



# **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**

**Proceedings of the  
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# 上合组织国家的科学研究：协同和一体化 国际会议

## 参与者的英文报告

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这些会议文集结合了会议的材料 – 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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二十一世纪至二十一世纪初, 全球化在婚姻和家庭关系中对人类轴突的影响  
**THE IMPACT OF GLOBALIZATION ON THE HUMAN AXIOSPHERE  
IN THE CONTEXT OF MARRIAGE AND FAMILY RELATIONS AT  
THE TURN OF THE XX-XXI CENTURIES**

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抽象的。 本文探讨了在二十一世纪至二十一世纪初, 在婚姻和家庭关系的背景下全球化对人类轴突领域的影响的实质。 揭示了西方文化对传统的家庭制度态度的影响特征。 在撰写本文的过程中分析了它们的主要特征和原因之后, 作者提出了解决它们的方法并得出了适当的结论。

关键词: 全球化, 家庭, 价值观, 传统, 个性, 社会规范, 婚姻和家庭关系。

**Abstract.** *This article examines the essence of the impact of globalization on the human axiosphere in the context of marriage and family relations at the turn of the XX-XXI centuries. The features of the influence of Western culture on the traditional attitude to the institution of the family are revealed. Having analyzed their main features and causes during the writing of this article, the author proposed ways to solve them and made the appropriate conclusions.*

**Keywords:** *globalization, family, values, traditions, personality, social norms, marriage and family relations.*

The driving wave of globalization in the context of modern reality is the most influential process in the entire world history. And in its rapid development, globalization significantly affects not only the spiritual, moral and value-oriented aspects of various cultures, but also forms false ideas and beliefs among the younger generation about the moral, ethical and social norms of modern society through the imposition of Western sociocultural traditions.

In the last quarter of a century, the problem of national and cultural unity, the cultivation of consumer values and the promotion of hedonistic attitudes have become more and more urgent. N.V. Sidorova rightly notes «... the structure of society before the era of the industrial revolution was static and simple; established value systems have existed for a long time. In subsequent years, with the



development of the scientific and technological revolution, a dynamic change in modern society takes place, accelerating the process of the formation of new values» [1]. In this regard, globalization, as a mechanism for transforming political, economic, religious and other processes aimed at creating a single field for cultural interaction, chooses a completely different strategy, the purpose of which is not only the recognition of Western ideology by mankind, but also the displacement and depersonalization of all other cultures.

In our dynamically developing world, value and worldview guidelines should be preserved and consolidated, accumulating deep concepts of the human axiosphere, overcoming his internal barriers and contradictions, forming the integrity and maturity of the individual, ensuring self-realization in priority areas, preserving cultural traditions and experience of previous generations, creating a family and survival as a species. As you know, the family influences the formation of the worldview and can determine the general direction of the evolution of the axiosphere of both humans and macro social systems. In the modern world and in capitalist society, women and men, in an attempt to arrange their personal lives, follow the path of least resistance, often ignoring traditional family values, such as: love, mutual understanding, respect, kindness and reverence for parents. Attempts are being made on both sides to achieve material wealth through an official marriage. In this situation, the likelihood of preserving and passing on to the next generation of national customs and traditions, cultivation and education of values, transfer of experience and models of behavior is significantly reduced. In this sense, we can agree with V.S. Kutkin, who believes that «... on a global scale, the institution of marriage over the past decades is gradually changing towards its liberalization, which, in turn, together with an increase in the standard of living and well-being, especially in economically developed countries of the West, the excess of the mercantile on the truly spiritual and etc., causes a decrease in the birth rate, the fragility of marriage bonds, and as a result - an increase in the number of official divorces of legal marriage» [2]. And this tendency arises in modern society due to the low level of culture, lost traditions, outdated intellectual and academic educational programs, the promotion of various types of content in social networks and contact communities, containing, among other things, hedonistic attitudes towards the traditional institution of the family. And what is the core of any culture that characterizes its fundamental origin? An important idea is expressed in this regard by V.K. Egorov: «The fundamental foundations of culture, its phenomena and universals, first of all, are precisely the values and traditions tested by the historical experience of the people» [3]... Therefore, we believe that with the imposition of Western culture through various information sources, ethical and moral qualities are lost, which create an integral and socio-psychological essence of the personality of subsequent generations.

