



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

Materials of the
International Conference

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**“Scientific research of the SCO countries: synergy
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这些会议文结合了会议的材料 – 研究论文和科学工作者的论文报告。它考察了职业化人格的技术和社会学问题。一些文章涉及人格职业化研究问题的理论和方法论方法和原则。

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Foreword

We thank all participants of our conference "Scientific research of the SCO countries: synergy and integration" for the interest shown, for your speeches and reports. Such a wide range of participants, representing all the countries that are members of the Shanghai Cooperation Organization, speaks about the necessity and importance of this event. The reports of the participants cover a wide range of topical scientific problems and our joint interaction will contribute to the further development of both theoretical and applied modern scientific research by scientists from different countries. The result of the conference was the participation of 62 authors from 7 countries (China, Russia, Uzbekistan, Kazakhstan, Azerbaijan, Tajikistan, Kyrgyzstan).

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

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

Fan Fukuan,

Chairman of the organizing committee of the conference

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

Full Professor, Doctor of Economic Sciences

前言

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

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

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

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

一种优化对象特征组成的通用方法
**A UNIVERSAL METHOD FOR OPTIMIZING
THE COMPOSITION OF OBJECT CHARACTERISTICS**

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注解。 提出了一种用于最佳地形成具有一种目的的任何物体的特征的组成的通用方法。 该方法的应用使得有可能对对象进行正确分类，合理地补充特征的初始组成，通过在每一轮中获得反馈来提高检查结果的准确性，保留Delphic程序的好处，找到与特征协调的特征的顺序。 每个专家组的成员，完全或近似地计算Kemeny

关键词：通用方法论，直观约定的选择，特征组成的完整性，逐步的排序细化

Annotation. *A universal method for optimal formation of the composition of the characteristics of any objects of one purpose is proposed. The application of the method makes it possible to correctly classify objects, justifiably supplement the initial composition of characteristics, increase the accuracy of the examination results by having feedback during each round, retain the benefits of the Delphic procedure, find the ordering of characteristics coordinated with the members of each expert group, calculating Kemeny exactly or approximately*

Keywords: *universal methodology, intuitively agreed choice, completeness of the composition of characteristics, step-by-step ranking refinement*

Formulation of the problem. It is known that in almost every subject area we have to solve problems related to *the quantitative comparative assessment and optimization of the composition of the characteristics of various objects*. However, this is not so easy. Firstly, because for many market products the number of characteristics (functions) they implement is in the hundreds and thousands. Thus, the number of functions of software products for document automation exceeded 500 (Evgeny Pakhomov [1]), the number of software functions for automation of accounting in *budget organizations* is 900 (Svetlana Shirobokova [2]). Secondly, the number of *modifications* of goods of the *same* purpose is also growing: the number of market SP for automation of accounting, personnel accounting, etc. in the *thousands*. [3]

Therefore, to perform a comparative quantitative assessment of the composition of *hundreds and thousands* of characteristics that *hundreds and thousands* of objects possess, it will require significant resources. However, at the same time there are a number of problems. How, for example, can a consumer or customer *find* among a multitude of *comparable and often competing objects* an object he needs with certain *characteristics*? How to *classify* objects according to the composition of characteristics-attributes? How to systematize information about the composition of the characteristics of objects for various purposes from different subject areas? How to create a complete list of characteristics that all analyzed objects possess? How to quantify the information weight of each characteristic and the degree of compliance of the analyzed object with the requirements of the top-level system? Moreover, it is desirable to get the result *quickly, with minimal time and other resources*.

Suppose now that *a method has been found* to promptly perform a comparative assessment of the composition of the characteristics of all objects of the same destination.

But how to determine which *new* characteristics make sense — according to the customer, consumer or owner — *to add* to the composition of the characteristics already available to the object? Which of the characteristics (functions) *of the top-level system of interest* cannot (or *do not possess*) any of the objects of the analyzed group? And finally, what characteristics are desirable or necessary, *first of all*, to supplement the initial composition of the characteristics of the object, based, for example, on economic or social grounds?

Today, as far as we know, none of the published methods can answer the listed questions.

The article proposed the author's method of optimizing the composition of the characteristics of objects, allowing to perform *a comparative quantitative assessment of the completeness of the composition of characteristics, and an intuitively agreed collective choice of the option to expand* the composition of the characteristics of *any* objects of a single purpose.

1. Comparative quantitative assessment of the completeness of the composition of the existing (source) characteristics of objects of one purpose.

Preliminary remark 1. On the estimation algorithm, analyzed objects and characteristics. The algorithm used [4-6] is focused on a comparative assessment of the completeness of the composition of the *characteristics-features of any* objects, i.e. objects that people encounter in their daily activities, solving specific tasks, for example, tasks related to:

* with a quantitative *comparative* assessment and optimization of the *composition of functions* and other *characteristics of consumer quality of various goods* [7]; * with a quantitative *comparative* assessment and the *optimal choice of the*

composition of the characteristics-competencies of experts, *business process performers*, applicants for specific vacant positions, *decision makers*; * with a quantitative *comparative* assessment of the composition of the *characteristics of buyers* of certain goods during market segmentation [4, 8]; * with a quantitative *comparative* assessment and optimization of the composition of characteristics (*requisites*-of lat. *requisitum*- “necessary”) of documents [9]; * with a quantitative *comparative* assessment of the composition and values of indicators characterizing the standard of living of the population of administrative and territorial entities [10]; etc.

1.1. The evaluation procedure. Let be $Z = |Z_i|$, ($i=1, 2, \dots$) - a set of compared objects to which identifiers Z_i are assigned using a table (or sensor) of random numbers. Baseline information is presented as a table $\{x_{ij}\}$.

Wherein

$$x_{ij} = \begin{cases} 1, & \text{if } i - \text{th object possesses } j - \text{th characteristic;} \\ 0, & \text{if } j - \text{feature is absent from the } i - \text{th object.} \end{cases}$$

Select objects Z_i and Z_k ($i, k = 1, 2, \dots$) and we introduce the following notation: $P_{ik}^{(11)}$ - number of characteristics owned simultaneously Z_i and Z_k , i.e. $P_{ik}^{(11)} = |Z_i \cap Z_k|$ - intersection power $Z_i = \{x_{ij}\}$ and $Z_k = \{x_{kj}\}$ ($j \in \overline{1, m}; x_{ij} \neq 0, x_{ij} = 1$); $P_{ik}^{(10)}$ - the number of characteristics possessed by the Z_i but missing in Z_k , i.e. $P_{ik}^{(10)} = |Z_i / Z_k|$ - set difference power $Z_i = \{x_{ij}\}$ and $Z_k = \{x_{kj}\}$; $P_{ik}^{(01)}$ - number of characteristics missing in Z_i , but entering into Z_k , i.e. $P_{ik}^{(01)} = |Z_k / Z_i|$.

As a measure of misalignment between strings Z_i and Z_k choose value $S_{ik} = P_{ik}^{(01)} / (P_{ik}^{(11)} + P_{ik}^{(10)})$, but to assess the extent of absorption by the system Z_k of the system Z_i (the degree of inclusion, "occurrence" the system Z_i into Z_k) - value $h_{ik} = P_{ik}^{(11)} / (P_{ik}^{(11)} + P_{ik}^{(10)})$.

Build matrices

$$P = \{P_{ik}^{(01)}\}, S = \{S_{ik}\}, G = \{g_{ik}\}, H = \{h_{ik}\} \quad (i, k \in \overline{1, n}),$$

where $g_{ik} = P_{ik}^{(11)} / (P_{ik}^{(11)} + P_{ik}^{(10)} + P_{ik}^{(01)})$ - Jacquard measure of similarity.

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

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

elements of which are defined as follows:

$$P_{ik}^0 = \begin{cases} 1, & \text{if } P_{ik}^{(01)} \leq \varepsilon_p \text{ and } i \neq k, \\ 0, & \text{if } P_{ik}^{(01)} > \varepsilon_p \text{ or } i = k; \end{cases} \quad S_{ik}^0 = \begin{cases} 1, & \text{if } S_{ik} \leq \varepsilon_s \text{ and } i \neq k, \\ 0, & \text{if } S_{ik} > \varepsilon_s \text{ or } i = k; \end{cases}$$

$$g_{ik}^0 = \begin{cases} 1, & \text{if } g_{ik} \geq \varepsilon_g \text{ and } i \neq k, \\ 0, & \text{if } g_{ik} < \varepsilon_g \text{ or } i = k; \end{cases} \quad h_{ik}^0 = \begin{cases} 1, & \text{if } h_{ik} \geq \varepsilon_h \text{ and } i \neq k, \\ 0, & \text{if } h_{ik} < \varepsilon_h \text{ or } i = k, \end{cases}$$

where ε - selected boundary values.

The analysis of the constructed matrices shows which object is the indisputable leader in terms of the composition of characteristics and which objects lack specific characteristics. The difference in the composition of the characteristics of the objects in question can be clearly shown on the graphs built on the matrices G_0 and H_0 . The degree of similarity of objects on the composition of the characteristics can be estimated by analyzing the matrix $G = \{g_{ik}\}$.

To estimate the information weight of the selected characteristics on the matrix P_σ , we find P_0^2 and amount $(P_0 + P_0^2)$. Matrix analysis $(P_0 + P_0^2)$ allows you to determine which of the characteristics of the objects being analyzed has the greatest information weight (rank).

Using the considered algorithm and software products developed on its basis, it is possible to quickly carry out a comparative analysis of *a virtually unlimited number of objects and characteristics*, correctly and with minimal effort, * classify objects according to the composition of characteristics-attributes, * systematize information about the composition of characteristics of objects of various purposes from various subject areas; * formation of a complete list of characteristics possessed by all analyzed objects; * *quantitative assessment* of the information weight of each characteristic and the degree of compliance of the analyzed object with the requirements of the top-level system.

2. Intuitively agreed collective choice of options for expanding the composition of the characteristics of objects (for example, based on the requirements of the upper level system).

Preliminary remark 2. On the choice of method. Obviously, in the process of implementation of the chosen method, it is necessary, based on the interests of certain groups of consumer customers, * *to identify*, * *supplement* and * *streamline* the characteristics of the analyzed set of objects of a specific purpose. Therefore, when optimizing the *composition of the characteristics* of objects, it is advisable to use the method of *step-by-step refinement of the ranking of objects* (SRRO), proposed and described in [11-13 15-18]. [The method is based on the *integration* of the Delphic procedure for predicting the future (developed by O. Helmer, N.

Dolky, T.J. Gordon - see, for example, [14 19, 20]) with the proposed median and distance by J. Kemeny JG between object rankings [15 21, 22]]. To this end, from a previously created database (DB) containing information about the characteristics (competencies) of experts participating in expert examinations in specific subject areas, a group of experts is selected (using a table or a random number sensor) to participate in the implementation of the selection procedure expanding the composition of the characteristics of the analyzed objects of one purpose. All experts of the newly created group are assigned identifiers also using a table or a random number sensor. At the next stage, *the list of new features* proposed by the experts is compiled for inclusion in the *newly formed expanded* composition and their ranking.

2.1. SRRO Method Description . If the experts are offered to carry out the ordering of m new characteristics of the objects being analyzed according to the degree of their importance and usefulness to the consumer, then several rounds of surveys are conducted. After processing the results of the next round, the average, minimum and maximum ranks for all m characteristics are put down in the questionnaires, as well as explanations of experts made in defense of very different answers Each ranking is represented as a matrix of ordering in canonical form, and then Kemeny's proximity measures (distances) between all the rankings are calculated. Kemeny distance d_{ij} numerically characterizes the degree of mismatch between the rankings of two experts ($d_{max}=m(m-1)$). In the matrix $D=\{d_{ij}\}$, ($i,j \in n$) will be presented all $(n-1)n/2$ distances between rankings. D is a symmetric positive matrix with zero diagonal elements. The sum of the elements of the i -th row of the matrix D corresponds to the mismatch value of the i -th expert with the others. Comparing the sums of all elements of the matrix D obtained after each round of surveys, one can estimate the rate of convergence of expert opinions, determine the most (least) coordinated rankings with all, and identify agreed groups of experts (choosing the various threshold values of the proximity measure $d_{ij} \leq \epsilon$). If the opinions of experts regarding the ranks of the characteristics are completely the same, $d_{ij}^0=0$, if opposite - $d_{ij}^0=1$.

2.2. The classification procedure (grouping) of the participants of the expert survey. Suppose now that the procedure of step-by-step ordering of the set of characteristics has been successfully completed. A Kemeny distance matrix between all expert rankings was obtained. Now you need to correctly identify *the agreed groups* of expert answers, i.e. implement *the procedure of searching for agreed groups* of experts' answers (*classes of experts*) and selection for this selected group of *coordinated streamlining* of answers.

Let, as a result of the step-by-step ordering of the set of characteristics, a group of n experts obtained Kemeny distances between rankings $\{d_{ij}\}$.

Step 1. Transforme the elements of the distance matrix into relative units using the formula $d_{ij}^0 = d_{ij} / d_{max}$. The maximum distance between the rankings of characteristics is $d_{max} = m(m-1)$. Get the Kemeny distance table in relative units $\{d_{ij}^0\}$.

Step 2. Choose, based on the real degree of consistency of expert answers, the threshold value of the distance d_{nop} .

Step 3. Convert the matrix of relative values of Kemeny distance $\{d_{ij}^0\}$ according to the selected threshold d_{nop} . In the process of such a transformation, each value d_{ij}^0 matches with d_{nop} and if $0 < d_{ij}^0 \leq d_{nop}$, then put 1, otherwise - 0.

Step 4. A search is performed for a ranking that is as consistent as possible with a selected group of interrelated responses. Moreover, a consistent ranking should be the point that is most consistent with the set of possible orderings. However, with a sufficiently large number of experts, calculations can be significantly simplified if we focus only on the answers of the participants in the examination. After all, if the sample is large enough, then the probability of obtaining the desired consistent ordering is close to unity. For this purpose, calculated values Σd_{ij} and Σd_{ij}^2 . Ranking expert whose value Σd_{ij}^2 . Minimal is considered the most consistent with the selected group of responses.

2.3. Analysis of the features and promising usefulness of the method. Differences method:

1) The Delphic procedure is used when experts rank the characteristics of objects (and not to predict the future); 2) For a quantitative analysis of the degree of convergence of expert opinions after each round of surveys, identifying agreed expert groups and assessing the feasibility of completing the examination, Kemeny distance is used (a measure of proximity to linear order relations), and Kemeny median is used as a resultant ranking; 3) For a group of participants in an expert survey who may have similar views on the ranking options for the characteristics under consideration, Kemeny distance thresholds between expert answers are set based on the probability of their opinions coinciding, for example, close to 0.8; 0.9; 0.95; 0.99; 4) To search in each of the resulting expert groups agreed with the members of the group ranking (streamlining) characteristics calculated Kemeny median.

Advantages of the method: 1) The correctness of the method (the theorem on correctness was proved in 1978 - "Kemeny median is the only resulting strict ranking, which is neutral, consistent and condorsset"); 2) Improving the accuracy of the results of the examination due to the presence of feedback in the implementation of each subsequent round; 3) When using step-by-step refinement of the ranking of characteristics, the well-known advantages of the Delphic procedure (anonymity and the ability to familiarize with the explanations presented in defense of very different answers) and the search algorithm for coordinated ordering of objects are preserved — Kemeny's correct median and distance; 4) Sharing both the Delphic procedure and Kemeny's correct approach to streamlining functions allowed: * to obtain a meaningfully acceptable quantitative criterion for a sound completion of the examination, * to form expert groups, focusing on Kemeny's selected distance threshold values, * to find the ordering of characteristics agreed upon with the members of each group of experts, calculating exactly or approximately the Kemeny median; 5) The method

of step-by-step refinement of the ranking of the characteristics of objects, being simple and correct, has no restrictions on the number of participants in the expert survey.

3. Approbation method. Solved problems:

The method of comparative quantitative evaluation and optimization of the composition of the characteristics of any single-purpose objects has been repeatedly and successfully tested for solving various applied problems. In particular, it was applied when choosing * variants of the *appearance* of objects (*projected and / or sold goods: software products, websites, cars, etc.*) [16]; * variants of ranking by various groups of consumers of the *functions* of objects (*projected and / or market goods and services: software, cars, websites, medical, educational, legal and other services and goods*); * solutions to complex problems [17]; * options for ranking *objects - decision makers (decision makers), participants in various competitions, etc. in terms of the composition of competencies and other characteristics, etc.*

FINDINGS. 1) A universal method for optimizing the composition of the characteristics of any single-purpose objects is proposed, based on the integration of *original, tested and software-implemented* algorithms * of a comparative quantitative assessment of the *completeness of the composition of characteristics* and * an intuitively agreed collective choice of *the option to expand* the composition of the characteristics of objects. The application of the method allows * to correctly partition (classify) objects into groups, * reasonably supplement the initial composition of characteristics, * improve the accuracy of the examination results by having feedback during the implementation of each round, * preserve the benefits of the Delphi procedure, * find agreed with the members of each group of participants expert survey streamlining characteristics, calculating exactly or approximately the Kemeny median.

2. The use of the method involves the implementation of two stages: the first is a quantitative comparative assessment of *the completeness of the composition of characteristics*, and the second is an intuitively agreed collective *choice of the option to expand the composition* of the characteristics of the analyzed objects.

3. *The possibility and validity* of applying the proposed method for * forming the optimal composition of object characteristics in various subject areas, * identifying the *relationship* between the composition of characteristics between objects of the same purpose, * *ranking and optimizing* the composition of characteristics of the selected set of objects *correctly, promptly, with practically unlimited the number of objects and their characteristics*, with minimal resources.

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智力资本报告: 改善上海合作组织国家大学信息透明度的潜力
**THE INTELLECTUAL CAPITAL REPORTING: POTENTIAL
FOR IMPROVEMENT INFORMATION TRANSPARENCY OF
UNIVERSITIES IN THE SCO COUNTRIES**

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注解。 本文讨论了智力资本的相关研究, 阐述了大学领域的智力资本形式, 概述了大学智力资本报告倡议中最相关的国际经验及其向上海合作大学利益相关者披露的重要性。 组织 (SCO) 国家。

关键词: 知识资本, 大学, 智力资本报告, 知识资本披露, 利益相关者。

Annotation. *The paper discusses the relevant research on Intellectual Capital, illustrating the form of Intellectual Capital within university sector; an overview of the most relevant international experiences dealing with Intellectual Capital reporting initiatives in universities and the importance of its disclosure to stakeholders of universities in the Shanghai Cooperation Organization's (SCO) countries.*

Keywords: *intellectual capital, universities, intellectual capital report, disclosure of intellectual capital, stakeholders.*

During the beginning of the new digital age the intellectual capital (IC) have become an important topic for discussion of academics, regulators and other groups of stakeholders. According to the European Commission (2006), IC is defined as a combination of intangible activities and resources that permit the organization to transform another type of resource (physical, financial and human) in a system which creates stakeholder value.

There is a generally accepted approach to divide IC into three basic subcategories: structural capital, relational capital and human capital (RICARDIS, 2006; Canibano, Sanchez, 2004; MERITUM, 2002; Stewart, 1998).

The importance of IC disclosure has been a topic of great interest within universities in the last decades, because of intention in increasing the level and quality of their flexibility and transparency. In the case of universities, we could explain the components of IC in the following way:

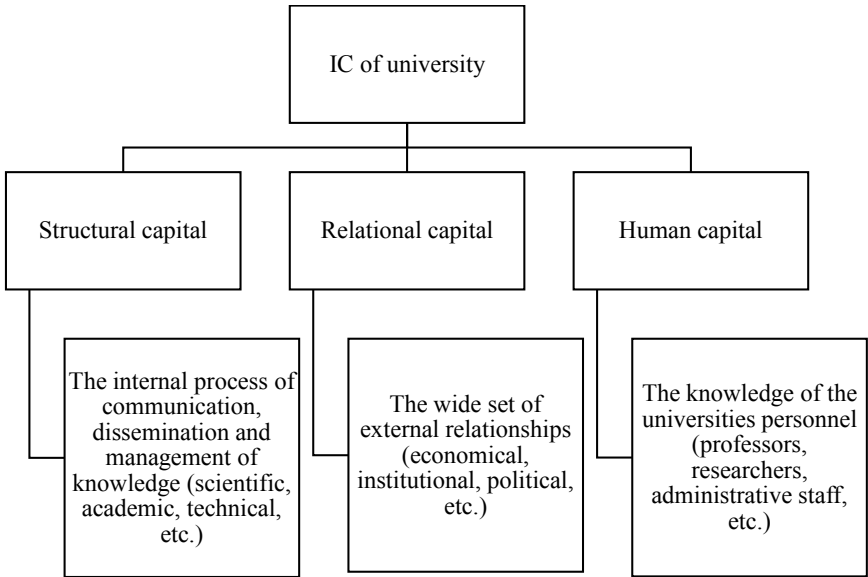


Fig. 1. Classification of subcategories of Universities' IC

Although the IC reporting and management concept was first developed within industry in the 1990s, it was soon adopted by public organizations including universities due to its overall significance (Mouritsen et al., 2004).

The main reason for disclosing the IC information by higher education institutions facing competitive and globalization challenges is the primary input and output of universities is knowledge, which consists of intangibles and intellectual properties. So, that measuring and reporting IC using a set of indicators can help to identify the elements which are not working in line with the identified strategic goals of universities and in turn can help in improvements (Fazlagic, 2005).

Austria has been the first country where the concept of IC disclosing has been adopted widely for universities and research organizations. In 1999 the Austrian Research Centers (ARC) published an IC report for the entire organization. The aim of this report was to give a clear overview of organization's knowledge flows and to provide interested parties and potential customers with information about its IC potential (ARC, 1999). In 2002 other IC initiative in Austria was introduced. The Austrian University Act (2002) is obliging publicly financed universities to implement a IC reporting system that are unique worldwide, making Austria the first country to establish an IC by law.

Further the idea of IC reporting has gained an increasing attention in other countries. The Danish guideline for IC reporting (DATI, 2000) was published in 2000 in the context of the project funded by Danish Agency for Trade and Industry. This guideline gives instruction on preparing an IC statement based on the experience of one hundred Danish companies which can be useful for universities area in term of starting IC statements development.

The MERITUM project (Guidelines for Managing and Reporting on Intangibles) funded by the European Commission was a set of guidelines for organizations explaining the potential tools of measurement and disclosure of intangibles which can be adopted to universities context (MERITUM, 2001).

In 2004, a high-level expert group tried to encourage universities to participate in the efforts to develop IC managing and reporting concept, as a part of a strategy to make universities accountable towards their stakeholders and society as a whole (Sanchez et al., 2006). Thus, RICARDIS report (Reporting Intellectual Capital to Augment Research, Development and Innovation in SMEs) aims at pushing universities towards the adoption of new reporting system improving both the transparency for stakeholders' demand and their knowledge management (European Commission, 2006).

Other initiatives drawing attention to the importance of managing intangibles in public universities in order to improve their level of competitiveness were the Observatory of the European University report (OEU, 2006), as well as IC Universities model (2006), the last one focused on the specific case of the Autonomous University of Madrid.

Consequently, European countries partly started benchmarking on a set of common IC indicators to learn from each other. The MERITUM report emphasizes the importance of IC indicators development and lists the valuable characteristics that these indicators should have. First of all, it is usefulness, that means facilitating decision making for users. Then, it is relevance (understandability and significance). Thirdly, IC indicator should be reliable, this requires it to be verifiable and truthful. Also, indicators should have a feasible characteristic which means the information about IC can be obtained from the universities' information system. And, finally, IC indicator could be used as a benchmarking tool enabling comparison, such that users (stakeholders) can make comparisons over time and across different universities (MERITUM, 2001).

Taking into account the fact that different universities might be in different stages of development, or that their strategy might have been severely affected by external environment factors at some point, we understand the need for adjustment in current practice to the specific need of the stakeholders of the particular education institution.

During this research, it has become clear that currently operating universities have a variety of stakeholders which can be classified into internal and external groups. We summarize and categorize all possible existing types of stakeholders in the context of universities a list of internal stakeholders includes consumers of the provided educational services, universities' internal communities and staff. External stakeholders are presented by applicants, employers, government authorities, other universities, research and social organizations, media and providers.

According to stakeholder theory universities should discharge accountability to their stakeholders and reduce the information asymmetry. This can be achieved by focusing on the quality of disclosure of IC information which is in the interest of users and meets their need.

In order to meet the requirements of administration staff or university governors, the IC report of universities should disclose indicators which characterize their special advantages, and potential triggers for more effective use of IC.

Disclosure of information about operational stability, university's reputation, the quality of human capital and opportunities for professional and career growth as well as represent the interest of teaching and research staff and internal communities.

Actual and potential consumers of provided educational services, concerns related to stability and reputation of university as well as including data submission about reputation and professional skills of teaching staff, and position in the international universities ranking.

A set of IC indicators which present universities' efforts and achievements in implementing scientific research, social, voluntary and other projects would be a crucial step toward providing useful information about IC to research organizations, social associations and other universities.

The most demanded data by stakeholders from the group of media, providers and public bodies is information about university's image, its role in sustainable development of the region and promoting the employment of population alongside the role in the development of national education system.

So, an improvement in the reporting system transparency of the SCO countries' universities could be achieved by the implementing a new form of reporting complementary to the current statements – the Intellectual Capital Report – which could contain a set of indicators most demanded by different stakeholders' according to the international practice while bearing in mind the experience of the case of the SCO countries' as well.

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从“转型”到“一代”：更新数字经济中管理专业化的优先事项
**FROM «TRANSFORMATION» TO «GENERATION»:
RENEWAL OF PRIORITIES FOR PROFESSIONALIZATION
OF MANAGEMENT IN A DIGITAL ECONOMY**

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注解。对经济增长的来源有不同的看法：创新经济，信息经济，知识经济。传统上，人们认为他们的转型将提供更新。我们认为，对这种三元组的现有理解以及方法论方法需要深刻反思和适应那些没有逻辑解释的情况。在我们的研究中，在数字经济中更新组织管理过程背后的主要驱动力是三个优先事项：“知识生成 - 管理工具 - 信息资源”。向数字通信的过渡需要在不断调整管理者智力工作的基础上形成和发展数字能力。

关键词：新知识，管理工具，信息资源，关键能力，数字能力，系统协调，数字能力模型。

Annotation. *There are different opinions regarding the sources of economic growth: innovative economy, information economy, knowledge economy. Traditionally it is believed that their transformation will provide an update. In our opinion, the existing understanding of this triad, as well as methodological approaches, requires deep reflection and adaptation to situations that have no logical explanation. In our study, the main driving forces behind the process of updating the organization's management in a digital economy are three priorities: "knowledge generation — management tools — information resources". The transition to digital communications requires the formation and development of digital competencies based on the constant adjustment of the intellectual work of managers.*

Keywords: *new knowledge, management tools, information resources, key competencies, digital competencies, system coordination, model of digital competencies.*

Introduction The need to study the problems of professionalization of management, as a priority direction of the scientific and technological development of the Russian Federation for 2019-2025, represents a certain intersection point of “the search for new knowledge ... in terms of focusing on a new economy” [1, p. 135] and “the selection of those management tools that are really needed taking into account the chosen direction of activity” [2, p. 125]. In turn, “information is viewed as a fundamental factor in the management process and therefore how quickly it affects the solution of socio-economic problems, the level of economic effect changes, and the degree of efficiency is characterized by the level of information richness and accessibility of information to participants in this process” [2, p. 127].

Of particular note is the fact that “the creation of network channels of information ... will contribute to the development of new ways of communication (electronic service channels, mobile applications, etc.) in a conversational mode, which will ensure prompt response to innovation” [3, p. 31]. The solution to the problem of developing new ways of communication is that the main goals, principles and tools, a common vision of the main directions of network communications, which will allow a systematic and comprehensive assessment of its effectiveness, should be determined by the organization's management. This is directly related to managers and top managers who specify the organization's mission and set specific goals. Effective communication is not possible without managers having digital competencies. In order to develop the skills of their application, it is necessary to form a vision “as it should be” by expanding them into structural elements, that is, to develop a model of digital competencies. In our opinion, digital competence is one of the key success factors for management in the effective use of information and communication technologies. At the same time, it is impossible not to understand that over time they may change under the influence of changes in the overall situation in the economy and, as a result, they are a zone of increased attention of managers.

In addition, “the composition and content of specific indicators that are formed within each of the competencies and determine the effectiveness of the organization's management activities may vary depending on the goals and objectives, the focus of professional activity, the features of the organizational structure and other activity parameters” [4, p. 246].

Another important aspect of changes in the professional activities of managers should be the formation of the “motive – goal” vector, with a shift of focus to innovation and new knowledge. New knowledge, modern management tools, information and communication resources create the possibility of transferring this vector to a new level, and this movement develops the manager's abilities, his interests and preferences in making management decisions - “... in order to improve the efficiency and effectiveness of the organization's activities and ensure correctness the strategy chosen by them is advisable to create and develop a holistic picture of the culture of staff involvement ”[5, p. 133].

Of course, creative thinking has a direct bearing on the promotion of digital competencies, which determines the possibility of updating the structure of business processes, the formation of integrative knowledge, and the solution of non-standard situations. In conditions focused on the new economy, “creativity implies the possibility of creating a new one, allowing you to make your personal life richer and achieve a certain professional success” [6, p. 197].

The strategic abilities of an organization depend, of course, on the strategic abilities of managers. To develop and successfully apply strategic skills, it is necessary to solve the problems of professionalization of management.

The aim of the research is to substantiate a strategically oriented vision of the prospects for solving the problems of professionalization of management in a digital economy. The objectives of the study are to justify the equivalence of the elements “knowledge generation - management tools - information resources”. This will create prerequisites for changing the professional activities of managers, streamlining information and communication links, stimulating production through the development of intellectual capital in the system of knowledge generation, and therefore ensuring sustainable management positions of the organization.

Research methods - abstract-logical and comparative analysis.

The results of the study. We suggest exploring key areas of management professionalization, setting goals with further developing ways to achieve them, coordinating selected areas of activity in the form of a sequence of problems, which helps to focus attention on certain points of management professionalization and indicates the most optimal interactions arising in the process of developing and implementing management decisions. In this regard, the work proposed a model of coordination of actions, based on the establishment and regulation of the equivalence of three elements (Fig. 1).

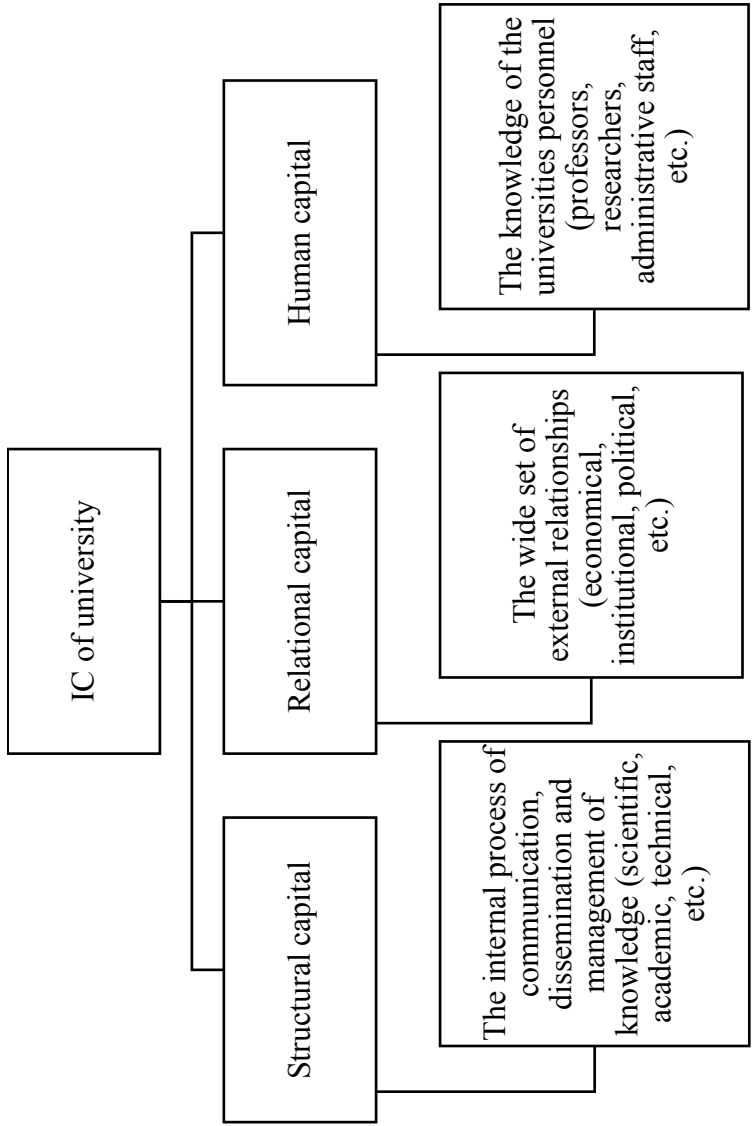


Fig. 1. The system model of coordination of actions for the professionalization of management

It is primarily about the competence of the manager as a specialist, solving problems through the ability to form fundamentally new high-quality management decisions and organize their effective implementation.

The elements included in the model indicate that their ordering is necessary both within themselves and in conjunction with each other.

In the approach developed by us to substantiate the process of professionalization of management, it is proposed, based on the organization's value chain, to develop a model of knowledge on which it should concentrate to ensure its own growth. In addition, in our opinion, this model should be inextricably linked with the core competencies that the organization possesses and which allow it to be unique. Key competencies are used as a strategic tool for a new knowledge model, which provides, firstly, the emergence of unexpected products and services that are produced at low cost and much faster than competitors, thereby ensuring a sustainable competitive advantage; secondly, identifying new combinations of skills and technologies that need to be developed or acquired in order to create new value for consumers in the future; thirdly, the ability to clarify what should be unique knowledge in conditions of uncertainty and competition, that is, conditions that have no logical explanation.

The final product of the generation of knowledge is "new knowledge" - the main source of innovation development, business growth in the organization, the formation of its competitive advantage.

Management of the organization, investing in special skills and technology, at the output as a product of managerial labor creates unique value for consumers. The authors believe that the model of knowledge being formed should characterize an adequate presentation of the organization's management about their social and professional characteristics and knowledge of technologies for overcoming professional destructions that negatively affect the productivity of managerial work.

The content of the element "management tools" is to systematically use "a set of specific methods and techniques that are used in collecting, processing and analyzing information and in developing management decisions based on this information" [7, p. 289]. The developed integrated approach to the assessment of management tools proposed by E.N. Tripolsky [7, p. 289–293]. Based on the position of this author, namely, "... strategic planning, customer interaction management system, consumer segmentation, benchmarking, mission and vision" [7, p. 291] are actively used at present, our research is aimed at justifying the relationship of the system element "management tools" with other elements of the model. Coordinating these modern management tools will allow integrating their characteristics into the process of creatively solving the problems of professionalization of management based on the constant adjustment of the intellectual work of the managers of the organization. An important role is played by the strategy

of “customer relationship management system”, which provides the generation of customer knowledge to build relationships that increase profits, but also the use of new management and information technologies. The need for detailing, formalizing and streamlining the process of analyzing competing enterprises and copying their positive experience, which is part of the process of creating integrative knowledge of an organization, determines the use of benchmarking technology in a competitive environment.

The last element - “information resources and communication technologies” - is aimed at integrating individual functions of departments, expanding the analytical space through the use of Internet technologies in order to improve business efficiency. Increasing the role and importance of digitalization in the economy led to the desire to develop digital competencies of managers to achieve professional success, to solve problems in identifying new business opportunities of the organization, as well as developing a special language, the use of which allows to discuss problems not on the basis of critical analysis, but on the basis of a creative process. Obviously, an adequate understanding of digital competencies is required, which will allow management to understand how information and communication technologies work, what they are for and how they can be used to achieve specific goals. Equally important is the distinction between the concepts of “digital competence” and “digital competency”. In our research, we proceed from the fact that digital competency is related to the ability of management to identify the need for information and the skills to find it effectively. In accordance with the terminological base of digital competencies, to describe the identification process, the concept of “information and communication competence” is used, by which we mean the ability of managers to use the information approach and analyze the information environment when interacting with information systems. We have proposed an integral model of digital competencies (Fig. 2).

