this area and become the main supplier of this type of energy in China, and even develop this energy overseas. In addition, Sinopec has launched the first phase of the REM project in Inner Mongolia with a capacity of 30,000 tonnes of hydrogen per year and a hydrogen storage capacity of 288,000 tonnes. As a result, harmful emissions should be reduced by another 1,430,000 tonnes per year<sup>9</sup>. In addition, it should generate \$87.17 million in GDP and \$4.36 million in taxes, confirming Xi Jinping's idea that green water should become a golden mountain.

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<sup>6</sup> China's coal-fired power plant construction surges in 2022// В 2022 году Китай резко нарастил строительство угольных электростанций – Коммерсантъ (kommersant.ru)

<sup>7</sup> Gansu Carbon Peak: promoting exploration of mid- and deep-sea geothermal energy and shallow geothermal energy resources// 甘肃碳达峰：推进中深层地热能 and 浅层地热能资源勘查-国际新能源网 (in-cn.com)

<sup>8</sup> Sinopec Xinjiang Kuqa Green Hydrogen Pilot Project Enters Operation, Leading China's Green Hydrogen Development// Sinopec Xinjiang Kuqa Green Hydrogen Pilot Project Enters Operation, Leading China's Green Hydrogen Development | China Sinopec (sinopecgroup.com)

<sup>9</sup> Sinopec Launches the World's Largest Green Hydrogen-Coal Chemical Project in Inner Mongolia // Sinopec Launches the World's Largest Green Hydrogen-Coal Chemical Project in Inner Mongolia | China Sinopec (sinopecgroup.com)

The same company estimates that carbon emissions will reach 9.9 billion tonnes per year in China by 2030, but by 2060 they will be reduced to 1.7 billion tonnes per year<sup>10</sup>. And including through the use of clean hydrogen, solar, wind and hydropower, as hydro power plants are now being actively built in the PRC - one of the cleanest types of electricity generation. As a result, the company's initiatives made it possible to avoid using 7.49 million tonnes of coal and preserve more than 40 hectares of land at the Fulin shale gas field by 2021<sup>11</sup>. Moreover, the company has made tangible contributions to environmental and biodiversity conservation, not only by publishing Sinopec's White Paper on Green and Low-Carbon Development, but also by actually contributing to the establishment of natural protected areas within its jurisdiction, such as the Sinopec ZRCC Heron Nature Reserve and the two major Chinese river basins of the Yangtze and Huanghe rivers in general<sup>12</sup>.

In addition, the company has already significantly improved the atmosphere in China by using geothermal energy in more than 60 cities in various provinces such as Hebei, Tianjin, Shandong, Henan, Shaanxi, reducing harmful emissions by 4,200,000 tonnes per year. The company is also planning to hold the 7th World Geothermal Congress in September this year, which would bring together «leaders from industry, academia, the financial sector, governments, NGOs and communities to collaborate and provide thoughtful solutions for a sustainable society» and pave the roadmap for further utilisation of this clean energy source<sup>13</sup>.

In addition, since 2022, the company has been capturing, transporting, storing and efficiently utilising carbon emitted by enterprises, which also contributes to China's fight against climate change and helps to clean up the country's air<sup>14</sup>.

The programme document of the 20th CPC Congress paid great attention to environmental protection and sustainable green development. In particular, it is noted that «Respect for nature, adaptation to nature and nature protection are the essential requirements for the comprehensive construction of a modernised social-

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<sup>10</sup> Sinopec Releases China Energy Outlook 2060, Anchoring New Path of Energy Transformation Development// Sinopec Releases China Energy Outlook 2060, Anchoring New Path of Energy Transformation Development | China Sinopec (sinopecgroup.com)

<sup>11</sup> Sinopec Publishes «The Sinopec Green and Low-carbon Development White Paper 2022» // Sinopec Publishes «The Sinopec Green and Low-carbon Development White Paper 2022» | China Sinopec (sinopecgroup.com)

<sup>12</sup> Ibid..

<sup>13</sup> Clean Geothermal, Green Earth: Sinopec to Host World Geothermal Congress 2023 // Clean Geothermal, Green Earth: Sinopec to Host World Geothermal Congress 2023 | China Sinopec (sinopecgroup.com)

<sup>14</sup> China Launches First 10-million-ton CCUS Project to Probe into Decarbonization Solutions for Industrial Enterprises in East China // China Launches First 10-million-ton CCUS Project to Probe into Decarbonization Solutions for Industrial Enterprises in East China | China Sinopec (sinopecgroup.com)

ist state»<sup>15</sup>, and development plans should be drawn up «based on the high position of harmonious co-existence of man and nature»<sup>16</sup>. It was also instructed to «pay close attention to the protection of mountainous areas, river and lake environment, forest area, arable land, steppe cover and sandy soils as a whole, and adhere to a systematic approach to their improvement»<sup>17</sup>, and, based on the system of nature reserves and national parks, accelerate the implementation of biodiversity restoration projects.

Special attention was paid to reducing environmental pollution, i.e. water, air and soil pollution, as well as to reducing carbon emissions as soon as possible and achieving carbon neutrality.

For the 1st half of 2023, significant progress has also been made in this direction.

On 1 January, Huang Junqiu, Minister of Ecology, chaired an executive meeting of the ministry, where 7 national environmental monitoring standards for the foundry industry were discussed and adopted, which was an important step forward for clean air, as the foundry industry is one of the most polluting industries in terms of harmful emissions.<sup>18</sup>

On the same day, technical recommendations on monitoring in the production of pesticides and fertilisers were adopted. In addition, from the 2nd to 20th of February, Minister of Ecology Huang Junqiu inspected Pingdingshan and Xuchang cities in Henan Province, where heavy smoke was observed at the end of 2022, especially during the New Year holiday. It found violations of laws and regulations on the operation of pollution control plants, excessive emissions, failure to take emergency measures to reduce emissions, and falsification of monitoring data.

The commission also visited the Huanghe River Basin Ecology and Natural Environment Research Institute, where positive results in recent years were presented<sup>19</sup>.

Also, from 2 to 21 February, Vice Minister of Ecology Zhao Yingmin went to Xiangyang, Weinan and Hancheng, other cities in Shaanxi Province, to inspect gas-related enterprises. As a result, several companies were found to have irregularities and direct falsification of facts in reporting monitoring results. As a result,

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<sup>15</sup> Xi Jinping. Carrying high the banner of socialism with Chinese characteristics, unitedly struggle to comprehensively build a modernised socialist state. Report to the 20th National Congress of the Communist Party of China on 16 October 2022.

<sup>16</sup> *ibid.*

<sup>17</sup> *ibid.*

<sup>18</sup> An executive meeting of the Ministry of Ecology and Nature Protection was held at the Ministry // 生态环境部召开部常务会议\_中华人民共和国生态环境部 ([mee.gov.cn](http://mee.gov.cn))

<sup>19</sup> Huang Rongqiu, Minister of Ecology and Environment, conducted a surprise inspection of air pollution prevention and control in key industries in Pingdingshan and Xuchang cities// 生态环境部部长黄润秋突击检查平顶山市、许昌市重点行业大气污染防治情况 ([baidu.com](http://baidu.com))



it was decided to hand over the identified problems to local environmental authorities for rectification, while fraud and data falsification were handed over to public security authorities to be dealt with in accordance with the law and regulations<sup>20</sup>.

In addition, China is also developing clean energy in other countries, such as in Central Asia, where wind energy has been particularly developed, such as in Kazakhstan at the Zhanatas site<sup>21</sup>.