The rapidly growing pace of globalization in recent years has embraced all priority spheres of society. In the modern world, it becomes possible thanks to scientific and technical solutions. The active introduction of digital technologies into the information and educational space makes it possible to create unified communication platforms for obtaining practically any knowledge and exchange of experience. To do this, it is enough to have any device with Internet access available. Such advances in the scientific and technological revolution can have very different consequences for different social groups and communities. A person is increasingly becoming dependent on a computer in various areas of his life and there is a possibility of manifestations in the conditions of his everyday life of social escapism and loss of his identity. And the dynamics of the development of this dependence continues to gain momentum. Considering the scientific and technical problem of globalization I.V. Borisov notes: «The self-destruction of the personality did not only diminish, it intensified even more: technical omnipotence and spiritual impotence, comprehension of the physiological foundations of control over the process of birth, aging of physical life and the lack of disclosure of the problem of meaning, blurred criteria and the lack of a developed practice of harmonious life» [4]. And in this sense, the ideology of Western culture through various information sources positively reinforces such key existential of human existence as love, family, career, creativity, loneliness, etc. The current situation with the pandemic also strengthens the fertile ground for increasing the influence of globalization on the family axiosphere. For a long time, most citizens were forced to be in quarantine and self-isolation, and some forms of cultural and social interaction were temporarily prohibited. Finding themselves in unusual conditions of life and having an abundance of free time, people from different countries were "attacked" by low-quality content of Western culture from a variety of media, forcibly influencing the value orientations of cultures and traditions of different peoples. In this regard, O.Y. Nesterova rightly notes: «Today the mass media is in the first place a tool of manipulation of society, its values» [5]. Thus, overcoming the current crisis situation in traditional family relations can jeopardize the distribution of areas of responsibility between spouses; pay more attention to their own interests due to the propaganda of Western idealists of a beautiful and free life. And if we talk about young people who have recently entered into a marriage union, for whom the desire for material wealth and an instant solution to socio-economic problems through marriage, as well as building a career and achieving a high social status, are in the foreground, and then this situation is much more difficult. Hence the need arises for alternative forms of marriage and family unions. And in this case, underage children are under attack.

Spiritual and moral values originate in the family. Compassion, respect, decency, humane treatment of people, and other ethical and moral norms of society

must be instilled from early childhood. To bring up a spiritual and moral personality in your family is the main task of parents. The values that exist in every family can be considered traditions. If, for any reason, they lose their significance, this leads to a crisis in the value system of the entire society as a whole. Using traditions as an example, children need to be shown how to create and constantly maintain an atmosphere of cultural, psychological and spiritual unity in the family, in which the child's desire to grow up as a responsible citizen of his country would be formed and consolidated. A family for a child is the main source of correct upbringing. He will enjoy in his adult and independent life what he was taught as a child. No other educational institution can compare with the family. It lays the foundations of the personality, and when the time comes to send the child to school, he is already more than half formed as a person. The main and important task of parents is to live one life with the child. And it should be filled with good content. In the process of growing up, a child should be aware of himself as a full member of society, consciously create a family and leave his biological footprint. And becoming a parent, continue to carry out the main task for society - to educate a spiritual and moral personality. As Z.G. Ishembitova: «For the all-round development of a child, it is necessary to create such conditions in the family in which his physiological, emotional, intellectual and moral needs will be satisfied sufficiently and at the required quality level. The result of such upbringing is the child's health, happiness and well-being» [6]. And the moral health and prosperity of our future society depends on how smart, decent, energetic, kind and decent our children grow up.