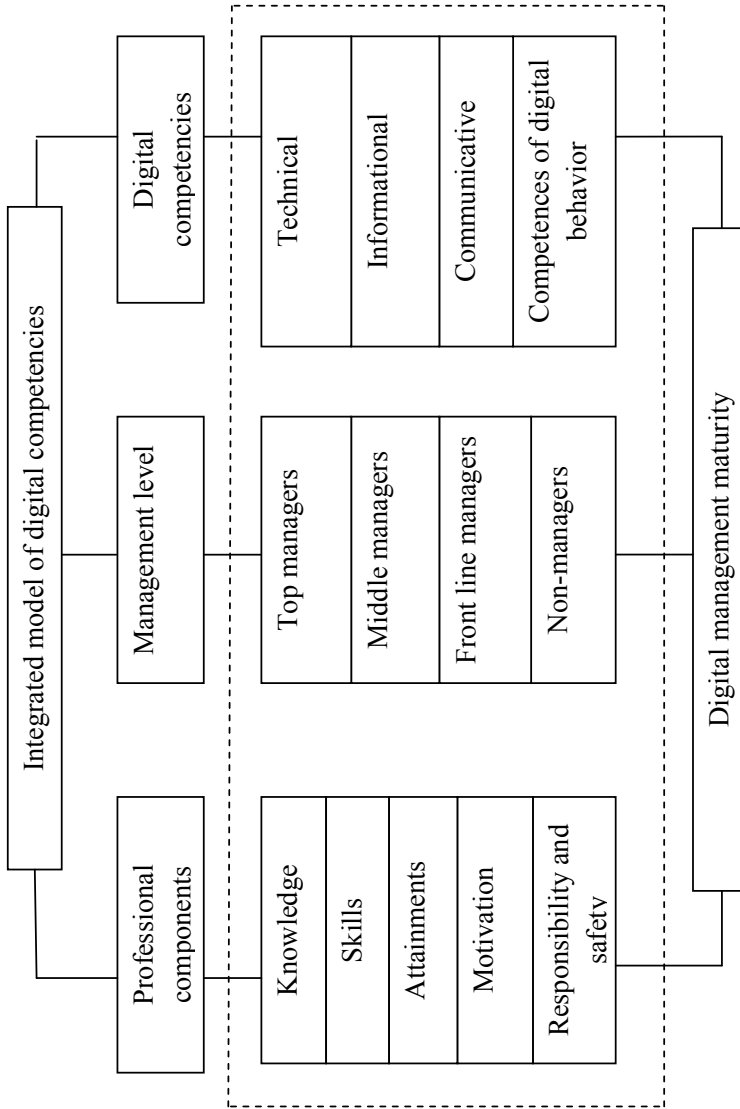


Fig. 2. Integrated model of digital competencies

Technical competencies are represented by specific competences, such as “owning 1C software”, owning project content management software “Project Scope Management”, “owning procurement (material resources) software“ Procurement Plan ”and others.

Information competences should be divided into two groups: competences of working with information and competences of using information technologies. We will include in the structure of digital information competencies: information retrieval competences, information analytical competencies, information technology competencies.

Communicative competencies include socio-communicative and organizational-communicative competences.

Competences of digital consumption are used to measure the level of knowledge and skills necessary for the safe and effective use of digital technologies and Internet resources.

Conclusions and conclusions.

1. Digitalization transforms the economy as a whole and the activities of organizations in particular, and the main beneficiaries of digital maturity of management will be managers adapting their competencies and abilities in order to fully utilize the potential of new information technologies.

2. Increasing digital competence is the formation of an appropriate digital culture in order to control the most important direction of management, generating relevant knowledge and finding ways to maximize their application.

3. The use of digital competencies, a combination of management tools and information resources will ensure the success of an organization’s business in any field over the next 15–20 years.

4. Professionalization of management is not possible without solving the problems of digital competencies, since it is the digital literacy of managers that creates the foundation for their successful activity.

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近代中国声乐艺术的爱国主义教育
**PATRIOTIC EDUCATION WITH THE AID OF VOCAL ART
IN MODERN CHINA**

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抽象。中国是最古老的文明。它在这方面教育年轻一代的经验需要今天特别反思。本文的目的是通过现代中国的声乐艺术来分析青少年爱国主义教育的特点。

关键词：爱国主义教育，声乐艺术，人文教育中的道德和审美发展，国家的精神遗产。

Abstract. *China is the oldest civilization. Its experience in educating the young generation in this regard requires special reflection today. The purpose of this article is to analyze the features of patriotic education of young people by means of vocal art in modern China.*

Key words: *patriotic education, vocal art, moral and aesthetic development in the lessons of vocals, spiritual heritage of the country.*

Patriotism is one of the main values of any nation and state, but in China patriotism acquired a special form of expression after the formation of People's Republic of China (PRC) in 1949, and became the basis for the development of "socialism with Chinese specificity". The strengthening of the national spirit is an essential condition for the preservation of the solidarity and unity of the Chinese nation, as it accelerates the realization of the "Chinese dream", which is to be realized by 2049. This is what XI Jinping said in 2012 as a new leader in his first public speech, and for the first time he set the Chinese people a long-term development goal. At the same time, XI Jinping called for the education of patriotism among young people to achieve the great revival of the Chinese nation.

In October 2017, a new law on Patriotic education came into force in China, and now students of junior and middle classes are obliged not only to learn the text and sing the national hymn, but also to learn in detail its history and rules of performance. As reported in the Chinese edition of China Daily, such measures will

help to maintain a sense of love for the country in the modern world and increase awareness of Chinese youth about patriotism [8].

Patriotic education in China is carried out at all levels of education. The important role of patriotic education of citizens is fixed by the legislation. Thus, in the Constitution of the PRC, article 24 states that the state defends such civic virtues as love for the Motherland, people, labor, science, socialism; it educates the people in the spirit of patriotism, collectivism, internationalism and communism, as well as dialectical and historical materialism to fight against bourgeois, feudal and other corrupting ideology [1].

In the PRC Law on education of 1995 in article 6 it is emphasized that the state should impart to the pupils such qualities as patriotism, collectivism, loyalty to the cause of socialism; clarify the meaning of concepts about the ideas of the legal system of the state, about the national defense of the country, on the principles of the unity of the nation [3].

In the PRC Law on higher education of 1999 in article 53 it is pointed that the students of higher educational institutions must comply with laws and regulations, the student code of conduct, respect teachers, study hard, strengthen their health, support the ideas of patriotism, study Marxism-Leninism, the ideas of Mao Zedong and theory of Deng Xiaoping, be moral and strive to possess a high level of scientific and cultural knowledge and specialized skills [2].

Patriotic education is one of the most important ideas of Chinese pedagogy and involves the education of the Chinese spirit, respect and observance of Chinese traditions. Chinese people from early childhood are brought up as patriots not only of their country, but also of their hometown, or other place where they were born. Every Chinese person is obliged to know the basic principles of the Constitution, the history of the CPC, the new laws adopted by the government. In the materials of the modern Chinese press it is noted that today in China the main slogan is not the construction of a Communist society, but the idea of "the great revival of the Chinese nation", which should be deeply rooted in the minds of the younger generation. Socialism is no longer perceived as a goal, but as a means of ensuring the greatness of the nation, and patriotism is called "the best tradition and the highest moral quality of the Chinese nation" [5].

The well-organized work of the teacher in the vocal class carries great potential in the process of education of active civil position of students, as vocal art has a strong emotional, aesthetic and moral influence on a person. The main direction of the formation of patriotism among Chinese students in the process of vocal training is acquaintance with the samples of national musical art. Chinese teachers believe that it is impossible to educate patriots of the country without the use of the rich potential of the ancient folk music of China, since Chinese folk music has a pronounced national character,

Chinese teachers note the difficulty of preserving the national musical art in modern conditions, as young people in China, as well as in other countries, are fond of modern dance rhythms and songs. In the era of globalization in China many genres of Western European and American music began to spread. Despite this, according to Zhang Jun, it is in China, as in no other country in the world, where musical national art is very well preserved [10].

Since vocal art is a mass form of creativity, teaching children singing is the best way to introduce them to their native culture. As Qin Qin stressed in his study, the lessons of vocal teacher must solve the following problems through the competent selection of repertoire: to develop aesthetic feelings of students; to motivate them to participate in the creative life of their native city or village; to cultivate a sense of love and respect for the small homeland and the country, which will eventually contribute to the formation of Patriotic feelings and qualities of students. According to the scientist, the best environment for patriotic education of children is the atmosphere created by the vocal team. This environment includes people united by a common favorite occupation, helps to create an atmosphere of friendship and mutual support, causes the desire to achieve their goals jointly, which ultimately helps every child to socialize in the team [6].

Another researcher Liu Jin also believes that the effectiveness of solving educational problems in vocal lessons is largely determined by the correct selection of repertoire. In this case, the teacher must take into account the degree of complexity of the material, focus on the abilities of their students and the level of preparedness. Patriotic education can not be separated from the moral and aesthetic development in the lessons of vocals, as music forms emotional responsiveness, helps to understand and respect the spiritual wealth of the native country, expands the musical horizons of students through acquaintance with the works of outstanding artists who have made an invaluable contribution to the development of musical education in China [4].

Students' compulsory knowledge of the history of vocal performance formation in China is emphasized in the study of Zhao Feilong, as young citizens should have an idea of famous personalities. True patriots, according to the scientist, should know, respect, love and be proud of the spiritual heritage of their country. The specificity of the Chinese vocal school is that the art of singing, for many historical reasons, has long been in a closed cultural space [11].

Yang Bo points to the important educational role of concert activity in his research. According to the scientist, the collective performance of songs of appropriate content during national holidays or other cultural events is especially valuable in the process of patriotic education. In the process of performance the participants are united by a common idea, they strive to convey to the listener the feelings, the beauty of the melody and the importance of the words of the song [9].

A significant role in the education of patriots of the country by means of vocal art, according to Shen Fanfan, is played by the head of the choir, who is not only obliged to combine professionally different methodological techniques in teaching children vocal, but also to captivate every child with music so that it evokes emotions and encourages reflection. As Shen Fanfan emphasizes, the emotional and sensual perception of the songs performed by children will contribute to the formation of life values and in the future will be embodied in actions. The teacher must remember that children feel keenly any mood of their teacher, so the importance of professional functions of the choir Director is difficult to overestimate, as children trust their teacher sincerely and consider him a role model. Educational work should be a single musical and pedagogical process, in which the most acceptable style of communication between teachers and students should be a combination of rigor and goodwill [7].

Summarizing the above mentioned, it should be noted that the pedagogical potential of vocal education in the patriotic education of students is recognized by all Chinese scientists, whose work results served as the material for this article. We highlight the main points that are emphasized by the researchers in educational work:

- using the rich potential of ancient Chinese folk music to instill love for national musical traditions and the spiritual heritage of the Chinese people;
- careful selection of the song repertoire of patriotic orientation, taking into account the degree of complexity of the verbal and musical material for specific performers, allowing to solve educational problems, combining patriotic education with moral and aesthetic development;
- using the developing and educating potential of the vocal team, creating an atmosphere of creative activity in the classroom, passion for the common occupation, mutual assistance and responsibility for the common success;
- expanding the musical horizons of students through acquaintance with the best examples of folk and modern music, as well as the history of the formation of vocal art in China, educational activities of outstanding musicians and performers who have contributed to the development of music education in the country;
- organization of the concert performances of students to make everyone feel responsible for the common occupation, as well as experience the joy of personal achievements;
- continuous improvement of the level of professional training of vocal teachers and heads of choral groups.

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游戏复杂和口语技能发展

GAMES COMPLEX AND SPEAKING SKILLS DEVELOPMENT

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注解。 文章讨论了语言技能发展的重要性。 因此, 找到改进这一过程的新有效机制非常重要。 作者在物理, 信息和非语言交流领域 (户外游戏, 非语言交流活动和网络任务) 中提供了更复杂的游戏。

关键词。 讲技能开发, 实体 (室内和室外游戏), 信息 (网络任务练习) 和非语言交际活动。

Annotation. The article discusses the importance of language skills development. Thus that it is important to find the new efficient mechanisms to improve this process. The authors provide the further games complex within physical, informative and non-verbal communication spheres (outdoor games, non-verbal communication activities and web-quests).

Keywords. Speaking skills development, physical (indoor and outdoor games), informative (web-quests exercises) and nonverbal communicative activities.

Speech skills development is the necessary aim in the didactics. Thus that it is important to find the most efficient methods and technologies to improve this process. The conception of Life-long education – 2025 describes the equal role of health-oriented, communicative and informative technologies. Here the authors believe the importance of outdoor games, non-verbal communication activities and web-quests which orient the teacher for speech skills development.

The researchers (V. Volkov, A. Keneman, F. Frebel, etc.) believe that game is the efficient instrument to improve the process of speech skills development. Moreover the game helps to be more disciplined and improve children's decision-making world-view. That obviously influences the process of language skills development. Below we give the examples of three above mentioned activities. *The first stage* of language skills development has the aim to use exercises which orient the student for identification, differentiation, substitution, transformation of the linguistic specificities. The exercises which help students to improve translation skills are important on this stage.

Example 1.

Form: 4

Module 6 «Visit to the zoo»

Lesson goal: to improve communicative skills (on the example of the topic «Animals»)

Aims:

1. To teach the new words (on the example of the topic «Animals» - a mouse, a cat, a dog, a bear, a hare etc.).
2. To improve memory, perception, decision-making skills.
3. To teach to provide team-working skills, tolerance.

Organization form: group form.

Game rules: children sit in a circle. Every child has a picture («A cat», «A dog», «A horse» etc.). The child doesn't show the picture and doesn't name the pet or an animal and should show the action. Other children should guess what it is. (Is it a hare? What is it doing? What can it do? – It is jumping. It is crawling, etc.)

The second stage of language skills development orients the students for better reproduction of the linguistic specificities in different non-variant typical speaking situations. The imitative and transformation exercises are necessary on this stage. We find that is it interesting to use mimics, poses, gestures which are the part of the speaking skills and the culture of people with different social background. Thus we provide the next games: expressive games, takesic games and proxemics games (V. Mizherikov, T. Yuzefavichus etc.). These games facilitate to organize interesting and non-standard classes, enlarge students' knowledge about different cultures and the social and cultural background of different peoples, and teach expressing the self-activity and self-expression which influence language skills development. We analyzed the teaching materials and saw the lack of these exercises and thus suggest these tasks in teaching languages process.

Example 2.

Game «An Englishman»

Form: 2

Module 5 «We love summer»

Lesson goal: to develop speaking skill (on the example of the topic «Seasons»)

Aims:

1. To teach the new words (on the example of the topic «Seasons» - spring, summer etc.
2. To improve memory, perception, decision-making skills.
3. To develop expressive skills (gestures, mimics etc.)
3. To teach to provide team-working skills, tolerance.

Game plan.

1. Organization: a teacher finds the necessary teaching material on the topic, analyze the possible expressive communication mimics and gesture.

2. Game rules stage:

A teacher suggests students to imagine themselves to be Englishmen. He speaks about the rules of eye to eye contact in England and says that eye to eye contact is an impolite manner in the country. Moreover that is not polite to stare the man in public places. Role-play the dialogues and use this eye to eye contact rule. Use the speech patterns on the blackboard to help you to role-play the dialogue.

3. Activity:

«Seasons»

Pupil 1: Hello, (name)

Pupil 2: Hello, (name)

Pupil 1: (name), what is your favourite season?

Pupil 2: My favourite season is...

Pupil 1: Why do you like...?

Pupil 2: ...

Pupil 1: You are right.

Pupil 2: ...is a wonderful season.

Pupil 1: I agree with you.

Pupil 2: (name), what is your favourite season?

Pupil 1: My favourite season is

Pupil 2: What can you do in ...?

Pupil 1: I can ...

Pupil 2: Yes, it is fine.

Pupil 1: Well, good-bye, (name)

Pupil 2: See you.

4. Generalization: children express their opinion, the pros and cons of these activities. The teacher discusses the problems children could have, analyze the mistakes.

Example 3.

The aim of the third stage is to show the role of web-quests to speaking skills development. The reserachers (M. Andreeva, Ya. Byhovskiy, T. Kuznetsova, I. Sokol, etc.) consider web-quest as the web-site in Internet which has the problem-oriented game task. The specificity of the web-quest task is to find the necessary

information in Internet to introduce it to each other, to organize the process to do the task, to evaluate and to find the right conclusion. Moreover they learn to change the information, to motivate speak the foreign language more, to create more communicative situations which influence their speaking skills development. Hyperlink is the efficient means to reach the goal of the web-quest task.

Form: 3

Module 6: «Furry friends»

Lesson goal: to improve speaking skills development (on the example of the topic «Favourite things»)

Organization form: individual, group.

Equipment: interactive blackboard, projector.

Stage 1. *Introduction* – The teacher gives the task to do the web-quest «Pets».

There are a lot of people who love animals. And many of them keep animals at home. These animals we call pets. You may have a dog, a cat, a hamster, a parrot, a fish etc. In this project, you will know a lot of exciting things about it. Then, you have to make a dialog. So let's surf the Net and gather as much information as possible about this.

Task - You can work in groups of two or individually. Your task is to give the definition of the words; to answer the questions; to do some activities; to write the dialog «Furry friends»

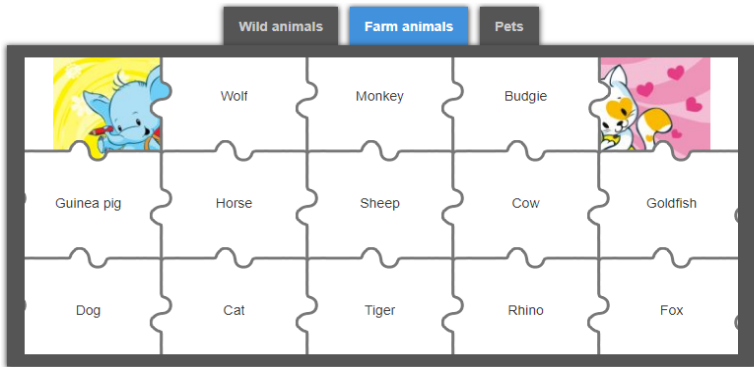
Stage 2. *Activities*

Step 1. Watch the video «Furry friends». Use subtitles <https://goo.gl/QUHA7t>

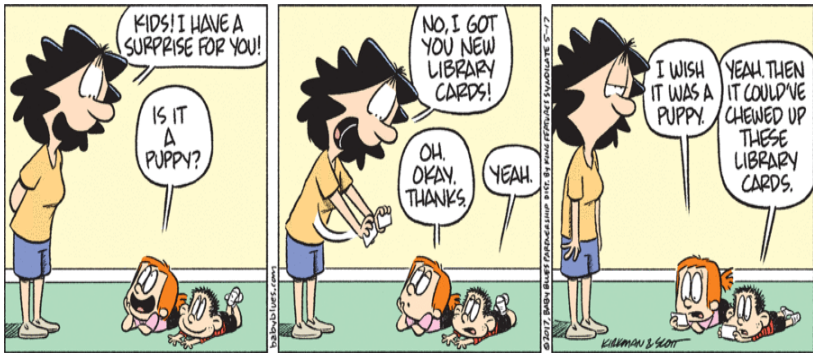


puppy
['rʌpɪ]
ЩЕНОК

Step 2. Do the exercise and revise the words. Use <https://goo.gl/6okPLL>



Step 3. Read comics about the puppy. Use <https://goo.gl/ixghig>



Step 4. Watch the dialogue example and prepare you dialogue. Use the subtitles from <https://goo.gl/LbqN3b>



Stage 3 Assessment and Conclusion - Congratulations! You have completed the web quest.

To come to conclusion we guess the above mentioned games complex will help to improve the process of speaking skills development.

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在V.V.Nabokov的小说“洛丽塔”中英雄身份方面的古代史诗的回忆
**REMINISCENCES FROM ARCHAIC EPICS IN THE ASPECT
OF THE HERO'S IDENTITY IN V. V. NABOKOV'S NOVEL "LOLITA"**

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注解。 本文提出了小说“洛丽塔”的历时解码的变体，通过小说文本中的直接指示给凯尔特人古老的传奇和他们的人物角色特征和一些地名(Elphinstone)，通过凯尔特史诗的回忆建立起来的上下世界的人物和太阳神话，对他们的识别有意义。

关键词：洛丽塔，亨伯特亨伯特，凯尔特史诗，太阳神话，历时解码，英雄身份。

Annotation. *the article proposes a variant of the diachronic decoding of the novel “Lolita” through direct indications in the text of the novel to Celtic archaic sagas and their characters which are given in the characteristics of the characters and some toponyms (Elphinstone), the correspondence of the characters to the upper and lower worlds through reminiscences from the Celtic epic is established and solar myth, meaningful for their identification.*

Key words: *Lolita, Humbert Humbert, Celtic epic, solar myth, diachronic decoding, hero's identity.*

K. Proffer is the first American Slavicist who wrote a commentary on the «Lolita» novel, addressing to the readers of the novel, noted that “someone who takes up reading a sadistic writer like Nabokov should have encyclopedias, dictionaries and notebooks next to him, if he wishes to understand at least half of what is happening in the novel”[11.p.17-18]. “Lolita” is a complexly organized, living, simultaneously closed and open to understanding and interpretation world in which “alien” worlds (E.Po, R. Chateaubriand, G. Flaubert, M. Meterlinka, A. S. Pushkin, F.M. Dostoevsky and many other artists of the word) enter into a dialogue with the new, “their” Nabokov’s world and with each other, thus forming a single cosmos of the novel. It is necessary to emphasize the fact that in addition to literary sources, Nabokov appeals to the folkloric tradition, leaving in the fabric

of the novel references to archaic, mythological texts, and the appeal to ritual and myth is conceptual, revealing not only at the level of semantic reminiscences - and allusion, but being reflected in the spatial model of the world of the novel, in the organization of its chronotop, in the principles of character identification. The diachronic way of reading the Nabokov novel is not an end in itself, but is aimed at establishing the completeness of the meaning of the image or episode in the context of the whole. Yu.M. Lotman who was describing the scientific achievements of O. M. Freudenberg emphasized the fact that the researcher considered ritual and myth as a “plot and myth-generating mechanism of culture,” and elements of ritual archaic acquire the status of “organic forms ensuring the integrity of human culture” [8.p.484]. In this way a study of archaic reminiscences in the novel by V.V. Nabokov "Pale Fire", undertaken by P. Meyer [5], aimed at establishing typological relationships and analogies of archaic epics and modern literature.

The diachronic way of decoding the plot of both folklore and literary is the leading method of the founders and followers of the myth-ritual school (D. Campbell (1997) [5], M. Bodkin (1934) [12], G.R. Levi (1953) [14]). The fundamental principle of the study of the text in the ethnolinguistic aspect is formulated by V.V. Ivanov and V.N. Toporov: “Every text contains its own history. It can come to life depending on its use.” [3.p.5]. The integrity of the world of Nabokov's novel is read as in the context of combining the text and metatext of the artist, the text and metatext of the preceding and synchronously existing literary tradition, the text and its archaic prototext.

Allusions from Celtic mythology in the semantic fabric of the novel complement, give a stereoscopic effect and an additional sound to episodes, accentuated by other artistic reminiscences; the meaning and significance of the images that organize the “nervous system of the book” [9.p.384] is enriched and deepened, their semantic potential gradually increases. Meanwhile, the participation of the Celtic artistic tradition in the formation of content in «Lolita» is indicated not only associatively, by means of subtext, but directly, therefore this reminiscent background of the novel cannot be ignored, trying to achieve the fullest possible understanding of the whole.

Humbert Humbert, defining his origin at the beginning of his confession, would call himself “a Swiss citizen, semi-French, semi-Austrian with a bit of Danube” [9.p.17]. Later the protagonist will point out his “strange accent”, and then present his citizenship as a common European (not only Humbert calls himself a “European” [9.p.261, 335]. Miss Pratt will define him as an “old-fashioned, European father” [9.p.238]. Moreover, as this generalization proceeds, Humbert will reveal a persistent tendency to etymologically reveal his origin : marking the “striking similarity” between himself and the newlywed from a poster in the Lolita’s room, Humbert points out the “Irish eyes” [9.p.53] of the young husband, then charac-

terizes his “interesting appearance” as “pseudo-Celtic” [9.p. 130] , in the «Halt of Enchanted Hunters», he describes himself as a “quiet gentleman of French-Irish origin” [9.p. 152], then, will mention the presence of “Celtic blood” in his veins [9.p.231]. In the English version of “Lolita,” contexts are identical to those which are given below: “... the writer's good Looks - pseudo-Celtic” [13.p.113]; “I watched dark-and-handsome, not un-Celtic” [13.p.208]. Thus, the European, emphatically mixed origin of Humbert does not mean mixing synchronously existing European nations, but is explained diachronically. Humbert’s nationality is identified genetically through one of the most ancient peoples of Europe - the Celts.

Celtic artistic tradition is at the origin of Western European medieval literature, preserved in the ancient Irish sagas. The mythological characters of European folklore are fairies genetically date back to the Celtic deities, Aos Sí (Sidhe), whose world in the Celtic epic exists in parallel with the world of people. The Sidhes belong to a different world, as later European elves sublimated the German-Scandinavian Alfar. As the modern Celtologists point out: “For the inhabitants of the Sidhe there are two main features: they are not subject to the laws of time or the conditions of space” [2.p.190]. A different world or Sidhe is “not limited to three dimensions” [2.p.190-191] and contains eternity interpreted by the Celts “as one infinite now” [2.p.191]. In the context of Humbert's persistent search for a way to stop time, his dreams of the island of eternally-ageless nymphets, this property of Sidhe is extremely significant, besides, it is the origin of Humbert that is designated in the novel as Celtic.

The city with the indicative name «Elphinstone», which acts as an analogue of the Celtic Sidhe or enchanted forest in medieval folklore - the world of the elves, completes the next round of «Lolita». In this place Humbert will lose Lolita forever. In the English version of “Lolita,” the name of the city sounds the same (the Russian equivalent is actually tracing from English), but the semantic accents are different: Elphinstone - in English is read as “elf stone” [13.p.266]. A ritual center was noted as a stone in the Celtic tradition, which simultaneously acted as a point of communication for the world of people and the other world, Sidhe. The division of Ireland into five regions and the formation of five sacred doroths which are connecting them are concentrated in the sacral center, in the Stone of the Division in Ushneh. G. V. Bondarenko indicates that “the tip of the five regions of Ireland led to the hill Ushneh,” center “of the island” [1.p.201]. In the Russian version of Lolita, Elphinstone is interpreted as “the moan of elves”: “Elphinstone (it is high-pitched but scary)”, “God forbid anyone to hear their moan” [9.p.302, 292]. The recurrence of the action, the idea of repeatability of events is emphasized by the fact that the hostess of the motel has a surname, which is pronounced as Haze, although it is written differently. As at the beginning of the novel, Humbert would call himself a Swiss, but he would add that his “daughter is half Irish” [9.p. 294], so now with respect to Lolita, the process of movement towards the genesis of Eu-

ropean culture has begun: from Irish, the diachrony of genealogy unwinds Celts. Besides, if Humbert is Swiss, then Lolita's mother is Irish. The mention of the Irish in connection with Lolita Humbert made already in the "Diary": wondering if Lolita is familiar with the secret of Menarche, Humbert will notice that the Irish call it a "curse" [9.p.62]. Humbert, including and concluding Lolita in his world, also endows it with the characteristics inherent in this world: if he is an Irishman with a pseudo-Celtic appearance, then Lolita will gradually acquire the same origin.

Although, defining his own appearance as pseudo-Celtic, Humbert chooses the prefix "pseudo" not by chance. Referring to his manly attractiveness, calling himself a "handsome brunet" [9.p.231], Humbert will point to "soft dark hair" [9.p.36], "dark-haired young husband" on the poster adorning Lolita's bedroom, «is amazingly similar to Humbert» [9.p.88]. Humbert has «thick black eyebrows and strange accent "[9.p.59]. Finally the epithet used by Humbert to characterize his charm is "gloomy"[9.p.36, 130]. In the Celtic saga "Matchmaking for Emer", Cuhullin, the hero of the ancient Irish epic, who embodies the archaic ideal of the hero, is depicted as follows: "In the chariot I see a dark, gloomy little man, the most beautiful of all the men of Ireland" [4.p.589], in the saga "Cuhullin's Disease" Sidhe Fand, welcoming Cuhullin, sings: "Over his beautiful eyes - // Bends of black, like bugs, eyebrows" [4.p.646], Ferdiad, intending to fight against Cuhullin, threatens: "With a spear I will blow his little body "[4.p.612]. The appearance of Cuhullin is characterized as exceptional, as is his martial art, as modern Celtic scholars emphasize, it corresponds rather to the archaic, pre-Celtic appearance of a hero from the Iberian tribe, the predecessors of the Celts. Cuhullin is at the same time a man, and more than a man, and according to one version, he is the son of Luga, the god of light. He belongs both to the human and another world. In the «Cuchulin Disease» saga the character hesitates to choose a world in which to continue life, making a choice between mundane love of his wife, Emer, or Sidhe Fand [4.p.648]. The small body of Cuhullin, referred to in the sagas, as well as the definition of "little man" indicate that Cuchulin corresponds to the appearance of the Sidhe, which are beautiful and small [4.p.22, 556]. The difference in the parameters is that Cuhullin is small, Humbert has a "big body" [9.p.36]. This fact emphasizes the fundamental similarity, aggravates the portrait likeness of the characters: the prominence of the hero's appearance marks his "dual citizenship", originally designated by Humbert as European polinationality, indicates on the ambivalent affiliation of both heroes to the human and to another world. According to the principle of neomythological transposition, some character functions, as well as the features characterizing them, are reproduced in the neomyth in the opposite quality, which corresponds to the neo-mythological transfer of the action of the archaic myth to other time-space, the changes are caused by this transfer and reflect and express it.

Characters endowed with external signs of sidhes and elves appear in the «Lolita» as the denouement approaches. At the "Between Snow and Elfinston" Colorado resort [9.p.283], Fay appears, as if she is an accidental partner of Lolita in tennis, who escaped with her from Quilty's ranch. She is characterized as "a rather matte brunette, about two years older than Lolita, with capricious mouth and hard eyes" [9.p.287]. The name of the heroine (Fay is phonetically identical to "fairy", although spelled differently, as well as the name of the hostess of the motel, Haze, matching the plural form of the genitive case - fairy - fairies), her appearance and the diminutive definition of "brunette" (either because of, or by virtue of miniature) indicate the appearance identical to the traditional image of the sidhes in the sagas.

In the lyrics of Nabokov, the world of elves is related to the world of insects by the similarity of parameters: elves are also small in size. In the poem from the 1916 collection "Summer Night" we can find the following context: "Elves with ladybirds in love // Hiding, kissing, from moon patterns" [10.p.407]. There is a similar collision in the "Mountain way" collection: "Fay's daughter drowned in a dewdrop, // at night, playing with a bug in love ..." [10.p.52]. The time of activity of fairies and elves in the lyrics of Nabokov is night. In the German-Scandinavian mythology, the lower deities, identical to the Celtic sidhes, the black alfas, live underground and go out at night - for them the sunshine is destructive. The world of the elves, therefore, we associate with Nabokov with other world. Remarkable is the appearance of the bridegroom by the Fay's daughter - the bug, which is correlated with the appearance of the elf - "the little black bridegroom" [10.p.52]. The owners of the damned treasure in the German-Scandinavian epos are the "Black Alfas", and one of the etymologies of the word "Nibelung" decodes it as the "child of the mist". The motive of the treasure and the inevitability of its loss are represented in the «Lolita» by the union of Lolita and Humbert, who calls Lolita a "souvenir" from Mexico ("there were now souvenirs throughout the house, including Dolores" [10.p.74]).

In Kasbime, Humbert sees from afar "an elf-like girl on a dragonfly-like bicycle and a disproportionately large dog" [10.p.261]. The symbolic meaning of the dog, whose intervention marked the most important episodes in the novel, in particular, the dog that was tucked under the wheels of the car - the cause of Charlotte's death - is an indication of a quick death or loss. The approaching loss of Lolita, the neighborhood of a dog and an elf should be noted in this episode. With the closest approach, the fabulousness collapses: the "promised cyclist" turned out to be "an ugly, plump little girl with pigtails" [10.p.261]: in Beardsley Humbert, carefully looking at Lolita's face, will also meet the "destroyed myth" [10.p.250]. Humbert meets deceptive elf before coming to Elphinstone, the city of elves, whose moan is "subtle but terrible," as the narrator notes in brackets [10.p.302], citing

the name of the city, Humbert will also notice in brackets: “God forbid anyone to hear them groan” [10.p.292]. Humbert hears this sound from another world, when he completely loses Lolita. Finally, the flight of an elf implied in the movement of an “elf-like girl”, whose dragonfly's wings imitate a bicycle, the ride on which thus acquires the status of an elf's flight, Humbert sees at that moment when Lolita escapes to Quilty in his absence. Creatures from the other world appear on the path of Humbert and Lolita the more often the closer Lolita's loss is. Humbert delivers Lolita to Elfston Hotel, accompanying his way with allusions from Goethe's “Elf King” (“Erlkonig”), only the forest king (the name of the Russian translation of V. Zhukovsky ballad) was “this time not a fan of boys, but girls” [10.p.295]

According to external signs, Humbert himself belongs to a different world. Humbert, defining his country “as purple and black Humbria” [10.p.205], does not find himself in the photo where he should be captured: turning over the “Bryslandsky bulletin”, Humbert is looking for a picture, “caught me on my dark path to the Lolita's bed” [10.p.321] four years ago, but, having received the required, he sees: “the outline of a girl in white and pastor Braddock in black; but if someone's ghostly shoulder touched his burly body, I could not find out here anything that could be related to me” [10.p.322]. The absence of the photograph indicates the invisibility of Humbert, his belonging to a different ghostly world, painted in purple and black.

If Humbert describes his appearance as gloomy, and the world as a “black and purple country”, then the image of Lolita is correlated with the solar principle. The hair of Lolita while she was playing tennis, Humbert would call “sunny-blond” [10.p.201]. Even the impartial Miss Pratt [10.p.239] notes the shine of Lolita's hair. The tan, lower back and the fluff on the Lolita's blades are characterized by the same epithet “apricot”. [10.p.283], Recalling the first vision of Lolita, Humbert calls it “dark-golden”, stressing that her gaze was directed upward [10.p.207], Lolita emits that heat (“hot silk charm” [10.C.72]. The “luminescence” also characterized by epithets “languid”, “ardent” [10.p.197]. The nymphet attribute – «honey hue skin» refers to the same semantic series. The presence of the sun marked fundamentally important episodes in which Lolita performs independently, not yet falling into Humbert's power or temporarily freeing herself: for the first time Lolita looks at Humbert on the veranda, “from the circle of the sun” [10.p.52], the scene of the ottoman develops in the “sunlit living room” [10.p.75], in Ku Camp to meet Humbert there comes out a “sun-painted orphan” [10.p.139], Lolita plunges into the “sunny distance” playing tennis [10.p.290], finding other partners, eventually one of whom is Quilty. The situation of Tennis game makes Humbert experience yet imaginary loss of Lolita for the first time, though ahead of time. During tennis, Lolita will receive an epithet crowning the paradigm of the solar figurative series, which is “golden” [10.p.289].

Humbert brings Lolita at night to the hospital outside the city ("I rode with her right into the blinding sunset" [10.p.295]), to the hospital which is in a lowland. The hospital itself acts as an intermediate link in which the world of the living and the world of the dead come into contact, because the disease is a temporary triumph of death within life. Lolita disappears from the hospital, as if rising from the "black and purple Humbria". The departure took place at the height of the day ("about two o'clock in the afternoon" [10.p. 302]. So in the episodes of Lolita's illness and flight from Humbert the otherworldly and ghostly world, the mythological attributes of the resurrection and return of the solar deity are read. The logic of the solar myth, but its categorical cycling is transformed into a linear epic narrative: temporary death entails a final one. But the epic immortality gained by Lolita in the book of Humbert, thus solar cycling is realized in a new semantic quality. The solar hero, having survived a temporary death freed from captivity, acquires its former qualities. In a modern novel, the loss is irreparable: Lolita falls from one captivity into another. Lolita, driven out by Quilty, has been working in small roadside restaurants for two years, and Humbert, presenting her life, will paint a picture of "the nasty kitchen of a roadside restaurant (Need A Supporter) in the darkest steppe state Where the wind is blowing and the stars are blinking on barns, lights, bars, couples and where everything is filth, decay, and death "[10.p.227]. One temporary death replaces the other, until finally, after the temporary death, the real one, aggravated by its doubling, comes: Lolita dies, resolving as a dead girl. The cyclical time of the myth, realized in the constancy of deaths and new births of the solar hero (or its analogue of the plant god), is transformed into novel linear time, making the hero's resurrection impossible in the world of "single phenomena" [8.p.26], but tell him the possibility of immortality only in the world of art, taken out of the linear time bracket, in the novel, the world of which acts as an analogue of eternity. This eternity of the world of art is defined by Humbert as follows: "I am talking about tours and angels, about the secret of strong pigments, about prediction in a sonnet, about salvation in art" [10.p.376]. But this eternity is acquired only beyond the limits of mortal life: by the beginning of the reading of the novel, all his characters are already dead. In the classical work of E. M. Meletynsky "Poetics of Myth" the study of the mythologism of the modern novel develops in two directions: the transformation of the hero, in the scope of the universal consciousness of which other heroes and the world reproduced by him (his consciousness) also fit, and the transformation of the linear time of the epic into the timeless world of myth [7]. Humbert defines the novel itself, or rather its book on Lolita, as a form of immortality, that is, space without time, or rather, space of eternity.