In terms of water resources protection itself, the Yangtze and Huanghe rivers were the first to be affected. In particular, on 2 February this year, the Ministry of Ecology held a meeting where it was noted «that environmental protection and the qualitative development of the Huanghe River Basin are major national strategies personally planned, deployed and promoted by General Secretary Xi Jinping». In connection with Xi Jinping's thought of ecological civilisation, comprehensive pollution control has been strengthened, environmental protection and restoration of the Huanghe River has been enhanced, and low-carbon development in the river basin has been achieved, which has greatly improved the environment and water quality to 1-3 categories as of January to March 2023<sup>22</sup>. The condition of the other major rivers of the Yangtze, Zhujiang, Sungari, Huaihe, Haihe and Liaohe have also improved to these levels, and even accounted for over 90 per cent of water of excellent quality like the Yangtze and the Zhujiang<sup>23</sup>.

Another important focus has been active participation in global ocean governance, for which China is participating in the Monaco Blue Initiative. The Minister of Ecology, Huang Junqiu, noted in this regard that «the ocean is an important part of nature and an important foundation for human survival and development»<sup>24</sup>. In addition, «Chinese President Xi Jinping has put forward the important concept of 'building a community with a common destiny for the ocean'<sup>25</sup>. It was also noted that the Chinese Government had also taken a number of measures in its territorial waters to «further enhance the quality and stability of marine ecosystems».

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<sup>20</sup> The Ministry of Ecology and Environment travelled to Xiangyang, Weinan and Hancheng to supervise and inspect key gas-related enterprises // 生态环境部赴咸阳市、渭南市、韩城市督导检查涉气重点企业\_中华人民共和国生态环境部 (mee.gov.cn)

<sup>21</sup> Having known each other for more than a thousand years and having started a new path hand in hand - the Central Asian countries look forward to sustainable and long-term co-operation with China // 特稿：相知相亲逾千年 携手同行启新程——中亚国家期待与中国在合作之路上行稳致远\_中国政府网 (www.gov.cn)

<sup>22</sup> The Ministry of Ecology and Environment has announced the status of surface water quality in the country from January to March 2023 // 生态环境部公布2023年1—3月全国地表水环境质量状况\_中华人民共和国生态环境部 (mee.gov.cn)

<sup>23</sup> *ibid.*

<sup>24</sup> Huang Junqiu, Minister of Ecology and Environment, attended the 14th Monaco Blue Initiative event and delivered a keynote speech // 生态环境部部长黄润秋视频出席第十四届“摩纳哥蓝色倡议”活动并作主旨发言\_中华人民共和国生态环境部 (mee.gov.cn)

<sup>25</sup> *ibid.*

It was also noted that also in its territorial waters, the Chinese Government has taken a number of measures to strengthen the protection of the marine ecological environment in order to «further improve the quality and stability of marine ecosystems»<sup>26</sup>.

It is also necessary to note the activities of religious organisations within the framework of building an ecological civilisation, as Buddhism and Taoism are traditionally the guardians of nature in China. As is known, around many monasteries monks have always actively planted forests, thus preserving the ecosystem and biodiversity. And in this sense, their activities are both traditional and modern, and fit in well with modernisation with Chinese specificity, one of the main characteristics of which is the harmony of man and nature, as stated in the report of Chinese President Xi Jinping at the 20th CPC Congress. Therefore, this useful activity has already been continued through legislation and, importantly, on a scientific basis.

In addition, another important project that has already been implemented is the initiative to civilise the burning of incense, as a result of which the quantity of incense has been significantly reduced, the quality has been significantly improved, and the smog over monasteries and temples has ceased, which has also contributed to the preservation of the atmosphere, historical relics, the health of monks, visitors to religious sites and surrounding residents, as well as reducing the burden on firefighters, and conserving resources, particularly forests, since the basis of incense sticks is wood.

It is clear from the above that the development of a green ecological civilisation in China is based on a solid foundation of a comprehensive approach - the elimination of pollution in all three habitats, the restoration of the country's forest cover, the creation of a system of nature reserves and national parks, and as a result, the preservation of biodiversity. As well as protecting the marine area, and launching a new initiative of «a community with a common destiny for the ocean».

In addition, the Chinese government is steadily promoting clean energy and is already ranked number 1 in the world, and is also pursuing these projects in other countries, such as Central Asia, which really extends its action on climate change to the global level. A system of green consumption, ecological culture is being introduced so that everyone can contribute to sustainable development. The traditional Chinese idea of harmony between man and nature is also used, which is expressed through the actions of religious organisations, which are also actively involved in the protection and restoration of nature.

Based on the ideas of President Xi Jinping and the continuous efforts of all sectors of society, China is steadily addressing the environmental challenges that have accumulated over the period of rapid economic growth and, as a responsible actor in international affairs, is making a significant contribution to overcoming the difficult

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<sup>26</sup> Ibid.

situation of our environment, as well as contributing to building a community of humankind with a common destiny that will follow the path of sustainable green development, which will ensure life and biodiversity for the long term

China's approach can be a model for many countries, especially in the area of ecosystem conservation, where all empty spaces are planted with forests, as this is one of the most important ecosystems for both biodiversity conservation and enhancing nature's capacity to absorb carbon. Making efforts to this capacity of the environment is also mentioned in Xi Jinping's report to the 20th CPC Congress. Also noteworthy is the strict accountability for falsifying environmental monitoring data, as well as the project to save one great river by means of another great river, which shows careful consideration of local conditions so that saving one will not harm the other and both sites will not be affected. And, of course, the development of clean energy is also a great example for many, as an alternative to the usual fossil fuels, and even more so to coal, which gives the greatest amount of carbon emissions. And at the same time, it should be noted that everything is done without sudden jerks, but at the same time both old and new are kept under strict control so that there is no failure in the energy system, according to the principle of «first introduce the new and then break the old».

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偏微分方程线性边值问题的通用近似解的改进谱法构造与求解  
**CONSTRUCTION AND FINDING BY AN IMPROVED SPECTRAL  
METHOD OF A UNIVERSAL APPROXIMATE SOLUTION  
OF LINEAR BOUNDARY VALUE PROBLEMS FOR PARTIAL  
DIFFERENTIAL EQUATIONS**

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注解。 在本文中，提出了基于正交正弦函数，使用作者开发的一种改进的谱方法，以 scho-divisional 三角傅里叶级数的形式构造和寻找偏导数微分方程边缘问题的通用逼近。 用于查找傅里叶系数，代表了伽辽金方法的发展。 此外，原始的异质边界问题必须首先转化为新的齐质边界问题，且通用正交基是公平的。

给出了借助改进的谱法对热导率方程的线性边缘问题的近似解进行构造和求解的示例。 将得到的近似解与该问题的精确解以及传统谱法得到的近似解进行了比较。

关键词：线性边缘问题的通用近似解、偏导数中的微分方程、一致收敛的傅里叶三角级数、正交正弦函数、傅里叶系数、伽辽金法、改进谱法、异质边界条件、热导率。

***Annotation.** In this article it is proposed to construct and find universal approximations of edge problems for differential equations in partial derivatives in the form of scho-divisional trigonometric Fourier series on the basis of orthogonal sinusoidal functions, using the developed by the author, An improved spectral method for finding Fourier coefficients, representing a development of the Galerkin method. Moreover, the original boundary problem with heterogeneous boundary conditions must first be transformed into a new boundary problem with homogeneous boundary conditions, for which the universal orthogonal basis is equitable.*

*Examples of construction and finding with the help of the improved spectral method of approximate solutions of linear edge problems for the heat conductivity equation are given. The obtained approximate solution is compared with the exact solution of this problem and its approximate solution obtained by the traditional spectral method.*

**Keywords:** *universal approximate solution of linear edge problems, differential equation in partial derivatives, uniformly converging trigonometric series Fourier, orthogonal sinusoidal functions, Fourier coefficient, Metod Galerkin, improved spectral method, heterogeneous boundary conditions, thermal conductivity.*

Spectral methods of solving linear edge problems of mathematical physics are known to be based on the Galerkin method [1]. Therefore, the accuracy, and therefore the effectiveness, of spectral methods, as in the traditional Galerkin method, depends to a large extent on the correct choice of basic functions.