Globalization is rapidly taking over all social strata of society, transforming the generally accepted way of life, beliefs, value-motivational structure, and community of people. The preservation of the traditional family structure is the most important task of any modern state. The researcher of this problem G.A. Gizatul-lina believes that «... today the same attack on society is leading the global process of integration of all mankind, there is a global unification of mankind, the transformation of the human mass into something homogeneous and typical. This process can be resisted by ethno-national culture, which is concentrated in a family, a normal traditional family» [7]. And we believe that in this matter, support at the state level is important in order to ensure socially significant goals and benchmarks. It will help solve a number of economic problems, preserve and strengthen the traditional institution of the family, cultivate spiritual, moral and moral and ethical forms of interaction in society and preserve the identity of the citizens of their country.

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日俄邻里协会的比较分析

**THE COMPARATIVE ANALYSIS OF NEIGHBORHOOD  
ASSOCIATIONS IN JAPAN AND RUSSIA**

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抽象的。传统形式的国际互动正在失去效力。各国需要在它们之间找到新的共同点。邻里协会可以纠正这种情况。不论国家隶属关系如何，邻里协会都包含其原始特征：单一领土，自治，集体民主原则，国内目标。社区协会之间的经验交流可以帮助发展国家之间的关系。本文的目的是通过比较分析来发现日本和俄罗斯的邻里协会之间的相似性。

关键字：邻里协会，chounaikai，jichikai，领土公共自治，领有牌照的领土协会，地方自治，市政当局，州。

**Abstract.** *Traditional forms of international interaction are losing their effectiveness. Countries need to find a new common ground between them. Neighborhood associations can correct the situation. A neighborhood association includes the original characteristics regardless of state affiliation: a single territory, a self-governance, principles of collective democracy, domestic goals. The exchange of experiences between neighborhood associations can help to develop relations between countries. The purpose of the article is to find the similarity between neighborhood associations in Japan and Russia by using a comparative analysis.*

**Keywords:** *neighborhood association, chounaikai, jichikai, territorial public self-government, licensed territorial association, local self-government, municipality, state.*

Russia and Japan are neighboring countries, each of them has a unique history and an original culture. Their features have a reflection in any aspects of life.

For example, Japanese municipalities are comfortable for living, their neighborhoods are attractive because of cleanliness and safety. A neighborhood association (NHA) has a direct impact on this result. The exchange of practices of interaction between citizens and local self-government is a way to develop a good-neighborly relation between countries.

Japan, being an eastern state, has a characteristic as collectivism. For this reason, researchers have a great interest in all kinds of associations, one of which is an NHA. Understanding of the implementation practice may become an aid for neighborhood associations in Russia. Relevant characteristics of these social institutions can be identified by a comparative analysis of laws and implementation practices in both countries. It can help to develop relations between countries at the level of neighborhood associations by means of citizen diplomacy.

A modern state is a complex and multi-level management system, where community can be considered as a constituent unit. The "free community" theory dictates that local communities are autonomous and not created by a state, they have natural rights to manage their own domestic affairs [2]. Any state can also be considered as an alliance of local communities which decided to submit some of their freedoms to the authority in exchange for maintenance of the social order. A neighborhood association is a modern form of the local community.

Because of the increasing complexity of bureaucratic system, local communities have lost some of their functions by limiting the self-realization as part of a municipality. Local self-government is a political phenomenon that is based on the interaction and confrontation between local communities and state authorities. The distribution of power is an integral part of political management, aimed at an efficient use of resources by the authorities for the good of citizens. States recognize the right of neighborhood associations to manage a territory. For example, European Union realize such principles by "The European Charter of Local Self-Government".

There is the practical experience, gained in implementing a neighborhood association in Japan. The definitions used to refer this form of cooperation are chounaikai and jichikai. Both are synonymous and they are most used to refer a neighborhood association in Japan. Chounaikai and jichikai are a voluntary form of self-organization, intended for the solution of community's problems. There are over 290,000 NHAs throughout the country [5]. They can occupy the territory of an entire settlement or a couple of houses. Historically, the constituent units of the Japanese community are households. It varies from 100 to 300 households [5]. Based on the United Nations report on household size in Japan (2.4 people) [6], one neighborhood association has from 240 to 720 people.