Analogies from archaic epos are a means of identifying a hero in the novel "Lolita", which is aimed at establishing the correspondence between the hero

and his world. Humbert's "pseudo-Celtic appearance", his delusiveness indicate his belonging to the other world, while "golden" Lolita, according to Humbert's thought, born in Mexico, belongs to the upper world or the world geographically opposite to Humbert's world. The archaic analogies from archaic mythology decorate features of the relations of heroes and program their tragic development.

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关于G. Musrepov的哈萨克文学经典的艺术技巧基础
**ABOUT THE ARTISTIC SKILLS BASICS OF G. MUSREPOV'S
KAZAKH LITERATURE CLASSICS**

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注解。 本文对民俗文学与文学联系的理论基础进行了科学的回顾，研究了自十九世纪下半叶以来哈萨克文学中的民间主题，以及Chokan Valikhanov, Ibrai Altynsarin的作品。 在民间主题的帮助下，对哈萨克文学中民间文学的深度进行了回顾。 在哈萨克文学经典穆斯特波夫的经典作品中，民间传统占据了一个重要的地方。 在他的每一部作品中，作者都能巧妙地运用民间民俗的动机，这是从小就对民间作品的深刻认识和发展的结果。

关键词：民俗学与文学联系，民俗传统，艺术表现形式，艺术传统，民俗学研究，文学研究，民族文学，民俗情节，公共内容。

Annotation. *The article provides a scientific review of the theoretical foundations of folklore and literary connection, the study of folk themes in the Kazakh literature since the second half of the XIX century and since the works of Chokan Valikhanov, Ibrai Altynsarin. With the help of folk themes, the review of the depth of folk character in the Kazakh literature is carried out. A significant place is occupied by folk tradition in the works of the classic of Kazakh literature Gabit Musrepov. In each of his works, the writer was able to skillfully use the motives of folk folklore, this is the result of his deep knowledge and development of folk works from an early age.*

Key words: *folklore and the literature connection, folklore tradition, artistic expression, artistic tradition, folklore studies, literature studies, national literature, folklore plot, public content.*

One of the most important problems of philological science comprehensively and thoroughly recognises the bonding of folklore and literature. Various as-

pects of the study of folklore are formed in native science. The role of folklore is very great in the establishment of national literature. For a long period of time there have been disputes among world leading scientists regarding their concepts of the definition “folklore”, nowadays this part of literature is known as a special heritage of the art of writing and the beginning of writing literature. V.Ya. Propp points out that “folklore is specific to the lowest strata of any people irrespective of the level of development they have” [1, 19]. Hereafter he points out specific signs of folklore and discusses the bonding of folklore and literature. He emphasizes that the most important and complex task of folkloristic and literary science is the study of internal structure of works of art. The science proved that the structure of folklore and literary works of art differ from each other i.e. folklore is specified by own structural laws. But literary science cannot explain this specific regularity and at the same time it may be studied and analyzed by the methods of literary studies and review. Therefore up today the problem of connection of folklore and literature and its peculiarities remain one of the most attractive to be studied.

Thus, the peculiar nature of folklore gives a special kind and its theory. “The theory of folklore considers, first of all, the problems arising from various social and everyday tasks and cognitive, educational and aesthetic functions, goals that it performs at different times” [2,11]. The most important of them, of course, are closely related to folk traditions. Folklore tradition is a continuation of the established creative method, and tradition in literature is a revival of previous experience. Specifically, traditions in folklore are a continuation of the existing creative method, and traditions in literature are not a change of the former, but a development, a continuation. Therefore, the literature is dominated by personality, and the author does not repeat to himself, absorbing still your truth, recommends that the peoples again and again. Tradition is a phenomenon that has led to the blood of the artist in the true folk spirit. Here is a concept of “folk tradition” (or in science it is called “folklorism”) has a peculiar way of development of the formation of the Kazakh literary education as one of the main channels.

Scientific notions of folklore and folklore science have begun forming in literature in the second part of XIX century in the works of Shokan and Ybray. At the beginning of XX century equivalent definitions of term “folklore” started to be applied in literary studies. For example A. Baitursynov named folklore «word of oral oeuvre», S. Seifullin names «oral literature», «folk literature», M. Auezov applies the notions «oral literature» and «folk poetry». On the research of the development of literary studies in XX century an important fact that the persons created literature and bearing its heavy burden did not remain uninvolved in its scientific problems has been revealed. Each of them who is ambitious to pursue science did not only collect the samples of oral literature – the most valuable folk heritage – but also gave their scientific justifications. He courageously applied the

samples of folk literature in his oeuvre. Therefore Saken Seifullin who binds the struggle for folk literature with revolutionary struggle thinks the application of the samples of folk heritage is the chief responsibility of literature. Saken collected and estimated the heritage of folk literature says: «folk literature is created by the application of old literature characters in literature, their consideration as per new rules, creation of new characters and persons, their sampling and making them to have the content of labor class» [3, 43]. So he pays attention on class character of literature and points out that folklore is the basis of writing literature. Magzhan Zhumabayev also highly appreciated oral literature as a special valuable spiritual wealth and pointed out the necessity of its veneration and preservation. «Whereas lots of things are lost our literature is richer than the literature of many other peoples». Our oral literature may be the basis of oral literature of the whole people. Without the support of oral literature none of people may create writing literature. And our writing literatures halltake oral literature as the basis. If we want to create our strong writing literature then we have to start from initial oral literature». By these words Magzhan puts a concrete and reasonable task before the developing literature [4, 341]. Every poet-writer of the beginning of XX century used folk heritage as the basis of their oeuvre.

In our national literature each artist is differentiated by its special artistic form unlike others. Therefore finding its place in the history of literature. Because it is impossible to dictate by force. Unseen with the naked eye, special content or meaning – folklore. With its help a writer is in relationship with a reader, finds a way to his heart. Because a true Kazakh reader has a national conscious, national mentality transferred to him with the mother's milk. Developing their art of word and only this writer who finds right way of its application achieves classic level of artistic person.

In its oeuvre Musrepov thinks that the most important is folk theme. Thinking the people to be a the most thsnakgul reader in his oeuvre he pays great attention to the fact whether the literature is available to his readers. For these purposes Musrepov tried to depict strong spirit, sharp mind, artistic energy, native talent and hot aspiration to freedom.

It is known that writers always draw knowledge from rich heritage of oral literature. The interest to folklore is born also from hot wish to master secret depth of folk language, to study folk sources and life. The research of performer's resume of G. Musrepov shows that the works of powerful stylist who measures seven times and cuts once is clearly seen fruitful trends of folklore motives. Gabit Musrepov consciously coming to the literature in the middle of XX century managed to take part in its development and take a worthy place in literature.

Defining folklore of a writer it is very important to study the way of his entering the literature and the reasons of his adherence to folklore. First of all as per

the data of «Autobiographic story», we see how he acquired a taste for literature. In this tale the writer heartily recollects his close relative Botbay. Botbay plays on Kobyz, Dombra, he is a singer, aficionado of hunting birds and swift horses in one word he was a comprehensively developed, enthusiastic man of power. Botbay was always surrounded by the youth to play on Kobyz, Dombra. In Botbay's childhood Gabit acquainted his countrymen with Eastern Dastan settled in Central Asia. «...In my childhood on my land there was literally flood «kissa» (epic poems) that reached local places from Kazan, Tashkent, and Bukhara. For the village both «Sal-sal» - kissa and «Kyz Zhibek» - kissa but Botbay remembered by heart «Kyz Zhibek», «Kozy- Korpesh», «Korugly», as for others – he did not learn by heart...» [5, 302]. So his tales tarts and can make up a conclusion that thanks to Botbay first love to poetry appeared in the youth soul of Gabit. Obvious that the main factor that Musrepov became a rare master of word in the history of literature is the period of his life in the village of mother's relatives. Here for the first time he stepped the doorstep of the school, he became a pupil of worthy citizen of his people, writer Beket Otetileuov. Namely directly under his direction Gabit developed and perfected his love to literature and his knowledge. Beket Otetileuov is a successor of Abay's realism, at the same time – pedagogic principles of Altynsarin, one of the brightest representatives of educating trend. It is possible to say that in the formation of Gabit Musrepov as an accomplished artist raised the Kazakh literature to the brightest highest level Beket Otetileuov played a great role who noticed young talent and fostered his talent and drive to creation. «...Taking notice my passion to epic poems, Beket started attracting me to literature. First of all he gave me his own poems «Zhigan-tergen» («From accumulated and collected»). I loved «Zhigan-tergen». ButwhenheaskedwhatexactlydidIlove, Icouldnotanswer. Then he gave me the poem «Shakhimaran» and in a week he forced me to retail it as a fairytale. It was found out that impressive work ran into my memory with such precision that I retailed it fluently. Then once an evening by the request of Beket I again said a fairytale in his house, before the guests...» [5, 305]. Here we can see the psychological and pedagogical methods of Beket directed to the development of new talent, by these methods he gave to his foster child the first notions that without the knowledge of the theory of literature it is impossible to pass our feelings what we like and what we do not. So from the writer's remembrance we see that from the childhood he liked epic poems and works of oral folk arts. And this fact precisely confirms that literary activity of Musrepov begins from folk traditions.

One more creative person that influenced and directed Gabit to be closely devoted to the literature is Sabit Mukanov. Two writers living and creating in XX century were always together, «in one team» both in literature and life and also they were the members of small but powerful group of doers, together laying foundation of Kazakh national literature. «...Sabit taking notice of my love to reading

and little skills to analyze creations, keeps on the alert and pushed me: «Start writing!» - G.M. writes in his «Autobiographic story», naming him as the first person pushing him to start writing creation. Studying together with Sabit on working faculty in Orenburg Gabit wrote his first story «In furious waves». Besides on the study of writing way of G.M., seeking for the factors of the starting of his way we get to know that a great role is played by Bi-aga - BaimbetMailin. About this he says in story «Our Bi-aga».

It stands to reason that we give detailed list of these names, our purpose is to emphasize a happy role of meetings with great persons and the influence they made on the formation of the writer's position. If Botbay and Beket developed an interest to folk literary heritage in G.M. then talented writers Beimbet and Sabit did not imagine their creative works separate of folk, they skillfully used folk heritage in their creative works. It is obvious that their perfect influence played not the last role in the fact that their traditions took the continuation in Gabit's creative works.

When Gabit wrote his first story «In furious waves», he was 25 years old. We noticed higher his early interest to arts of word. About this the scientist N. Gabidullin writes: «...Gabit from the childhood adores literature, he listened the creative folk works of his great heritage of oral folk arts with delight and he accepted it with all heart. He remembered by heart the legends heard from the oldest generation, fairy tales and capturing epic and also he inure himself to retold to others...» [6, 5]. His feather became sharpen from the very first work and his talent reached its perfection in dramaturgy. Specific relationship of Gabit to folklore, his love immediately became noticed from the first steps in dramaturgy, when he started embodying originally folk works in dramaturgy like dramaturgy works. Certainly first of all before dramaturgy the writer worked a lot in prose and achieved certain highest. And in these first prosaic works his adherence to dramaturgy is seen because plot is very involute and contains lots of elements of struggle, actions and dialogues of personages peculiar to drama. In 1934 on the basis of folk epos scene «Kyz Zhibek» came to world as a music drama later on it was reborn into opera. Then in 1939 the tragedy «Kozy Korpesh – Bayan sulu», becoming a true classic drama. N. Gabidullin deeply studied the dramaturgy of Musrepov. He divides plays born on the basis of oral literature by dramatic structure and manner of letter into two groups: «...In the first group lies those works the core of which is oral literature but they in accordance with high requirements of dramaturgy are given in new type with skillfully found scenes and plots that make complex the initial event laying in the work and expressed in new quality where the signs of this epoch of the childhood are seen. And these works where oral literature is given as a drama i.e. forced into the limits of dramatic work not changing much the incident and leading to initial folk work may lay into the second group...» [6, 21]. And in this connection he refers to the first group «Kozy Korpesh», and for the second – «Kyz Zhibek».

Folklore in the works of Musrepov – an entire system of artistic world of a writer. His works are similar with his original experience in the theory of folklore. To understand them it is necessary to dive into the depth of artistic world of Musrepov, mystery of his language, bathe into language nature of the writer. The researchers of the works of the writer N. Gabdullin, M. Bekbergenov, Zh. Smagulov, S. Zhumabekov, Kh. Adibayev and soon in their researches consider folklore of the writer as a part of mental outlook, world outlook and through purposes and tasks of these works – objects of their research. At all stages of development of literature, folklore is the most viable tool in the formation of genuine art of word. Literature «refined» like through sieve selected from great heritage the most valuable and absorbed in itself could depict by folklore tradition not only the present but also the past.

Each artist grown in certain national medium who well knows life, history, folklore of its people loving native nature can not be separated from rich poetic content of folk arts, to live separately. We can say the same about the master of artistic word Gabit Musrepov. The prove is the literary heritage, thoughts and journalism of the writer not for a moment adhere to a principal about spiritual fate of its people. The writer skillfully uses folklore means, folklore plots and motives, folklore personages. These methods refer to each developed literature. The popular folklorist, scientist U.B. Dalgat says «...There are individual creative processing, re-processing, transposition of folklore samples, styling under folk-poetic forms, when the writer or poet decides to speak in the language of folklore creating its works like folklore tradition. And here dominating form of systematic relationships is idea – estetic, narrative – composition, emotional-smemantic transformation of folklore means and events...» [7, 15] – give characteristics of folklore of the writer or poet, explains literary – estetic meaning of their intrusion into folklore. Availability or absence of folklore heritage in the works of the writers and poets depend on the medium of education, it is obvious that every writer touching once the origination of invaluable national wealth will automatically continue supporting on folklore in his creative works. And the folklore of G. Musrepov as we see from autobiographic tale initiates from his child love to epic poems «kissa», fairytales and legends. The writer managed in the construction of plot in folklore, image creation, application of various methods. Plot is a complex notion. It is a core of piece of art, basis of its entirety. Folklore plot becoming predecessor of writing literature is one the artistic delivery of life truth. Fables, legends, fairytales, myths, heroic plots, specific folklore motives are comprehensively used in vast prose of G. Musrepov. At present the application of folklore plots and personages is method not only deciding its problematics but also enriching artistic possibilities of the writer.

Understanding the entire depth of folk literature In the writer's prose, this method is sometimes traced but sometimes it is not noticeable. This is certainly connected with the masterpiece of the writer having his own style.

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市政员工的有效形象

EFFECTIVE IMAGE OF THE MUNICIPAL EMPLOYEE

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注解。在提交的文章中，分析了市政雇员的概念，类型，结构和形象维护。作者还标出了市政雇员形象的主要特征。确定市政雇员的形象包括外表，教育程度，行为方式，思维速度，言语，个人和职业素质，个人魅力，对待自己和对周围人的态度等因素。这些组成部分也属于市政雇员形象的制作要素：语调，停顿，微笑，外表，幽默，魅力，外部空间组织，注意取向。市政员工的有效形象是员工和狭隘专家长期活动的结果，也是行为模式的正确选择。市政雇员的形象既可以是基本的，也可以是活动的副产品，并不总是人工教育。重要的不仅是创建和广播市政员工的正面形象，而且要定期具体结果市政活动确认。

关键词：市政服务，市政职工，形象，正面形象，个人形象，形象结构，形象塑造。

Annotation. *In the submitted article the concept, types, structure and the maintenance of image of the municipal employee are analysed. Authors have marked also out the main features of image of municipal employees. It is established that image of the municipal employee consists of such components as appearance, level of education, a behavior manner, speed of thinking and the speech, personal and professional qualities, charisma, the attitude towards itself and towards people around. Such components as also belong to the making elements of image of the municipal employee: intonations, pauses, smile, look, humour, charisma, organization of external space, attention orientation. Effective image of the municipal employee is result of long activity both the employee, and narrow experts, and also a right choice of behavior model. Image of the municipal employee can be both the basic, and an activity by-product, and it is not always artificial education. Important not only to create and broadcast positive image of the municipal employee, but to confirm it with regularly concrete results municipal activity.*

Keywords: *municipal service, municipal employee, image, positive image, individual image, structure of image, image formation.*

Sociological poll shows that the image image of the modern public and municipal servant does not meet reality and expectations. Meanwhile, the municipal employee as the representative of the correcting sphere, through the image emphasizes very important status and functional value. The image of the employee has to act as one of conditions through which the population expresses the trust to bodies of municipal authority. Another, the important employee creating characteristic and who is closely connected with a concept of image the concept of professional culture is. Most often understand the integral property of professional community acting as a measure of development of a profession in this or that society by means of system integrity of content of professional activity, competence, professional values, the relations and norms as this term and also as a measure of development of this profession at the level both an individual personality, and separate professional groups. Through these elements there is a perception of employees by people around. Professional culture bears those signs which are attributes of municipal employees as specific professional group that allows to cause interest in this profession, gives the chance more highly and effectively to provide qualities of work. As an important factor serves also that circumstance that now positions of the municipal employee are rather well paid, at the same time rather high pension, an expanded package of social security is guaranteed to employees. Besides, municipal employees have an opportunity to establish "useful" contacts. It explains the fact that municipal service to treat one of prestigious specialties therefore even to younger positions of municipal service try to take "" (friends, relatives, acquaintances, etc.). In the absence of recommendations and "communications" hit on municipal service is extremely complicated.

Social responsibility of the municipal employee is caused, first of all by the fact that municipal authority - the power, closest to the people. In the Message to Federal Assembly in December, 2013 the President V.V. Putin spoke about need of a bigger approach of municipal authority to the people.

The term "image" (from English image - an image, reflection) is understood as the image which is artificially created in individual and public consciousness by means of psychological influence and mass media.

The term "image" was created in foreign management. This concept was introduced for scientific use by the economist K. Boulding in the sixties of the 20th century. Today the concept "image" is applied in the attitude towards heads, leaders of political parties, the public and municipal servants, heads of municipalities, territorial subjects of the Russian Federation, the states.

Most of researchers study image of the personality or image as a social phenomenon. Concrete determination of image of the municipal employee and his components is not given. Today the image of the municipal employee can be defined as follows:

- the certain image created as the municipal employee, and which developed in consciousness of residents of the municipal unit, in public mass consciousness;
- certain stereotype of behavior of the municipal employee;
- an impression which the municipal employee makes on people around;
- external image.

The image of the municipal employee is his image, perception of the employee by people around that in general defines the relation of the population of the municipal unit to local governments and forms image of municipal service.

The main types of image are applicable also to municipal employees:

- mirror - image of own representation of the municipal employee about;
- flowing - the image characteristic of a view of the municipal employee from outside;
- wished - the image reflecting that option which the municipal employee seeks to reach;
- mythological - the image which developed taking into account myths and legends, popular in this local community;
- modelled (strategic) – the image created by means of the involved experts;
- the closed image - image in which it is possible to enter those lines of the municipal employee which are considered as the most convincing.

The business image and image for acquaintances calculated on municipal employees as the people possessing a certain administrative resource is distinguished to rather social role of the person.

Also it is allocated: organic image (self-construction); resulting (copying of a sample); induced (intermediate to search of).

As a rule, the following components of image of the municipal employee are allocated: family, study, sport, pets, interests and hobby, weaknesses. Filling of these components is very significant since does image of the municipal employee to more live and brings closer it to residents of the municipal unit. In case these components are not filled with the municipal employee independently, then they are formed by mass consciousness at discretion, and then subsequently it is more difficult to introduce new information since it will be necessary to break a barrier of already existing installation in public consciousness.

Today unambiguous definition of the term "image" is not formulated, all its signs and components are not marked out. The image can exist separately from the personality, for example, to change (to improve or worsen) while the municipal employee can remain almost invariable.

The modern image of the municipal employee has to be at the same time following types:

- 1) external - shown in the external environment focused on public (on residents of the municipal unit);

- 2) internal - formed as an impression about activity and the office relations (corporate ethics, etiquette, features of office communication, business traditions);
- 3) positive - all PR-activity is directed to its achievement;
- 4) negative – formed by opponents by means of an anti-advertizing and "black PR";
- 5) natural, i.e. developed independently as a result of practical activities of the municipal employee, without use of special technologies, PR-actions and advertizing campaigns;
- 6) artificial, i.e. created purposefully during advertizing campaigns and PR-actions;
- 7) cognitive – providing only general, "dry" special information interesting to narrow experts;
- 8) emotional – the strong emotional response directed to mass audience and designed to cause.

Thus, the image of the municipal employee consists of such components as appearance, level of education, a behavior manner, speed of thinking and the speech, personal and professional qualities, charisma, the attitude towards itself and towards people around. Such components as also belong to the making elements of image of the municipal employee: intonations, pauses, smile, look, humour, charisma, organization of external space, orientation of attention.

Image of the municipal employee irrespective of, personal it or professional, has to perform the following functions:

- psychological protection of the municipal employee;
- a social training of the municipal employee (in image the employee spontaneously adjusts, adapts itself for a mass image);
- social and symbolical knowledge of the municipal employee (the image is a peculiar mark of readiness for perception of social values: riches, authorities, career, success);
- illusory and compensatory function of image ("to play unfulfilled" to compensate stereotype of ordinary life, keeping thereby the personality, but, without breaking a behavioural framework of group roles).

The effective image of the municipal employee is result of long activity both the employee, and narrow experts and also a right choice of behavior model. The image of the municipal employee can be both the basic, and an activity by-product, and it is not always artificial education. Important not only to create and broadcast positive image of the municipal employee, but to confirm it with regularly concrete results municipal activity.

肥胖症中身体质量的组成与压力聚焦行为的关系
**THE RELATIONSHIP OF THE COMPOSITION OF THE MASS
OF THE BODY AND STRESS-FOCUSING BEHAVIOR
IN THE OBESITY**

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Alimentary-constitutional obesity is recognized as one of the most important public health problems of the World and its associated chronic diseases and discrimination in society [1]. Overweight affects not only the physical condition of a person, but also the psychology of his behavior, emotional reactions, social life [3,5]. Despite the large number of studies of this problem, there is no consensus on the pathogenesis, methods of treatment and prevention of obesity. In recent years, the problem of healthy and metabolically complicated obesity has been actively discussed [1,2]. The biopsychosocial relationships in the pathogenesis of the stress-obesity cycle [3,4,5] have not been studied and whether overweight is always a negative factor in chronic stress.

Purpose. Assess the relationship of the psycho-emotional state of the patient with the structure of the body in obesity.

Material and research methods. A random sampling method in compliance with

the requirements of the Declaration of Helsinki (1975) examined 101 women aged 18-68 years old with overweight and obesity of grade 1-3 (WHO), who underwent medical examination at the outpatient department of Aksion Medical Center, Izhevsk. All patients according to the test results using the Holmes Social Adaptation Scale and Rage (determination of the level of actual stress) were divided into 2 groups. The first group consisted of 49 (48.5%) people who had high rates of accumulated, chronic stress (> 300 points). Of these, overweight was found in 14 people (group 1a), obesity of 1 degree - in 10 people (group 1b), 2 degrees - in 16 people (group 1c), 3 degrees - in 9 people (group 1d). The second group included 52 women (51.5%) who had low levels of stress (< 299 points): overweight was found in 16 people (group 2a), obesity grade 1 - in 12 people (group 2b), grade 2 - 14 people (group 2c), 3 degrees - 10 people (group 2d).

The complex of studies included anthropometric measurements: height, weight with the calculation of body mass index, waist circumference; analysis of clinical and laboratory parameters: assessment of total blood cholesterol, low and high density lipoproteins, triglycerides. Body composition was judged according to an In Body analyzer with an estimate of body mass index (BMI), skeletal muscle percentage, fat, water, and dry weight in the body. Coping behavior in stressful situations was analyzed by S. Norman. Food behavior was judged according to the Dutch Food Evaluation Questionnaire (DEBQ, 1986).

For the extended characteristics of the relationship of body composition with stress-coping behavior in obesity, a study was carried out in three stages: 1) study of the body composition of patients; 2) eating analysis; 3) assessment of the psychological state of this category of patients. The first stage included anthropometric measurements: height, weight with the calculation of body mass index, waist circumference; analysis of clinical and laboratory parameters: assessment of the level of total blood cholesterol, low and high density lipoproteins, triglycerides, data from the In Body analyzer with body mass index (BMI), skeletal muscle percentage, fat, water and dry weight in the body were used. The second stage consisted in the analysis of eating behavior according to the Dutch Eating Questionnaire (DEBQ, 1986).

The results of the study. Patients in both groups were comparable in age, sex, body weight, body mass index (BMI). Significantly higher average waist circumference (112.1 / 105.1 cm), waist / hip ratio (1.18 / 0.79), triglyceride levels (1.79 / 1.33 mmol / l) compared with the group without chronic stress ($p = 0.047$). Figure 1 shows the correlation of skeletal muscle and age.

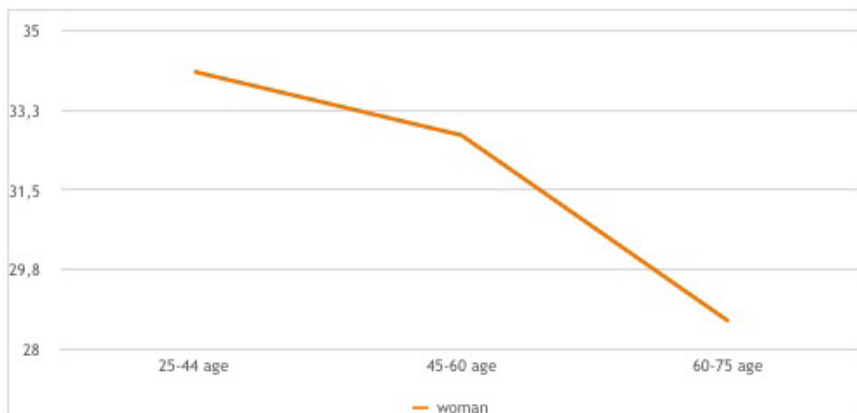


Figure 1. Correlation of skeletal muscle and age

The structure of the graph in Figure 1 shows that the minimum percentage of skeletal muscles is noted in the older age category ($r = 0.38$; $p < 0.05$); from this we can conclude that with age the contribution of muscle mass to body weight decreases ($r = 0.38$; $p < 0.05$).

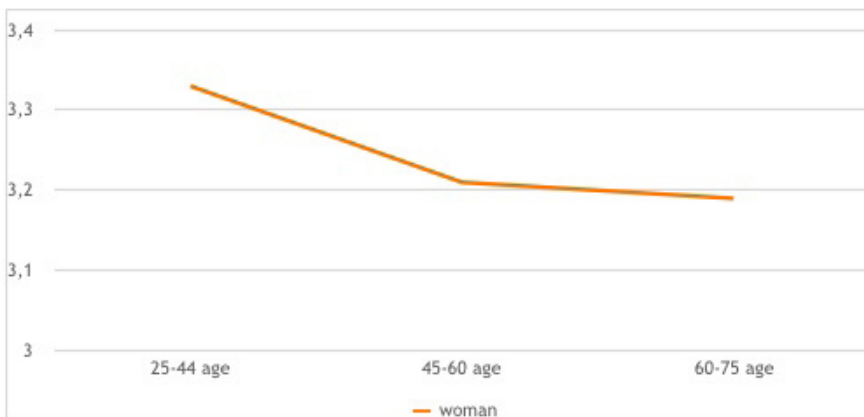


Figure 2. Correlation of mineral content in different age categories

When analyzing the dynamics of the mineral composition of body weight, presented in Figure 2, it was found that the minimum mineral content in the body (including bone minerals) is also recorded in the older age group ($r = 0.35$; $p < 0.05$). suggests a decrease in the content of minerals in bone tissue. The main decrease in minerals was registered in the premenopausal period, with the subse-

quent smoother dynamics of their decrease. The data of anamnesis and physical examination did not allow to explain this phenomenon. Perhaps this is due to the small number of elderly people in the sample.

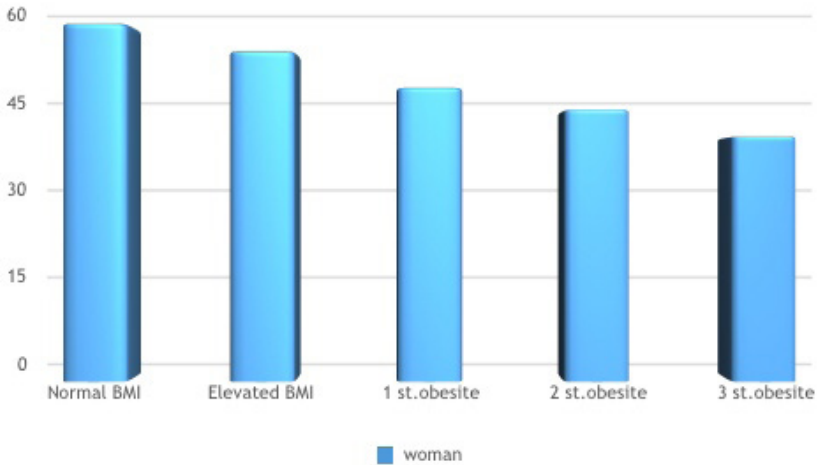


Figure 3. Dependence of the content of dry mass in the body from BMI

Separately, an analysis of the correlation of dry body weight with the degree of obesity. Figure 3 shows the relationship of the percentage of dry weight in the body from BMI. Analyzing this graph, it is possible to reveal the inverse dependence of the percentage of dry body weight on BMI, the minimum percentage is observed in people from 3 tbsp. obesity ($r = 0.42$; $p < 0.05$). Dry matter is the sum of minerals (including bone minerals), proteins, and skeletal muscle mass. On this basis, we can conclude that the BMI increases mainly due to the percentage of adipose tissue in the body.

An eating analysis gave the following results. In both groups, a high percentage of eating disorders was detected in 37 (75.5%) and 44 (84.6%) cases, while the restrictive type of eating behavior was present in both groups, reflecting attempts at self-correction of the diet. Against the background of chronic stress, restrictive eating behavior was positively correlated with the level of destructive anxiety ($r = 0.32$; $p = 0.05$). Attempts to correct the diet in these patients were accompanied by an increase in anxiety and anxiety even on the most insignificant reasons ($r = 0.40$; $p = 0.05$). They were characterized by manifestations of autonomic stigma anxiety: sweating, dizziness, tachycardia ($r = 0.37$; $p = 0.05$). A characteristic feature of this group of women who were under chronic stress was a tendency to decrease confidence not only in the people around them ($r = 0.56$; $p < 0.01$), but also in themselves ($r = 0.27$; $p > 0.05$).

In the absence of chronic stress, a correlation of restrictive eating behavior with stress-coping behavior in the form of “social distraction” ($r = 0.35$; $p = 0.05$) was revealed, which reflected the desire to be in public, to engage in communication with them, discussing the problem, to cope with stressful situations.

When assessing the characteristics of eating behavior, the frequency of registration of the emotiogenic type in the observation groups was 1 / 1.7, externalities 1 / 0.8. In both groups, emotiogenic eating behavior was associated with anxiety levels. However, in the group with a low stress load, it was inversely correlated with constructive anxiety ($r = -0.36$; $p = 0.04$), whereas with chronic stress this indicator increases with an increase in deficiency anxiety ($r = 0.39$; $p = 0, 05$).

The most significant for the intensive increase in body weight is the external type of eating behavior, as they begin to take food when they see a beautifully served table or smell the cooking food.

The analysis of integrative values showed that with comparable (19.4 / 20.5) indicators of adaptive capacity (ability to withstand adverse circumstances, to defend one's life positions, while maintaining significant interpersonal relationships), there were significant differences in groups according to the criterion of overall constructiveness - ability to adequately positive self-determination and social adaptation ($p = 0.05$). With a history of social adaptation in this group was associated with the absence of severe restrictions, with a wider choice of food, which allowed them to withstand stress.

In the 1st group, the overall constructiveness was 35.9 ± 2.1 , in the 2nd group - 44.2 ± 1.9 . The potential of mental activity, reflecting the ability to form and defend their own goals and positions was higher in the 2nd group, reaching 20.1 ± 5.8 points, against 16.2 ± 6.8 in the 1st group.

To assess the relationship of high stress load with a feature of the body structure, a factor analysis of psycho-emotional data and clinical and laboratory parameters obtained during body composition analysis was carried out.

Four significant groups of factors were identified, the percentage of the total variance of which is less than 75%.

In the first set of factors (25.5% of the total variance), the body mass index had the highest negative factor load ($r = 0.94$), which correlated with the level of total cholesterol ($r = 0.91$), low-density lipoproteins ($r = -0, 89$). This factor group was conventionally designated as the effect of excess body weight.

The second factor group (15.1% of the total variance) was represented by the indicators of body composition in women: the average body mass index - 28.8, the percentage of dry body weight - with 3 degrees of obesity - 34.4%; the average percentage of skeletal muscles in the body of the age category: 25-44 years old - 34.1% ($p < 0.05$), 45-60 years old - 32.7% ($p < 0.05$), 60-75 years old - 28, 6% ($p < 0.05$); the average percentage of body fat in the age group is 25-44 years old - 37.1% ($p < 0.05$), 45-60 years old - 40.3% ($p < 0.05$); the average level of basal metabolism (kcal / day)

in different age categories: 25-44 years - 1790, 45-60 years - 1753; the average level of basal metabolism is minimal in those studied with a reduced BMI of 1011 kcal / day; the average waist-hips index for women studied with a reduced BMI is 0.86. This factor group was designated as body composition.

The third group of factors was identified as emotionally directed coping behavior (0.72), which positively correlated with destructive anxiety (0.69). deficient personality traits (11.5%). The main indicators in it were the deficiency aggression (0.77), which correlated with the deficient external I-delimitation, which in the aggregate indicates the insufficiency of personal qualities for setting and achieving goals.

The fourth group of factors - behavioral (10.5%), reflects the importance of achieving compliance (9.2%). In this group of factors, the largest share is the indicator of destructive external I-demarcation, which indicates excessive closeness and rigidity of the external border I, contact the barrier to the productive exchange of social energy and communication with others (including the doctor).

Discussion of the results. A complex of studies has shown that in women, with age, the percentage of skeletal muscles decreases from 34.1% to 28.6%, the percentage of minerals and the percentage of body water from 3.3% to 3.19%.

The leading role of the reduction of minerals in women in menopause, which requires targeted medical examination of women with obesity before the development of menopause (35-45 years), is revealed. This will prevent possible fractures in the post-menopausal period.

The role of chronic stress in the formation of abdominal obesity was revealed. The study noted that triglycerides were significantly higher than in patients not affected by stress factors that could lead to coronary artery disease, atherosclerosis. It was also found that a high stress load, as a psychosomatic factor, reduces biopsychosocial adaptation, which is associated with personality deficiency characteristics and behavioral reactions in a stressful situation. In turn, the low adaptation potential against the background of the existing excess body weight contributes to the development of metabolically complicated obesity. In this case, an important role is played by a low level of compliance between the patient and the doctor.

In addition, the known factors of changes in body structure with age, such as a decrease in muscle mass and a decrease in bone mass in one row, put a high stress load, contributing to a more pronounced development of metabolic disorders in obesity. High stress load is interrelated with the severity of metabolic disorders in obesity and increased levels of morning serum cortisol, which is not a factor in the development of these changes. In patients with obesity, psychosomatic development of metabolic disorders during prolonged stress is possible, which is associated with deficient personality traits, unproductive stress-coping behavior and low compliance with a doctor.

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在医疗实践中使用碘有机组合物1,3-二乙基苯并咪唑三碘化物的前景
**PROSPECTS OF USING IODOORGANIC COMPOSITIONS
OF 1,3-DIETHYLBENZIMIDAZOLIUM TRIIODIDE
IN MEDICAL PRACTICE**

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抽象。含有生物活性组合物的配方
给出1,3-二乙基苯并咪唑三碘化物。基于罗斯托夫国立医科大学皮肤病科的
专利文献和科学经验，成功应用含有1,3-二乙基苯并咪唑三碘化物的组合物治疗
多种疾病的可能性，如局限性硬皮病，寻常痤疮，已经表现出fur病，多发性硬化
症，肺结核，非典型肺炎，骨髓炎。

关键词：碘化化合物的生物活性成分，局灶性硬皮病，多发性硬化。

Abstract. *Recipes for biologically active compositions containing
1,3-diethylbenzimidazolium triiodide are given. Based on the patent literature and
scientific experience of the Department of Skin Diseases of the Rostov State Medi-
cal University, the possibility of successfully applying compositions containing
1,3-diethylbenzimidazolium triiodide in the treatment of a number of diseases,
such as localized scleroderma, acne vulgaris, furunculosis, multiple sclerosis, tu-
berculosis, atypical pneumonia, osteomyelitis, has been shown.*

Key words: *biologically active compositions of iodine compounds, focal scler-
oderma, multiple sclerosis.*

The study of etiological and pathogenetic factors of the diseases onset and the
search for medicines for their treatment is one of the main stages of an integrated
research approach.

Thus, scientists of the Rostov State Medical University for several years now have used chromatographic research methods to substantiate the microbiological theory of the origin and development of diseases. They also conducted a search for new drugs for diseases that are difficult to treat.

Using the method of gas-liquid chromatography, acne vulgaris, circumscribed scleroderma, gastric ulcer and duodenal ulcer, prostatitis, uterine myoma were studied [1]. A large number of wax-like compounds were found in the biopsy specimens of the diseases cited.