By choosing the orthogonal system of sinusoidal functions as the universal basis, one can construct the Fourier trigonometric series, which is the desired approximation of the differential equation. Moreover, this series would allow the maximum possible speed of convergence to the generalized (accurate) solution of the differential equation. In addition, if a universal approximate solution of the differential equation is constructed and found in the form of a convergent or uniform Fourier trigonometric series, the Fourier coefficients of which are found with the power of the author of the improved spectral method [2 and 3] then it will approach the generalized solution with any given precision.

Note that the approximation of the solutions of the differential equations by the trigonometric Fourier series should be seen as an approximation of these solutions with the help of the Galerkin method, which uses the same orthogonal basis functions [3] as weight functions.

In order for the theory of solving boundary problems, including its important stage of constructing and finding a universal approximation, to be uniform for all differential equations, it is necessary to transform the boundary problem with heterogeneous boundary equationsconditions in the boundary problem with homogeneous boundary conditions. The procedure of such a transformation can be demonstrated with the example of the edge Dirichlet problem for the Poisson equation from the domain  $\Omega$  with a given continuous function  $g$  at its boundary  $G$ :

$$-\Delta u = f \text{ в } \Omega, \tag{1}$$

$$u = g / G \tag{2}$$

$w(x)$  – is smooth enough to meet the conditions  $\Delta w \in L_2(\Omega)$  and  $w = g / G$

$z = u - w$ , we will have to  $z$  boundary task

$$-\Delta z = f + \Delta w \text{ в } \Omega, \tag{3}$$

$$z = 0 \text{ на } \Gamma. \tag{4}$$

Thus, the boundary condition for the function  $z$  uniform.

So  $z = 0$  на  $\Gamma$  и  $z \in H_A$  ( $H_A$  -Hilbert space), so functionality

$$F_z = (z, z)_A - 2(f + \Delta w, z) = \int_{\Omega} \sum_{i=1}^N \left( \frac{\partial z}{\partial x_i} \right)^2 dx - 2 \int_{\Omega} (f + \Delta w) z \cdot dx \tag{5}$$

takes the minimum value of  $H_A$  and element  $z_0 \in H_A$ , at which this minimum is achieved is general solving of (3) and (4).

Let's see, what properties should  $w(x)$  transform a non-uniform boundary condition into a homogeneous one

Considering that  $z = 0$  /  $\Gamma$  and  $z \in H_A$ , formal application of Green's theorem to the second integral in equation (5) gives

$$\int_{\Omega} \Delta w \cdot z \cdot dx = - \int_{\Omega} \sum_{i=1}^N \frac{\partial w}{\partial x_i} \frac{\partial z}{\partial x_i} dx .$$

so the functional (5) can be written as

$$F_z = \int_{\Omega} \sum_{i=1}^N \left( \frac{\partial z}{\partial x_i} \right)^2 dx - 2 \int_{\Omega} f z \cdot dx + 2 \int_{\Omega} \sum_{i=1}^N \frac{\partial w}{\partial x_i} \frac{\partial z}{\partial x_i} dx . \tag{6}$$

It can be seen from expression (6) that it is possible to relax the requirements imposed on the function  $w(x)$ , and consider it as a function satisfying the  $w = g / G$  and having a partial derivative only of the first order, quadratically integrated in the sense of Lebesgue in  $\Omega$ .

The procedure shown in this example can easily be extended to more general cases.

The sequence of construction and finding of the universal approximation can be shown with the classical example of solving the edge problem for the thermal conductivity equation

$$\frac{\partial u}{\partial t} - \frac{\partial^2 u}{\partial x^2} = 0 \tag{7}$$

with the initial conditions

$$u(x,0) = g(x) , \quad g(x) = 5x - 4x^2 \tag{8}$$

and heterogeneous boundary conditions

$$u(0,t) = \mu_1(t) = 0 \quad \text{и} \quad u(1,t) = \mu_2(t) = 1 . \tag{9}$$

Reducing this problem with heterogeneous boundary conditions (9) to a problem with homogeneous boundary conditions.

New problem solved for equation

$$\frac{\partial v}{\partial t} - \frac{\partial^2 v}{\partial x^2} = 0 \tag{10}$$

with new initial

$$v(x,0) = \bar{g}(x) , \quad \bar{g}(x) = u(x,0) - w(x,0) = 5x - 4x^2 - x = 4x(1-x) \tag{11}$$

and new homogeneous boundary conditions

$$\left. \begin{aligned} v(0,t) &= \bar{\mu}_1(t) & \bar{\mu}_1(t) &= u(0,t) - w(0,t) \\ v(1,t) &= \bar{\mu}_2(t) & \bar{\mu}_2(t) &= u(1,t) - w(1,t) \end{aligned} \right\} \tag{12}$$

Equation solution (10) is a deviation of some known function  $w(x, t)$  from the desired solution  $u(x, t)$

$$v(x, t) = u(x, t) - w(x, t) \tag{13}$$

Choose an auxiliary function  $w(x, t)$  in a way that  $\bar{\mu}_1(t) = \bar{\mu}_2(t) = 0$ .

To do this we will make next equation

$$w(x, t) = \mu_1(t) + x[\mu_2(t) - \mu_1(t)] = x \tag{14}$$

With any  $t$ .

Thus, boundary conditions (12) including equation (14) for  $w(x, t)$  homogeneous

We will look for a universal approximate solution  $\tilde{v}(x, t)$  of problems (10) – (12) taking into account equation (14) as trigonometric Fourier series

$$v(x, t) \cong \tilde{v}(x, t) = \sum_{k=1}^m \tilde{v}_k(t) \sin k\pi x \quad (k = 1, 2, \dots, m), \tag{15}$$

counting  $t$  as parameter, with decomposition by elements of orthogonal basis  $\varphi^k = \{\sin k\pi x, k = 1, 2, \dots\}$ ,

for which orthogonal conditions are fulfilled in Euclidean space  $L2[0, 1]$

$$(\varphi^l, \varphi^k) = \begin{cases} 0 & (l \neq k) \\ \lambda_k & (l = k, \lambda_k > 0) \end{cases}$$

Solution (15) satisfies homogeneous boundary conditions (12) taking into account equation (14) in any choice of Fourier coefficients  $\tilde{v}_k(t)$ .