The legal basis for a neighborhood association in Japan is the article 21 of the Constitution of Japan, which guarantees the freedom of assembly and the freedom

of association throughout the country. Based on the article 16 of the constitution, people have the right to make a peaceful petition for all matters of interest to them. Because of that, they can affect the municipal authority. Any neighborhood association in Japan has the right to be established as legal entity. Before 1991, any establishing had the form of a non-profit organization, but after the amendment to the "Local Autonomy Law", neighborhood associations acquire the status of a licensed territorial association (Ninka Chien Dantai) [4].

A licensed territorial association (LTA) is a neighborhood association that is established by the mayor. An LTA has a legal personality. The mayor's recognition can be obtained by following certain requirements, located in the "Local Autonomy Law". An LTA has to submit a bylaws, which includes the following provisions: the name of the association, the purpose of the association, the occupied territory, the location of the office or a meeting place, representatives and the internal structure, matters concerning community property. In accordance with the article 260-2 of the "Local Autonomy Law", the association's bylaws shall be reviewed. Once approved by the head of the municipality, the neighborhood association acquires the status of an LTO. The legal entity is obliged to follow the requirements imposed on them by the "Local Autonomy Law". An LTO is obliged to provide membership to all residents who live in the area indicated in bylaws and who are ready to take an active part in the life of the association. Also, a formal registered neighborhood association cannot be used by any political party.

There is the institutionalized form of a neighborhood association in Russia. It is a territorial public self-government (TPSG). Residents have the right to take the initiative to organize themselves. Such self-organized party can solve local issues within their own living space. According to the "National Territorial Public Self-government Association", there are more than 30 thousand self-organized NHAs in the Russian Federation [2]. TPSGs have the same number of members as any local community. It varies from 100 to 2,000 people [2]. The legal basis for a neighborhood association is the Constitution of the Russian Federation and the Federal Law №131 "About the General Principles of the Organization of Local Self-Government in the Russian Federation". According to the paragraph 3 of article 27 of the Federal Law №131, a TPSG is self-organized association for independent implementation of their own initiatives on issues of local importance within the territory of settlements. Territorial public self-government may be implemented within the following territories: the part of an apartment building, an apartment building, a group of apartment buildings, a residential neighborhood, a rural settlement, other territories of residence [3].

A neighborhood association acquires the status of a TPSG from the moment of registration of its bylaws by the authorized body of a local self-government. The procedure for registering a bylaws is laid down by the municipal law of a

locality. The content of a bylaws should include the following information: the occupied territory, the purpose and objectives of the association, the form of participation in the local self-government, main activities, the structure of TPSG bodies, the decision-making procedure, issues related to community property. Having received the approval of the head of the municipality, the neighborhood association acquires the formal status as a participant of municipal legal relations. Also, residents can initiate a registration of the legal entity in the form of a non-profit organization.

The comparative analysis has included several aspects of the above-mentioned social institutions: the principle of self-organization; the principle of territorial unity. However, there are an additional characteristic of the neighborhood association, which was not mentioned. It is the principle of collegiality in decision-making.

Japanese associations are characterized by collegial bodies. Their structure and internal organization can be observed by an analysis of the legislative framework. A neighborhood association with an LTO status is obliged to have an official chairman in accordance with the provisions of article 260-5 of the "Local Autonomy Law". In addition, one or more auditors are voluntarily appointed, according to the article 260-11 of the same law. Additionally, there are positions such as a vice-chairman, a general secretary, an accountant; together they are referred to as "officials". All issues may be solved by the general meeting, except those delegated to representatives and other officials.

Representatives of a licensed territorial association must hold a regular general membership meeting at least once a year. Before calling a general meeting, the representative must give five days' notice to the association's members before the meeting. The notice must include all matters on which decisions will be made. The chairman will call a special meeting if one-fifth or more of members apply with a corresponding request. The "Local Autonomy Law" states that decisions are made by voting, where each member has an equal vote. Members who are not present at the general meeting may participate in a written form by proxy. The law states that each member has the equal right to take part in solving issues of the neighborhood association.