According to T. Takatovi [2], wax-like substances are produced by the microorganisms *Micrococcus libeus* and Velich-Fraenkel bacilli. We can assume the formation of wax-like compounds also as a result of metabolic disorders. The presence of these compounds will determine [3] the development of clinical complications, which is due to the fact that they violate the oxygen and biologically active compounds penetration into affected tissues.

In this regard, the researchers faced the task of finding drugs that can overcome the histochematogenous barrier. Attention was drawn to iodine-containing organic compositions.

In the 60-70 years of the last century the theory of biologically active halide compounds has been developed and substantiated by Russian scientist Mokhnach V.O.. This theory explains the biological activity of drugs containing active iodine radical in the oxidation state J^- , JO^- . Presumably, biologically active iodine is easily incorporated into the intracellular and molecular transport system, activates T-lymphocytes, selectively affects components foreign to the body. The pharmacological effect of iodine preparations is explained by the hypothesis of the halogens blocking action on the amino groups of active proteins and nitrogenous bases of foreign microorganisms, which provides a wide range of antimicrobial, antifungal, antiviral and anthelmintic effects.

Guided by this theory and, in particular, the principle of enhancing the pharmacological properties of iodine compounds in combination with biologically active amines, in the Rostov regional veterinary production laboratory iodine-containing preparations of 1,3-diethylbenzimidazolium triiodide and sulfanilamide bismuth iodide were obtained and introduced into practice by Livitsky V.I.

Based on the biologically active 1,3-diethylbenzimidazolium triiodide, the following preparations were launched into veterinary practice: powder containing 20% triiodide 1,3 diethylbenzimidazole and 80% polyvinylpyrrolidone under the trade name "Lazine"; the composition of 1,3-diethylbenzimidazole triiodide, 16% polyvinylpyrrolidone and 0.34% potassium iodide in ethyl alcohol - "Liquid lasine"; Vaseline ointment 10-20% benzimidazole triiodide under the trade name "Mieran".

It should be noted that "Lazin" with low toxicity of the drug LD_{50} - 5 g / kg has a broad spectrum of antimicrobial and antiviral effects, exhibits high antitumor

activity and can overcome histoematic and blood-brain barriers [4]. High rates of pharmacological activity of this drug are provided by both the polyiodine radical and benzimidazolium. The use of polyvinylpyrrolidone sorbent in the composition of "Lazin" is explained by the high chemical activity of iodine and iodine ions. To reduce the halogen chemical activity in the compositions, the triiodide radical exists in the form of a chemical compound with an amine and a weakly active complex with polyvinylpyrrolidone.

Currently, "Stellanin" ointment containing 3% 1,3-diethylbenzimidazole triiodide in the practice of treating skin diseases is permitted. This drug shows good results in the treatment of purulent skin diseases, trophic ulcers, abscesses, hemorrhoids, including the third stage of acne vulgaris, in which there is a presence of wax-like compounds in the affected tissues. In combination with the drug "Dimexide" and a complex therapy "Stellanin" successfully applied in the treatment of difficult circumscribed scleroderma, in the affected tissues of which contain up to 90% of wax-like compounds.

"Dimexide" (dimethyl sulfoxide) is a synthetic drug for external use, which has antibacterial, analgesic, fibronolytic and anti-inflammatory properties. This compound promotes the penetration of the biologically active triiodide into the of pathological processes focus. We present here some results of treatment with the use of the Stellanin-Dimexide combination.

Treatment of acne of 3-4 degrees. Case history No. 023XXX / 545, skin disease clinic of Rostov State Medical University.

Patient N., 22 years old, "acne conglobata" diagnosis. Suffering from acne for 2 years, periodically treated on an outpatient basis without visible improvement. In the skin clinic of the Rostov State Medical University the patient daily locally applied iodine-containing composition using a tampon 1 time per day on pustules. There was a rapid treatment progression: pustules opened, wounds healed and resolved almost without leaving scars or cicatricial atrophy.

Treatment of a patient with furunculosis. Case history No. 024XXX / 97, skin disease clinic of Rostov State Medical University.

Patient V., 19 years old, diagnosed with acne and furunculosis. At the place of residence in the city of Makhachkala for one and a half years was treated on an outpatient and inpatient basis with a slight unstable improvement. In the skin clinic of Rostov State Medical University the patient daily locally applied iodine-containing composition using a tampon 1 time per day on the affected tissue. The improvement came on day 4-5. He was hospitalized for 14 days. The patient was discharged in the stage of full clinical recovery.

The composition has been applied in the treatment of scleroderma. Case history No. 024XXX / 574, skin disease clinic of Rostov State Medical University.

Patient P., 15 years old, localized focal scleroderma diagnosis. The area of the

largest focus is 27.5 cm². Three small - 1.2 cm², 1.3 cm², 1.6 cm². Previously, the patient received three courses of complex therapy with an interval of 1 month, there was a slight clinical improvement. When using complex therapy and application of a iodine-containing composition to the affected skin with a cotton tampon once a day for 30 days, there was a decrease in the lesion area of the main focus to 14 cm² and the disappearance of small lesions.

At the same time, the density of the large focus decreased, and the affected skin areas acquired a more natural color.

To enhance the positive results in the treatment of iodine-containing drugs, the staff of the Rostov State Medical University developed a number of biologically active compositions [5] and tested the composition "VILIV" [6] capable of exhibiting a pronounced anti-inflammatory and antimicrobial effect. These properties are confirmed in the treatment of simulated inflammatory processes [SIP] on the skin in 7 rats. So compared with the control group of rats, the process of wound healing was reduced from 14 days to 8 days.

Interesting results are reported in the Internet space [7] and patent sources on the use of preparations containing 1,3-diethylbenzimidazolium triiodide, for example, "Vilkov drops" and "Lazine". These drugs have been proposed to treat a number of diseases, such as multiple sclerosis, tuberculosis, hepatitis B and C, AIDS, SARS, osteomyelitis, pyelonephritis, schizophrenia, epilepsy, cataracts.

In a patent search, there can be found dozens of patents for use of 1,3-diethylbenzimidazolium triiodide in treatment. There is even a patent (RU 2243653 C2) of the "Lazin" use as an antidote in water bodies of fish farms contaminated with pesticides.

Undoubtedly, preparations of biological active iodine and, in particular, 1,3-diethylbenzimidazolium triiodide should be more widely used in various fields of scientific research and incorporated into the therapy of diseases. To do this, it is necessary to continue the active study of the biological activity of iodine compounds with some organic substances, explaining the mechanisms of their wide impact on various pathologies.

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在神经精神疾病患儿中寻找细胞因子基因VNTR多态性与龋齿的关联
**SEARCH FOR ASSOCIATIONS OF VNTR-POLYMORPHISM
OF CYTOKINE GENES WITH DENTAL CARIES IN CHILDREN
WITH NEUROPSYCHIATRIC DISEASES**

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抽象。在所有年龄组中，患有精神神经病理学的儿童龋齿的高发病率促使人们检查已知的并且寻找新的因果因素和牙科病理学的发病机制。从文献回顾数据表明与龋齿的发展和和其它牙齿疾病细胞因子的可能的相关性。在从96名患有神经精神疾病的儿童和97名没有共病病变的儿童中抽取的生物样本中，检查了小卫星 (VNTR) 基因标记IL1RN (rs2234663) 和IL4 (rs8179190)。结果表明IL4基因 (rs8179190) VNTR多态性与龋齿发展有关，因为IL1RN的VNTR多态性的杂合子可能对龋齿更具抗性。但是，随着“短等位基因”或以其他方式的等位基因A2 (240沸点) VNTR IL1RN (rs2234663) 的存在基因型为牙齿腐烂的危险因素。VNTR IL4的还需要进一步研究，由于较大的样本中龋考虑年龄也。

关键词：儿童，龋齿，神经精神疾病，细胞因子，基因标记，基因分型。

Abstract. *The high incidence of dental caries in children with psycho-neurological pathology in all age groups motivates to examine the known and search for new causal factors and pathogenetic mechanisms of the dental pathology. Data from the literature reviews suggests a possible association of cytokines with the caries development and other dental diseases. In biological samples drawn from 96 children with neuropsychiatric diseases and 97 children without comorbid pathology, minisatellite (VNTR) gene markers IL1RN (rs2234663) and IL4 (rs8179190) were examined. The results suggest the presence of an association of the IL4 gene (rs8179190) VNTR-polymorphism with the development of caries, since heterozygotes for the VNTR polymorphism of IL1RN are probably more resistant to caries. However, genotypes with “short alleles” or otherwise the presence of an allele A2*

(240 b.p.) VNTR IL1RN (rs2234663) is a risk factor for teeth decay. Further study of VNTR IL4 is needed due to caries in a larger sample considering age also.

Key words: children, dental caries, neuropsychiatric diseases, cytokines, gene markers, genotyping.

The role of cytokines in the dental caries pathogenesis is not clear yet, but some studies have shown that the components of *S. mutans*, the leading bacteria-invader, stimulate the proinflammatory cytokines production [1]. The system of interleukin 1 plays an important role in protection against microbial colonisation, infection and malignant transformation. The interleukin 1 receptor antagonist gene (IL1RN) encodes a protein belonging to the IL1 cytokine family and functions as a competitive inhibitor in the regulation of pro-inflammatory activity induced by IL1.

A variable number of tandem repeats (VNTR) with a 86 b.p. sub-unit (rs2234663), present in intron 2 of the IL1RN gene, is described, and six alleles are found, among which there is a short allele with two repeats (VNTR/2) and long alleles (VNTR/L) containing from 3 to 6 repetitions.

86-b.p. VNTR polymorphism has attracted great interest from researchers. The pro-inflammatory immune response of individuals homozygous for the VNTR/2 IL1RN allele has been found to be longer and stronger than the carriers of other VNTR genotypes for the IL1RN gene [2]. In this regard, the effect of the VNTR/2 IL1RN allele has been widely studied in various diseases, including autoimmune [2, 3]. In particular, the role of this marker in the development of sepsis and mortality from this disease was studied.

A meta-analysis was conducted to identify the role of this marker, which combined six extensive studies including 1,731 cases of sepsis and 2199 cases of control, in order to provide more reliable conclusions about the effect of 86-bp VNTR IL1RN on the risk of sepsis and a possible role in mortality from this disease [3]. As a result of meta-analysis, the role of 86-bp VNTR of the IL1RN gene polymorphism in the sepsis development was revealed, but not in mortality, and the VNTR/2 allele was established as a risk allele [3].

The role of 86-b.p. VNTR polymorphism of the IL1RN gene and polymorphic variants of other cytokines in the development of caries, the features of its course [1,4] and other dental diseases, in particular, in the development of various types of periodontal pathology [5,6] was studied. Associations of individual alleles and VNTR IL1RN genotypes with various types of periodontal diseases were identified, thus, the VNTR polymorphism of the IL1RN gene is a candidate biomarker for this disease.

In this regard, the study of VNTR polymorphism in intron 2 of the IL1RN gene is included in our study on the development of caries in children with neuropsychiatric diseases (PNZ) and in the control group of children without comorbid pathology, given the fact that children with PNZ are extremely low level of hygiene and, in this regard, the role of cytokine genes in the carious process in children of this group is not

excluded, and perhaps in children of the control group, taking into account the previously identified links of the polymorphisms of this gene with dental and other diseases.

IL-4 - interleukin 4 acts as an anti-inflammatory agent, interleukin 4 (IL4) gene is localized on the long arm of chromosome 5 (q23-31) along with other cytokine genes. This gene contains a tandem repeat in 70-bp with a variable number of tandem repeats (VNTR) or a mini-satellite repeat that is found in intron 3 and is associated with IL-4 production. Two main alleles were found, due to VNTR polymorphism: one with a 70-bp deletion, and the other with an insertion of 70-bp, which are designated as P1 and P2, respectively [7].

P2P2 genotypes of the IL4 gene are associated with lower concentrations of IL-4. Using various studies, it was suggested that the P1 allele induces a higher expression of the IL4 gene compared to the P2 allele. Also, the P2 allele can be protective in some diseases [7]. A number of studies have been carried out on the association of the VNTR polymorphism of the IL4 gene in various populations, including immune and autologous diseases, for example, recurrent aphthous stomatitis [7]. In our study, the possible association of this polymorphism with caries was analyzed both in children with PNZ and without comorbid pathology.

Materials and methods. Biological samples were obtained from children with psycho-neurological diseases and the control group of participants of comparable age without comorbid pathology. Samples were obtained in the form of buccal scrapings of the cheek mucous membrane in the pediatric department, dental clinic of the Kuban State Medical University and, in part, in the form of blood samples on the base of the Children Regional Clinical Hospital, Krasnodar. Parents' Informed consent was obtained to conduct a genetic study and biological material collection in 120 children with PNZ and 112 children in the control group.

In all children with PNZ, dental caries were detected mainly in the compensated / subcompensated form of disease (DFC / SFC). In children of the control group, the lower carious process activity (compensated form of caries (CFC)) or its absence were observed.

Genomic DNA was isolated from most biological samples (96 samples from children with PNZ), 97 samples of isolated DNA from children of the control group) with the "Izogen reagent kit" (Moscow) using a standard method according to the manufacturer's prescription. DNA samples were stored in a freezer at -20 ° C. The minisatellite (VNTR-variable number of tandem repeats) - the IL1RN gene marker (rs2234663) and the minisatellite (VNTR) IL4 gene marker (rs8179190) were chosen as objects for the study.

The selected minisatellite polymorphic marker for the IL1RN gene is due to the presence of the 86-bp subunit repeat in intron 2 of the gene. The polymorphism of the IL1RN gene was studied using the polymerase chain reaction (PCR) [8]. The PCR amplification products were analyzed by electrophoresis in a 2% agarose gel. For PCR

amplification, sets of reagents for PCR by “Izogen” manufacturer (Moscow) were used. The polymorphic region of the gene was amplified using forward and reverse primers: 5'-CTCAGCAACACTCTCTAT-3' и 5'-TCCTGGTCTGCAGGTAA-3', respectively. Primers were synthesized by the company “Liteh” (Moscow).

The PCR protocol is as follows: denaturation at 95 ° C for 5 min, 30 cycles with denaturation at 94 ° C for 30 s, annealing of the primers at 57 ° C for 45 s, elongation at 72 ° C for 1 min and final elongation at 72 ° C during 10 min with the device of MJ Research company (USA). PCR products were visualized in a 2% agarose gel stained with ethidium bromide (see Figure 1- IL1). The expected spectrum of polymorphic fragments of the IL1RN gene is represented by the following fragments: 410bp fragment (base pairs (bp)) - this fragment corresponds to a fourfold repetition of the 86bp subunit (IL1RN1 allele).

The IL1RN2 allele is represented by a 240bp fragment and corresponds to two copies of the repetition. The IL1RN 3 allele is represented by a fragment of 325 bp (three copies of repetition). The IL1RN 4 allele is represented by a 500 bp fragment (five copies of repetition), the IL1RN 5 allele is a 585bp fragment (six copies) and IL1RN 6 is a 155 bp fragment (one copy).

Not all of the possible alleles were identified in our sample: IL1RN1, IL1RN2, IL1RN4 and IL1RN6 were detected. Alleles IL1RN3 and IL1RN5 were not detected.

To study the 70bp VNTR of the IL-4 gene polymorphism (rs8179190), PCR was used as in [7] using the “Isogene” PCR kit. PCR amplification was performed with a forward and reverse primer: F5 ' AGG CTG AAA GGGGAAAG C -3 ', R 5'-CTG TTC ACC TCA ACT GCT CC-3 ', respectively. Primers were synthesized by the company “Liteh” (Moscow). The PCR protocol is as follows: denaturation at 95 ° C for 5 min, 30 cycles with denaturation at 94 ° C for 30 s, annealing of primers at 58 ° C for 45 s, elongation at 72 ° C for 1 min, and final elongation at 72 ° C for 10 min with the “MJ Research” company device (USA). PCR products were visualized in a 2% agarose gel stained with ethidium bromide (see Fig. 2 - IL4).

For the P1 allele, the PCR product was 183 bp long and for the P2 allele it was 253 bp long. We identified a minor allele in 113bp. For reliability of typing and reproducibility of the method, internal controls for each genotype were included. For statistical data processing, Statistica 6.0 algorithms and WinPepi algorithm (for determining OR (odds ratio)) were used, 95% interval of OR CI (time interval) was determined in case of probability value $p < 0.05$ by Fisher exact test (two-tailed- for two distributions. However, unfortunately, no reliable OR estimates were found. Allele frequencies, Hardy-Weinberg equilibrium, and estimated heterozygosity were determined. The samples were compared using G-test.

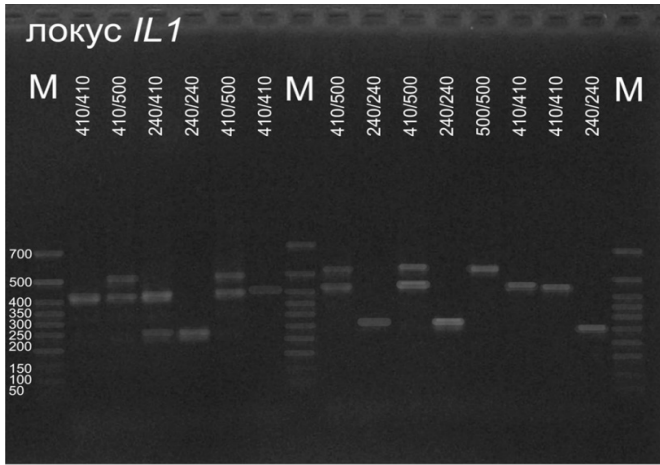


Fig. 1 - IL1 locus. An electrophoregram analysis of the microsatellite (VNTR) *IL1N* locus in a 2% agarose gel is presented

At the extreme lanes and in the center, a molecular weight marker is presented indicating the lengths of the fragments (bp) The remaining tracks show the results of the analysis of VNTR polymorphism for the studied locus with different genotypes. Numbers indicate the lengths of the identified alleles in bp.

One band corresponds to homozygous genotypes, two to heterozygous alleles of 410bp (IL1RN1), 500bp (IL1RN4) and 240bp (IL1RN2), carrying 4, 5, and 2 tandem repeats in 86-bp, respectively, are shown.

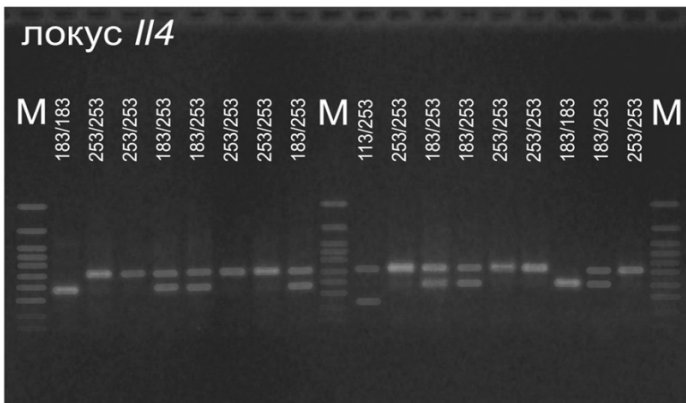


Fig. 2 - IL4. An electrophoregram of the VNTR analysis of the *IL4* polymorphism was presented

At the extreme lanes and in the center, a molecular weight marker is present indicating the lengths of the fragments in the b.p. (base pairs) The remaining tracks show the results of VNTR polymorphism analysis for the studied locus with different genotypes. Numbers indicate the lengths of the identified alleles in b.p. One band corresponds to homozygous genotypes, two - to heterozygous. Alleles of 183 b.p. (P1), 253 b.p. (P2) and 113 b.p. (P3) are shown, differing in the presence of a tandem repeat in 70bp.

Results. The frequencies of VNTR IL4 alleles in the studied groups were established, differences in the frequency of alleles or genotypes in the two studied groups were not observed when compared with each other. Analysis of the distribution of heterozygosity parameters showed a lack of heterozygosity in children of both groups studied with decompensated and subcompensated forms of caries, which suggests the likely role of the studied marker in the development of caries in both groups.

It should be noted that in children with a compensated form of caries, there was no shortage of heterozygotes. In a generalized analysis of the VNTR IL4 marker depending on the activity of caries in children with PNZ and children of the control group, differences in the distribution of VNTR IL4 alleles between children with decompensated / subcompensated caries and caries with compensated caries / without caries were not established.

Meanwhile, the lack of heterozygotes in children with decompensated / subcompensated forms of caries as compared with children with compensated form of caries / without caries remains, although it does not reach the threshold of reliability. The obtained result can serve as evidence of the likely involvement of VNTR polymorphism in LL4 in the association with the development of dental pathology. Undoubtedly, it can be concluded that further study of VNTR IL4 is useful in connection with dental caries on a larger sample and in more detail.

When analyzing the distribution of polymorphic variants of VNTR IL1RN (rs2234663) in children with PNZ and in children of the control group of the study, there was a difference in frequencies for this marker. When analyzing the distribution of polymorphic variants of VNTR IL1RN (rs2234663) in children of the control group, depending on the degree of caries activity, there were no significant differences in the distribution of genotypes of the studied marker.

Of greatest interest is the comparison of the presence of the number of genotypes in groups with genotypes containing short alleles (due to the above described features of gene expression under consideration depending on different alleles of the polymorphism under study). In this comparison, the differences also did not reach the level of significance; the highest score was obtained when comparing contrasting groups of children with DFC and CFC, respectively ($G = 3.3372$, $df = 1$, $p > 0.05$). However, there is an increase in the frequency of the A_2 allele in the

range from $P_{A2} = 0.1500 \pm 0.0349$ in children of the control group with CFC / without caries, to children of the control group with DFC / SFC $P_{A2} = 0.2667 \pm 0.0466$ and to $P_{A2} = 0.3269 \pm 0.0651$ in children of the control group with DFC. Thus, the maximum differences in the frequency of the A2 allele are observed in the control group between children with CFC and with DFC with frequency differences of almost two times. We believe that with an increase in the sample, the considered differences can reach the threshold of reliability. Therefore, it can be concluded that there are really genotypes with “short alleles” or else the presence of allele A2 is a risk factor for the development of caries. “Long” alleles in the genotype cause resistance to caries, and “short” ones - sensitivity.

Analysis of the distribution of polymorphic variants of VNTR IL1RN (rs2234663) in children with PNZ depending on the caries activity degree when comparing alternative groups did not reveal significant differences between them. Thus, there are no specific features of the genotypes distribution in children with PNZ, depending on the degree of the caries activity. The features noted for a similar analysis in children of the control group, in general, remain here. Due to the relative small number of samples, it was not possible to reach the threshold of reliability for the noted features. Further study of the marker in connection with caries in large samples is necessary.

Conclusion. The results can serve as evidence of the likely involvement of VNTR polymorphism for IL4 (rs8179190) in association with the development of caries, since heterozygotes for VNTR IL1RN are probably more resistant to caries, which is confirmed by the distribution of heterozygosity parameters in children with high caries activity (DFK / SFK) in comparison with low activity of caries (CFC). There is no doubt that it is possible to draw a conclusion on the useful further study of VNTR IL4 in connection with caries in a larger sample and in more detail with regard to age. It was not possible to establish the specific features of caries development in children with PNZ when studying the VNTR of the IL4 gene as compared with the children of the control group.

However, it can be concluded that genotypes with “short alleles” or the presence of the A2 (240 bp) VNTR IL1RN (rs2234663) allele is a risk factor for the development of caries. The “long” alleles in the genotype (500 and 410bp) cause resistance to caries, and the “short” ones - sensitivity.

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糖尿病视网膜病变发病机制中的神经营养因子
**NEUROTROPHIC FACTORS
IN THE DIABETIC RETINOPATHY PATHOGENESIS**

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抽象。糖尿病性视网膜病变 (DR) 是糖尿病的严重并发症, 其导致不可逆的视力丧失。目前正在研究神经营养因子在其发病机理中的作用。本文介绍了主要神经营养因子 (神经生长因子, 脑源性神经营养因子, 神经营养因子-3, 神经营养因子-4, 睫状神经营养因子, 胶质细胞源性神经营养因子) 的特征, 实验和临床研究结果显示 NTF 在 DR 中的神经变性, 炎症和血管生成中的作用。

关键词: 糖尿病, 糖尿病视网膜病变, 神经营养因子。

Abstract. *Diabetic retinopathy (DR) is a severe complication of diabetes mellitus that leads to irreversible vision loss. The role of neurotrophic factors in its pathogenesis is currently being studied. The article presents the characteristics of the main neurotrophic factors (nerve growth factor, brain-derived neurotrophic factor, neurotrophin-3, neurotrophin-4, ciliary neurotrophic factor, glial cell-derived neurotrophic factor), the results of experimental and clinical studies showing the role of NTF in neurodegeneration, inflammation and angiogenesis in DR.*

Keywords: *diabetes mellitus, diabetic retinopathy, neurotrophins.*

According to the International Diabetes Federation, there are about 415 million people with diabetes mellitus (DM) in the world (8.8% of the world's population) [1]. Diabetic retinopathy (DR) is the most severe late complication of diabetes mellitus, leading to irreversible vision loss [2].

Fully, the pathogenesis of DR has not been fully studied, however, according to modern concepts, metabolic disorders caused by chronic hyperglycemia result in damage to the pericytes and vascular endothelium, which leads to the development of microaneurysms, intraretinal vascular abnormalities and capillary nonperfusion zones [3].

Recently, the DR are attempted to be considered not only as a vascular complication of diabetes, but also as a neurodegenerative disease [4]. Neuronal changes in the DR primarily include the retinal ganglion cells death, activation of glia and a decrease in retinal thickness. The leading causes of these changes are ischemia, oxidative stress, neuroinflammation, changes in the levels of neurotrophic factors (NTF) and the expression of their receptors in diabetes [5-11].

NTFs are polypeptides that are synthesized by neurons and glial cells and are involved in regulating the processes of growth, differentiation and ensuring the viability of nervous tissue [12].

The most studied neurotrophins are close to each other in structure: nerve growth factor (NGF), brain-derived neurotrophic factor (BDNF), neurotrophin -3 (NT-3), as well as neurotrophin-6 (NT-6) and neurotrophin-4/5 (NT4/5). Neurotrophic factors also include two subfamilies: the glial factor subfamily (glial cell-derived neurotrophic factor – GDNF) and subfamily of the ciliary factor (ciliary neurotrophic factor – CNTF).

General characteristics of neurotrophins.

NTFs are secreted growth factors that regulate neurons differentiation and their survival, activate the axonal growth and synapse formation. All NTFs are synthesized as precursors, which are subsequently converted into mature forms [10-11, 13] by proteases (plasmin, furin, matrix metalloproteinases).

NTFs affect the neuron through high-affinity tyrosine kinase receptors (Trk-A, Trk-B, Trk-C), as well as through the low affinity p75 receptor [12]. NGF preferentially interacts with TrkA receptors, BDNF and NT-4 bind to TrkB receptors, while NT-4 interacts with TrkC receptors. Interacting with tyrosine kinase receptors, NTFs realize their main effects in the form of differentiation of neurons, increasing their survival and growth.

By interacting with the p75NTR receptor, neurotrophins induce neuronal apoptosis. The mature forms of NTF have a greater affinity for the Trk receptors, while their precursors have a greater affinity for the p75 receptor [14-15]. Currently, a violation of the ratio of the precursors of NTF and their mature forms is considered one of the causes of neurodegeneration, including the DR.

It should be noted that the functional diversity of the neurotrophins effects on the cell is not carried out using a huge set of factors, but through complex combinations of a small number of polypeptides interaction with the neuron receptor apparatus, ensuring the restoring neural plasticity and forming the mechanisms involved in disturbed neurological functions. These proteins prevent the neurons degeneration and stimulate the survival of various types of nerve cells. By now, it has become clear that NTFs play an important role in protecting nervous tissue during ischemic damage, since the mechanism of neuronal death largely depends not so much on the absolute amount of neurotoxic substances, but on the lack of neurotrophic support [12]. The lack of synthesis of NTF contributes to the death of nerve cells as a result of necrosis and accelerates the processes of apoptosis.

Nerve Growth Factor (NGF).

In 1968, the first representative of the NTF, nerve growth factor (NGF), which is currently the most studied peptide of this group, was isolated and purified to a homogeneous state by the scientists R. Levi-Montalcini and S. Cohen. In 1995, H. Hammes et al., using diabetes induced rats, showed that exogenous administration of NGF prevents early death of retinal ganglion cells (GCS), activation of Mullerian cells and the development of capillary nonperfusion, confirming the theory of the participation of NGF deficiency and other NTFs in the development and progression of DR [5]. However, several subsequent studies showed a paradoxical increase in the level of NGF in the serum of patients with type 1 diabetes and in the serum and tear fluid in patients with DR. Elevated levels of NGF had a positive correlation with the stage of DR and the severity of diabetes [16-19].

As noted above, all NTFs are synthesized as precursors that ripe into a mature form intracellularly under the action of furin and extracellularly under the action of matrix metalloproteinase-7 (MMP-7) [10]. Until recently, methods of laboratory diagnostics did not allow differentiation of mature forms from the predecessor NTF (proNTF). Under the action of oxidative stress, the activity of proteases is inhibited in DR, which leads to the accumulation of the precursor. This theory was confirmed in the study of samples of the corpus vitreum taken from patients with proliferative diabetic retinopathy, which revealed a significant increase in proNTF [8]. As noted above, proNTPs have a greater affinity for the p75 receptor, interaction with which triggers neuron apoptosis, which, together with a deficiency in mature NTF forms, potentiates the neurodegeneration in the retina with DR.

Brain-derived neurotrophic factor (BDNF)

BDNF is a dimer with a total molecular weight of 27.2 kDa, structurally similar to NGF. Like other neurotrophins, BDNF is involved in the development and preservation of neurons, including RGC [20]. Despite the fact that the level of BDNF in DR was studied by many authors, the data obtained are rather contradictory and its role in the DR pathogenesis has not been fully elucidated. Liu and colleagues reported a high serum BDNF level in patients with DR compared with patients without diabetes [21]. M. Suwa et al. revealed high serum BDNF levels in patients with newly diagnosed type 2 diabetes compared with healthy patients [22]. S. Mohammad et al., investigating the serum BDNF level in patients with proliferative diabetic retinopathy, in patients with diabetes mellitus (DM), but without retinopathy and in patients without diabetes, revealed a significant decrease in the level of BDNF in patients with DR compared to other groups [23]. U. Taslipinar and colleagues showed low levels of BDNF in serum and anterior chamber moisture in patients with DR, lower levels of BDNF correlated with the severity of DR [24]. M. Seki and coworkers demonstrated the therapeutic potential of intravitreal administration of BDNF in rats with diabetes induced [25].

Neurotrophin -3 (NT-3), Neurotrophin-4 (NT-4)

These neurotrophic factors support different populations of neurons in the central and peripheral nervous system. NTs are secreted proteins detected in the bloodstream that can signal to individual cells for survival, differentiation or growth [12]. Neurotrophins act by preventing the initiation of apoptosis in a neuron. They also induce progenitor cell differentiation, which promotes the formation of neurons. NT-3 and NT-4 play an important role in the functioning of the nervous system, participating in the regeneration of damaged neuronal structures.

Recently, the role of neurotrophins in the angiogenesis has been considered. A. Abu El-Asrar and colleagues investigated the levels of neurotrophins and their receptors in the corpus vitreum of patients with proliferative diabetic retinopathy [26]. High levels of NT-3 and NT-4 were found in patients with PDR in comparison with the control group, while NGF and BDNF were not detected in any of the groups. The authors associated an increase in NT-3, NT-4 levels in the corpus vitreum of patients with PDR with their possible participation in the angiogenesis and the progression of DR.

Glial cell-derived neurotrophic factor (GDNF).

GDNF, isolated from the glial cell line, a glycosylated homodimer with a molecular weight of 33-45 kDa, is synthesized in almost all areas of the central and peripheral nervous system. GDNF is considered as an autocrine regulator of neuromuscular activity, affecting axon growth and gene expression of neuronal regeneration [27]. The factor contributes to the preservation of various cell populations of the central and peripheral nervous systems, including the neurons of the visual system. J. Boss investigated the levels of neurotrophins and cytokines in the corpus vitreum of patients with diabetic retinopathy [28]. The levels of NGF, BDNF, NT-3, NT-4, CNTF, GDNF were higher in patients with DR comparing with patients without diabetes, this difference was particularly high in patients with non-proliferative diabetic retinopathy.

A high correlation between the level of cytokines and the level of neurotrophins was revealed. Pro-inflammatory cytokines (IL-1 β , TNF- α) are supposed to stimulate the production of NTF by Mullerian cells. The role of GDNF in the protection of retinal photoreceptors under oxidative stress has been shown. N. Nishikiori et al. revealed a high level of GDNF in the vitreous body in patients with active PDR and suggested its role in the formation of epiretinal membranes [29].

Ciliary Neurotrophic Factor (CNTF)

Human CNTF is a single-chain polypeptide of 200 amino acid residues with a molecular weight of 22.7 kDa. Functionally, CNTF showed activity as a factor in the survival and differentiation of cells of the nervous system [12].

Subsequent in vitro studies have shown stimulating activity against the neurons of the sensory ganglia, motoneurons and sympathetic neurons. High concen-

trations of CNTF can induce apoptosis. J. Boss in the corpus vitreum of patients with DR revealed an elevated level of CNTF [28]. Using the example of rats with induced diabetes, M. Mingming and colleagues showed a decrease in the level of CNTF in the corpus vitreum during initial DR, and the intravitreal administration of CTNF increased the survival rate of GCS [30].

Conclusion

Thus, the role of NTF in the pathogenesis of DR is a promising field for research that may lead to the discovery of new targets for the treatment and prevention of vision loss in this disease. Not surprisingly, NTFs play an important role in diabetic retinal damage, in which hyperglycemia and oxidative stress lead to neuroinflammation and impaired retinal homeostasis.

Many studies have been conducted to clarify the role of NTF in DR, but the results of these studies are rather contradictory and do not fully reflect the mechanisms of the effect of deficiency and / or excess NTF in the development of various DR stages. Further study of NTF and their interaction with the system of cytokines and other growth factors will allow us to expand our understanding of the pathogenesis of DR.

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十二烷基 (3,5-二甲基-4-羟基苄基) 硫化物的分光光度描述
SPECTROPHOTOMETRIC DESCRIPTION
OF DODECYL(3,5-DIMETHYL-4-HYDROXYBENZYL)SULFIDE

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抽象。 十二烷基 (3,5-二甲基-4-羟基苄基) 硫化物是一种具有抗氧化作用和酚类结构的新型药物。 选择紫外分光光度法作为简单, 可靠, 准确的方法, 用于定性和定量分析开发。 发现所研究的乙醇物质的紫外光谱在280nm处具有最大吸收, 在260nm处具有最小吸收。 NaOH-乙醇溶液中的紫外光谱在260nm处具有最大吸收。 所有解决方案都显示出可重复性和线性。

关键词: 分光光度法, 酚类抗氧化剂。

Abstract. *Dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide is a new pharmaceutical substance with antioxidant effect and structure of phenols. UV-spectrophotometry was chosen as simple, reliable, accurate method for the purpose of qualitative and quantitative analysis development. It was found out that UV-spectrum of the researched substance in ethanol has maximum absorption at 280 nm and minimum absorption at 260 nm. UV-spectrum in NaOH-ethanol solution has maximum absorption at 260 nm. All the solutions revealed repeatability and linearity.*

Key words: *spectrophotometry, phenolic antioxydants.*

1. Introduction

Dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide (*Fig. 1*) was created in the Research Institute of antioxidant chemistry, Novosibirsk State Pedagogical University.

It is known today that this substance can neutralize free radicals in a human body and in this way activate cells regeneration, detoxification and immunity. All these facts let us consider dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide to be a promising drug, which can be recommended for treatment atherosclerosis, hepatitis, tumors, inflammations etc. There are no data about specifications and analytical methods for researched substance because its chemical and physics properties haven't been investigated yet. The aim of our research is to develop accurate, robust and easy-to-use methods for qualitative and quantitative determination of dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide and its dosage forms.

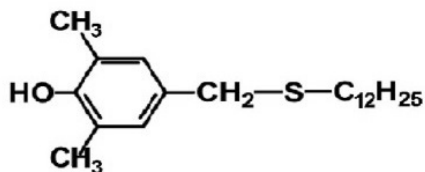


Fig.1. Formula of dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide

Ultraviolet-visible spectroscopy is one of the most popular analytical techniques. It can be used in a qualitative manner, to identify functional groups or confirm the identity of a compound by matching the absorbance spectrum. It can also be used in a quantitative manner, as concentration of the analyte is related to the absorbance. Moreover, studying of spectrophotometric characteristics of substances is important because UV-spectroscopy is a very popular detector for other analytical techniques, such as chromatography. Therefore we think it is necessary to reveal spectrophotometric description of dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide.

2. Materials and methods

A “SF-56” (Russia) UV-spectrophotometer was used for all experimental work pertaining to the results reported in this article. An analytical electronic balance was used for weighting.