At  $t = 0$  this approximate solution takes the form of

$$\tilde{v}(x, 0) = \sum_{k=1}^m \tilde{v}_k(0) \sin k\pi x \Big|_{m \rightarrow \infty} \rightarrow v(x, 0) = 4x(1 - x) \quad (k = 1, 2, \dots, m) \tag{16}$$

For the condition (16) to be met, Fourier coefficients must be reliably determined

$$\tilde{v}_k(0) = 2 \int_0^1 g^*(z) \sin k\pi z \cdot dz \quad (k = 1, 2, \dots), \tag{17}$$

where  $g^*(z)$  – periodic, quadratic integrable in the Lebesgue sense, identically equal to the interval  $[0, 1]$  of the function  $\bar{g}(z)$ , i. e.  $g^*(z) \equiv \bar{g}(z), z \in [0, 1]$

Fourier coefficients  $\tilde{v}_k(t)$  at arbitrariness  $t$  must be such that satisfy equation (10) after insertion of the desired solution (15):

$$\sum_{k=1}^m [(k\pi)^2 \tilde{v}_k(t) + \dot{\tilde{v}}_k(t)] \cdot \sin k\pi x = 0 \quad (k = 1, 2, \dots, m)$$

This equation will be satisfied if the expression in square brackets is zero:

$$\dot{\tilde{v}}_k(t) = -(k\pi)^2 \tilde{v}_k(t) \quad (k = 1, 2, \dots). \tag{18}$$

Thus, the second-order partial differential equation (10) in this representation of the solution sought (15) has been reduced to a simpler ordinary first-order dif-



differential equation (18) for finding Fourier coefficients  $\tilde{v}_k(t)$ . Solving this equation taking into account the initial condition (16) and the expression (17) for  $\tilde{v}_k(0)$ , we have

$$\tilde{v}_k(t) = \exp[-(k\pi)^2 t] \cdot \tilde{v}_k(0) \quad (k = 1, 2, \dots). \quad (19)$$

Computing the integral in the expression (17) for an arbitrary function  $g^*(z)$  is difficult due to the presence of a rapidly oscillating multiplier  $\sin k\pi z$  с постром  $k$ . This integral is closed for a limited class of functions  $g^*(z)$ .

In most cases of an analytic representation and its tabled representation, the integral has to be decided numerically. The Fourier series (15) and (16) with approximate calculated Fourier coefficients (17) and (19) have the Gibbs effect [3], so diverge. Therefore, the Fourier series (15) variation problem with approximate Fourier coefficients (19) refers to an incorrect Tikhonov A.N. problem [4].

Attempts to suppress the Gibbs effect have been made by many authors through the introduction of the  $\sigma$  Lanzosh multipliers or the addition of Philo and Feuire [5]. However, they were not a decisive success. In this connection, the author proposed an improved spectral method for constructing converging and uniformly converging Fourier series [2, 3] which lack the Gibbs effect. In addition, the author offers formulas for approximate calculation of Fourier coefficients [5], which allows to construct solutions of linear edge problems in the form of trigonometric series Fourier (15) and to calculate their Fourier coefficients so, that as the number of members increases, the solution found can approximate the generalized (accurate) solution of the differential equation (10) with any accuracy.

In this case, for edge problem (10) - (12), taking into account equation (14), the integral in the expression (17) is computed in the final form, that at  $t = 0$  allows to write for Fourier coefficients

$$\left. \begin{aligned} v_k(0) &= \frac{32}{(k\pi)^3} \quad (k = 1, 3, 5, \dots), \\ v_k(0) &= 0 \quad (k = 2, 4, 6, \dots) \end{aligned} \right\}$$

Fourier coefficients (19) at arbitrary  $t$  take the form

$$v_k(t) = \exp[-(k\pi)^2 t] \frac{32}{(k\pi)^3} \quad (k = 1, 3, 5, \dots). \quad (20)$$

Then, using equations (13) - (15) and expression (20), it is possible to issue a universal approximate solution to the original edge problem (7) - (9)

$$\tilde{u}(x, t) = x + \sum_{k=1}^m \exp[-(k\pi)^2 t] \frac{32}{(k\pi)^3} \sin k\pi x \quad (k = 1, 3, 5, \dots, m), \quad (21)$$

where  $m$  is an arbitrary odd number.

The alternating series (21) is convergent at any  $t$  and  $\delta \in (0, 1)$ , since for it the sign of convergence Leibniz [6].

For example, if  $x = 0.5$  we have

$$\left| \exp\left\{-[(k+2)\pi]^2 t\right\} \frac{32}{[(k+2)\pi]^3} \sin \frac{(k+2)\pi}{2} \right| < \left| \exp\left[-(k\pi)^2 t\right] \frac{32}{(k\pi)^3} \sin \frac{k\pi}{2} \right|^n$$

$$\lim_{k \rightarrow \infty} \left| \exp\left[-(k\pi)^2 t\right] \frac{32}{(k\pi)^3} \sin \frac{k\pi}{2} \right| = 0 \quad (k = 1, 3, 5, \dots).$$

Although Fourier coefficients are calculated precisely, the solution (21) remains approximate, as only finite Fourier series have to be used.

The table shows a comparison of approximate solutions of the heat and water equation obtained by Fletcher using the known spectral method [1] and equation (21) with the exact solution [1].

**Table.**

*Comparison of the solutions of the initial edge problem for the heat conductivity equation, received by different spectral methods.*

Significance $t$ at $x = 0.5$	Approximate solution $\tilde{u}$ , received by Fletcher [1]			Approximate solution $\tilde{u}$ , calculated by equation (21)			Exact solving $u$ [1]
	$m = 1$	$m = 3$	$m = 5$	$m = 1$	$m = 3$	$m = 5$	
0	1.5	1.5	1.5	1.5320	1.4938	1.5021	1.5
0.02	1.3143	1.3466	1.3384	1.3472	1.3407	1.3408	1.3408
0.04	1.1620	1.1993	1.1911	1.1954	1.1943	1.1943	1.1943
0.06	1.0371	1.0752	1.0670	1.0708	1.0707	1.0707	1.0707
0.08	0.9347	0.9729	0.9647	0.9686	0.9686	0.9686	0.9686
0.10	0.8507	0.8889	0.8807	0.8846	0.8846	0.8847	0.8847
0.12	0.7819	0.8201	0.8118	0.8157	0.8157	0.8158	0.8158
0.14	0.7254	0.7636	0.7553	0.7592	0.7592	0.7592	0.7592
0.16	0.6791	0.7173	0.7090	0.7128	0.7128	0.7128	0.7128
0.18	0.6411	0.6793	0.6710	0.6746	0.6746	0.6746	0.6747
0.20	0.6099	0.6481	0.6399	0.6434	0.6434	0.6434	0.6434
$\ u - \tilde{u}\ _2$	$9.88 \cdot 10^{-4}$	$1.97 \cdot 10^{-5}$	$1.2 \cdot 10^{-5}$	$9.72 \cdot 10^{-5}$	$3.47 \cdot 10^{-6}$	$3.95 \cdot 10^{-7}$	
$\ u - \tilde{u}\ _2^*$	-	-	-	$0.38 \cdot 10^{-5}$	$0.4 \cdot 10^{-8}$	$1.31 \cdot 10^{-9}$	

Calculation error calculated by relative norm

$$\|u - \tilde{u}\|_2 = \frac{1}{N} \sum_{i=1}^N [u_i(x, t) - \tilde{u}_i(x, t)]^2 \quad (i = 1, 2, \dots, N),$$

where  $N$  is the number of points in time  $t$ .

With the increase of  $m$ , both approximate edge problem (7) - (9) solutions obtained by different spectral methods quickly converge to the exact.

It should be noted that the solution (21) obtained is still more accurate than the approximate solution obtained by the conventional commercial method. Moreover, the main contribution to the error of the solution (21) is the error at  $t = 0$ . If this point is excluded, since the exact value of the solution is based on the condition (16) is known without computation, then the error calculated by norm

$$\|u - \tilde{u}\|_2^* = \frac{1}{N-1} \sum_{i=2}^N [u_i(x,t) - \tilde{u}_i(x,t)]^2 \quad (i = 2, 3, \dots, N)'$$

would be much smaller.

That is, in order for the approximate solution (16) for  $t = 0$  to give a more precise known value, more terms of the Fourier series must be used. For the rest of the points in time already at  $m = 3$  the solution (15) gives a good approximation to the exact, which allows more economical calculations.

The table shows that the approximate solution obtained by Fletcher at arbitrary  $t$  is significantly inferior in accuracy to the universal approximate solution (21).