Russian associations are also characterized by having collegial bodies, the presence of which can be observed by an analysis of the Federal Law №131 "About the General Principles of the Organization of Local Self-Government in the Russian Federation". Collective decisions can be made by a meeting of citizens or a conference (a meeting of delegates). They form collegial bodies and determine the activity of the neighborhood association. Collegial bodies of a territorial public self-government are engaged in representing the interests of the residents. Their economic activity aims to meet all the needs of members.



In conclusion, there is the similarity of neighborhood associations in Japan and Russia. Their activities take place at a certain territory of a municipality, based on the principle of self-organization and territorial unity. In both countries they have a formal status and are recognized by national authorities as part of a local self-government. Both forms of neighborhood association are characterized by the fact that members are all residents living in the territory, which is delimited according with the bylaws. The similarity of the characteristics of these social formations allows us to consider that neighborhood associations can be promising participants of international relations at the level of citizen diplomacy. The unity of purpose and objectives is the basis for the possible exchange of experience in the practice of direct democracy between countries.

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经济全球化对国际体系转型的影响

## THE IMPACT OF ECONOMIC GLOBALIZATION ON THE TRANSFORMATION OF THE INTERNATIONAL SYSTEM

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抽象的。 本文探讨了在正在进行的经济全球化进程的影响下国际体系转型的可能变化。 作者得出的结论是，金融全球化对国际体系的结构及其组成部分的性质均具有严重影响。

关键词：国际体系，金融全球化，转型，资本流动，主权，金融环境。

**Abstract.** *The article examines possible variations in the transformation of the international system under the influence of the ongoing processes of economic globalization. The author comes to the conclusion that financial globalization has a serious impact on the international system, both on its structure and on the properties of its constituent parts.*

**Keywords:** *international system, financial globalization, transformation, capital movements, sovereignty, financial environment.*

An international system is a collection of political units or parts that interact with each other to the extent that they can be considered a single whole. The international system includes two elements: the actual set of parts and the mutual relations that form a certain structure [1]. For the international system, the parts are still States, despite the fact that they have lost their influence against the background of the activation of various non-state actors. It is worth noting that States have never been the only international actors, but they have occupied and continue to occupy a special, leading position. And since the system is determined not by all the actors that succeed in its framework, but only by the main ones, then only states remain parts of the international system in the strict, formal sense. The parts of the international system that differ in size, shape, and wealth are the same in terms of the functions performed. States solve or try to solve problems common to all of them. The same can be said about the goals they strive for. A single State largely duplicates the activities of other States. Each of them has bodies

responsible for the development and implementation of laws, for filling the treasury, for national defense. Each state provides its citizens with various benefits, relying on the resources available to it. Being functionally the same, the parts of the international system are seriously different in their capabilities. This is where the difference between the international political system and the national political system lies. In the last part, they perform different functions, having generally the same capabilities. In the international system, some parts have significantly greater capabilities than others, which puts them in a special position associated with a greater potential for influence. The distribution of opportunities among the parts of the international system determines the structure of this system itself.

The structure of the system, being its second key feature, is a pattern of interaction of parts, expressed in the mutual positioning or arrangement of parts relative to each other. Individual units can approach each other, forming various alliances, or move away from each other, forming opposing blocks. At the same time, individual parts can fall under the influence of others or, on the contrary, gain influence over others, thereby forming some international hierarchies. It follows that the structure can imply both horizontal and vertical interactions of parts of the system. The structure is formed by the joint actions of the parts of the system that care about their own interests. Its appearance is explained by the fact of the coexistence of parts. Although it affects the behavior of all parts of the system without exception, none of them is involved in its development, establishment and preservation. In other words, it is produced spontaneously, being an unintended consequence of the interaction of international actors. Structure is the arrangement, the order of the parts of the system, and how these parts are compared and combined will determine the functioning and characteristics of the entire system. Different structures will produce different results, even if the list of interacting parts does not undergo any changes.