The substance of dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide was acquired in the Research Institute of antioxidant chemistry, Novosibirsk State Pedagogical University. All chemicals used were analytical grade and water was purified.

About 0,1 g of researched substance was weighted and dissolved in 100 ml 95% ethanol (standard solution). Then 3 separate solutions were prepared:

- 1 ml of standard solution was diluted with 9 ml 95% ethanol;
- 1 ml of standard solution was diluted with 0,5 ml 0,1M HCl and 8,5 ml 95% ethanol;
- 2 ml of standard solution was diluted with 4 ml 0,1M NaOH and 4 ml 95% ethanol, then 1 ml of prepared solution was diluted with 9 ml 95% ethanol.

For examining repeatability 10 ethanol solutions and 10 NaOH-ethanol solutions were prepared. For examining linearity 10 ethanol solutions with concentrations 0,004%, 0,009%, 0,013%, 0,017%, 0,022%, 0,026%, 0,030%, 0,034%, 0,039%, 0,043% were prepared and also 10 NaOH-ethanol solutions with concentrations 0,0005%, 0,0010%, 0,0015%, 0,0021%, 0,0026%, 0,0031%, 0,0036%, 0,0041%, 0,0047%, 0,0052% were prepared.

Results were estimated as it's said in the page “Analytical methods validation”, State Pharmacopeia of Russian Federation.

3. Results and discussion

The spectrum of dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide dissolved in either 95% ethanol or 95% ethanol with addition of 0,1M HCl, shows a peak of maximum absorbance at 280nm and a peak of minimum absorbance at 260nm (Fig.2). If 0,1M NaOH is added to 95% ethanol, the dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide peak of maximum absorbance shifts to 260nm. This peak-shift associated with solvents can be a useful method for dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide identification, especially if more sophisticated equipment is not available.

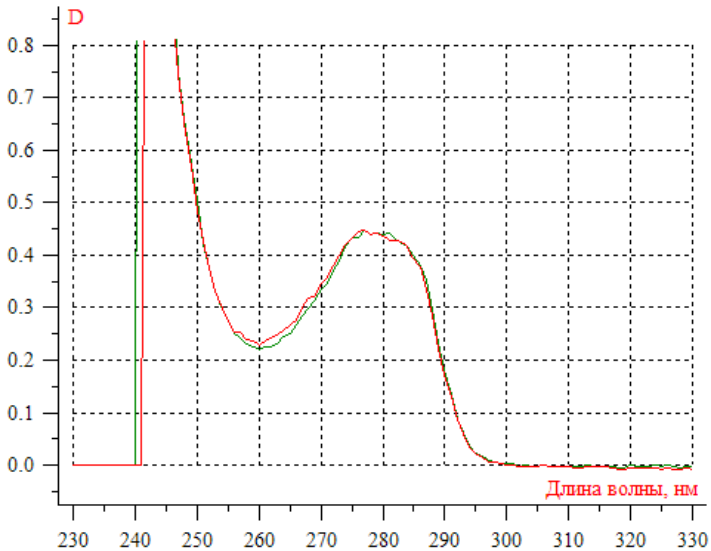


Fig. 2. Spectrum of ethanol (green) and HCl-ethanol (red) solutions of dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide

Repeatability test showed that maximum and minimum of absorption are sustainable either in ethanol solutions (Table 1) or NaOH-ethanol solutions (Table 2).

Table 1. Repeatability of ethanol solutions of dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide

λ	C%	D	D _{average}	RSD, %	E _{1%/1cm average}
280 nm	0,01296%	0,5223	0,53775	1,1	41,49
		0,5135			
		0,5659			
		0,5305			
		0,5607			
		0,5558			
		0,5164			
		0,534			
		0,5305			
		0,5479			

Table 2. Repeatability of NaOH-ethanol solutions of dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide

λ	C%	D	D _{average}	RSD, %	E _{1%/1cm average}
259 nm	0,00208%	0,4340	0,46968	1,39	225,8
		0,4866			
		0,4476			
		0,5021			
		0,4553			
		0,4719			
		0,4593			
		0,4766			
		0,4882			
		0,4752			

Linearity test showed that both ethanol (Fig. 4-5) and NaOH-ethanol (Fig. 6-7) solutions have linear relations between absorbance and concentration. In all results we found out acceptable degree of linearity.

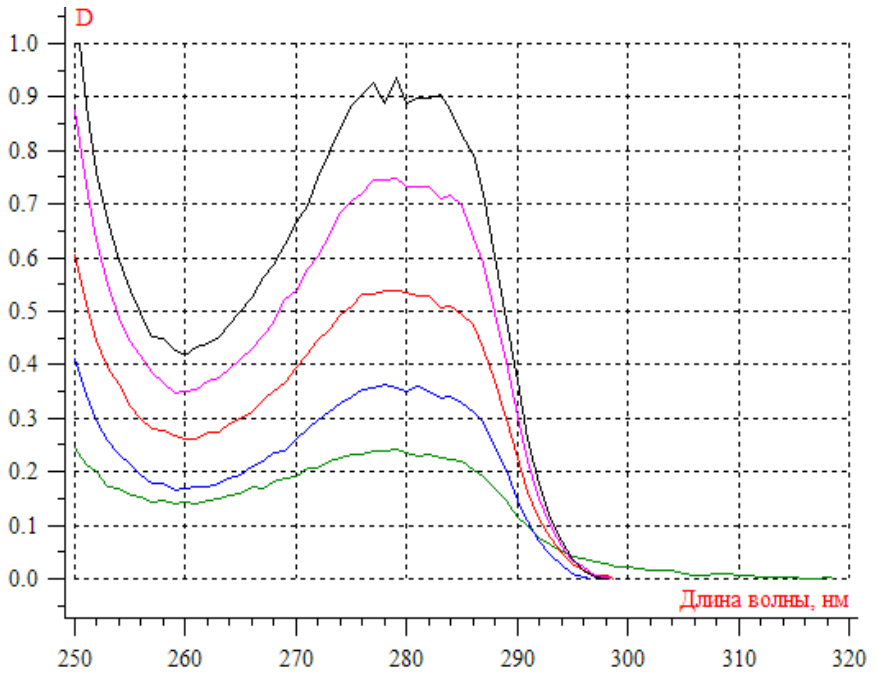


Fig.4. Linearity spectrum of ethanol solutions of dodecyl (3,5-dimethyl-4-hydroxybenzyl)sulfide

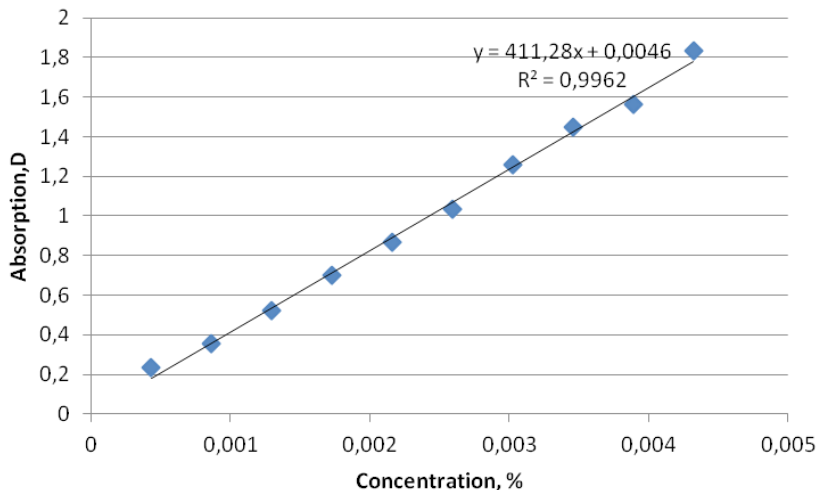


Fig.5. Linearity graph of ethanol solutions of dodecyl (3,5-dimethyl-4-hydroxybenzyl)sulfide

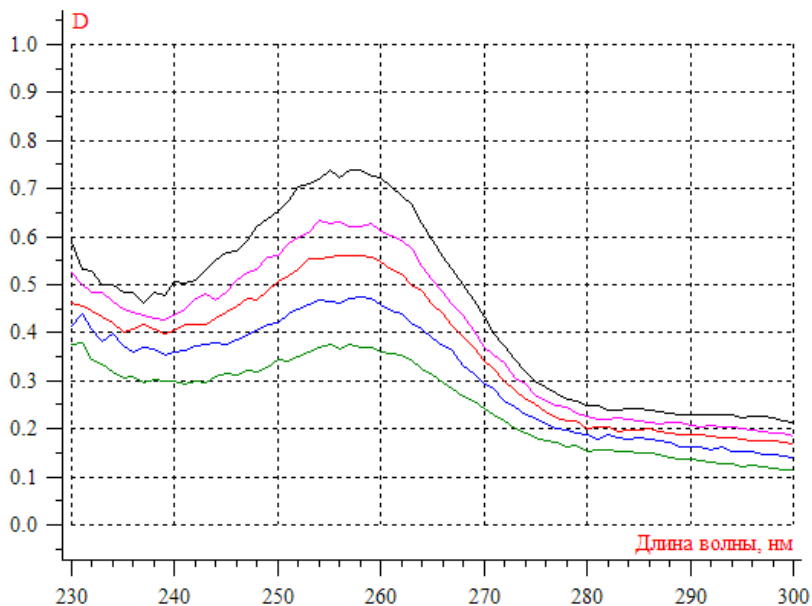


Fig.6. Linearity spectrum of NaOH-ethanol solutions of dodecyl (3,5-dimethyl-4-hydroxybenzyl)sulfide

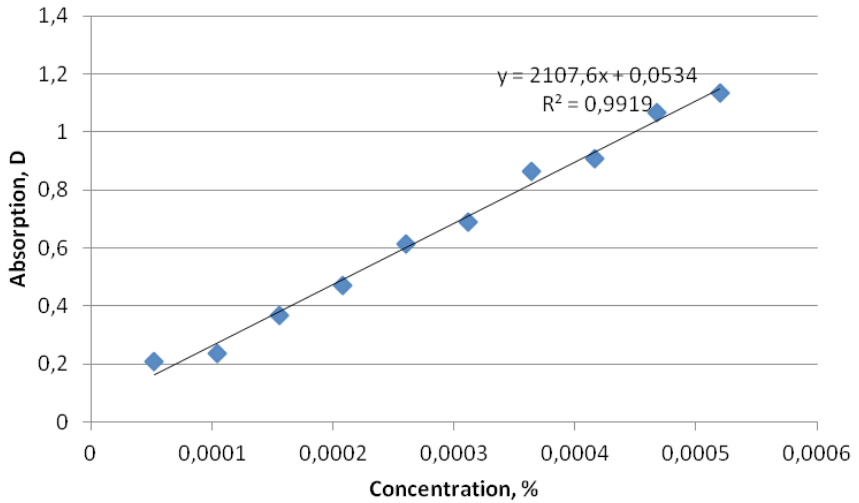


Fig.5. Linearity graph of NaOH-ethanol solutions of dodecyl (3,5-dimethyl-4-hydroxybenzyl)sulfide

Therefore, obtained spectrophotometric description of dodecyl(3,5-dimethyl-4-hydroxybenzyl)sulfide can be useful in the identification method development and also in the development of quantitative determination with use of chromatograph with UV-Visible detector.

科拉核电站30公里影响区森林植物群落的生态状况
**ECOLOGICAL CONDITION OF FOREST PHYTOCENOSES
IN THE 30-KILOMETERS AFFECTED ZONE
OF THE KOLA NUCLEAR POWER PLANT**

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抽象。本文介绍了科拉核电站(NPP)(俄罗斯摩尔曼斯克地区)30公里区域森林植物群落生态状况的研究结果。在本文中,首次将环境监测中先前未合并的辐射生态学和地球遥感方法与方法相结合。土壤和植被的放射生态学研究是在科拉核电站周围的固定监测点网络上进行的。详细研究了长寿命技术成因放射性核素¹³⁷Cs的含量。使用多区域空间感知(使用Landsat-7和Landsat-8航天器的材料)详细审查了每个场地。根据地面放射生态学研究的结果和科拉核电站地区空间地球遥感数据,首次评估了森林植物群落的健康状况。设置表征环境状态的渐变。需要继续研究俄罗斯欧洲-北极地区森林生态系统的土壤和植被覆盖,采用辐射生态学和多区域空间探测方法。

关键词:摩尔曼斯克地区,科拉核电厂,土壤,植被,放射生态学研究,技术成因¹³⁷Cs放射性核素,从空间遥感地球。

Abstract. *The article presents the results of studies of the ecological state of forest phytocenoses in the 30-kilometer zone of the Kola nuclear power plant (NPP) (Murmansk region, Russia). In this paper, for the first time, the approaches of radiation ecology and remote sensing of the Earth from space, which were not previously combined during environmental monitoring, are methodologically combined. Radioecological studies of soil and vegetation were carried out on the network of stationary monitoring sites around the Kola NPP. The content of a long-lived radionuclide of technogenic origin - ¹³⁷Cs is studied in detail. Each site was reviewed in detail using multi-zone space sensing (using materials from the Landsat-7 and Landsat-8 spacecraft). According to the results of ground-based radioecological research and data of remote sensing of the Earth from space in the area of the Kola NPP location, the well-being of forest phytocenoses was assessed for the first time. Set the gradient characterizing the environment state. The*

need to continue the study of soil and vegetation cover of forest ecosystems in the Euro-Arctic region of Russia with methods of radiation ecology and multi-zone space sounding is noted.

Keywords: Murmansk region, Kola NPP, soil, vegetation, radioecological studies, technogenic ^{137}Cs radionuclide, remote sensing of the Earth from space.

The Murmansk region is one of the most industrially developed regions in the Russian Far North. The largest mining, concentrating and metallurgical enterprises in the country are located here (Report..., 2018).

Kola NPP (KNPP) also operates in the region. The nuclear power plant was built in 1973-1984 in two phases, it is located on the shores of Lake Imandra, 11 km from the satellite town of Polyarny Zori and 170 km from the regional center - Murmansk. The KNPP has 4 power units with VVER-440 reactors with a total capacity of 1,760 MW. During operation, the station generated more than 260 billion kWh of electricity (Kizeev, 2015).

The Murmansk region is rich in forests and is an excellent training ground for forest radioecology. It is known that forest ecosystems on Earth represent an independent type of communities organization of organisms living. They are very sensitive to industrial pollution. The radiosensitivity of coniferous forests as a whole is quite close to that in mammals (including humans) - the most radiosensitive living organisms. Forests play a large protective role in the deposition of radioactive substances, becoming a biogeochemical barrier to the migration of radionuclides in areas contaminated by radiation (Aleksakhin, 2010; Shcheglov and Tsvetnova, 2010). Since the KNPP is surrounded by coniferous forests, it can be assumed that the intensive accumulation of technogenic radionuclides occurs in the components of plant communities in the area of its location. At the same time, the study of the state of highly sensitive forest phytocenoses in the 30-kilometer area of a nuclear power plant, a potential source of increased radiation hazard, is becoming especially important.

Since 2009, scientists of our Institute, together with specialists from Moscow and Voronezh State Universities, as well as the Geological Institute of the Kola Scientific Center of the Russian Academy of Sciences, with the support of employees of the KNPP Department of Radiation Safety for Environmental Protection have been successfully conducting soil cover studies near the location of the nuclear power plant. Initially, research was conducted on 10 stationary monitoring sites in the observation zone (ZN) of the KNPP, limited by a circle of 15 km, the center of which coincides with the geometric center between the vent pipes 1 and 2 of the enterprise. 5 trial plots are located directly in ZN, at a distance of 10 km from the station and 5 control sites - on the border of ZN, 15 km from it (Kizeev, 2015). Since 2014, the existing network of sites has been expanded and current-

ly represents a well-formed radial-concentric system consisting of 12 sites of 4 types: 2 station sites are located within the sanitary protection zone (SPZ) of the nuclear power plant - C-1 (coordinates 67°27'59.821"n.lt. и 32°26'42.299" e.lg.) and SPZ dry light waste storage – DLWS - C-2 (67°28'56.701"; 32°24'50.400"); 5 test sites are located in the ZN KNPP at a distance of 10 km from the station: P-1 (67°32'27.780"; 32°19'13.260"), P-2 (67°33'32.461"; 32°29'16.321"), P-3 (67°27'7.081"; 32°40'24.539"), P-4 (67°22'50.941"; 32°26'0.060") and P-5 (67°24'13.561"; 32°20'15.900"); 4 control sites - on the border of ZN at a distance of 15 km: K-I (67°34'6.060"; 32°14'18.780"), K-II (67°35'25.200"; 32°35'48.120"), K-III (67°26'2.940"; 32°53'30.840") and K-IV (67°20'8.700"; 32°23'0.600"); as well as 1 background plot - at a distance of 30 km from the station - F (67°34'38.820"; 31°49'47.219"). A cartographic representation of the site system (monitoring points) is shown in Fig. 1.

The study sites are located in the area of lakes Imandra and Verchnyaya Pыр-enga. According to the forest type, most of the monitoring points belong to the bilberry-lichen pine forests and greenberry-lichen blueberry pine forests. The stand here is characterized by the predominance of Scots pine (*Pinus sylvestris* L.) with the participation of other tree species - hybrid forms of drooping birch and pubescent birch (*Betula pendula* Roth. X *Betula pubescens* Ehrh.), and also Siberian spruce (*Picea obovata* Ledeb.). In the grass-shrub cover dominated by representatives of the genus *Vaccinium*, mostly bilberry ordinary or bilberry myrtle (*Vaccinium myrtillus* L.), and in the moss-lichen cover - lichen of the genus *Cladonia*, mostly *Cladonia stellaris* (Opiz) Pouzar & Wezda (reindeer moss).

The objects of study were selected soil (podzols, illuvial-ferruginous dwarf surface-podzolic and fine podzolic sandy and sandy loam on the moraine) and the components of vegetation — the branch and needles of Scots pine, myrtle-blueberry sprouts, and also yagel isidia (pods of reindeer moss) which are very sensitive to the content of chemical elements in the biosphere. The selection of soil and plant samples was carried out during the growing season of the year (June-September), in accordance with the general requirements for sampling (Chernykh, Sidorenko, 2003).

Radiation-ecological studies included a radiometric survey of the terrain ($\mu\text{Sv} / \text{h}$), determination of the exposure dose rate (MED, $\mu\text{Sv} / \text{h}$), as well as the measurement of specific activities of one of the main long-lived man-made radionuclides - ^{137}Cs (half-decay period 30.17 years, Bq / kg) using a “Multirad” scintillation spectrometry complex with a NaI (Tl) 63x63 gamma detector and a “Progress” software.

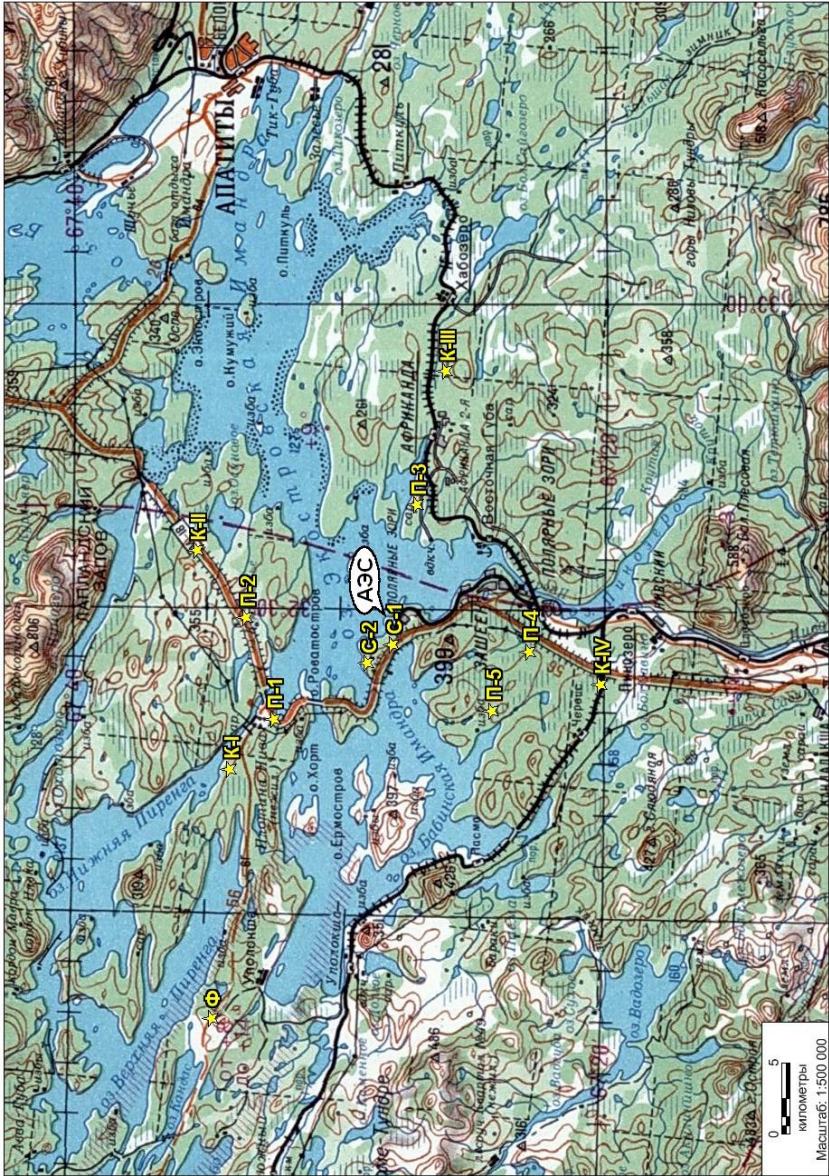


Fig. 1. Layout of stationary monitoring sites around the KNP

Along with radioecological studies, in the 30-kilometer zone of the KNPP, the method of remote sensing of the Earth from space was used for the first time - a publicly available measuring instrument that meets the requirements of researchers studying various terrestrial objects and processes and has in common such unique properties as the globality of the zone observations, objectivity of the information received, high repeatability, reproducibility, availability of archives of long-term observations, etc. (Kizeev, Silkin, 2017). According to the data of multizone space sounding, the analysis of the well-being of forest phytocenoses was made. The paper used the materials of the spacecraft: Landsat-7 and Landsat-8 (NASA, USA). Each site was observed during the growing season with an average of 6 separate scenes.

It was established that the radiation background in the zone of influence of the KNPP averaged $0.09 \mu\text{Sv} / \text{h}$. The exposure dose rate (EDR) on the surface of the wet and air-dry mass of plant samples did not exceed $0.15 \mu\text{Sv} / \text{h}$. These indicators were within the EDR for the population in open areas ($0.2 \mu\text{Sv} / \text{h}$) and corresponded to low levels of ionizing radiation (the low dose range for living objects was up to $0.2\text{-}0.5 \text{ Sv}$, according to NRB-99, 1999).

The patterns of the vertical distribution of ^{137}Cs over the soil profiles at the sites under consideration had a similar character. Maximum values of the specific activity of this radionuclide were noted in the litter (horizon O), and on average ranged from 30 to $103 \text{ Bq} / \text{kg}$. Such a spread of values, apparently, was due to the amount of organic matter: the more it was in the litter, the higher the specific activity of ^{137}Cs was in it. In the transition horizon, the specific activity of ^{137}Cs decreased, and ranged from 14 to $69 \text{ Bq} / \text{kg}$ on average.

In the lower horizons, the specific activity of the radio nuclide under study decreased even more. In the eluvial horizon E, it ranged from 1 to $12 \text{ Bq} / \text{kg}$; in the horizon B1f - from 1 to $7 \text{ Bq} / \text{kg}$, and in the horizons B2f, BC and C was below the detection limit. In assessing the state of soil during pollution, as a rule, the indicator "density of pollution" is used, calculated as the stock of a radionuclide in the soil (Kizeev, 2015). The density of ^{137}Cs contamination of the root zone ($0\text{-}30 \text{ cm}$) of all the studied soils averaged from 530 to $2459 \text{ Bq} / \text{m}^2$. These values were significantly lower than the established reference level of $1 \text{ Ci} / \text{km}^2$ ($37,000 \text{ Bq} / \text{m}^2$), which makes it possible to assign monitoring points to areas with a relatively favorable environmental situation (Criteria ..., 1992).

The specific activity of ^{137}Cs in the components of the plant cover varied at different sites (see table).

Table 1. ^{137}Cs specific activity in plants, Bq / kg

Sites	Scots pine		Bilberry myrtle		Reindeer moss
	branches	needles	branches	leaves	isidia
C-1	10 ± 5.6	13 ± 2.5	35 ± 6.5	13 ± 10.9	49 ± 2.7
C-2	15 ± 3.7	7 ± 2.1	50 ± 5.9	61 ± 9.6	59 ± 2.9
P-1	19 ± 3.4	23 ± 3.1	87 ± 6.9	165 ± 17.1	72 ± 3.7
P-2	12 ± 2.4	9 ± 2.9	38 ± 7.6	58 ± 12.5	80 ± 3.8
P-3	14 ± 3.7	19 ± 4.6	36 ± 5.1	72 ± 13.4	37 ± 4.4
P-4	11 ± 2.7	23 ± 3.0	38 ± 4.7	51 ± 8.3	29 ± 2.0
P-5	11 ± 3.8	18 ± 3.2	26 ± 4.9	56 ± 10.2	49 ± 2.7
K-I	26 ± 3.5	34 ± 3.7	80 ± 7.2	115 ± 13.9	105 ± 3.3
K-II	13 ± 4.1	21 ± 3.2	31 ± 8.2	41 ± 13.6	29 ± 1.4
K-III	9 ± 2.6	11 ± 2.4	69 ± 8.1	71 ± 12.6	22 ± 1.8
K-IV	15 ± 3.2	32 ± 4.0	59 ± 6.6	66 ± 11.1	64 ± 3.4
F	21 ± 3.0	27 ± 3.8	90 ± 8.7	120 ± 15.6	58 ± 3.1

In the branches of Scots pine, the average activity ranged from 9 to 26, and in the needles from 7 to 34 Bq / kg. In the branches of bilberries - from 26 to 90, and in the leaves - from 13 to 165 Bq / kg. The specific activity of ^{137}Cs in the reindeer moss isidia was from 22 to 105 Bq / kg (table).

As is known, the main routes of radionuclides entry into boreal forest ecosystems are atmospheric and water transport, as well as migration caused by geochemical factors (Chernykh, Sidorenko, 2003). The accumulation of ^{137}Cs in the studied plants could be caused by the natural cycle of fission products entering the atmosphere and soil from nuclear weapon tests conducted earlier on the planet's testing grounds, as well as due to global air pollution from the Chernobyl nuclear power plant (Kizeev, 2015; Kizeev, Silkin, 2017; Kizeev et al., 2018).

The maximum values of specific activity of ^{137}Cs in pine, bilberry myrtle leaves and moss within the 30 km zone of the KNPP did not exceed the established standard indicators for the studied radionuclide content in medicinal plants - 400 Bq / kg (SanPiN 2.3.2.1078-01, 2011).

As can be seen from the table, on most sites, plant leaves contain an increased amount of ^{137}Cs . In the branches its content was less. In the bilberry sprouts and in the moss isidia the content of ^{137}Cs was more than in the parts of Scots pine. The content of ^{137}Cs in the moss is caused by its aerial absorption from the atmosphere.

The maximum content of cesium isotope in bilberry sprouts is related to the root input from organogenic soil horizons, in which, as is known, the content of ^{137}Cs increases (Scheglov and Tsvetnova, 2010). The lower concentration of ^{137}Cs in pine is due to the fact that the zone of absorption of the trees roots is at a sufficiently large depth, where the content of the given radionuclide is insignificant.

Studies of the forest vegetation state in the 30-kilometer zone of the Kola NPP showed that it does not experience visible oppressive anthropogenic effects from ^{137}Cs . Based on the current “Sanitary Safety Rules in Forests” (The rules..., 2013), the living state of the stand here can be generally described as “healthy (without signs of weakening)” and assigned to category I on the tree condition scale. For such trees, the stand is characterized by a dense crown, green needles / leaves, an increase in the current year of normal size.

At the same time, due to complex studies of the state of vegetation in the area of the KNPP location using the methods of radiation ecology and multi-zone space sensing, a stable relationship was found between the specific activity of ^{137}Cs and the well-being of phytocenoses. In order to be able to objectively compare the results of ground-based radioecological studies and materials of remote sensing of the Earth from space, a generalized empirical indicator (α) was constructed that takes into account the area covered by pine and bilberries at monitoring sites together with ^{137}Cs specific activity values in their assimilation organs.

The vegetation index NDVI, which characterizes the well-being of phytocenoses, was also determined (Schovengerdt, 2013). Using correlation analysis of the obtained spatial distribution of the indicator α on the one hand, and NDVI values on the other, it was the first time shown that the negative effect of plant communities around the atomic station is less intense than at a greater distance from (within the study area) (Fig. 2). In other words, as the distance from the KNPP increases, the degree of ^{137}Cs influence on the state of the plants increases.

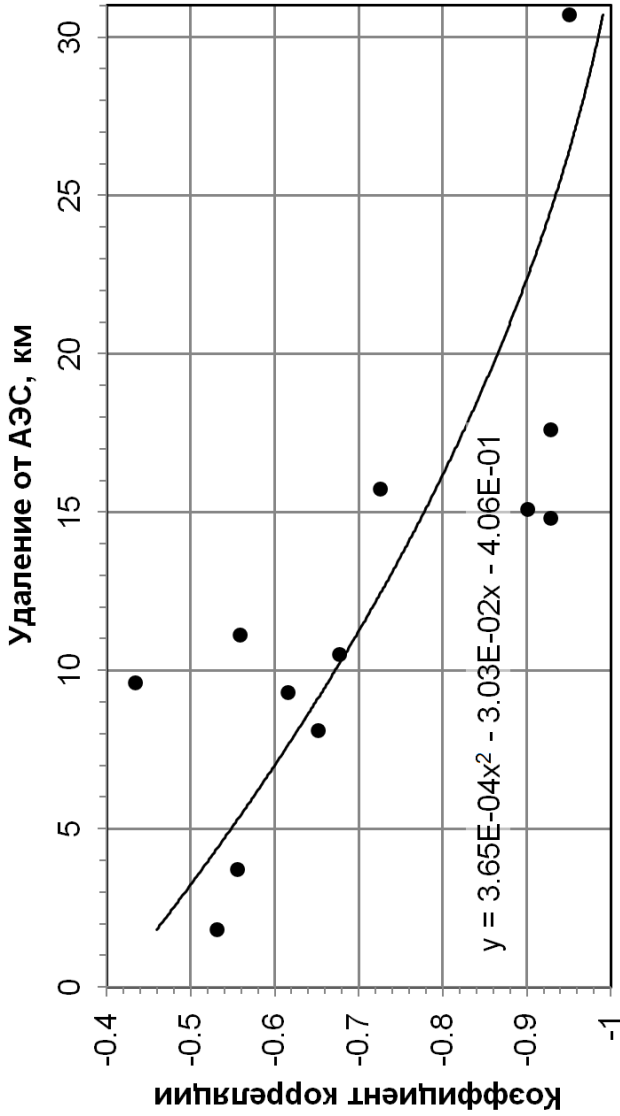


Fig. 2. The correlation coefficient between biomass activity and NDVI, depending on the removal of monitoring points from the KNPP
 The abscissa axis is the distance from the NPP, the ordinate axis is the correlation coefficient

Thus, as a result of this work, new information was obtained on the status of land cover in the 30-km zone of the Kola NPP. The content of ^{137}Cs anthropogenic radionuclide in the soil and in the dominant plants (pine, bilberry, myrtle, moss) was within the established radioecological norm. Potential sources of the studied radionuclide in the soil-vegetation cover are noted. The presence of a gradient characterizing the state of plant communities up to 30 km from the nuclear power plant is shown.

At the same time, it is necessary to continue radioecological studies of forest ecosystems of the Euro-Arctic region of Russia - first of all, the study of soils, which are characterized here by low availability of nutrients (K, Ca), as a result, even in low the content of technogenic radionuclides in them, the background levels due to global fallout, and their availability to plants will be quite high. The study of the accumulation of radioactive elements by plants, even in small quantities, also becomes extremely important, since ecosystems developed on poor soils are very vulnerable to their possible contamination with both radionuclides and heavy metals. At the same time, the assessment of boreal forest eco-systems that are subjected to the influence of small doses / concentrations of pollutants should become an indispensable element of the integrated environmental monitoring of natural communities through the use of high-resolution satellite materials.

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化学成分对软弱小麦群体数量和细胞学特征的影响

**INFLUENCE OF CHEMICAL COMPOUNDS ON QUANTITATIVE AND
CYTOLOGICAL CHARACTERS IN SOFT WHEAT POPULATIONS**

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注解。基于多年研究的结果,已经显示了在东西伯利亚条件下使用化学诱变剂创造新的起始材料以选择春小麦的有效性。揭示了西伯利亚基因库和普通小麦突变 - 品种杂种品种的种群变异和遗传模式以及数量性状。研究了获得的突变的遗传性质,诱变剂和基因型对突变谱的影响,突变基因的表型表现,重新定义突变体中数量性状的相关关系及其在变化的环境条件下的杂种。建立了生产力和适应性提高的基因捐助者,以便纳入过境方案,创建了俄罗斯联邦和哈萨克斯坦共和国国家育种成就登记册中包括的三种冬季品种和四种春季软质小麦品种。

关键词: 小麦, 诱变, 突变, 品种, 突变体, 杂种, 种群, 变异性, 遗传, 相关性, 杂交, 选择。

Annotation. *Based on the results of many years of research, the effectiveness of the use of chemical mutagens in the creation of a new starting material for the selection of spring and winter wheat under conditions of Western Siberia has been shown. The patterns of variability and inheritance of population and quantitative traits of varieties of the Siberian gene pool and mutant-varietal hybrids of common wheat are revealed. The genetic nature of the mutations obtained, the effect of mutagens and genotypes on the mutation spectrum, the phenotypic manifestation of mutant genes, the redefinition of the correlation links of quantitative traits in mutants and their hybrids in changing environmental conditions were studied. Donors of genes of increased productivity and adaptability were established for inclusion in the crossing programs, three varieties of winter and four varieties of spring soft wheat, included in the State Register of Breeding Achievements of the Russian Federation and the Republic of Kazakhstan, were created.*

Keywords: *wheat, mutagenesis, mutation, variety, mutant, hybrid, population, variability, inheritance, correlation, hybridization, selection.*

Introduction. Hereditary heterogeneity of populations is a necessary prerequisite for selection work [1]. However, in recent years there has been a narrowing of the genetic base of the main domesticated crops, including wheat, as a result of using the same donors in breeding for high productivity, disease resistance and grain quality [12]. A decrease in the genetic diversity of wheat varieties during the breeding process can lead to genetic erosion in the gene pool of Russian wheat and the loss of a significant number of genes or alleles of productivity and resistance to biotic stresses [13]. The genetic similarity of varieties bred in the framework of regional breeding programs is much higher than recommended, which leads to massive lesions of crops by pathogens in large areas (epiphytotics) due to uniform susceptibility to them. Genetic varietal monotony of wheat, which until recently was a problem of individual regions, has acquired a global scale. In this regard, worldwide studies are being conducted to expand the genetic base of wheat at the expense of various sources of its variability [14]. In the selection process, a special place is occupied by the improvement of economically valuable traits of existing varieties and the breeding of new ones with the help of induced mutagenesis. Currently, work on induced mutagenesis is underway in almost all countries of the world. The greatest successes in the field of mutational breeding were achieved in Japan, India, China, Russia, high in Sweden and relatively modest in England, Germany, France, Italy and the United States [7]. The basis of modern approaches to the management of genotypic variability in plant breeding is fundamentally new views on the role of mutations and recombinations. They concern the genetic nature of the structural organization and functioning of quantitative traits, consider the plant as an integrated system of genetic determinants, take into account the role of abiotic and biotic environmental conditions, which act not only as selection factors, but also as inducers of mutation and re-combination variability of organisms [8].

The authors of the present article also widely used chemical supermutagens discovered by I.A. Rapoport, to increase the level of genotypic variability in wheat populations and achieved certain scientific and practical results. However, the inaccessibility of chemical mutagens on the one hand, and the widespread use of pesticides with identified mutagenic properties in agriculture, on the other, prompted the authors to use them in new experiments. Increasing the effectiveness of experimental mutagenesis is currently associated with the search for new chemical compounds that provide a high yield of useful and valuable mutations. It has been established that pesticides can be quite effective mutagenic factors for creating the initial material of grain crops. Despite the fact that the mutagenic effect of chemi-

cal compounds has been tested on various genetic systems - insects, mammals, plants, microorganisms, the effects of micro-quantities of chemical compounds on organisms are still unknown. The increasing use of these compounds in agriculture and the increasing level of environmental pollution raises the question of studying their genetic activity. In the context of the above, it is particularly relevant for the authors to study and use them as a mechanism for obtaining a wide range of selective and valuable hereditary changes in wheat culture.