It would be useful to consider another example of finding a universal approximate edge problem for equation (7) when the initial condition is given in the following form:

$$u(x,0) = g_2(x), \quad g_2(x) = \sin \pi x + x. \quad (22)$$

Boundary conditions (9) remain.

Then the initial condition of the new problem for equation (10) takes the form

$$v(x,0) = \bar{g}_2(x), \quad \bar{g}_2(x) = u(x,0) - w(x,0) = \sin \pi x. \quad (23)$$

Maintaining the procedure for finding a universal approximation of a new problem for equation  $\tilde{v}(x,t)$  (10) with new initial conditions (23) and new boundary conditions (12) taking into account equation (14) the same as for problem (10) - (12) taking into account the same equation (14) Define Fourier coefficients of the function  $g_2^*(z) \equiv \bar{g}_2(z)$ ,  $z \in [0, 1]$ ,  $t = 0$ :

$$\tilde{v}_k(0) = 2 \int_0^1 g_2^*(z) \sin k\pi z \cdot dz = \frac{\sin \pi(k-1)}{\pi(k-1)} - \frac{\sin \pi(k+1)}{\pi(k+1)} \quad (k = 1, 2, \dots). \quad (24)$$

In this expression, the second term is zero at all  $k \geq 1$ . The first term at  $k \geq 2$  is also zero, and at  $k = 1$  it gives an uncertainty of the type  $\frac{0}{0}$ , which is disclosed by the Lopital rule:

$$\lim_{k \rightarrow 1} \frac{\sin \pi(k-1)}{\pi(k-1)} = \lim_{k \rightarrow 1} \frac{\pi \cos \pi(k-1)}{\pi} = 1$$

It is now possible to prescribe a universal approximate solution to the original problem (7), (9) and (22), which is represented as the Fourier trigonometric series (15) taking into account the Fourier coefficients (19)  $\tilde{v}_k(t)$  and  $\tilde{v}_k(0)$  (24), respectively

$$\tilde{u}(x, t) = \tilde{\delta} + \exp(-\pi^2 t) \sin \pi x = u(x, t).$$

The approximate solution found coincides with the exact [1].

Thus, using the examples given, it was shown that applying the procedure of transformation of the original boundary problem with heterogeneous boundary conditions to a new boundary problem with homogeneous boundary conditions, it is possible to build and find a universal Lubricating accurate or universal approximate solutions of linear edge problems for partial differential equations in the form of converging Fourier trigonometric series, which restore generalized solutions with any accuracy.

It is recommended that the approximate Fourier coefficient values be found by an improved spectral method [2, 3] which provides a uniform convergence of the Fourier series to the desired solution of the partial differential equation.

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小吨位自主液化天然气储存终端在俄罗斯联邦内部和边境地区能源供应中的作用  
**THE ROLE OF LOW-TONNAGE AUTONOMOUS LNG STORAGE  
TERMINALS IN THE ENERGY SUPPLY OF INTERNAL AND  
BORDER REGIONS OF THE RUSSIAN FEDERATION**

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抽象的。 本文讨论了国内能源供应和边境贸易中液化天然气小吨位储存问题。 与其他能源相比，LT LNG 具有经济、社会和技术优势，以及该行业能源领域的国内发展。 作为区域和边境范围内的新能源供应来源，建设自主独立的液化天然气储存终端的前景已经得到证实。 这可以通过在存储、施工方法和方法以及技术设备领域引入创新提案来促进。

关键词。 LNG、小吨位储存、自主储存终端、LT储存技术、LT IR施工方法。

**Abstract.** *The article deals with the issues of low-tonnage storage of LNG for domestic energy supply of the country and border trade. The economic, social and technological advantages of LT LNG in comparison with other energy sources, the provision of domestic developments in this energy segment of the industry are noted. The prospects for the construction of autonomous independent LNG storage terminals, a new source of energy supply on a regional and border scale, are substantiated. This can be facilitated by the introduction of innovative proposals in the field of storage, methods and methods of construction, as well as technological equipment.*

**Keywords:** *LNG, small-tonnage storage, autonomous storage terminals, LT storage technologies, LT IR construction methods.*

Storage of natural gas is an important part of the technological chain from its production to consumption. Small-tonnage storage of liquefied natural gas is usually referred to as its storage in tanks up to 5000 m<sup>3</sup> in contrast to medium-tonnage (5000-60000 m<sup>3</sup>) or large-tonnage storage in tanks with a volume of more than 60000 m<sup>3</sup> [LNG 495.1325800.2020; ] The cost of R&D and LNG storage terminals ranges from 25 to 50% of the cost of LNG plants.

Small-tonnage LNG tanks are divided into those manufactured at the plant and constructed on site.

LNG consumers can be divided into two groups [1]:

- the first group - the consumption of the gas phase (for which a necessary condition is the presence of a storage and regasification complex);
- the second group - direct consumption of LNG in the liquid phase, (which requires only an isothermal storage with installations for filling LNG into fuel tanks or tanks).

**The first group of consumers includes:**

- gas power plants; - industrial and agricultural enterprises;
- industrial and household boiler houses; - population.

**The second group includes:**

- cargo and passenger vehicles; - sea and river vessels;
- railway locomotives; - aviation equipment;
- rocket and space technology.

The beginning of the development of small-scale storage of liquefied natural gas (LT LNG) is associated with covering the peaks of gas consumption in the face of limited opportunities for peak deliveries through gas pipelines. Subsequently, LT LNG began to be used to supply individual consumers with energy and as a gas motor fuel.

Although storage of LNG is closely related to its production, but the capacitive parameters of IR are not strictly tied to the tonnage of production (small, medium, large). This significantly expands the limits of applicability of LT IR. Thus, unlike large- and medium-tonnage RRs, which, as a rule, are part of LNG export facilities and experience serious technological, financial, and political restrictions, LT IRs have their own LNG storage technologies [1, 2, 3, 4]. In addition, small-scale storage of LNG has other advantages, namely:

**First**, a wider demand, due to the internal needs of the Russian Federation. Thus, Russia, being the leader in gas reserves (48.7 trillion m<sup>3</sup> in 2017) and one of the leaders in LNG production (642.25 billion m<sup>3</sup> in 2017) in 2019. had 31 regions with little or no gas supply (most of them are the eastern regions of Russia).

The solution to the problem of regional gasification can be an autonomous gas supply through the MTP LNG, which is determined by:

- lower cost (almost 2 times) of gasification through the use of MT LNG plant (MTS LNG) than when using a gas pipeline;
- lower storage and transportation costs (LNG is 600 times less in volume than natural gas);
- the presence of its own advanced technology for the production of LT LNG [2, 3, 4, 9], which provides LNG profitably to an area within a radius of 300 km, and a special EU Directive EUR - Lex-32014 L0094 provides for the location of LNG filling stations, after 400 km;
- higher calorific value of LNG at a relatively low cost (Table No. 1), which makes it possible to increase the energy efficiency of boiler houses and TPPs while

reducing costs by up to 20%, and also leads to a reduction in harmful emissions into the environment;

- a small amount of resources required for the production of LT LNG, which makes it possible to place the corresponding facilities almost anywhere.

Secondly, the capital investment in the MTP LNG is much less than in a large-capacity LNG plant. Thus, the experience of building a large number of MTPs in China (about 90) [5] showed a lower cost (\$500 per ton of LNG) of an MTP of LNG compared to a large-capacity one (\$1,500 per ton of LNG), [7] which contributes to financing MTP LNG.

Thirdly, the construction period of a MT plant (MTS LNG) (1-3 years) is shorter than a large-capacity plant (3-5 years).

Fourth, LNG MTP has a payback period of 3–5 years (\$2.5 billion) compared to 12–15 years for large-scale LNG production (LNG LTP) worth \$60 billion (according to the American BTIG [1]).