The international system does not function in a vacuum, but is placed in a certain environment that constantly influences it. This environment is complex, including many components: the economic segment, the technological segment, the environmental segment, the social segment, the regulatory segment, and so on. Thus, the invention of nuclear weapons, which is a technology of mass destruction, has had an impact on the international system, destroying, in the opinion of many, its fundamental principles. Even at the dawn of the nuclear revolution, many well-known scientists, including the founders of the theory of international relations, such as G. Morgenthau, J. Hertz and K. Boulding [2], believed that nuclear weapons deprive states of the ability to defend themselves by their own means, making them rudimentary elements in terms of the security function. Later, nuclear weapons forced a revision of the concept of a monopoly on violence, acting for states, according to D. Dodni, in the same role as gunpowder once played

for feudal possessions [3].

However, most of the discourse devoted to the transformation of the international system under the influence of the environment is occupied by the processes of economic globalization, which undermine the state's ability to control cross-border exchanges and perform traditional functions in the field of security and well-being. J. Agnew compares the state to a large «territorial container» [4], which has now leaked. According to S. Strange, «the impersonal forces of world markets, integrated not by joint decisions of governments, but by private initiatives in the areas of finance, production and trade, are now more influential than the states that are supposed to have supreme political power over society and the economy. ... If earlier the states were the masters of the markets, now the markets have become the masters of the states» [5]. According to R. Gilpin, «in a highly integrated global economy, the state, according to some estimates, is losing its position, becoming an anachronism» [6]. S. Sassen later noted that the processes taking place today in the global economy denationalize everything that was once created as exclusively national [7].

Financial globalization, which involves the removal of all obstacles and barriers to the cross-border movement of capital, has had and continues to have a special impact on the international system. The global economic crisis of 1929-1939, accompanied by the rejection of liberal principles in the field of finance, led to the fact that parts of the international system dramatically increased control over the movement of capital across their territorial borders. Previously, such control was practiced, but on a much smaller scale and only for a relatively short time. France, Germany, and even the main defenders of the liberal financial order, Britain and the United States, have taken various measures to control the movement of capital. However, until 1931, these measures were imposed for a limited time in order to achieve certain political goals (for example, to close access to financial markets to hostile states). After the crisis, they have become an integral and permanent attribute of economic policy, set at the service of higher, national goals.

The first states to resort to large-scale capital controls were Japan and Germany, which were the first to reject liberal practices. Initially, the measures were developed for purely practical purposes, which were to maintain the balance of payments in the context of the global crisis. However, these two States soon adopted capital controls as an integral and permanent component of their economic policies. [8]

The countries of the so-called «golden bloc», first of all France, Belgium, the Netherlands and Switzerland, being under the stronger influence of liberal ideas, significantly longer refused any serious restrictions on the balance of payments. In the early 1930s, their financial markets remained relatively free, as their governments took only minor steps in the area of capital controls. Only the monetary

crisis that occurred in the second half of the 1930s forced them to reconsider their economic policy [8].

In the United States, the economic crisis caused a marked reconfiguration of the political landscape, culminating in the election of President F.D. Roosevelt in 1932. The new administration, backed by an alliance of farmers, workers, and individual business leaders, blamed the economic chaos on New York's financial community and made a series of efforts to put monetary policy under tighter government control. The reforms were intended not only to moderate competition and limit the power of bankers, but also to increase the political responsibility of the Federal Reserve System (Fed) [9].

Important political changes also occurred in Britain, which was forced by the crisis to abolish the gold standard, but despite the political changes that were taking place, Britain remained true to basic liberal principles until the Second World War. The war forced not only to introduce currency control, but also to attract a number of economic scientists to the Ministry of Finance, who advocate the need for an interventionist economic policy [8].