The authors of this article are conducting a comparative study of the biological potential of varieties and chemomutants of bread wheat of different genetic and ecological origin. For theoretical generalizations, retrospective materials from previous joint research conducted in 1980 in two independent experiments are also used. Referring to these data allowed us to discover patterns that had not been revealed earlier and are of interest both for practical selection and for theoretical study of genetic phenomena and mechanisms of mutagenesis [9]. We used a systematic approach to the study of genotype integration based on correlation and regression analysis with the calculation of integral parameters of populations to optimize the selection process and build statistical and graphical models of populations and individual traits [3]. The use of an ecological approach was associated with the study of the damaging effects of mutagens and pesticides on plant organisms. The selection of biotypes adaptive to growing conditions was carried out, the dependence of the implementation of the genotype (expressiveness of genes) of the studied forms of different genetic and ecological origin in contrasting conditions of growth was evaluated.

Winter wheat varieties of soft wheat were used by us as a starting material for obtaining new forms due to the fact that it has attained a higher biological potential of productivity than of spring wheat. Winter wheat mutants were obtained by exposure of ethyleneimine (EI) and nitrosoethyl urea (NEU) to winter varieties: PPG-186, Mironovskaya - 808 and Ilichevka and then included in the crosses as maternal forms (experiment LA Krotovoy). The second series of mutants consisted of spring phenotypic analogs of winter wheat varieties: Bezostaya - 1, Bezostaya - 2 and Krasnodar - 39, obtained using EI and EMS (ethyl methane sulfonate) and also served as the parental forms in hybridization. The resulting mutation is associated with the return of the allele from the recessive structure (*vrn*) to the dominant (*Vrn*), which determines the spring type of development (experiment E.Ya. Beletskaya). The best breeding varieties of spring wheat, zoned in the region and most adapted to the growing conditions in Western Siberia and Northern Kazakhstan, served as paternal cross-breeding components (testers) for both mutant series. With the first series of mutants, 15 hybrid combinations were obtained, with the second, 20 mutant-varietal hybrids.

The degree of development, character of inheritance, heritability of quantitative traits, features of correlation dependencies between them, frequency and degree of heterosis manifestation in intervarietal and muganous-varietal hybrids, combination of mutant and initial forms, calculation of integral parameters of populations were conducted. The measurement results for 16 characters in hybrids F-1, F-2 and parents (at least 11 thousand plants per year) were subjected to statistical processing. Dominance indicators were calculated by the method of Bale and Atkins, the inheritance coefficient was calculated using the formula of Mahmoud and Kramer. The calculation of paired correlation coefficients between the signs was carried out in the computer center OmGAU according to a special program. Kor-relational Pleiad studied by the method of P.V. Terentyev. To assess the combination ability of the used cross-breeding components, one-factor and two-factor analysis of variance were used. The calculation of the integral parameters of populations for the implementation of a systematic approach to the study of genotype association was carried out according to the method of V.K. Savchenko.

A comparative analysis of the two studies showed that with the inclusion of winter and spring mutants in crosses with spring varieties there is a significant increase in the variation of the whole complex of altered traits. There were mainly similar trends in the manifestation of phenotypic variability, which is consistent with the law of homologous series in the hereditary variability of N.I. Vavilova, accepted by the authors as a working hypothesis of the study. However, some differences in the manifestation of the phenotypic variability of the hybrids of winter and spring components of the crossing were found. The range of variability by quantitative traits in most hybrids obtained from the crossing of spring mutants decreased in unfavorable growing conditions [11], and in many hybrids with the participation of winter forms it increased in extreme conditions. This is probably explained by the more complex splitting associated with the hybridization of winter forms that have recessive alleles in the genome that determine the winter type of plant development [10].

It has been established that hybrid types of both sets of mating components are characterized by all types of inheritance of the main features of productivity: from overdominance to depression. The value of the dominance coefficient was determined both by the genotype of the crossed forms and by the meteorological conditions during the years of the experiment. The manifestation of the action of genes was highly dependent on environmental factors — under conditions of drought, a greater variety of inheritance types was observed in hybrids with winter mutants, unlike hybrids with spring mutants, which showed greater tolerance to changes in vegetation conditions. Since the overall productivity of plants depends more on external factors than on the genotype and the low heritability of the trait, it is more expedient to work with individual elements of the productivity of the

main spike, the variability of which is less affected by environmental conditions. Identification of genotypes will be more reliable in character, controlled by additively acting genes and exhibiting intermediate inheritance (plant height, number of spikelets per spike).

New series of chemomutants were created in 1984, 1994 and 1997-2018, which were included in the breeding programs. As a result of studying the combinational capacity of varieties and mutants of spring wheat according to the characteristics of the plant's productivity and adaptability to external conditions, it was found that they are controlled mainly by the additive action of genes. This makes it possible to select the necessary biotypes according to the effects of the general combining ability (ACS) already in the early fissile generations. On the basis of information on the level of additive variability in the studied populations, donors of the gene complexes of interest were identified and it was established that in this case linear selection may be promising [9].

The study of relationships between characters plays a large role in breeding work, since these connections can be used in selecting the desired plant genotypes [3]. The data of our experiment showed that the nature of the relationship between the signs of productivity and adaptability in different combinations is not the same, which is obviously a consequence of differences in the genetic nature of the studied forms. The information we obtained about the correlation links between the quantitative traits allowed us to more efficiently select the best biotypes [10], which later became varieties included in the state register of breeding achievements of the Russian Federation and the Republic of Kazakhstan. In addition to assessing pairwise correlations between quantitative traits, we studied their correlation pleiades, which characterize the whole complex of traits as an integral system. As a result of the pleiad analysis, we found stably inherited clusters of signs of productivity and adaptive properties. Correlation and regression analysis allowed us to carry out a systematic approach to the study of genotype integration, which increased the theoretical significance of our research [3]. This new approach allows to obtain on its basis the integral parameters of populations that can be used in the planning and implementation of effective breeding programs.

During the period of joint work from 2013 to 2019, a new scientific project "Study of the effects of chemical compounds on wheat plants" is being developed, founded on the basis of an agreement on scientific cooperation between the Pedagogical and Agrarian Universities of Omsk and included in the list of innovative projects of OmGPU and OmGAU.

In addition to chemical mutagens, we studied the effects of fungicides on the population characteristics of wheat plants and the behavior of chromosomes in mitosis. In 2014-2018, the first generation (M-1) was grown with fungicides of wheat seeds. In order to detect the presence or absence of chromosomal aberrations in

the mitotic cycles of mutants obtained by L.A. Molecular by means of chemical supermutagens, and mutants obtained by exposure to fungicides, we studied in 2017–18 the meristematic zones of division of the primary root of the wheat germ. Cytological study of two series of mutants and their original forms showed that no chromosomal abnormalities were detected in all phases of mitosis [4, 6]. Germination in rolls of seeds treated with chemical mutagens and fungicides showed that mutagens inhibited the development of plants of the first mutant generation (M-1), and fungicides had a stimulating effect on all studied traits: germination energy, laboratory germination, enhanced development of primary roots and coleoptiles (Fig. 1).



*Fig. 1. Effect of mutagens (left) and Scarlet fungicide in three concentrations on the development of seedlings.
Far left in the second sample group - initial wheat variety*

Conclusion. Creating with the help of experimental mutagenesis of the Siberian gene pool of winter wheat and its involvement in hybridization with spring was a new stage in the selection of culture in the region. Both the direct use of the mutants studied and their inclusion in the crosses allowed us to significantly increase the genetic diversity of spring and winter wheat due to recombination of gene complexes, reorganize the genotype of plants in the right direction [5]. The effect of mutagens on population traits depended on both the type of mutagens and their concentration, and on the genotypic characteristics of the varieties. The created collection of mutants of winter and spring soft wheat, mutant-varietal and inter-mutant hybrids are tested in all parts of the breeding process of the laboratory for planting winter crops of the GNU SibNIISH of the Agricultural Academy and the Center for Breeding, Seed and Genetics of the Field Crops. S.I. Leontiev (OmGAU). The use of mutant material allowed us to create three varieties of winter wheat: Omsk, Siberian Niva, and Omsk winter (included in the State Register of Breeding Achievements of Russia). The spring soft wheat varieties have been created and included in the State Register of Breeding Achievements of Russia: Slavyanka Siberia (mutant variety), Svetlana-ka (inter-variety hybrid), Silver-colored (mutant-varietal hybrid). The variety Svetlanka is included in the State Register of the Republic of Kazakhstan. Since 2019, the Omsk Yubileinaya variety of spring wheat (mutant-varietal hybrid) has been included in the State Register of Breeding Achievements of Russia.

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建筑仿生学：过去和现在

ARCHITECTURAL BIONICS: PAST AND PRESENT

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抽象。这项工作致力于开发建筑仿生学这样一个有趣的主题。该主题研究的相关性是由于我们国家和世界都在发生的过程。这项工作的目的是研究从过去到现在这一方向的发展。本文以蒙古的现代建筑和建筑古迹为例。

关键词：建筑学，仿生学，建筑结构，形式，最优性，自然。

Abstract. *The work is devoted to the development of such an interesting topic as architectural bionics. The relevance of the study of this topic is due to the processes occurring both in our country and in the world. The aim of the work is to study the development of this direction from the past to the present. The article deals with modern buildings and architectural monuments of Mongolia as examples.*

Keywords: *architecture, bionics, building structures, form, optimality, nature.*

Introduction

Architectural bionics enriches modern architecture. It is based on perfect patterns of wildlife, using their laws. We can identify the main trends in the development of this science: biomaterial science, biotectonics, bionic architecture, bionic urban studies, green architecture, architectural and bionic ecology, and others.

In the future there will be new directions. Bionic architecture is the creation of projects that combine natural forms in building structures, structures and the surrounding nature [1] - [5]. Thanks to the development of this direction, unique structures appeared in the world (Fig.1). They surprise with their unusual shape. Many architects in the world use bionic style in their projects.



Fig. 1 –Examples of unique structures

Connection of the past and the present in architectural structures

The world is experiencing a rapid development of architectural bionics (Fig.2, 3). The most perfect forms from the point of view of beauty, the organization of space both inside the structure and around it, were created in the process of evolution of natural objects.

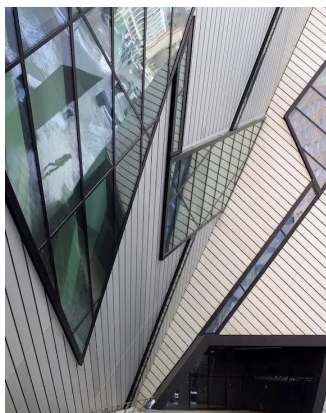


Fig. 2 –Examples of bionic style in modern buildings

a)



b)



*Fig. 3 – Royal Museum Ontario (Canada): a - general view;
b - element of the facade of the building*

The amazing facade of the Royal Museum Ontario with a refracted reflection of the environment is shown in Fig. 3,b. When creating this structure, the features of urban development were taken into account. This is a combination of ancient buildings and modern structures (Fig. 4).

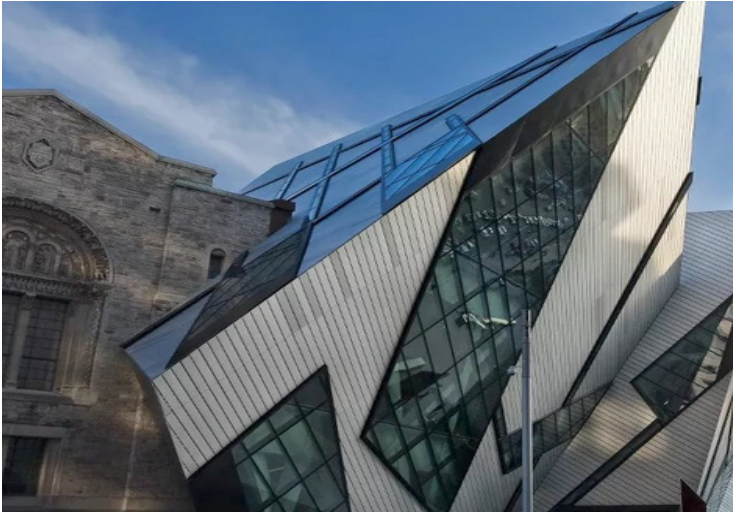


Fig. 4 – Royal Museum Ontario (Canada): past and present side by side

Bionics penetrates into many spheres of human activity. It is believed that the first architect working in the bionic style, A. Gaudi and his followers [6] - [9]. If you carefully study the architectural objects in the world, you can find such structural elements in architectural monuments, for example, the buildings of ancient temples and monasteries (Fig.5, 6). Gandantegchinlen Monastery The monastery was founded on the location of the city of Ulan Bator. This is a functioning monastery. Erdene-Zuu Monastery is a UNESCO World Heritage Site.



Fig. 5 – The Monastery of Gandantegchenlin



Fig. 6 – The Monastery of Erdene-Dzuu

Consider the development of architectural bionics in Mongolia. Basically, in recent years, constructions were built thoroughly, without any bionic elements in the structures. In Mongolia, only now architects began to build modern buildings in the bionic style (Fig.7, 8). There is a search for new technologies and methods with this design [10] - [14]. In the modern building, special attention is paid to the internal interior, which not only has a functional load, but also emphasizes the beauty of the exterior of the building.

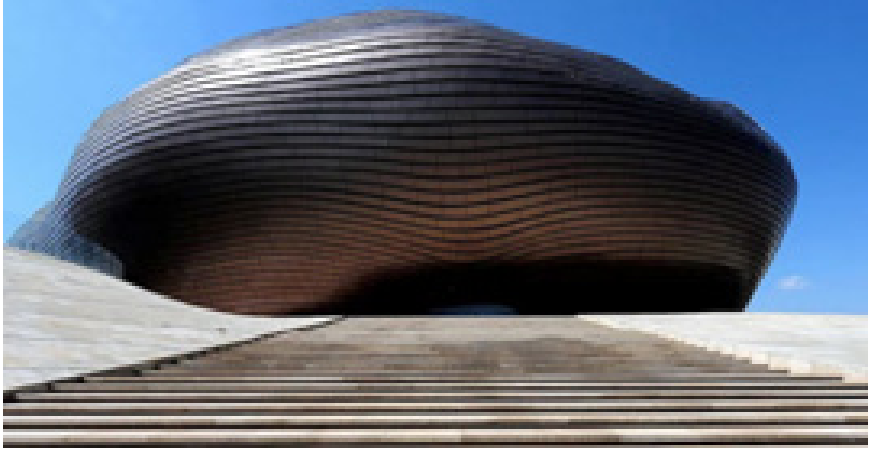


Fig. 7 – Museum of Art and History of Ordos (Mongolia)



Fig. 8 – The element of interior space in the Museum of Art and History of Ordos (Mongolia)

Modern architectural bionics is based on new methods of calculating and designing unique structures using mathematical modeling and software systems. Architects try to find the optimal form in their projects, to apply the most diverse modern materials, to ensure the reliability of the design [12] - [14].

Now the appearance of cities in Mongolia begins to change, there are an amazing modern buildings (Fig.9).

There are a lot of modern office buildings. All the more surprising among all this are the ancient Buddhist monasteries among modern buildings. (fig.10). Buildings create their own unique style, which has its own national characteristics, monumental buildings and architectural complexes.



Fig. 9 – Hotel "Blue Sky": a - general view; b - roof shape



Fig. 10 – Urban environment of Mongolia

But no less beautiful and interesting in form and organization of space were built in the past. Yurt is the traditional Mongolian nomadic housing (Fig.11). It has a round shape, foldable wooden frame, and the top is covered with felt.

Such a direction as bionics of the interior develops, in which natural forms and materials are used, principles that are found in natural objects, in the organization of space, in the design and decoration of rooms [7], [10].

Wood is one of the most common materials in the interior of the bionics style. In the yurts in Mongolia, the following materials were used in the interior and in the construction itself: wood, wool, felt, leather, bamboo and others (Fig. 12).



Fig. 11 – Yurt: a - general view; b - interior

In modern architecture, bionics has taken a special place. Architectural bionics is based on the feasibility of applying the bionic principles of shaping, on creating a comfortable environment. In this regard, modern architects have new opportunities for creativity, for the further development of modern architecture.

Modern architecture at the design stage lays the creation of new materials, technologies and designs necessary for the construction of unique structures. An unlimited number of images is drawn using mathematical models for calculating natural images using the bionic principles of shaping and organizing space.

Conclusion

Architectural bionics is a science that considers the possibility of creating architectural forms based on the study of natural objects, a distinctive feature of which is beauty, harmony, environmental friendliness, and the use of natural materials.

It is necessary to pay more attention to the development of this direction. Bionic buildings adorn our environment. The search for interesting solutions in the projects of modern facilities is relevant, especially in our time.

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研究额尔齐斯剪切带结构中的早期碰撞和过渡塑性脆性变形
**STUDYING EARLY COLLISION AND TRANSITIONAL PLASTIC-
FRAGILE DEFORMATIONS
IN THE IRTYSH SHEAR ZONE STRUCTURES**

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抽象。用脆塑性变形代替粘塑性变形表达了碰撞的迹象。在这种情况下，发生了许多不连续的地壳，伴随着后来由不和谐的堤坝治愈的位移。总共在研究区域内确定并研究了在3500万年地质时间范围内的早期碰撞的八个痕迹。Ongonite 堤坝穿过ISZ西南侧的构造构造而没有位移。在彼尔姆，ISZ和Kalba-Narym Terrane在地球动力学过程中作为单一结构参与。

关键词：碰撞，结构，片麻岩，巨型块，增生，岩层，地体，年龄，堤坝，地球动力学。

Abstract. *the signs of collision were expressed in replacing viscous-plastic deformations with brittle-plastic ones. At this, numerous discontinuities of the crust occurred, accompanied by displacements that were later healed by discordant dykes. In total, eight traces of an early collision in the range of 35 million years of geological time were identified and investigated in the studied territory. Ongonite dykes cross the tectonic structures of the southwestern side of the ISZ without displacement. In Perm the ISZ and the Kalba-Narym Terrane in geodynamic processes participated as a single structure.*

Keywords: *collision, structure, gneiss, megablock, accretion, lithoplates, terrane, age, dyke, geodynamics.*

The first geological signs of the collision manifestation were expressed in replacing viscous-plastic deformations with brittle-plastic ones and changing the lateral stresses with the northeast vector to multidirectional stresses with vectors

ranging from north-north-west to east-northeast. At this, numerous discontinuities of the crust occurred, accompanied by displacements that were later healed by discordant dykes. An example is a displacement along the fault hidden under the floodplain of the Ulba river, which led to the frontal conjugation of the structures of the left and right banks. Such changes in the tectonic mode were caused by the general rise of the crust in connection with the beginning of the collision between the Kazakhstan and Siberian plates. The change of a single stress vector during accretion to multidirectional discontinuities of the crust is caused by the appearance of vertical movements, as well as increasing the crust thickness due to the plates collision and subduction phenomena accompanying these processes.

The time of manifestation of the early stage of the collision was recorded in the zircon of igneous rocks of discordant dykes and small bodies dissecting the concordant NW-SE of the ISZ structure formed during the accretion stage.

Test No. 56 was taken from the dyke of plagiocenic dissecting the gneisses of the Kurchum gneiss megablock. It contained typical magmatic zircon with no signs of corrosion and a well-developed rhythmic structure.

The weighted average age is 352 ± 2 Ma, which corresponds to the Tournaisian stage of the early Carboniferous.

The age of the same vein of pomegranate granite on the Kaldzhir river cliff dissecting the gneiss of the Kurchum megablock, was 362.8 ± 5 Ma [1].

The age of zircon from plagiogranites, Sary-Tau massif, occurring in the gneisses of the Kurchum megablock, determined [2] by the SHRIMP method, was $354 + -2.5$ Ma.

In the central part of the Irtysh shear zone, the collapse in the north-western outskirts of Ust-Kamenogorsk near the village of Sogra there were obtained convincing evidences, excluding the widely recognized version of the Late Paleozoic age of the Irtysh shear zone. Here, in a cliff of the railway, there are dykes of fine- and medium-grained Adamellites, which are located discordantly in the northeastern direction, break through gneisomigmatite and diopside crystalline schists with the general northwest strike.

Zircon has all the signs of magmatic origin: a pronounced rhythmic microstructure, perfect cut, the absence of relic inclusions. The isotope characteristics and the age of local analysis points in zircon grains are shown in Table 1.

Table 1
Uranium-lead dating of zircon grains from sample 94

Points	%206Pbc	U, ppm	Th, ppm	232Th/238U	206Pb*,ppm	206Pb / 238U, Ma
94.1.1	1.24	70	26	0.39	3.36	344± 8.4
94.2.1	0.30	275	192	0.72	13.8	365± 6.7
94.3.1	0.26	447	268	0.62	21.4	349± 6.2
94.4.1	0.00	385	225	0.60	19.1	361± 6.7
94.5.1	0.30	129	54	0.44	6.3	356± 7.2
94.6.1	0.09	369	178	0.50	18.4	363± 6.4
94.7.1	0.22	241	104	0.45	11.8	356± 6.8
94.8.1	0.47	238	67	0.29	11.3	346± 6.3
94.9.1	0.77	119	44	0.38	5.95	364± 7.6
94.10.1	0.26	326	184	0.58	15.8	354± 6.4

The position of the weighted-average ellipses on two concordias made in different coordinates, age 356 ± 4 Ma, corresponds to the border of the late Devonian and early Carboniferous (Fig. 1).

In total, eight traces of an early collision in the range of 35 million years of geological time were identified and investigated in the studied territory. The additional time of this period is given by the interpretation of new materials on the Chechek gneiss dome.

In many publications, in the articles dealing with the ISZ much attention is paid to the Chechek gneiss dome.

The entire dome is mottled with fractures such as are usually observed in cooled granite massifs and are called individual cracks, or shrinkage cracks.

The fracture mapping shows that in the center of the dome separate lithoplates bedding is either subhorizontal or very hollow.

In the NW, parts of the dome and cracks and separate lithoplates at the angle of $25-30^\circ$ are submerged under the south-western marginal Irtysh fault and under the Surov massif.

All the wells in the south-western endocontact of the Surov massif, after crossing gabbroids at different sites, were included in the Takir and Kystav-Kurchum shale. Therefore, all the claims that the gneisses were located above the Surov massif and were genetically formed under the Surov massif influence do not correspond to reality. Rather, the Surov massif together with the hornfels exocontact zone was tectonically pulled over the Chechek dome, which at that time already existed. It is also not possible to confirm the affiliation of chechekchits to the amphibolite facies of metamorphism. Back in the 80-s of the last century, they wrote that:

Sample 94 10 points

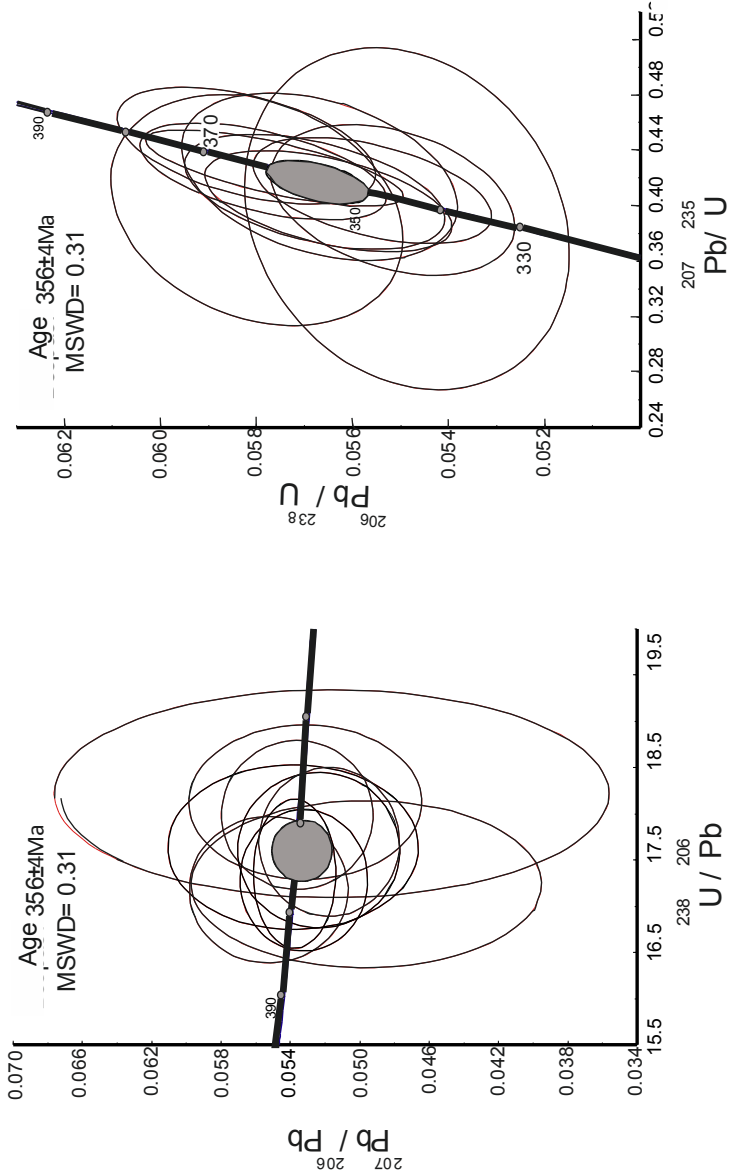


Figure 1– Zircon concordias of sample 94 at 10 points

1) there are abundant biotite and muscovite in chechekchits, but there is no potassium spar, which is a sign of the green shale facies metamorphism (decay of biotite and formation of potassium spar is the lower boundary of the amphibolite facies);

2) garnet in chechekchits is everywhere represented by the low-temperature almandine-spessartine phase, and in the garnet the content of the pyrope molecule is 2–3 %, which is also a property of the green shale facies. In the metamorphic rocks of the amphibolite facies, the pyrope content in the garnet is, in principle, determined by the environment and the crystallization temperature, is usually close to 10 % and reaches 16-18 %. The Chechek gneiss massif is a protrusive dome which roots go to the gneiss base of the Kalba-Narym zone and are not directly connected with the Irtysh zone.

If we take into account the figure of Chang et al. 375 ± 2 Ma at the start of the gneiss diapir moving upwards, then the beginning of the early collision of the Irtysh zone should be considered from the middle Devonian.

The data showed that the ongonite dykes (age 282 ± 2 , sample 129) intersect the tectonic structures of the southwestern side of the ISZ without displacement. This means that already in the Perm the ISZ and the Kalba-Narym Terrane participated as a single structure in geodynamic processes.

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参与Orlovskiy矿床复杂矿石选矿技术废物处理的可能性
**POSSIBILITY OF INVOLVEMENT IN THE PROCESSING OF
TECHNOGENIC WASTE OF COMPLEX ORES BENEFICIATION
OF THE ORLOVSKIY DEPOSIT**

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抽象。 本文介绍了处理Orlovskiy矿床技术成因选矿废物的可能性。 本文给出了化学分析的结果和有价值组分分布对研磨细度的依赖性分析。 根据获得的数据得出结论。 显示了含水提取物的结果。 考虑了Orlovskiy矿床复杂处理技术形成选矿废物的可能性。

关键词: 选矿废弃物, 化学分析, 筛分分析, 水提取物。

Abstract. *This paper describes the possibility for processing of technogenic beneficiation waste of the Orlovskiy deposit. The results of chemical assay and analysis of dependence of valuable components distribution on grinding fineness were shown in this paper. Conclusions were made based on the obtained data. The results of aqueous extract are shown. The possibility for complex processing of technogenic beneficiation waste of the Orlovskiy deposit was considered.*

Key words: *beneficiation waste, chemical assay, sieve analysis, aqueous extract.*

Depletion of valuable components resources leads to the necessity of gradual involvement of complex ores (including off-balance ore) into industrial use. Also including metallurgical and beneficiation production waste [1,2].

The solution to this problem will contribute to the development and implementation of nonwaste technologies, which will positively affect resource conservation, as well as reduce the scale of pollution of the water and air basins.

A significant amount of technogenic waste of complex sulphide ores flotation beneficiation is accumulated in the Eastern Kazakhstan. These flotation tailings contain non-ferrous and precious metals in amounts comparable in volume and often in grade with several deposits of Rudny Altai.

Tailings dumps may become an alternative raw-materials base for non-ferrous metallurgy in conditions of considerable reduction of geological exploration works in recent years and due to this, a formation of a deficit of proven ore reserves.

Technogenic waste of complex ores beneficiation of the Orlovskiy deposit was selected for the research. The results of chemical assay show the presence of valuable components in the researched sample. The data are given in the Table 1.

Table 1. *Chemical assay results for technogenic product of complex ores beneficiation of the Orlovskiy deposit*

Element	Cu, %	Pb, %	Zn, %	Au, g/t	Ag, g/t	S _{total} , %	Fe _{total} , %
Grade	0.28	0.21	0.44	0.76	25.4	8.48	24.59

Chemical assay of technogenic beneficiation waste of the Orlovskiy deposit indicated that the main valuable components are copper, zinc, gold, silver and partially lead. So based on the results, there is a possibility of processing of such tailings, especially since the technologies for production of non-ferrous and precious metals from technogenic waste of ores beneficiation with approximately the same grade are now being developed and implemented [3,4].

Mineralogical analysis showed that ore minerals are represented mainly by sulphides of copper, zinc, lead and iron, and appear in form of fine-grained attachments and emulsive impregnation among themselves and non-metal minerals.

After conducting of chemical assay and mineralogical analysis, a sieve analysis was performed with the separation of the main valuable components by size fraction. These results are given in the Table 2.

The sieve analysis of the initial sample of technogenic beneficiation tailings of the Orlovskiy deposit shows that, according to the particle size distribution, the sample of aged tailings consists of fine-grained material with a predominance of grains of minus 0.044 mm grain size (up to 57.66%).

Table 2. Sieve analysis results for the initial sample of technogenic beneficiation tailings of the Orlovskiy deposit

Size fraction, mm	Yield	Grade, %, g/t		
	%	Cu	Zn	Au
-800+0.63	3.30	0.28	0.37	0.78
-0.63+0.315	4.7	0.38	0.39	0.67
-0.315+100	11.63	0.37	0.46	0.44
-100+0.074	7.11	0.47	0.85	0.65
-0.074+0.044	57.66	0.31	0.63	0.79
-0.044	15.6	0.22	0.65	0.85
TOTAL:	100	0.28	0.44	0.76

The results of determination of ion and chemical composition of aqueous extract are given in the Table 3. It can be seen from the results that elements such as copper, zinc, iron, calcium and manganese are released into the liquid phase. Due to the fact that the waste is stored for a long time in the tailings dump, the process of oxidation gradually begins. The longer the tailings are stored, the more intense the oxidation process becomes [5].

Table 3. The results of quantitative and chemical assay of the composition of aqueous extract of technogenic beneficiation tailings of the Orlovskiy deposit

Component name	Units of measure	Waste tailings sample
Medium pH	ea · pH	5.1
Suspended materials	mg/dm ³	779
Copper	mg/dm ³	71
Zinc	mg/dm ³	1778
Iron total	mg/dm ³	0.70
Calcium	mg/dm ³	663
Manganese	mg/dm ³	385
Sulphate-ion	mg/dm ³	5799
Total liquid	mg-eq/l	63
Dry residue	mg/dm ³	9797

Composition and structure of this raw material don't allow it's processing by conventional methods used in beneficiation and metallurgy, because these methods cannot ensure the required completeness of recovery, complexity of mineral resources use and production of commercial output of the required quality.

That is why it is necessary to study the possibility of using of combined beneficiation and hydrometallurgical methods for processing of this type of raw materials.

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形成统一的东西伯利亚地区的入侵范围旋转 – *Perccottus glenii* Dybowski
**FORMATION OF UNIFIED EASTSIBERIAN REGION
OF THE INVASIVE RANGE OF ROTAN –
PERCCOTTUS GLENII DYBOWSKI**

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注解。旋转带状疱疹*Perccottus glenii* Dybowski的入侵始于20世纪初。在一百年的时间里，rotan渗透到西欧的许多水系统，俄罗斯欧洲部分的许多水体，西亚的水体，哈萨克斯坦和中亚。尽管旋转的原生栖息地位于阿穆尔河下游，上阿穆尔盆地的水库和贝加尔湖的盆地，但直到最近才出现旋转。在本世纪末出现在这些地区，rotan迅速扩大其边界，现在已经到达河流的中间路线。Khilok（贝加尔盆地）和Ingoda河（阿穆尔盆地）的中间路线，表明在东西伯利亚地区形成一个统一的旋转区域。预计它将迅速向东移动，带来所带来的所有负面后果。

关键词：罗坦，东西伯利亚地区，入侵，发育区，栖息地，河流，湖泊，羚羊，上阿穆尔盆地，贝加尔湖盆地

Annotation. *The invasion of rotan shingles *Perccottus glenii* Dybowski began in the early 20th century. For a hundred-year period, rotan penetrated into a number of water systems in Western Europe, numerous water bodies of the European part of Russia, water bodies of Western Asia, Kazakhstan, and Central Asia. Despite the fact that the native habitat of rotan is located in the lower reaches of the Amur River, in the reservoirs of the Upper Amur basin and the basin of Lake Baikal, rotan was absent until recently. Appearing in these regions at the end of the century, rotan quickly expanded its borders and has now reached the middle course of the river. Khilok (Baikal basin) and the middle course of the Ingoda river (Amur basin), which indicates the formation of a unified area of rotan in the East-Siberian region. It is expected to move rapidly eastward with all the negative consequences that this entails.*

Keywords: *Rotan, East-Siberian region, invasions, developmental area, habitats, rivers, lakes, oxbows, Upper Amur basin, Lake Baikal basin*

Rotan *Perccottus glenii* Dybowski is a freshwater species of fish of the family Golemish (Eleotrididae), is a representative of the Amur ichthyofauna. Its native habitat in the Amur basin captures the Amur region, south of the Khabarovsk Territory, northeastern China and North Korea. Constantly found in large tributaries of the Amur, such as Zeya, Sungari, Ussuri. He was ample in the basin of Lake Khanka. To the north of the Amur estuary it goes to the Tugur River, which flows into the Sea of Okhotsk, to the south - to Vladivostok and the Sui-Funn and Tumannaya rivers (Nikolsky, 1956; Annotated ..., 1998).

The resettlement of rotan began in 1916, when it was released from the aquarium into the garden pond in the Leningrad Region, where it multiplied and where its penetration into the surrounding water reservoirs began. Later it penetrated into the water bodies of the coastal part of the Gulf of Finland, and the rivers of the Baltic Sea Basin - Pregel, Vistula, Western Bug, etc.

Over the past 100 years, rapid penetration of rotan into the water bodies of Central and Eastern Europe, Western Asia, Kazakhstan, and Central Asia has occurred. He appeared in the basins of the Dnieper and the Don, quickly settled in the waters of the river. Volga, began to occur in the waters of the Gorky, Tula, Ryazan, Kaluga, Yaroslavl, Vladimir, Nizhny Novgorod, Samara and Arkhangelsk regions. Later, it penetrated into Siberian water bodies - the Tobol, Irtysh, Ob, and Lena water systems, preferring mainly small lakes, ponds, quarries and other non-flowing water bodies that were heavily overgrown with aquatic vegetation (Bogutskaya, Naseka, 2002; Sokolov, Tsepkin, 1992, Reshetnikov, 2004) The most complete picture of the current habitats of rotan is reflected in the work of A.N. Reshetnikova (2009).

Despite the fact that the native part of the range is located in the south of the Amur basin and adjacent territories, the territory of Russia and Central Asia was rapidly forming an invasive range of this species, in the waters of Eastern Siberia, there was no rotan in the Baikal basin and the Upper Amur basin until the middle of the 20th century. This is confirmed by the materials of the Amur ichthyological expedition (Nikolsky, 1956) and the study of fish in the Transbaikal region, including the ichthyofauna of the Shilka, Argun, Onon, Ingoda rivers, conducted in the 1970s by G.L. Karasev (1987).

In the basin of Lake Baikal, rotan, according to a number of authors (Bolonev et.al, 2002; Neronov et al., 2002), was accidentally brought to Lake Gusinoye from the Khabarovsk Territory when unloading a live-stock car with a carp in 1969. Definitely rotan in Gusinoye Lake has been seen since 1978. From Gusinoye Lake, rotan penetrated into Selenga, where it was first noted in 1980. Rotan settled rather quickly into water bodies adjacent to the city of Ulan-Ude, the Selenga delta, Posolsky sor, Bay Proval. In recent years, rotan has been intensively exploring the coastal waters of the western part of Baikal, spreading from the mouth of the Buguldeyka River to the sources of the Angara River, the Irkutsk reservoir

(Demin, 2001). The resettlement of rotan to the north in the Baikal Basin continues and direct and calculated data are obtained on the withdrawal of tuvod fish resources, which make it possible to conclude that significant damage has been done to the fish resources of the Selenga river delta and the Selenginsk shallow water (Litvinov, 1993; Bolonev et al. 2001; Pronin et al., 2006).