The first serial Russian locomotive (GTth-902 gas turbine locomotive) running on LNG made an experimental trip without refueling for 700 km with a load of 9 tons [3], which is extremely important for non-electrified highways.

The first serial Russian locomotive (GTth-902 gas turbine locomotive) running on LNG made an experimental trip without refueling for 700 km with a load of 9 tons [3], which is extremely important for non-electrified highways.

In 2017 “Gazprom transgaz” LLC Yekaterinburg was the first in the world to develop and implement a new unique technology for producing LNG 4 times cheaper than the existing one. This unit with a capacity of 3 tons per hour (it is expected to increase its capacity to 25, 50 and 100 tons per hour) is cost-effective when transporting the resulting LNG by road, rail and water transport within a radius of 300 km. These small complexes can provide gas to remote settlements, form and provide a network of gas filling stations along highways and railways and bunkering bases in shipping companies.

In addition, LT IR are part of the production and distribution network of large-tonnage LNG, including LNG production, transportation, storage, regasification of LNG, which also expands the scope of small-tonnage isothermal tank building [1], and also LT IR participate in the process of bunkering LNG ships [4]. As Skolkovo experts note [4], Russian companies, using Russia’s common border with China and Europe, can achieve the dominance of domestic LNG in the border areas of China and other countries.

Isothermal tanks are the basis for the creation of LNG storage facilities, but their operation requires technological equipment. The results of the analysis of the production of such equipment showed that the Russian Federation has almost all the equipment necessary for these purposes [7].

The main element of LNG storage equipment is pumps for pumping and circulating LNG in RR during storage. In Russia, “LGM” JSC has developed a line

of cryogenic pumps for use in LNG storage systems at natural gas liquefaction plants, in tanks of gas carrier ships, fuel ships using natural gas fuel, as well as in LNG terminals.

LGM JSC conducts technical research and mastered mass production of electric pumps with built-in electric motors operating directly in a cryogenic environment in a submerged state. Pumps of this type are used for pumping LNG in various technological processes: both in LNG loading and unloading systems and in LNG storage systems.

Technical characteristics of the line of electric pumps developed by “LGM” JSC: LNG supply 100...2300 m<sup>3</sup>/h (up to 55,000 m<sup>3</sup>/day); head up to 400 m; permissible cavitation reserve 1.0 ... 1.5 m; electric motor power 150...1200 kW.

In terms of performance, the pumps developed by “LGM” JSC are not inferior to those of Ebara, Shinko, Nikkiso and are similar in overall parameters, which makes it possible to use this equipment instead of imported analogues installed at existing facilities. One such pump ensures the operability of RRs with a volume of up to 60,000 m<sup>3</sup>. If necessary, the range of pumps can be expanded.

“NPF Contekh-Cryo” LLC has developed a two-stage vertical hermetic centrifugal pump NkpG1-12/230 (flow rate 12 m<sup>3</sup>/h, pressure head 230 m, electric motor power 15 kW). The enterprise has mastered the experience of creating pumps for pumping oxygen, nitrogen, argon in a liquid state.

Other Russian enterprises producing pumps for pumping cryogenic liquids may also master the production of pumps for LNG. There are design, technological and production facilities for the production of submersible pumps for the storage technology of RR with a volume of hundreds to hundreds of thousands of cubic meters of LNG.

This type of equipment, such as shut-off, shut-off and control valves and valves, for cryogenic liquids is traditionally produced by “Cryogenmash” PJSC, “Kurgankhimmash” JSC, etc., there are design and production facilities.

An analysis of the current state and development trends of domestic and foreign LNG MTP allows us to identify, along with the already noted directions for its further development, which, in our opinion, are associated with the development of autonomy of LNG storage facilities. This is due, as shown above, to the possibility of gasification of areas remote from energy supply, maintenance of river and sea port infrastructure, as well as highways, railways and airways. In addition, as domestic and foreign experience shows [1, 3, 4, 5], such terminals are promising in border trade with China and Europe. For example, this is how cross-border trade between Norway and Sweden is carried out. In Russia, LNG from the terminal in Vysotsk (Gazprombank) is supplied (shipped to gas carriers) to autonomous consumers in Spain, Turkey, as well as Norway and Sweden, while Cryogas supplies MT LNG to Europe, including Poland and Estonia.



The structure of such autonomous terminals depends on many factors, such as:

- quantity and consistency in the selection of LNG by consumers;
- reliability and economy of LNG terminal supply;
- number and tonnage of IR in the terminal;
- area of the terminal and its distance from residential facilities and LNG receiving facilities.

A line of IR :T LNG of various volumes should be developed, enabling the customer, on the basis of a feasibility study, including an assessment of the risk of operation, to build LNG storage facilities of any capacity and occupied area.

Consider the line of storage terminals (ST) LT LNG. Such terminals are necessary for power supply of residential areas of housing and communal services remote from the main gas pipeline, river and sea infrastructure, as well as auto, rail and air routes (Fig. 1a, b). There are 2 options for supplying gas to such terminals - pipeline and "virtual pipe", i.e. road or other mobile transport. Calculations carried out for compressed gas (CG) [6] for a 100-kilometer distance connecting the parent automobile gas-filling compressor station (CG) in Yakutsk with a consumption point in the village. Magaras showed the following advantages of supplying CG compared to NG supplied via a gas pipeline:

- capital costs are 12 times lower;
- operating costs are 1.9 times lower;
- the construction period is less than 30 times.

**The general pattern, which can be extended to an even greater extent to LNG, is that the greater the distance of the consumer from the main pipeline and the smaller the volume of consumption, the higher the efficiency of the "virtual pipe" [6].**

Thus, power supply to areas of regional and regional significance remote from main pipelines and natural gas liquefaction plants with a coverage radius of up to 300-400 km can be carried out using low-tonnage LNG storage terminals (LNG storage terminals) (Fig. 1a,b). These LNG storage terminals can have maximum autonomy with a total storage volume (depending on local demand) from 500 to 10000m<sup>3</sup>.

By calculation, it is possible to choose the optimal composition of the process and capacitive equipment of LNG ST, taking into account the peculiarities of supply and consumption: the amount of daily and seasonal unevenness, taking into account the rate of evaporation of the product, etc. for different districts and regions.

The most economical way of storage in LNG STin vertical ground isothermal tanks with a volume of 500 m<sup>3</sup>, 1000 m<sup>3</sup>, 2000 m<sup>3</sup>, 5000 m<sup>3</sup> and 10000 m<sup>3</sup>. These tanks, depending on the distance from the main pipeline or LNG plant, can be filled in different ways.

1. If gas is received from the main pipeline, this gas is liquefied at LNG storage facilities using mini-gas liquefaction units and fed to the IR. From the IR, liquefied

gas is supplied to the regasification unit, after which, at a pressure of 15–20 MPa (150–200 atm), it can be supplied to refuel automobile, river or railway vehicles with appropriate fuel systems. Regasified LNG is supplied to the housing and communal services systems at a pressure not exceeding 2.5 MPa (25 atm.) (Fig. 1a).

2. In the case of providing a “virtual pipe”, the RR is filled with LNG by stand-by from mobile tanks (cryogenic road or rail tanks and containers) (Fig. 1a).

3. In a combined way, consisting of the first two, in case of insufficiency of one of them.

Thus, a new object of internal energy supply of a local or regional scale is created for remote regions of the country, as well as border trade.

The first method can be implemented in two versions:

1. The mini LNG plant is located near the main gas pipeline and fills the LNG storage terminal. Further, after regasification, the gas goes to consumers - transport workers, industrial facilities and housing and communal services. At the same time, LNG is transported by a “virtual pipe” (cryotransport) to a remote (up to 300–400 km) LNG storage facility, where it is also stored in the RR, and then sold locally (Fig. 1a).

2. In the second option, the remote LNG storage terminal itself is a source of gas supply for the following storage terminals, even more remote from the main gas pipeline (Fig. 1b). The remoteness of storage terminals from each other is determined by logical and economic calculations.

Consider the features, capabilities and requirements for micro- and mini-installations for liquefying natural gas. Currently, there are various types of these installations: stationary, as well as in container and block-modular versions of foreign and domestic production. Manufacturers NPK NTL, LLC SPG, PJSC Cryogenmash, Moscow State Technical University named after N.E. Bauman, LNGotm, SHELL MMLS, etc. These systems have the following properties to varying degrees:

- management of the LNG collection system to ensure gas analysis during the peak period;

- IR loading during the period of reduced or increased gas analysis;

- management of NG liquefaction and LNG storage technology;

- use of LNG to generate electricity for own needs;

- feed gas (methane) is the fuel, refrigerant and product;

- relocatability (block design) with a small area of placement;

- 100% above ground installation (minimum foundation works);

- factory preparation of operation, modular design with the possibility of container transportation by road, rail or water transport;

LT LNG projects are divided into three categories by installed capacity:

- lower segment (micro LNG) – up to 5 t/h (< 40 thousand t/year);

- middle segment - 5-10 t/h ( $\geq 40$  -  $< 80$  thousand tons/year);
- upper segment - 10 -20 t/h ( $\geq 80$  - 100 thousand tons/year);

Thus, autonomous energy supply to remote regions of the country is realized. This can be facilitated by innovative methods of manufacturing and constructing IRs.

A promising method for the manufacture and construction of metal tanks is a spiral-wound welded method (“Mechanized sheet-by-sheet method of mounting the tank wall by growing”), which can be implemented in the construction of single-walled and double-walled all-metal IR, as well as internal shells of combined (with an outer reinforced concrete wall) IR[7;8,9,16]. This technology is promising for the construction of small and low-tonnage RRs in remote and hard-to-reach places for “anchor consumers”, along the main transport routes, in arctic conditions, as well as at LNG plants [7].

Another promising direction in the domestic isothermal tank building is the use of patented [10,11]. Innovative technologies “Eco-concrete” - a fundamentally new mechanized complex for the preparation of a concrete mixture in a sealed chamber high-speed concrete mixer, providing transportation of the mixture under high pressure of 1.4 MPa at a speed 120-200 m / s and concreting in a water-aerosol environment in a hermetically closed system that absolutely excludes dust and rebounds in order to achieve an environmentally friendly environment.

Ultra-high density of concrete and reinforced concrete structures is achieved by compaction and displacement of water and air from the concrete mixture to the peripheral surface of the concreting. It provides the strength of a homogeneous single-layer concrete mixture at an early stage of concreting up to 40%. [7, 15]

The use of fiber-reinforced concrete with composite reinforcement in the “eco-concrete” technology has an advantage over traditional reinforced concrete due to its higher physical and mechanical properties compared to it.

When constructing individual RRs and autonomous LNG terminals, it is rational to use innovative domestic developments [7, 12, 13, 14] in the field of liquefied gas storage systems that have domestic patents [12, 13]. These proposals, which are in varying degrees of development (from implemented to those at the stage of research and development) can significantly affect the geometric parameters of R&D, as well as industrial safety, energy and economic efficiency, operational reliability and rational use of land and human resources, both for stand-alone RRs and stand-alone LNG terminals.

A promising direction in the construction of small-capacity tanks is the use of a refrigeration gas machine (RGM) to liquefy the vapor phase directly in the tank by maintaining a low-temperature storage regime without the traditional removal of vapors outside the tank to re-liquefy (compress) the evaporating gas and return it back to the IR [13, 14].

And the release of the interwall space in the full containment tank from heat-insulating structures with their transfer to the outer surface of the outer tank will allow using the vacated volume as a reserve or emergency tank [12,14]. This solution can be implemented in LNG IR as part of plants and autonomous terminals. It can also serve as a reserve volume when the product receipt volume is exceeded. In the storage, in addition, the security of the IR itself is increased, since the volume of the gas space increases and the rise time of dangerous overpressure in the event of failure of the safety valves.

The above innovative solutions in the field of storage systems and RR construction methods make it possible to create autonomous independent LNG storage terminals - new sources of energy supply on a regional and border scale for industrial facilities, housing and communal services, railway, road and water transport. This will require public and private investment.

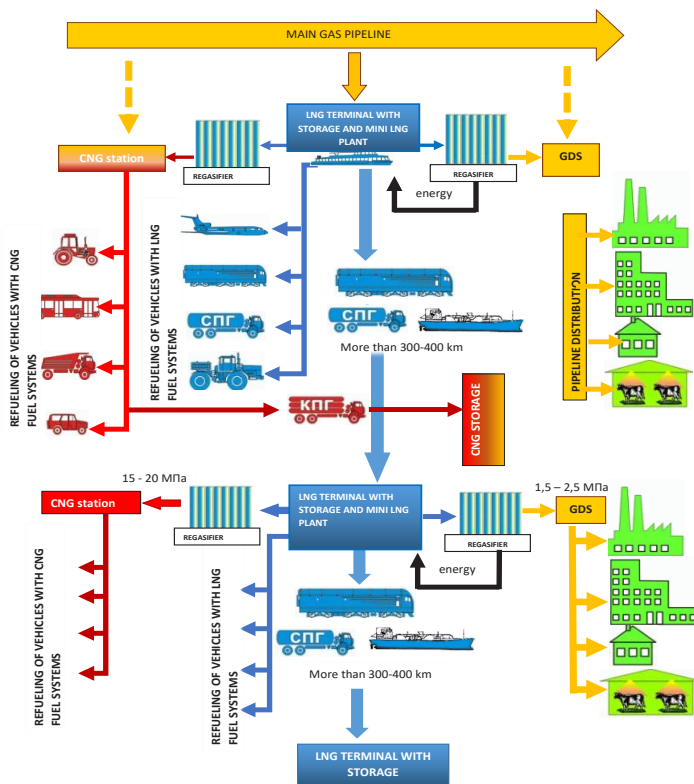


Figure 1, a. Block diagram of NG, CNG and LNG supply to industrial enterprises, housing and communal services and transport in remote regions

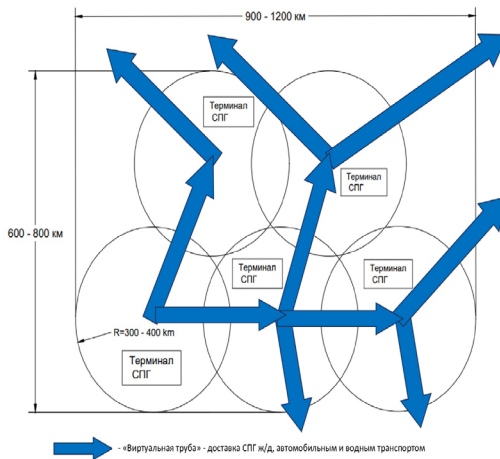


Рис. 1, 6. Схема обеспечения энергоресурсами негазифицированных районов РФ с использованием автономных терминалов СПГ

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优化捕食性螨类加州新绥螨子宫培养物的微生物组，以提高生防种群的繁殖效率  
**OPTIMISATION OF THE MICROBIOME OF THE UTERINE  
CULTURE OF THE PREDATORY MITE *NEOSEIULUS  
CALIFORNICUS* TO IMPROVE THE BREEDING EFFICIENCY OF  
A BIOCONTROL POPULATION**

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抽象的。证明了改善在二斑叶螨上生长的加州新绥螨母体培养物的种群生长参数的可能性。通过用益生菌枯草芽孢杆菌处理种群，消除对四环素敏感的螨微生物区系并调节加州奈瑟菌的微生物组，从而提高加州奈瑟菌种群的增长率并减少不活跃螨虫的比例。

关键词：捕食性螨虫、枯草芽孢杆菌、益生菌、植绥科。

**Abstract.** The possibility of improving the population growth parameters of *Neoseiulus californicus* mother cultures grown on the spider mite *Tetranychus urticae* is demonstrated. Elimination of the tetracycline-sensitive mite microflora and modulation of the microbiome of *N. californicus* by treating the population with the probiotic bacterium *Bacillus subtilis* leads to an increase in the growth rate of the *N. californicus* population and a decrease in the proportion of inactive mites.