As noted above, in the reservoirs of the Upper Amur basin, rotan was absent almost until the end of the 20th century. The presence of this species is noted for the first time in the Argun River in the Sredneargunsk area in 1987 (Reshetnikov, 2009). In the Transbaikal Territory, we found rotan for the first time in 1996 in the mouth of the Sredny Borzya River, which is a first-order tributary of the Argun River (Gorlacheva et al., 2008). It should be noted that neither in the Argun River, nor in the numerous open-pit reservoirs of the Middle Borzya Rotan river floodplain during this period was not registered. This may indirectly indicate that the invasive range of the Amur basin rotan was initially insignificant.

Later, the distribution of rotan in the Argun basin in the Trans-Baikal Territory was rapid. In 2001-2002, rotan was observed not only in numerous open-pit reservoirs along the Lower and Middle Borzya, but also in the riverbed, and oxbows of the r. Upper Borzya, in Krasnokamensk reservoir, in the r. Argun near Gorbunka (Gorlacheva et al., 2008). In subsequent years, rotan was recorded in the Uru-lyungui River, in the Argun River, in the area with. Kaylistuy, Olochi, Argunsk, Priargunsk, in the river Gazimur (a tributary of the Argun), near the village of Gazimurovsky Zavod, and the village of Krasnoyaroovo.

In the Shilka river basin, which at the confluence with Argun, gives rise to Amur, rotan appeared, probably later than in the Argun river basin, as evidenced by the ichthyofauna assessment of the Shilka river from the town of Sretensk to its mouth, conducted in 1987-1988 by the laboratory aquatic ecosystems IPREK SB RAS in connection with the design of the Shilka hydroelectric complex. There was no rotan in the ichthyofauna of the Shilka River in the surveyed site. This species was first registered in the Shilka river basin in 2005–2006, and it was noted not in the Shilka River itself, but in its tributaries, the Nercha River and the Nerchi tributary, the Uldurga River (Gorlachev, Gorlacheva, 2014)

In 2013-2014, work was continued to assess the distribution of this species in the water bodies of the Upper Amur basin (Gorlachev, Gorlacheva, 2016). The obtained materials show that rotan has significantly expanded its range in recent years and has mastered new reservoirs. It appeared in the Onon, Ingoda, Chitinka rivers, in the Nerchinsky and Uru-lyungu reservoirs, in two ponds of the Chita SDPP.

Over the past ten years, rotan in many biotopes of the Shilka River basin has become a mass species. Especially favorable for its habitat were the old ladders, richly overgrown with vegetation, ducts with a slow flow and career reservoirs left

after the excavation of gravel in the floodplain of the river itself. The high abundance of rotan was noted by us in the Shilka canals near the village of Savvateevo, the mouth of the Kiya river, the Shilka open-cut reservoirs, and the Nercha river in the channel. Populations of rotan in these bodies of water were represented by individuals of different ages with a high population, including juveniles.

In 2013, rotan was recorded directly in the Onon river, the Aga and Unda rivers, as well as small floodplain lakes near the village of Nizhny Kokuy and Nurinsk. In the same year, rotan was first observed in the Ingoda river basin, near the Karymskaya station. In large numbers, he lived in abundantly overgrown aquatic vegetation of the same lake in the floodplain. It was also noted in floodplain lakes near the village of Makkaveevo. Upstream by 2014, rotan had risen to the mouth of the Chita River, where it was caught by single specimens, both in the area of the city of Chita and upstream. Chita In 2014, young rotan were caught in two ponds of the ash dump of the Chita CHPP-1, and adults in the filtration pond of this ash dump.

In 2014, rotan in the Ingoda floodplain was not noted above Chita, nor was it in the control catches in the middle reaches of the Khilok River near the village of Maleta. However, in 2018, rotan appeared above the city of Chita in floodplain reservoirs near the village of Novaya Kuk and was noted in the city pond of Petrovsk-Zabaykalsky, located in the middle reaches of the Khilok River. Certainly in the coming years, we should expect the promotion of rotan up the Ingoda, and its appearance in the lakes Balsa, Nikolayevskoye, Tanga, located in the floodplain of this river. We should expect the promotion of rotan up the river Hilok. Its appearance not only in floodplain lakes, but also in large Ivano-Arakhley lakes, can have a significant negative impact on the ichthyofauna of these bodies of water.

The promotion of rotan up the Ingoda and Khilok rivers and its fixation in the middle course of these rivers actually indicate the geographical confluence of the Baikal and Upper Amur populations of rotan and the formation of a single East Siberian invasion of this species.

In the coming years we should expect the expansion of the East-Siberian region of invasion of rotan to the east. The major floods of 2013 and 2018 covered not only the main part of the Amur, but also its headwaters. The water level rise on certain rivers of the Upper Amur basin exceeded 4 meters. With such a raising of the level, many streams, bayou, floodplain reservoirs in which a large number of rotan juveniles live have turned into running water, which should facilitate the transfer of a significant part of rotan juveniles to the headwaters of Amur itself, where rotan was absent before.

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大豆种子数量性状和播种品质形成的特征取决于植物的位置
**FEATURES OF THE FORMATION OF QUANTITATIVE TRAITS AND
SOWING QUALITIES OF SOYBEAN SEEDS IN DEPEND
OF THE LOCATION ON THE PLANT**

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注解。 本文介绍了大豆种子数量性状和播种品质形成的特点,这取决于它们在Gribskaya饲料品种中的形成位置以及1782/5和1782/10饲料方向的样品。 据透露,根据研究样品的特征,植物下部形成的豆类种子数量最多,为53%至68%。 所研究样品中最大和最完整的种子在植物的中部形成。 已经确定,可以从在上层大豆植物中形成的种子获得强壮的幼苗。 在制备高质量种子材料时,建议考虑所研究品种和样品的显示特征。

关键词: 大豆, 不同品质, 种子播种质量, 生物指标

Annotation. *The article presents studies on the peculiarities of the formation of quantitative traits and sowing qualities of soybean seeds, depending on the place of their formation on the plant in the Gribskaya fodder variety and samples of 1782/5 and 1782/10 fodder directions. It was revealed that the largest number of beans and seeds is formed in the lower part of plants from 53 to 68%, depending on the characteristics of the studied samples. The largest and fullest seeds in the studied samples are formed in the middle part of the plant. It is established that strong seedlings can be obtained from seeds that have formed in the upper tier of soybean plants. The revealed features of the studied variety and samples are recommended to take into account when preparing high-quality seed material.*

Keywords: *soybean, different quality, sowing qualities of seeds, biometric indicators*

Diversity of seeds (disparity of their potential viability) is composed of morphological, anatomical, physiological and biological features. The process of formation of these features occurs at all stages of plant development, starting with fertilization and ending with seed ripening.

The quality of seeds is the result of many factors: non-simultaneous passage of the stages of morphogenesis, unequal sex elements involved in fertilization, the anatomical structure of the conduction system, differences in the activities of the assimilation apparatus, mineral nutrition and water supply [6].

Quality varieties of seeds are widely studied in many crops [4]. However, the study of this phenomenon in soybean forage directions in the conditions of the Amur region is of practical interest for obtaining high-quality seeds. The purpose of the study is to study the features of the formation of quantitative traits and sowing qualities of soybean seeds, depending on the place of their formation on the plant.

To study the matric variety of quality in the nursery of the competitive test (the village of Gribskoye, experimental field of the Far Eastern State Agrarian University), 25 plants were selected from each plot of experience in the phase of complete ripeness. The preselected plants were divided into three equal parts: lower, middle and upper. In the laboratory, biometric parameters were determined, the weight of 1000 seeds (GOST 12042-80) laboratory germination, germination energy, the degree of seedling development.

Germination energy, laboratory germination was determined according to GOST 12038-84, subject to the germination of soybean seeds in rolls of filter paper (P). [5]. The day when the seeds were laid for germination and the day of germination or laboratory germination was counted in one day.

The degree of development of soybean seedlings (growth force) was determined by the morphophysiological method according to the degree of their development during germination under laboratory conditions by the method of B. S. Likhachev (1977) [3]. The repetition is threefold. The essence of this method is to identify and classify individual differences in the formation of essential structures of seedlings. This takes into account the size of the germ, its integrity, the number and size of germinal roots, pathogenic anomaly.

The growth force index was the recorded linear dimensions and the degree of seedling development (Table 1).

Table 1 - Criteria for evaluating soybean seedlings (in points) by the degree of their development

Strong seedlings			Weak seedlings	
point 5	point 4	point 3	point 2	point 1
Main germinal root more than 3cm, there are lateral roots, hypocotyl more than 2cm	Main germinal root less than 3 cm, lateral roots absent, hypocotyl not less than 1 cm	Main germinal root not less than 3 cm, but there are lateral roots, sprout is absent	Main germinal root not less than 2 cm, sprout is absent	Main germinal root not less than seed length

Analysis of the obtained data showed that the height of plants in the studied variety samples varied from 76 to 88 cm. The number of beans and seeds varied from 5 to 23 and from 11 to 43, depending on the sample and location. It was revealed that the largest number of beans is formed in the lower part of plants from 53 to 68%, depending on the characteristics of the studied samples. On average, the tier of the zoned Gribskaya feed grade forms 27% of the total beans, the prospective samples form 17-18%. Soybean variety Gribskaya fodder and sample 1782/5 in the upper tier formed 20% of beans each, and in the perspective sample 1782/10 only 14% of beans were noted. A similar situation was observed in the number of seeds (Table 2).

It was revealed that in the lower tier of the studied samples from 51 to 65% of seeds are formed. In the middle tier, it is noted from 18 to 26%, and in the upper tier from 17 to 23%. At the same time, it is necessary to note the feature of promising samples that over 60% of seeds form in their lower tier.

Table 2 - The variability of quantitative indicators of soybean, depending on the place of their formation on the plant, 2018 year

Grade (sample)	Tier	Plant height, cm	Number of beans, % ¹	Number of seeds, % ¹	Seed mass, % ¹	Weight 1000 seeds, g
Gribskaya feed	Upper	76	20	23	21	103,3
	Average		27	26	28	109,5
	Lower		53	51	51	108,7
1782/5	Upper	81	20	20	19	80,3
	Average		17	18	18	84,4
	Lower		63	62	63	84,2
1782/10	Upper	88	14	17	13	82,7
	Average		18	18	21	114,9
	Lower		68	65	66	109,9

¹ – percent of total

The largest and fullest seeds are found in the middle part of the plant. Since a larger number of seeds is formed in the lower part of the plants of the studied samples, therefore, the greatest mass of seeds was obtained in the lower tier.

Germination energy is considered an important indicator of the sowing qualities of seeds, as it shows the ability of seeds to germinate quickly and unanimously. This indicator characterizes the simultaneous growth and development of plants, as well as the ripening and filling of grain, which improves its quality and facilitates cleaning, which is inextricably linked with germination. Seed germination makes it possible to reveal the ability of seeds to form normally developed seedlings (plant stems at the very beginning of its development from seed (sprouts) together with developed germinal roots) (Table 3) [2].

The seed germination energy in tiers was changed from 76.7 to 96.6%. The maximum germination energy was noted in the middle part of the plants, and the best result was shown by the variety Gribskaya fodder. The minimum values of germination energy were characterized by seeds from the upper part of the plants, the smallest was observed in the variety sample 1782/10. Higher laboratory germination was characterized by seeds that were formed in the upper tier of plants. Reduced laboratory germination was observed in the seeds of the middle and lower tiers.

Table 3 - Variability of the quality of soybean seed feed direction depending on the place of formation on the plant, 2018

Grade (sample)	Tier	Germination energy, %	Laboratory germination, %	The degree of development of seedlings, %		Not germinated seeds, %
				strong seedlings	weak seedlings	
Gribskaya feed	Upper	94,0	96,0	91,3	4,7	4,0
	Average	96,6	93,9	90,6	3,3	6,1
	Lower	96,4	91,3	90	1,3	8,7
1782/5	Upper	89,3	99,3	80,0	19,3	0,7
	Average	93,6	97,0	79,0	18,0	3,0
	Lower	94,0	94,0	77,3	16,7	6,0
1782/10	Upper	76,7	100,0	98,0	2,0	0
	Average	95,5	98,3	94,6	3,7	1,7
	Lower	91,3	90,0	85,3	4,7	10,0

The power of seed growth is a combination of properties that make it possible to germinate when confronted under suboptimal conditions and resist adverse biotic and abiotic factors [1]. The strength of growth is characterized by the degree of development of seedlings: strong and weak seedlings.

An assessment of the growth strength of the samples showed that seeds obtained from the upper part of the plant Gribskaya feed and variety sample 1782/10 formed more than 91% of strong seedlings, while the variety 1782/5, regardless of where the seeds were formed, had more weak seedlings .

According to the degree of development of seedlings, it is possible to give a more objective assessment of the possibility of seed germination in field conditions. Therefore, the values of the degree of development of strong seedlings are significantly different from laboratory germination. Weak seedlings in the field will not give full shoots. It is generally accepted opinion of scientists and practitioners that the seeds of the middle tier are better suited for sowing, as they are characterized by higher sowing qualities. However, our research has shown that in the soybean variety Gribskaya fodder and promising fodder samples, strong seedlings can be obtained from seeds that have formed in the upper tier of plants. Thus, in the variety Gribskaya fodder seeds of the upper tier, 91.3% are characterized by the degree of development of strong seedlings, whereas in the middle and lower tiers this indicator is reduced by 0.7 and 1.3%, respectively. In sample 1782/5, the seeds of the upper tier have a higher degree of seedling development (80%), compared with the seeds that were formed in the middle and lower tiers. A similar trend has been established for sample 1782/10.

This is probably due to the peculiarity of the morphophysiological peculiarities of the studied samples. Since the process of reproduction in them begins with the middle nodes of the main stem, spreading first up, down and on the branches, the seeds in the middle tier are larger, and the seeds of the upper tier are characterized by higher sowing qualities. Therefore, this feature of the studied varieties and samples must be considered when preparing high-quality seed material.

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语音识别算法的挑战和方法
**CHALLENGES AND APPROACHES
TO SPEECH RECOGNITION ALGORITHM**

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抽象。 语音识别是机器智能最集成的领域之一，因为人们每天都会识别语音。 这个问题吸引了科学家们一个重要的学科，并对社会产生了技术影响。在这篇综述中讨论了语音识别的过程，其中包括特征提取，语音识别方法的类型。 每种方法都具有不同的识别率和改进的分类过程。

关键词：自动语音识别 (ASR)，线性预测编码分析 (LPC)，Me1频率倒谱系数 (MFCC)

Abstract. *Speech recognition is one of the most integrated areas of machine intelligence, as people recognize speech every day. This question attracted scientists to an important discipline and created a technological impact on society. In this review discusses the process of speech recognition, which includes feature extraction, types of approaches to speech recognition. Each method has a different recognition rate with a modified classification process.*

Key words: *Automatic speech recognition(ASR), Linear Predictive Coding Analysis (LPC), Mel- Frequency Cepstral Coefficients (MFCC)*

Introduction

The twenty-first century has clearly manifested itself as an era of "information explosion", the distinctive feature of which is the active development of science and technology. It is important to note one of the features of the current stage of technical progress, which is to increase the interest in studying intellectual forms of human interaction with information computers. One of the most promising types of such interaction at the moment can be considered the interaction of man and machine with the help of voice commands, and the most actual kind of intelligent systems are automated speech recognition systems. Humans are very much interested to attach with speech to the computer system effectively and friendly. Such

type of system is called speech recognition system. Speech Recognition (is also known as Automatic Speech Recognition (ASR), or computer speech recognition) is the process of converting a speech signal to a sequence of words, by means of an algorithm implemented as a computer program. The objective of speech recognition is to determine which speaker is present based on the individual's characterization [1]. Several techniques have been proposed for compensating the mismatch occurred between the testing and training sessions. The communication among human computer interaction is called human computer interface.

Since 1960s computer scientists have been researching ways and means to make computers able to record, interpret and understand human speech. In computer science, speech recognition (SR) is the translation of spoken words into text. The speech recognition system would support many valuable application like dictation, command and control, embedded applications, telephone directory assistance ,spoken data base querying , medical applications, blind peoples, banking etc.,[2,3] .

The main goal of speech recognition area is to develop techniques and systems for speech input to machine. In this paper presents the review of the different speech recognition system and its recent progress. In the world of science, computer has always understood human mimics. The idea which generated for making speech recognition system is because it is convenient for humans to interact with a computer, robot or any machine through speech or vocalization rather than difficult instructions.

Classification of speech

A number of parameters define the capability of a speech recognition\ system [4].

i. **Isolated word:** The Isolated word have sample windows.it accepts single word or single utterances at a time. Isolated utterance might be a better name of this work [5].

ii. **Connected word:** The Connected word system are similar to isolated words but allow separate utterance to be “run together minimum pause between them.

iii. **Continuous speech :** It allows user to speak almost naturally, while the computer will examine the content. There are special methods used to determine utterance boundaries and various difficulties occurred in it.

iv. **Spontaneous speech:** A System with spontaneous speech ability should be able to handle a variety of natural speech

Approaches to speech recognition

i. The acoustic-phonetic approach-This approach is based upon theory of acoustic phonetics and guesses.

ii. Pattern Recognition approach-Pattern training and comparison are the steps includes in pattern recognition approach. Using a well formulated mathematical framework and pledges reliable speech pattern for pattern comparison.

iii. Artificial intelligence approach-Machine works like human being. It is the combination of the pattern recognition approach and acoustic phonetic method.

iv. Template based approaches- Unknown speech is equaled against a set of pre-recorded words patterns correct to catch the best Match.

v. Stochastic approach-Stochastic modeling involves the use of probabilistic models to pact with uncertain or inadequate information.

vi. Knowledge /Rule based approach - The “skilled” knowledge about distinctions in speech is hand-coded into the system. And it uses set of topographies from the speech, then the training system engenders set of production rules automatically from the samples.

vii. Dynamic time warping- Dynamic Time Warping is an algorithm for calculating resemblance between two classifications which may diverge in time or speed. This technique is also fairly efficient for isolated word recognition and can be adapted to recognize connected word too.

viii. Learning based approach-Objective of machine learning is study or determine some kind of knowledge from a documents set.

ix. Neural Network based approach- An extra broad approach spending neural networks is phoneme recognition. It is better than HMMs model results.

x. Statistical based approach- Here the differences in speech are modeled statistically, by the learning events. This approach signifies the current state of the skill.

xi. Hidden markov model-Hidden Markov Model are very much used because, they can be trained automatically. Hence the HMM is simple and computationally possible to use.

xii Vector quantization - Vector Quantization (VQ) is frequently applied in speech recognition and it is valuable for speech coders, that is., efficient data lessening.

xiii. Support vector machine- SVMs use linear and nonlinear separating hyper-planes for data classification.

Speech feature extraction techniques

Feature Extraction is the most important part of speech recognition since it plays an important role to separate one speech from other. Because every speech has different individual characteristics embedded in utterances. These characteristics can be extracted from a wide range of feature extraction techniques proposed and successfully exploited for speech recognition task. But extracted feature should meet some criteria while dealing with the speech signal such as:

- Easy to measure extracted speech features
- It should not be susceptible to mimicry
- It should show little fluctuation from one speaking environment to another
- It should be stable over time
- It should occur frequently and naturally in speech

The most widely used feature extraction techniques are explained below.

Linear Predictive Coding Analysis (LPC)

LPC is one of the good analysis techniques for extracting features and hence encoding the speech at low bit rate .LPC has capability for speech compression, synthesis and as well as identification .LPC is spectral estimation technique because it provides an estimate of the poles of the vocal tract transfer function.The LPC algorithm is a Path signal is stationary within and zero outside,the analysis window.

Mel- Frequency Cepstral Coefficients (MFCC's)

The cepstrum coefficient is the result of a cosine transformation of the real logarithm of the short time energy spectrum expressed on a Mel-frequency scale. This is a more robust, reliable feature set for speech recognition then the LPC coefficients. The sensitivity of the low order cepstrum coefficient to overall spectral slope, and the sensitivity of the high-order cepstrum coefficient to noise, has made it a standard technique. It weights the cepstrum coefficient by a tapered window so as to minimize these sensitivities, frame and these are used as the feature vector. In MFCC's, the main advantage is that it uses Mel frequency scaling which is very approximate to the human auditory system. The coefficients generated by algorithm are fine representation of signal spectra with great data compression[6]. The process of extracting MFCC's from continuous speech is illustrated in Fig [1].

Conclusion

The objective of this review paper is to summarize and compare some of the well known methods used in various stages of speech recognition system and identify research topic and applications which are at the forefront of this exciting and challenging field. Therefore, this research work is to understand the process of speech recognition and to develop in the future an effective speech recognition system for people with unlimited accuracy.

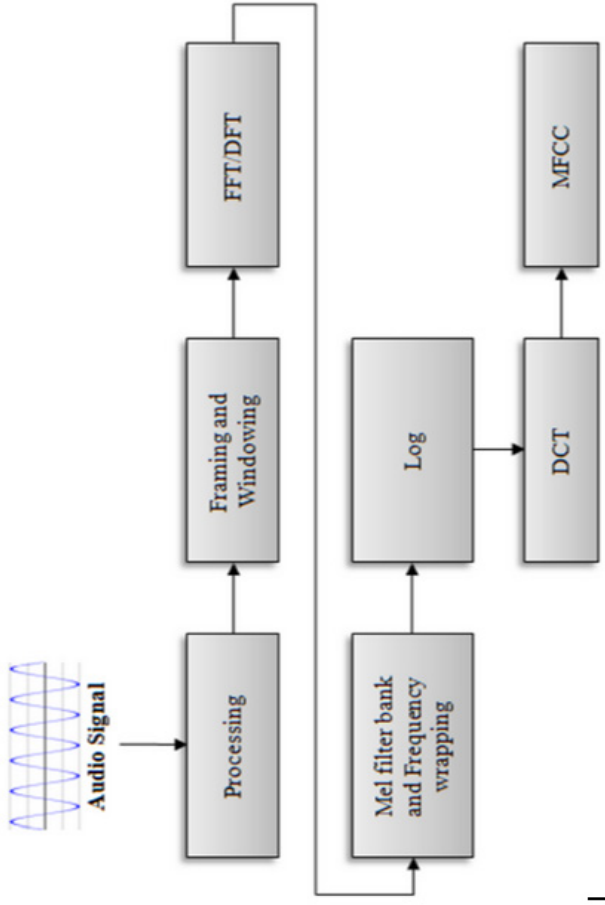


Fig.1 Flow Chart for MFCC Technique

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生命周期阶段的高科技产品端到端建模
**END-TO-END MODELING OF HIGH-TECH PRODUCTS
AT THE STAGES OF THE LIFE-CYCLE**

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抽象。 本文展示了使用多维模型在生命周期阶段对高科技产品进行端到端建模的方法。 多维建模的环境基于复杂和完整的模型，这些模型在生命周期的所有阶段提供产品线和单个产品的建模，并具有统一的方法学位置。 给出了在生命周期的所有阶段的信息通信网络的端到端多维建模的示例。

关键词：横切建模；多模型建模；复杂模型；综合模型；生命周期；CALS；多维建模环境；高科技产品；信息通信环境。

Abstract. *The article shows the methodology of end-to-end modeling of high-tech products at life-cycle stages using multidimensional models. The environment of multidimensional modeling is based on complex and integral models that provide modeling of the product line and individual products at all stages of the life cycle with uniform methodological positions. An example of an end-to-end multidimensional modeling of an info-communication network at all stages of the life cycle is given.*

Keywords: *cross-cutting modeling; multi-model modeling; complex models; integrative models; life-cycle; CALS; multidimensional modeling environment; high technology products; information communication environment.*

Modern specialists in various fields of knowledge constantly have to deal with complex systems and objects, viewing them from different points of view, comparing objects and groups of objects by several criteria, designing new systems and modernizing existing ones. Specialists are forced to constantly interact with their colleagues and with specialists from other, often very remote areas of knowledge, develop com-

promise solutions, act in conditions of insufficient information [1-2]. Modern economic realities require the development of competitive solutions in the shortest possible time, which requires the availability of technologies that enable them to generate several solutions, evaluate solutions based on several criteria and choose those that meet the conditions of the tasks to the maximum. The basis of such technologies should be a special kind of models that provide a multidimensional representation of knowledge about the objects being simulated at all stages of the life cycle.

Classical mathematical models that are systems of integral-differential or algebraic equations do not explicitly contain knowledge of the structural and functional properties of objects, confining themselves to only the representation of the natural processes occurring in the simulated objects. Such models do not contain many other types of knowledge. These models are one-dimensional, and thus fundamentally do not differ from models of natural sciences. In addition, classical models are usually designed for use at any one stage of the life cycle. The essence of technical objects requires the introduction of multidimensionality in a model, the representation in the explicit form of knowledge about the structural and functional properties of modeling objects, the possibility of generating structural solutions and choosing the solution that best satisfies the conditions of the task. This is possible only by incorporating the formalisms used in modern information technologies (object-oriented models, knowledge engineering, artificial intelligence and expert systems) into mathematical models of technical objects, the theory of operations research, mathematical programming and decision theory.

By multidimensional models we mean models that provide reflection of various aspects of the object, and can be used at various stages of the life cycle. The main concepts of multidimensional modeling are the aspect and model, space, environment and object. The aspect reflects some points of view at the object. Examples of aspects are: functional, constructive, technological, organizational and economic aspects. Models are formalisms that provide one or more aspects (Figure 1).

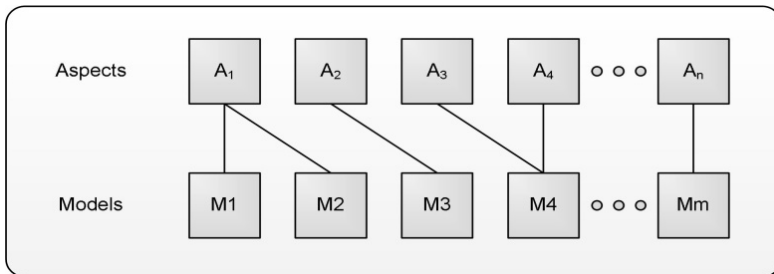


Figure 1. Aspect-Model Relationship

Multidimensional models can reflect both a single object and a whole class of objects, and are the basis of a multidimensional environment that provides a comprehensive multidimensional modeling of High-Tech products at all stages of the life cycle. Multidimensional models can be represented by two classes: complex and integrative models.

A complex model is a systemological model in which various types of knowledge about an object are represented by mathematical models belonging to different classes (1). The complex model reflects various aspects of an individual object and system aspects of a class of objects [3]. Thus, the complex model describes a class of objects at the level of system aspects and a single object at the level of all aspects to be considered, and for which formalisms providing them are available. The complex model is designed to unite many mathematical and computer models representing various aspects of objects into a single whole.

$$CXM = \langle A^{ob}, M^{ob+}, R^{CXM} \rangle \quad (1)$$

where A^{ob} – the aspects of the object under consideration, and the system aspects of the class of objects, M^{ob+} – formalisms for representing aspects of the object and the system aspects of the class of objects, R^{CXM} - links between technical and economic characteristics (*TECh*), technical and economic requirements (*TER*) and M^{ob+} .

For the purposes of computer modeling, a complex model can be represented in the following form (2):

$$CXM = \langle P^{(1)}, I, E, I^E, R, P^{(2)}, Eval, Valid \rangle \quad (2)$$

where $P^{(1)}$ – primary parameters of the object, E – information about the components (subsystems) that make up the object, I – information about the interfaces of the modeled object, I^E – information about the interfaces of the components (subsystems), R – switching space, $P^{(2)}$ – secondary parameters of the object, *Eval* – rules for calculating the secondary parameters of the object, *Valid* - object validation rules.

Complex models do not replace other types of models (mathematical, imitative, statistical), but are a kind of superstructure over them. They are the link that unites the other models into a single whole. Thus, in the theory of complex models, mechanisms are developed that ensure:

- consolidation of information models describing various aspects of the object in a single system;

- links between information models and predictive models (mathematical physics, imitative, statistical);

- manipulation of information models without reference to predictive models (finding objects that meet certain requirements, determining compatibility between objects, integrating objects), including multi-criteria and intelligent search, taking into account the compatibility of objects.

An integrative model is a systemological model of a class of objects, containing knowledge of both the analysis and the synthesis of objects belonging to the class in question (3). The integrative model is an optimization multi-criteria model with structurally-parametric control, containing the formalized representation of technical and economic requirements, an intensional set of structural-parametric solutions [4], methods for calculating all the object characteristics of interest and an algorithm for solving a multicriteria optimization problem.

$$\text{Integrum} = \langle MSO^U, TER^U, TECH^{Sel}, S^{Sel}, Op^{Opt} \rangle \quad (3)$$

Here, MSO^U is the set of mathematical models of all system objects belonging to a certain class, TER^U is a generalized TER for a given class of systems, S^{Sel} is a technical solution with technical and economic characteristics of $TECH^{Sel}$ found with the help of the Op^{Opt} operator.

The integrative model is based on various types of formalisms: mathematical analysis and linear algebra, mathematical programming, the theory of multicriteria optimization, knowledge engineering, theory of algorithms, programming technology and information technologies. Thus, the theory of integrative models should provide:

- creation of methods of intensional representation of a set of alternative structural solutions (morphological set) that are invariant to the type of objects being modeled;

- organization of search on the set of structural solutions (morphological set);

- organization of calculation of characteristics and objective function of synthesized objects using external computer modeling systems (involving mechanisms of complex models).

The joint use of complex and integrative models will provide information about objects and classes of objects in all diversity.

Cyber environment CALS of the new generation should provide continuous (end-to-end) modeling of high-end products at all stages of the life cycle, conducted from unified methodological positions. The given environment should provide representation of models both a product line, and the separate product admitting deep customization. It is advisable to shift the emphasis from individual computer systems involved in supporting the life cycle to aspects, and thereby ensure the most natural representation of information, as well as provide distributed modeling (Figure 2).

The application of multidimensional models will allow to reach a new level of virtualization [5], guaranteeing the completeness and integrity of information at all stages of the life cycle, increasing the degree of re-use of technical solutions, the dynamic formation of groups of specialists and distributed productions, the ability to manage both the project and individual products (Figure 3).

End-to-end modeling of high-tech products at the life cycle stages will be con-

sidered using the example of the infocommunication network. At the first stage, the systemic aspects of the created infocommunication network are formalized. The creation of a multidimensional model should begin with a presentation of the generalized technical and economic characteristics of the $TECh^U$ infocommunication network, which is achieved by identifying the set of parameters P_i required for an exhaustive description of its $TECh$, determining their types and the regions of the assumed values of P_i^{constr} (4).

$$TECh^U = \{P_i\}, P_i \in P_i^{constr}, i \in [1, n] \quad (4)$$

As a result of this procedure, an information template will be obtained to set a set of technical and economic characteristics of infocommunication systems (Figure 4). The information model of a single system can be obtained by setting specific values of P_i^* , taking into account the fulfillment of requirements (5).

$$TECh^U = \{P_i^*\}, i \in [1, n] \quad (5)$$

The $TECh$ allows us to present the system aspects of a single infocommunication network, and the $TECh^U$ – a whole class of networks. The next step is the formalization of technical and economic requirements for the class of TER^U telecommunication systems, by setting the qualitative functions for the $TECh^U$:

$$TER^U = Q(TECh^U) = \{Qi(P_i)\}, i \in [1, n] \quad (6)$$

As in the case of a formalized presentation of technical and economic characteristics, the presentation of technical and economic requirements for an individual infocommunication system is specified by concretizing TER^U . In general, TER is a vector consisting of partial criteria, but, if necessary, can be transformed into a scalar quantity, by applying one of the procedures for the convolution of the criteria:

$$K = \{\alpha_l, \Theta_l(\Pi_l)\}, l \in [1, v] \quad (7)$$

Expressions (4-7) represent the systemic aspects of the infocommunication network, including the formalized terms of reference and quality indicators. If these expressions sufficiently describe the object, including an assessment of the quality of the system throughout the life cycle, then we can assume that formulas (4-7) simultaneously characterize the life-cycle system itself.

At the second stage, the infocommunication network is designed. To achieve maximum efficiency, complex models of modules of various levels of disaggregation are needed, from which an infocommunication network and an automated system of integration are created, which is a specialized automated information and analytical system containing information on radio electronic modules from various manufacturers.

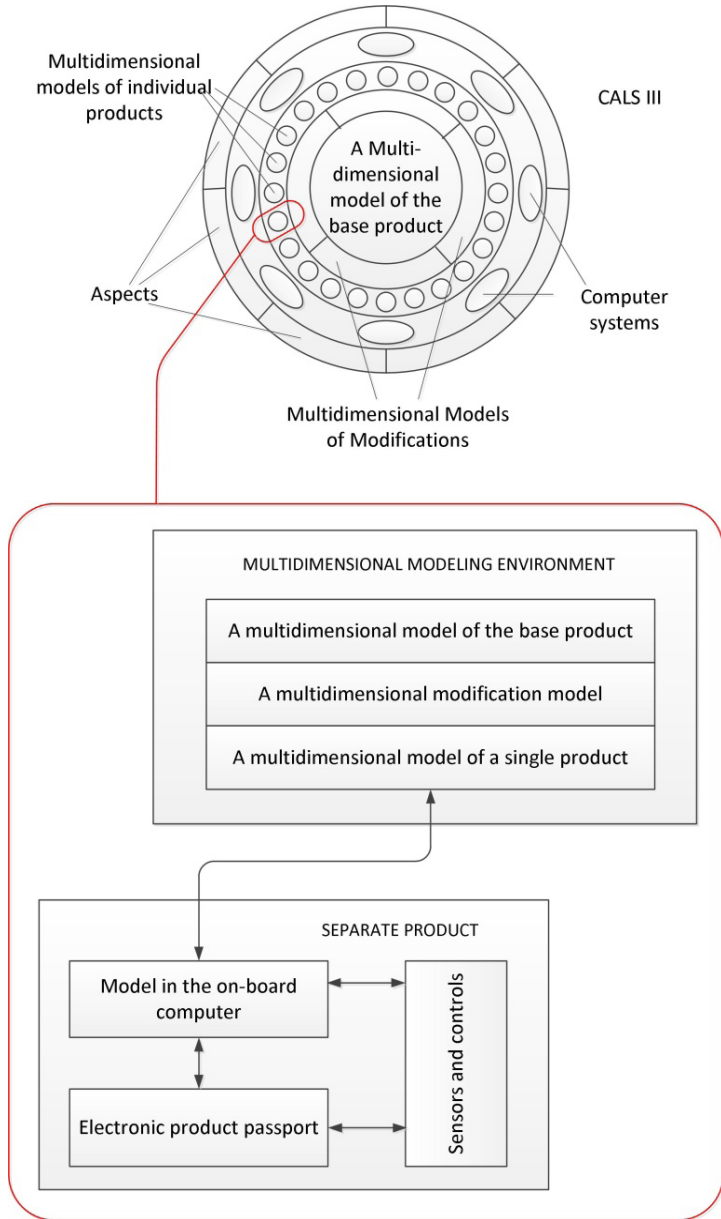


Figure 2. The concept of multidimensional distributed modeling in next-generation CALS

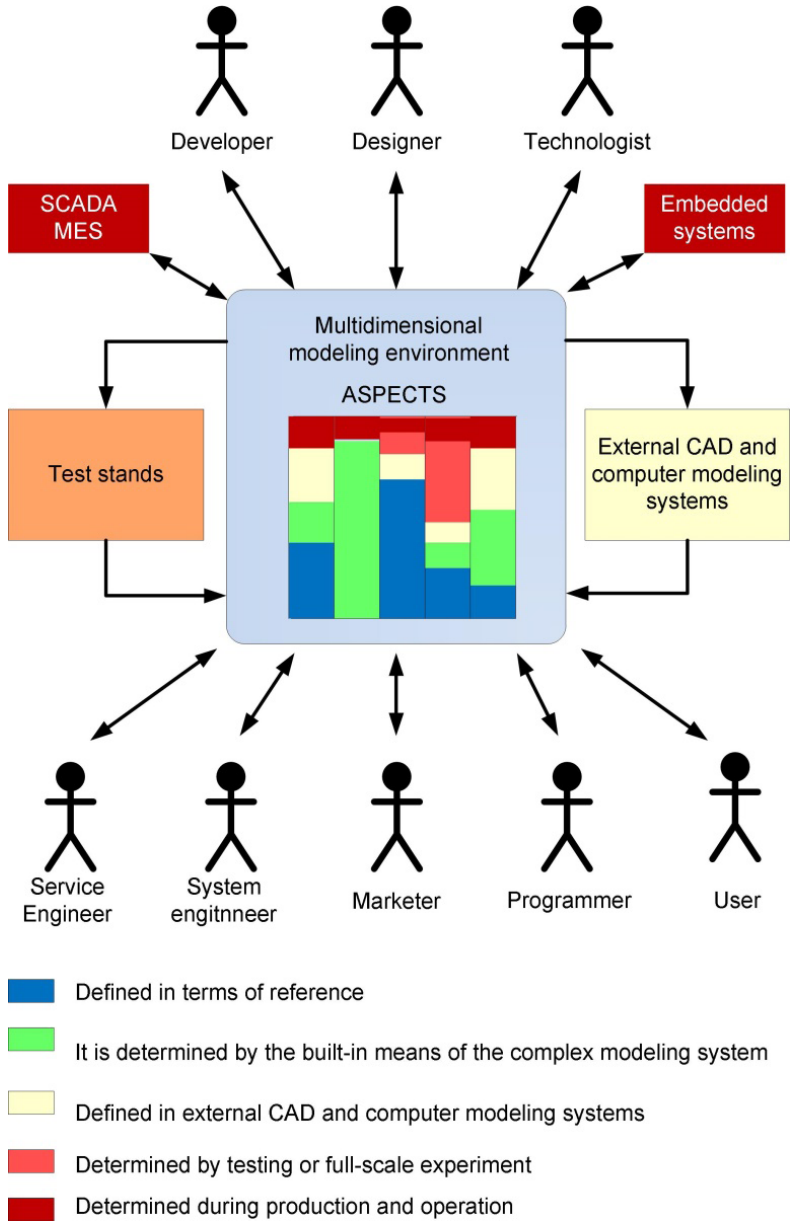


Figure 3. The concept of cross-cutting multidimensional modeling

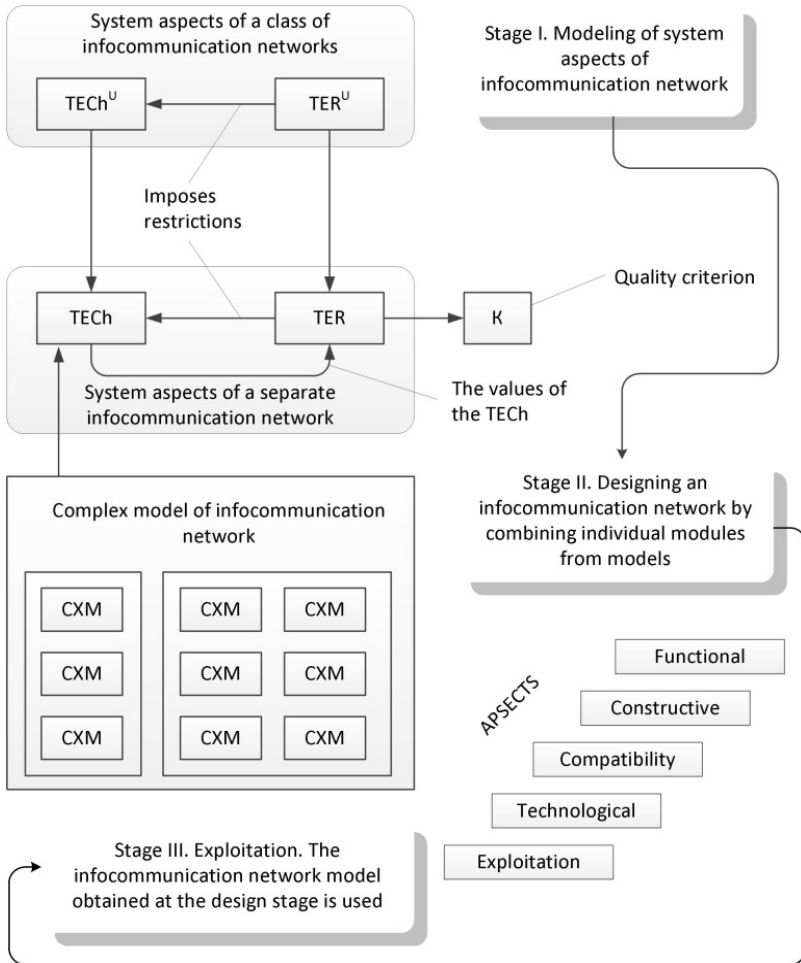


Figure 4. Cross-sectional modeling of the infocommunication network

At the third stage, the infocommunication network is implemented for the created project. The information-analytical system of electronic modules can be interfaced with the electronic commerce system, which will ensure the prompt acquisition of the necessary electronic modules for creation and modernization. Since the modules in the system are represented by complex models, the configured model of the infocommunication network can also be used in the process of operation.