**Keywords:** predatory mites, *Bacillus subtilis*, probiotic bacteria, Phytoseiidae.

### Introduction

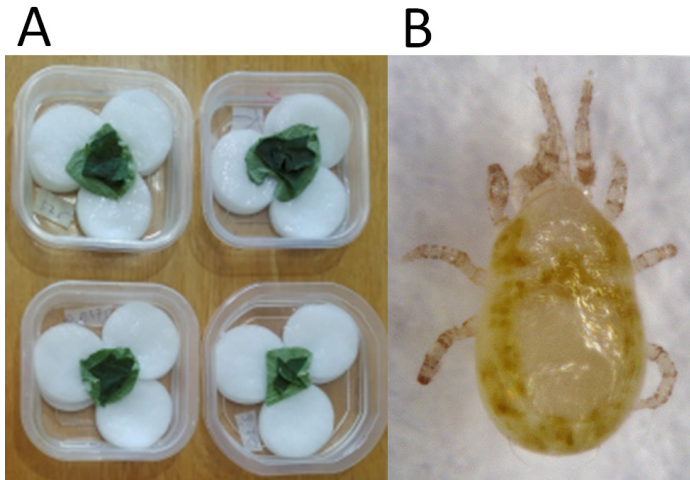
*Neoseiulus californicus* (McGregor, 1954) is one of the most promising phyto-seiid mite species for biological control of spider mites, including the widely distributed *Tetranychus urticae* (Koch, 1836) [Sanchez et al., 2008; Akyazi, Liburd, 2019]. To maintain consistently high viability and efficiency of biocontrol populations, it is essential to control the state of the mite microbiome. Predatory phyto-seiid mites are often infected with pathogenic and opportunistic bacteria that form chronic infections. Chronic infection of biocontrol populations of *Phytoseiulus*

*persimilis* with the bacterium *Acaricomes phytoseiuli* results in a reduction in mite longevity and fecundity, as well as low mite activity in feeding on spider mites, rendering such biocontrol populations unresponsive [Gols et al., 2007]. Chronic infection of biocontrol populations of *Metaseiulus occidentalis* with the bacterium *Serratia marcescens* leads to impaired digestion and mite adhesion to the substrate [Hoy, Jeyaprakash, 2005; 2008]. In this communication, we present the result of an experiment to model the microbiome of the *N. californicus* population by sequentially treating ticks with an antibiotic (tetracycline) and a probiotic bacterium (*Bacillus subtilis*). The resulting parent culture of *N. californicus* acquired a higher growth rate and the number of abnormal individuals decreased.

### Materials and methods

The biocontrol population of *N. californicus* was obtained from the collection of the Laboratory of Acarology and Entomology (All-Russian Scientific Research Institute of Phytopatology) [Glinushkin et al. 2019]. The mother culture of *N. californicus* was cultivated at 25°C, 90% relative humidity and 20 hours of daylight. The spider mite *T. urticae* served as the feeding mite of the uterine population. To test the growth of the mother culture under controlled conditions, we used rafts in which the mites feed on bean leaves surrounded by water, which prevents the mites from dispersing Figure 1. Ten *N. californicus* females were placed on each raft. *N. californicus* feeding was carried out on days 3 and 5 by placing a bean leaf with spider mites on it. The number of mites was counted 7 days after the start of the experiment, which corresponds to the life cycle of *N. californicus* from eggs to mites. The counts of larvae, nymphs and adult mites were carried out: males and females. The experiment consisted of a test and a control. In the control, the mites were not treated. In the experiment, two pre-generations were obtained. The first generation of mites was treated with tetracycline. For this purpose, feeding mites reared on plants sprayed with tetracycline were obtained. The basic solution of tetracycline 30 mg/ml in 70% ethanol was diluted twice with water before the experiment and this solution was sprayed on bean plants infested with spider mites. One day after treatment, bean leaves were used to load rafts with predatory mites or to supplement the mites on the rafts. After 7 days, the generation of *N. californicus* mites growing on tetracycline-treated leaves were collected and transferred to rafts without tetracycline but sprayed with a 5% solution of *Bacillus subtilis* spores to obtain the second preliminary generation. The base solution of *Bacillus subtilis* spores was diluted with sterile water to activate it before spraying. The *Bacillus subtilis* spore suspension was sprayed daily. After 7 days, second pre-generation mites were collected and transferred to rafts for the experiment. The mite population growth experiment was carried out by daily spraying with *Bacillus subtilis* spore suspension. Experiment and control were set up on 10 rafts each in three replicates. There were 30 rafts for the experiment and 30 rafts for the control in total.





**Figure 1.** Panel A. Rafts of bean leaves infested with spider mites on which *N. californicus* mites feed under controlled conditions. Panel B. Female *N. californicus*. Photograph provided by the author of the article (Meshkov Y.I.).

**Results and discussion.**

The results of the mite counts of all developmental stages on day 7 of the experiment are shown in Table 1.

**Table 1.**  
*Age distribution in the growing mite culture on day 7 of the experiment*

Type of experiment	Number of tick individuals				Sum
	Females	Mails	Larva	Nymph	
Control	435 (15)	249 (8)	294 (10)	597 (20)	1575 (53)
Experiment	576 (19)	387 (13)	216 (7)	789 (26)	1967 (65)

Note. The total number of mites obtained in 30 replicates of the experiment is given in figures. The average number of mites in an experiment is given in brackets.

Comparison of the distribution of the number of mites at successive developmental stages from larvae to adult mites in the experiment and control using the  $\chi^2$  criterion shows the presence of reliable differences. The value of the  $\chi^2$  criterion is 45.097, which is significantly higher than the critical value of  $\chi^2$  (11.345) with three degrees of freedom and a significance level of  $p=0.01$ . The differences are

therefore statistically significant. A numerical predominance of females was observed in both control and experiment. The ratio of females to males is 1 : 0.57 in the control and 1 : 0.67 in the experiment. The difference between experiment and control is not statistically significant. Thus, the experimental factors we used did not have a significant effect on the mechanism of sex determination in the population of *N. californicus* studied.

To characterise the health of the experimental and control populations, we scored the appearance of the females on a two-point scale. Normal actively feeding females have a bloated body, and the degree of bloating increases in females carrying eggs. In addition to the normal females in the population, there are always a few sluggish females with flat bodies that almost never feed. The causes are many, but one of them is the presence of pathological microflora causing mite poisoning. We divided all females into flat and normal females based on visual observation. The estimated percentage of flat females for the general population of the control population at the 99% significance level is  $20\% \pm 4.92$  according to the result of the Z-test. In the experiment, it decreased to  $6\% \pm 1.93$ . The differences between the experiment and the control are significant. The results obtained indicate the effectiveness of double sequential treatment of the mother mite population with antibiotic and probiotic *Bacillus subtilis* bacterium in stabilizing the reproduction of the mother mite culture.

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