The article suggests an approach to end-to-end modeling of science-intensive products at all stages of the life cycle, carried out from unified methodological positions. This approach will ensure the use of the same models throughout the life-cycle phase – from marketing research to recycling.

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使用声学参量扬声器来研究大气湿度

THE USE OF ACOUSTIC PARAMETRIC LOUDSPEAKERS TO STUDY THE HUMIDITY OF THE ATMOSPHERE

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注解。 本文讨论了声学参量扬声器在大气湿度研究中的应用。 为了实现参量扬声器, 建议在辐射模式中使用具有高灵敏度的高频换能器作为泵浦天线中的换能器。 基于对文献的回顾, 分析了所考虑的天线的特性。 结果表明, 与其他系统相比, 使用声学参量扬声器研究大气湿度是最有效的。

关键词: 参量扬声器, 大气, 多频方法, 天线阵, 非线性介质, 方向性, 声定位器, 方向性模式。

Annotation. *The article discusses the use of acoustic parametric loudspeakers for the study of atmospheric humidity. To implement parametric loudspeakers, it is proposed to use high-frequency transducers with high sensitivity in the radiation mode as transducers in the pump antenna. Based on a review of the literature, the characteristics of the antenna under consideration are analyzed. It is shown that the use of acoustic parametric loudspeakers for the study of atmospheric humidity is the most effective compared with other systems.*

Keywords: *parametric loudspeakers, atmosphere, multifrequency method, antenna arrays, nonlinear medium, directivity, acoustic locators, directivity pattern.*

Introduction. At present time there is an increasing interest in the study of the propagation of sound waves in air in the world. Sound propagation near the earth's surface is affected by various parameters, such as: meteorological parameters (temperature, pressure, humidity, atmospheric turbulence, etc.), as well as sound propagation geometries (height of the source and receiver above ground level, characteristics of the propagation path) [1-2, 4]. Therefore, this paper considers the effect of the humidity parameter on the propagation of acoustic signals in the atmosphere.

The main text. The sound absorption factor, namely the irreversible transformation of the energy of a sound wave into other forms of energy, for example, into heat, has a strong effect on the range of sound waves in the air. As well as weighty factors are: the directivity of the radiation and the speed of sound propagation, which in turn depends on the environment.

It is also worth noting that in the case of vibrational relaxation in the frequency range from 125 Hz to 12.5 kHz, sound absorption in air significantly depends on the vibrational relaxation mechanisms of O₂, N₂, CO₂, H₂O molecules.

Classical sound absorption was first considered by Stokes [2] and developed by Rayleigh [2] and Kirchhoff [2]. The coefficient of classical sound absorption due to the viscosity and thermal conductivity of air is determined by the Stokes-Kirchhoff formula:

$$\alpha = \frac{53,54\eta f^2}{pc}, \quad (\text{m}^{-1}) \quad (1)$$

In which η is the viscosity, p is the atmospheric pressure, c is the speed of sound, f is the frequency of sound.

Harris carried out detailed experimental studies of the absorption of sound in the atmosphere [5–6], taking measurements in one-third octave frequency intervals in the frequency range from 2 to 12.5 kHz, and temperatures from 0.5 to 25.1 °C. Figure 1 shows the data described below.

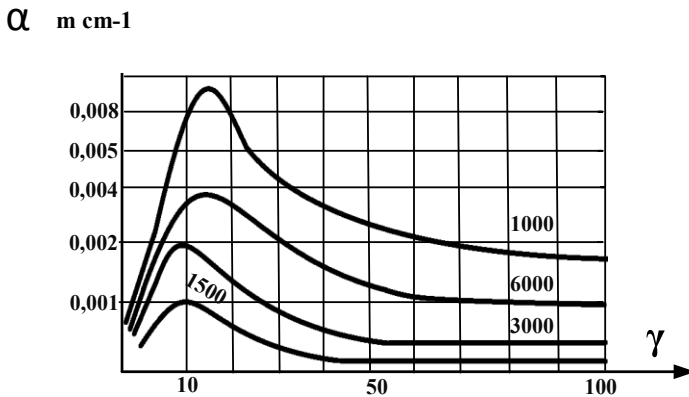


Figure 1. The dependence of the absorption coefficient of sound on humidity at various frequencies ($\text{m} \cdot \text{cm}^{-1}$)

Based on the experimental data obtained, the following conclusions can be made: 1) the sound absorption coefficient increases with increasing temperature; 2) the maximum in the curve depicting the dependence of the absorption coefficient shifts towards a decrease in the relative humidity with increasing temperature.

Recently, acoustic instruments for determining the parameters of air masses have become highly popular [1-3]. Studies vary depending on the conditions of sound propagation in the atmosphere [1-2] and on the parameters of measuring instruments and systems. The measurement results and their errors depend on the frequency range of the applied acoustic oscillations, since the propagation of waves in the air medium and the characteristics of the air acoustics devices largely depend on the parameters of the medium.

The first meteorological acoustic locator was created in Australia in 1968 for military purposes. In 1972, about 20 papers on the application of acoustic locators in meteorology were published, and by 1975 the number of applications of acoustic locators in meteorology reached 120. By 1978, more than 200 acoustic locators were functioning in 15 countries of the world [4]. Acoustic locators are used to probe the atmospheric boundary layer to obtain quantitative and qualitative information at the South Pole, in the ice of the Arctic Ocean, on land and on ships at all points of the World Ocean [3].

In our country, work on the acoustic sounding of the atmosphere began in the mid-seventies at the Institute of Atmospheric Optics of the Siberian Branch of the Academy of Sciences, the Institute of Radio Engineering and Electronics of the Academy of Sciences, the Institute of Atmospheric Physics of the Academy of Sciences and the Kharkov Institute of Radio Electronics of the Ministry of Higher Education of the Ukrainian SSR.

Since then, acoustic and radio-acoustic meteorological locators have been created and used. A striking example of this is mono-frequency locators and multi-frequency locators operating in bistatic and monostatic modes.

Since in air the attenuation of acoustic waves at low frequencies is small, the main drawbacks of sodar systems are the large size of narrowly directed antenna systems and the pronounced dependence of the width of the directivity characteristic on frequency, leading to different scattering volumes at different frequencies and the presence of side lobes leads to ambiguity of atmospheric measurements in different layers.

Elimination of such defects is possible by using a radiating parametric antenna. This is a unique tool that forms the same directivity at all radiated difference frequencies. As well as the side lobes of these antennas are practically absent, the geometric dimensions are ten times smaller than that of traditional acoustic locators.

Technical implementation of a parametric antenna. In order to implement a parametric antenna in air, let us select highly sensitive FSDAUDIOTW-T 25 loudspeakers (Figure 1) assembled into a pumping antenna. These loudspeakers have the following characteristics: sensitivity in radiation mode is 109 dB, peak power is 100 W, nominal resistance is 4 Ohms, case diameter is 58 mm, radiating surface diameter is 43 mm. The parameters of the pump transducers allow you to implement an effective parametric antenna in the air.



Figure 2 - Highly Sensitive Loudspeakers FSDAUDIOTW-T 25

A parametric antenna has unique properties and creates its own signal shaping at the difference frequency. Using different combinations of frequencies, we obtain a tool for studying the humidity of the atmosphere.

We will calculate the characteristics of projected parametric loudspeakers. As the parameters of the pumping antenna will use the characteristics of the speakers discussed below.

Figure 3 shows the axial distributions of the generated waves in the frequency range from 300 Hz to 10 kHz

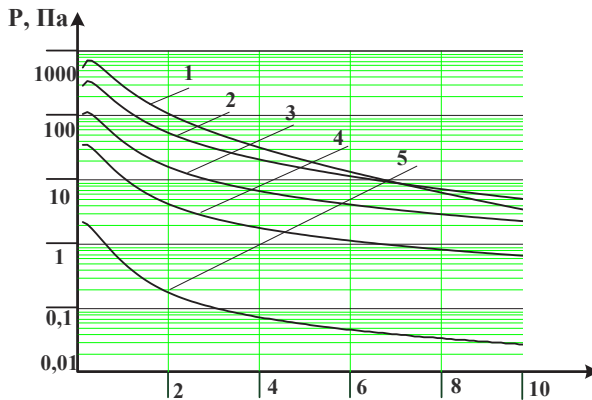


Figure 3 – Plot of pressure difference frequency amplitude equal to 300, 1500, 3000, 6000, 10000 Hz versus distance in meters

According to the results of the study, a strong dependence of the amplitude of the generated signal on the frequency appears.

Figure 4 shows the experimentally obtained results of the directivity characteristic (simulation) of a pumping antenna consisting of a single transducer.

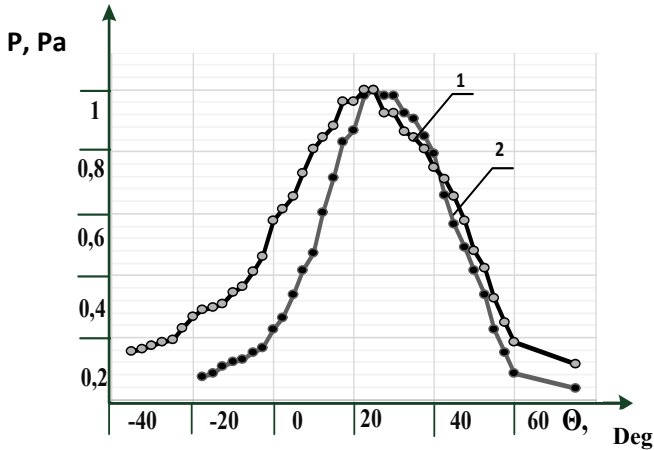


Figure 4 - The directivity pattern of a single transducer (1 - frequency is 20 kHz; 2 - frequency is 17 kHz)

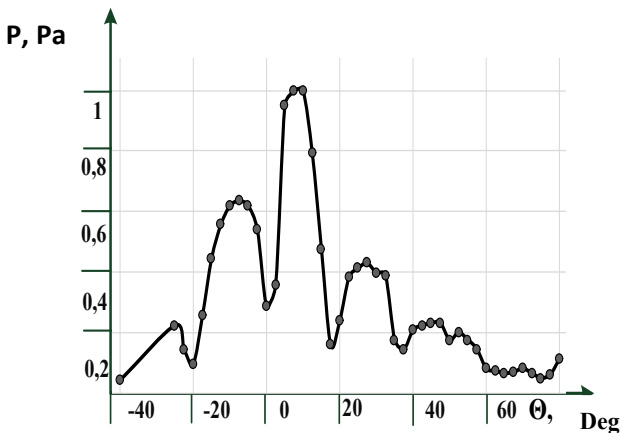


Figure 5 - The pump antenna pattern at a 17 kHz pump frequency

A pumping antenna was assembled from two loudspeakers and studies were made of its directivity in the plane passing through the centers of the loudspeakers.

Acoustic horns were used in order to evenly distribute the radiated energy over the antenna surface; the studies were conducted at different frequencies. The results of experimental studies are presented below in Figures 5-7.

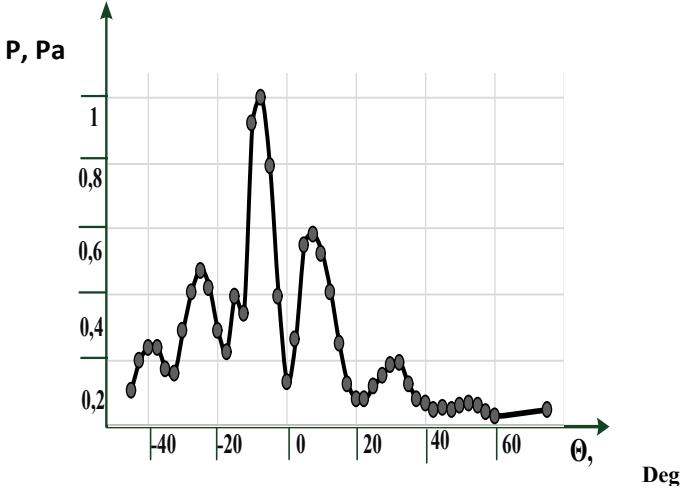


Figure 6 - The radiation pattern at a pump frequency of 20 kHz

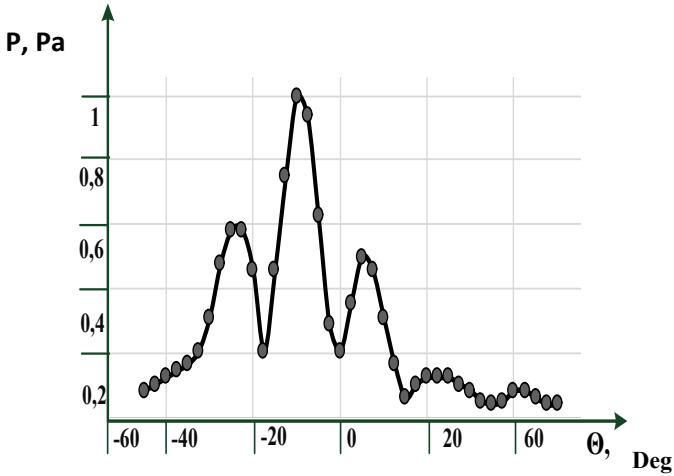


Figure 7 - The radiation pattern at a pump frequency of 21 kHz

Experimental studies show that a narrow directivity pattern with a high level of side lobes is formed in such antenna.

Conclusion. The article discusses a multi-frequency location method for studying atmospheric humidity using acoustic parametric loudspeakers.

Analysis of the calculated and experimental data showed the fundamental possibility of using the selected loudspeakers for the implementation of a parametric antenna for the study of sound waves in air.

As a result, it can be concluded that it is more efficient to use acoustic locators with acoustic parametric transducers to study the humidity of the atmosphere. Since the directivity of the radiating antenna is the same at all radiated difference frequencies, the side lobes are almost absent, and the size of such systems is ten times smaller than that of traditional acoustic locators, which makes it possible to install on mobile carriers, thereby increasing the mobility of systems and measurement accuracy.

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基于具有指定精度的支撑函数计算2维和3维凸壳的凸包
**COMPUTATIONS OF THE CONVEX HULL OF 2 AND
3-DIMENSIONAL SETS BASED ON SUPPORT FUNCTION
WITH SPECIFIED PRECISION**

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注解。 本文描述了用于寻找尺寸 $n = 2$ 和 $n = 3$ 的凸包的数值解，其考虑了中间计算误差。 考虑凸壳为集合 F 的点数 N 与精度 ε 的相关性。

关键词：凸壳，Hausdorff距离，支撑函数，数值构造

Annotation. *This article describes the numerical solution for finding convex hulls for dimensions $n = 2$ and $n = 3$, which takes intermediate computational errors into account. The dependence of the number N of points whose convex hull is a set F on the accuracy ε is considered.*

Keywords: *convex hull, Hausdorff distance, support function, numerical construction.*

In most of numerical methods, only convergence of methods is considered and some criterion for stopping the calculations is specified, which ensures the “proximity” of the calculated values to the desired ones, but does not guarantee the achievement of the specified accuracy. However, the computational errors of solving these auxiliary problems can be very significant. This article is devoted to the practical implementation of such a numerical method that would guarantee the specified accuracy of the calculated values and account for the intermediate computational errors.

Definition 1. A set F from the space E^n is called convex if for any two points x_1 and x_2 from the set F and any non-negative numbers α and β such that $\alpha + \beta = 1$, the condition is satisfied: $\alpha x_1 + \beta x_2 \in F$.

Definition 2. The convex hull $\text{conv}F$ of the set F is the smallest convex set containing F .

Let us denote the space $\Omega(\mathbf{E}^n)$ consisting of all non-convex compact subsets of the space \mathbf{E}^n , and through $\text{conv}\Omega(\mathbf{E}^n)$ – space of all nonempty compact convex subsets of the space \mathbf{E}^n [1].

Definition 3. In the space $\Omega(\mathbf{E}^n)$, introduce the Hausdorff distance between the elements and according to the formula $h(A, B) = \min\{r \geq 0 | A \subset B + S_r(0), B \subset A + S_r(0)\}$, here $S_r(0)$ denotes a ball of radius r centered at the origin, that is, $S_r(0) = \{x \in \mathbf{E}^n | |x| \leq r\}$.

The Hausdorff distance between the sets $\{0\}$ and $F \in \Omega(\mathbf{E}^n)$ is called the module of the set F and we denote $|F| = h(\{0\}, F)$.

Definition 4. The scalar function $c(F, \psi)$ of some argument $\psi \in \Omega(\mathbf{E}^n)$, defined by the condition $c(F, \psi) = \max_{f \in F}(f, \psi)$, is called as support function of the set $F, F \in \Omega(\mathbf{E}^n)$.

Formulation of the problem. In the space \mathbf{E}^n , there is a support function $c(F, \psi)$ of a non-empty convex compact set F and an arbitrary positive number ε is given. It is required to build a set \bar{F} numerically so that the Hausdorff distance between the sets F and \bar{F} does not exceed the number ε and the inclusion $F \subset \bar{F}$ is fulfilled. We take a circle, an ellipse, a ball, and an ellipsoid as convex sets. Accordingly, we will conduct a series of numerical experiments based on the theorem on the recovery of a convex set for dimensions $n = 2$ and $n = 3$.

To construct the set \bar{F} in the space \mathbf{E}^n , we introduce the spherical coordinate system:

$$x_m = r \cos \alpha_{m-1} \prod_{i=m}^{n-1} \sin \alpha_i; \quad x_n = r \cos \alpha_{n-1}; \quad m = 1, 2, \dots, n - 1.$$

Spherical radius is $r \geq 0$, and spherical angles are $\alpha_1, \dots, \alpha_{n-1}$,

$0 \leq \alpha_{n-1} < 2\pi, 0 \leq \alpha_m < \pi$, with $m = 1, 2, \dots, n - 2$. The arbitrary vector $\Psi \in S$, where S is the unit sphere. In the spherical coordinate system, it is written as

$$\Psi = \left(\prod_{i=1}^{n-1} \sin \alpha_y, \dots, \cos \alpha_{m-1} \prod_{i=m}^{n-1} \sin \alpha_i, \dots, \cos \alpha_{n-1} \right)$$

Denote by Ψ_k the vector of unit length ψ written in the spherical coordinate system, whose angle $\alpha_{n-1} = K\alpha$, where $0 \leq \alpha < \frac{\pi}{2}, K = 0, 1, \dots, \left[\frac{2\pi}{\alpha} \right]$. [2] We introduce the following notation:

$$\bar{x}_{1, \dots, n-1} = \frac{c(\widehat{F}, \Psi_{k+1}) \cos K\alpha - c(\widehat{F}, \Psi_k) \cos(K+1)\alpha}{\sin \alpha},$$

$$\bar{x}_n = \frac{c(\widehat{F}, \Psi_k) \sin(K+1)\alpha - c(\widehat{F}, \Psi_{k+1}) \sin K\alpha}{\alpha}$$

$c(\widehat{F}, \Psi_L) = c(\widehat{F}, \Psi_k) + \frac{\varepsilon}{2}$. The point (\bar{x}_1, \bar{x}_2) , $n = 2$ will be from space E^2 . For $n \geq 3$ point will have coordinates:

$$(\bar{x}_{1, \dots, n-1} \prod_{i=1}^{n-2} \sin \alpha_i, \dots, \bar{x}_{1, \dots, n-1} \cos \alpha_{m-1} \prod_{i=m}^{n-2} \sin \alpha_i, \dots, \bar{x}_{1, \dots, n-1} \cos \alpha_{n-2} \bar{x}_n).$$

In this numerical method, we consider the following convex set $\bar{F} = \text{conv} \{ \bar{x} \mid \alpha_i = m_i \gamma, m_i = 0, 1, \dots, \left[\frac{\pi}{\gamma} \right], i = 1, 2, \dots, n-2, \alpha_{n-1} = K\alpha, K = 0, 1, \dots, \left[\frac{2\pi}{\alpha} \right] \}$.

Theorem 1. Let the set $F \subset \Omega(E^n)$ and for the angles α and γ , the inequalities hold:

$$0 \leq \alpha < \arcsin \frac{\varepsilon}{4(|F| + \frac{\varepsilon}{2})}, \quad 0 \leq \gamma < \arcsin \frac{\varepsilon}{6\sqrt{n}(|F| + \frac{\varepsilon}{2})},$$

then the estimate $h(F, \bar{F}) \leq \varepsilon$ and the inclusion $F \subset \bar{F}$ are true [3].

Using the corollary of Theorem 1, in which the inequality holds

$|c(\tilde{F}, \Psi) - c(F, \Psi)| \leq \varepsilon_*$, $\Psi \in S$, F is some set from the space $\text{conv}\Omega(E^n)$, then the following inequality $h(F, \tilde{F}) \leq \varepsilon + \varepsilon_*$, here, \tilde{F} is the set reconstructed from the support function $c(\tilde{a}, \Psi)$ with accuracy ε .

In the course of numerical calculations, it was noticeable that the larger the value of ε , the smaller the number of points that make up the convex hull of the figure. In this case, the value of the angle α increases in each subsequent case. The values of the angle α for each case are calculated on the basis of Theorem 1.

For sufficiently large values of ε , the parameters of the described figure can be neglected, the convex hull for cases of dimension $n = 2$ will be constructed by 13 points. For cases of dimension $n = 3$, the convex hull is 117 points. For ellipsoids with any parameter equal (in these cases 10) there will be the same cases, since the maximum is taken from the axes.

Next, the dependence of the number N of points whose convex hull is a set \bar{F} is constructed on the accuracy ε . The general scheme of construction is as follows: the values of accuracy ε are set on the grid and for each ε_i the set \bar{F} is constructed and the number of points necessary for construction is calculated.

Two different scenarios are considered: small values of accuracy $\varepsilon = 10^{-8}, \dots, 10^{-1}$ and large values of $\varepsilon = 1, \dots, 100$, and for each of them are cases of dimension $n = 2$ and $n = 3$. For small values of accuracy, it is expected that the dependence of the number of points on accuracy corresponds to the law

$$N(\varepsilon) \approx \left[O \left(\frac{1}{\varepsilon^{n-1}} \right) \right].$$

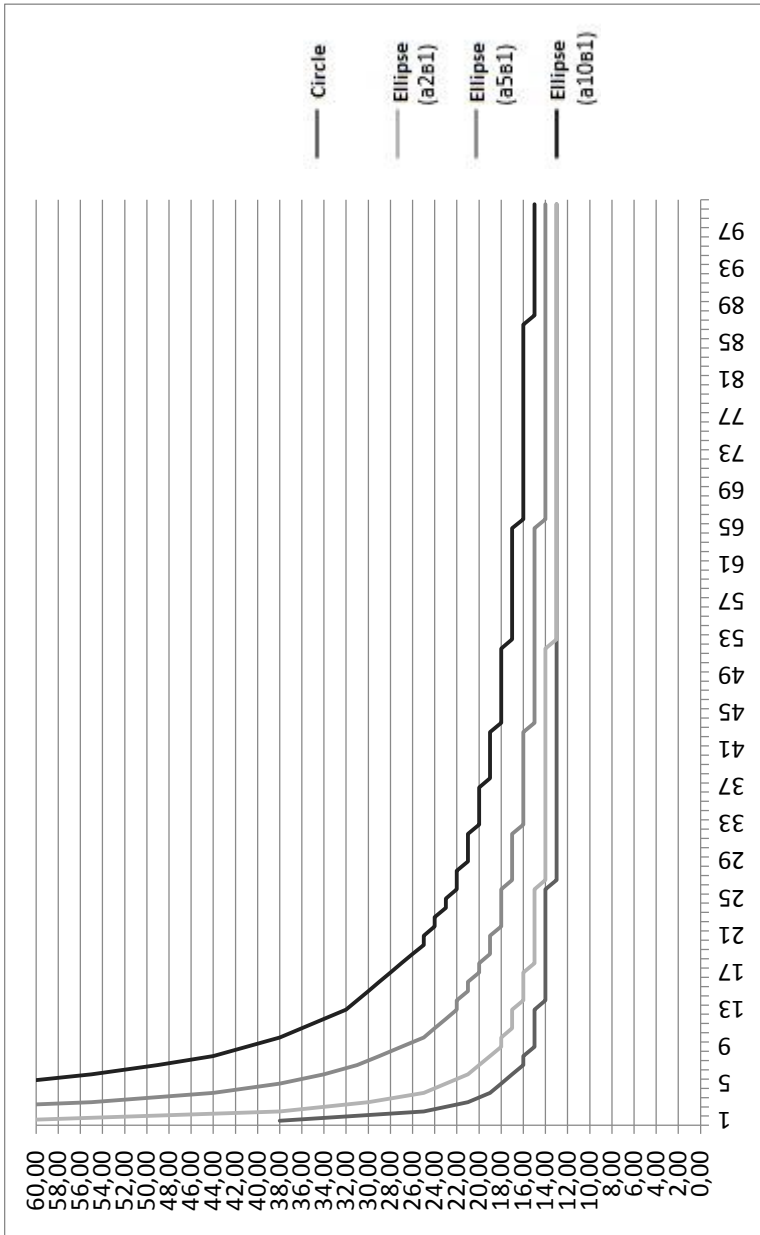


Fig. 1. The numerical dependence of points of a convex hull on the accuracy ε for 2-dimensional set

For relatively large values of $\varepsilon = 1, \dots, 100$, the number of points N changes less intensively with increasing ε . You can notice a significant decrease in N with values of ε within $[1,10]$ (for a circle) and $[1,20]$. At the same time, the values of ε located on the horizontal axis on the right correspond to a much smaller slope of the curves. The change in N occurs in a “stepwise” manner for sufficiently large ε due to the fact that in the formula for calculating N , integer parts of numbers are taken.

The parameters of the figure significantly affect the number of points N with relatively small $\varepsilon \in [1,20]$ and have a weak effect on N with another ε . Moreover, the lower curves reach the horizontal asymptote $N(\varepsilon) = 13$. Experiments show that in reality $N(\varepsilon)$ reaches the value 13 for all four curves. This fact can be interpreted as follows: for very large ε , regardless of the stretching of the ellipse along one of the axes, the boundary of the reconstructed convex set is close (geometrically) to a regular polygon (in this case, a 13-gon).

With the dimension of the space $n = 3$ for $\varepsilon = 1, \dots, 100$, the curves have the same qualitative characteristics: a “sharp” descent with $\varepsilon \in [1,25]$ and a less intensive change, with another ε , a stepped form of the curves, the achievement of asymptote $N(\varepsilon) = 91$.

For small values of accuracy, $\varepsilon = 10^{-8}, \dots, 10^{-1}$:

For convenience, the graph shows the curves of $N(\varepsilon)$ simultaneously for $n = 2$ and $n = 3$ (in logarithmic scales along both axes).

The dependence of the number N of points on the accuracy ε is very well described by the law $N(\varepsilon) \approx \left[O \left(\frac{1}{\varepsilon^{n-1}} \right) \right]$, which corresponds to expectations.

In another words, for $n = 2$, as the value of ε decreases by a factor of 10 times, the minimum number of N points needed to reconstruct a convex set increases by approximately 10 times. For $n = 3$, as ε decreases 10 times, the value of $N(\varepsilon)$ increases by about 100 times.

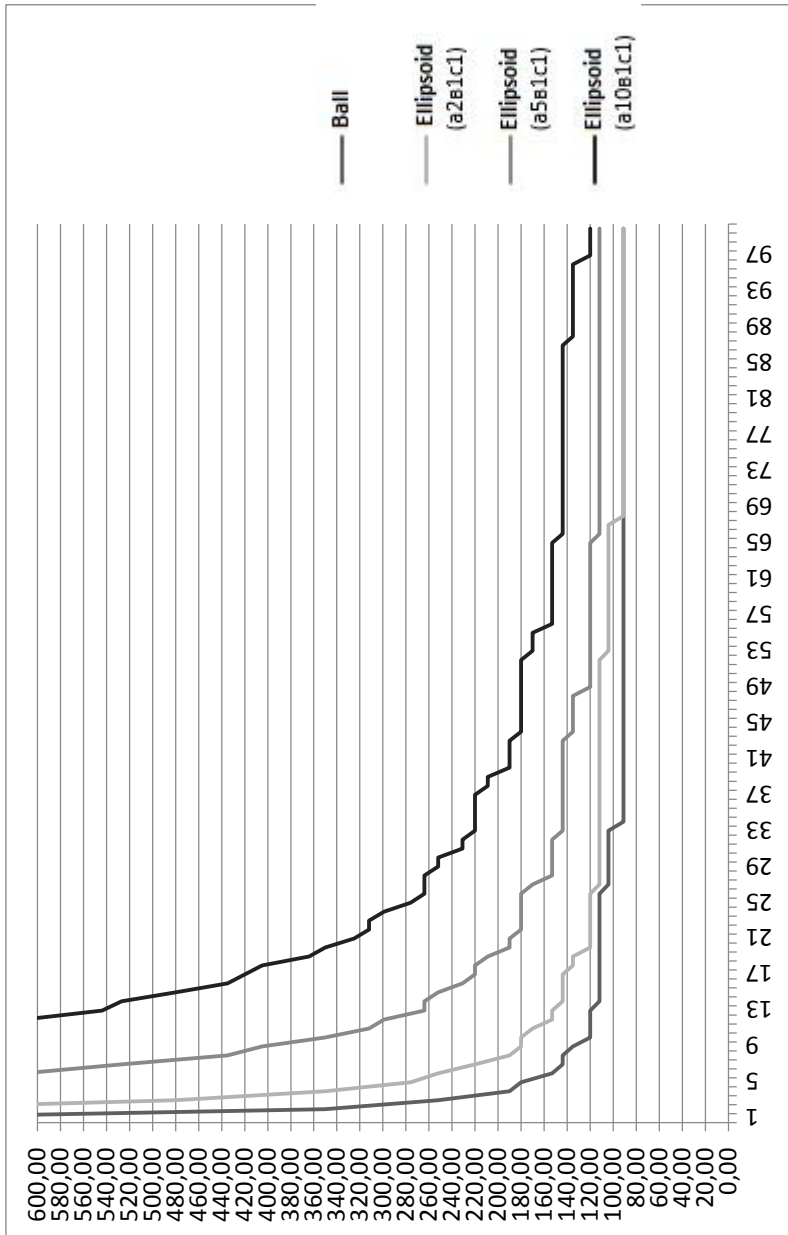


Fig. 2. The numerical dependence of points of a convex hull on the accuracy ϵ for 2-dimensional set

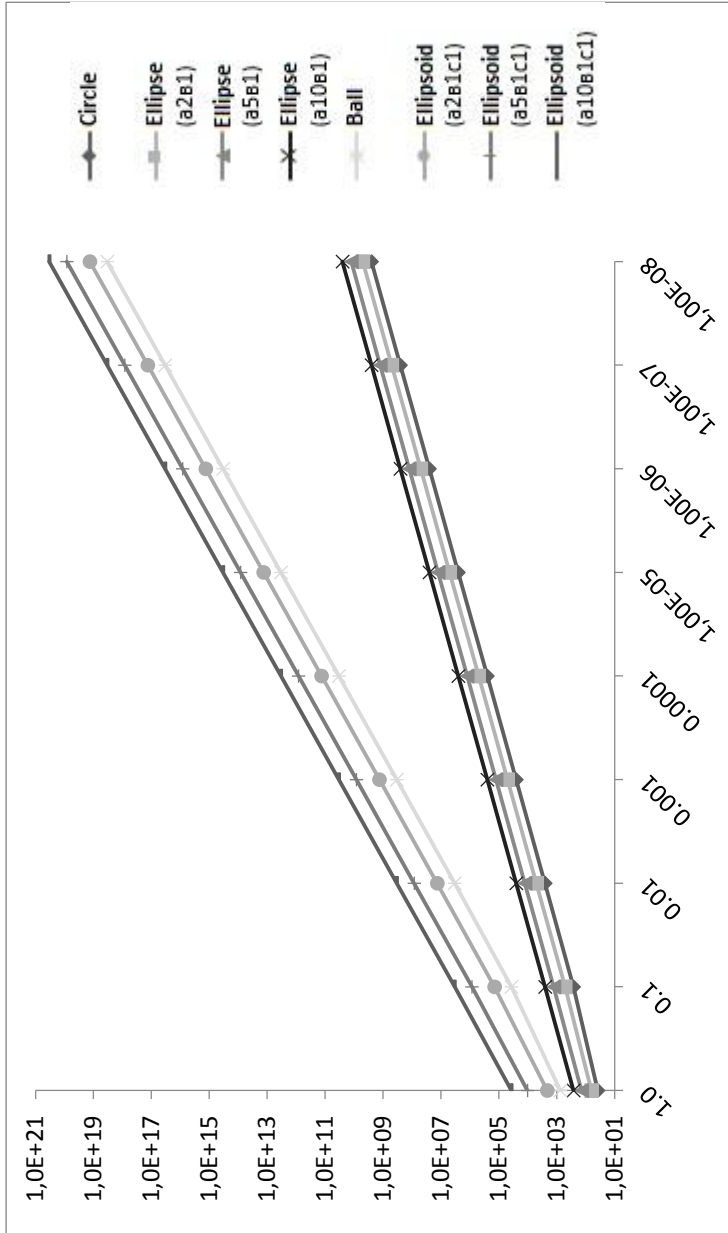


Fig. 3. The numerical dependence of points of a convex hull on a sufficiently small accuracy ϵ

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