At the moment, the scientific community has developed several approaches to explaining the reasons for the revival of financial globalization in the 1970s. Some authors believe that financial globalization is a consequence of technological changes that break down the barriers that separate some financial markets from others [10]. The information and communication revolution has made it more difficult for Governments to control incoming and outgoing financial flows. The reduction in the time and cost of international communications, as well as the emergence and development of the inherently limitless Internet, have reduced the effectiveness of any capital controls, undermining the very foundations of Keynesian economic policy. Today, agents who are interested in non-legal financial transactions have many channels and offshore jurisdictions that allow them to circumvent almost any prohibitions [11]. From the point of view of technological determinism, the current globalization differs from the one that took place in the world before 1914. At that time, more time-consuming communications, as well as the general lack of development of financial markets and related services, even in advanced countries, allowed governments to exercise some control over the movement of capital. Thus, Germany and Sweden, which were not as strongly committed to the principles of the free market as Britain, were quite simply able to control the movement of capital [12]. Today, it is much more difficult to control financial flows, as globalization has taken a different form.

Whatever the reasons for its revival, financial globalization has a serious impact on the international system, both on its structure and on the properties of its components. As financial interdependence increases, parts of the international system receive additional incentives to group into different formal and informal

currency zones, which increase the stability of their currencies, which are subject to market fluctuations. States that have entered the currency area strengthen confidence in their currency, while gaining access to a joint reserve that allows them to finance emerging balance of payments deficits on a much larger scale. An example of a modern currency zone that promotes the stability of monetary relations of its members is the African franc zone. In turn, currency zones influence the political behavior of their constituent parts of the international system.

At the same time, financial globalization changes the very properties of parts of the international system, primarily eroding their sovereignty, and each of them weakens in a financially integrated world.

This manifests itself in the following.

First, globalization increases the likelihood of internal conflicts and civil war. It breaks the economic ties that have developed within a single state, weakening the dependence of different regions and social groups on each other. With the change of sources of income, which are now located not inside the country, but outside it, the potential costs of the conflict decrease and, consequently, the probability of its beginning, continuation or aggravation increases [13].

Secondly, financial globalization affects the universalization of monetary relations, thereby turning any attempts to gain monetary independence made by any part of the international system into a serious threat to other parts that are interested in maintaining interdependence and are ready to fully intervene for this purpose. Such attempts deprive the states that issue the world's fiat currencies of a powerful tool of political influence, causing an extremely negative reaction on their part that ignores sovereign rights.

Third, financial globalization favours the survival of the so-called unrecognized States. Despite the challenge they pose to the principles of territorial integrity, the unrecognized States do not attempt to undermine the established system of sovereign States or create any alternative forms of statehood. They simply seek a place in a system that does not accept them as eligible members.

Fourth, financial globalization encourages technological innovations to reduce the costs of communication and physical movement. Today, States cannot fully control the cross-border movement of capital, losing the ability to perform the full range of their traditional financial functions, in particular, to conduct an effective monetary policy. These processes affect the sphere of control, but not the authorities, since States are not deprived of the right to manage their borders, despite the fact that globalization seriously weakens this ability.

In a financially integrated world, it is the financial environment that is becoming one of the most important factors generating transformational impulses for the international system. Financial globalization is changing the structure of the international system, setting different criteria for grouping the parts of the inter-

national system that form new political alliances and hierarchies. It also changes the properties of individual parts of the international system, primarily weakening all types of their sovereignty – internal, external, status and functional. Moreover, with the intensification of financial globalization, it affects not only the structure of the international environment and the main properties of its individual parts, but also the relationships between such parts. In such circumstances, various financial means of interaction, through which some parts of the international system try to influence other parts in their political interests, become particularly important.

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专业可靠性储备结构中工程思维的决定因素  
**DETERMINANTS OF ENGINEERING THINKING IN THE  
STRUCTURE OF THE PROFESSIONAL RELIABILITY RESERV**

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科学对现代工程活动细节的兴趣，其心理特征是由于工程工作成果的重要性。他们对社会生活几乎所有领域的积极介绍，决定了其在该领域的专业活动中的特殊地位和地位。劳动力市场对工程人员的需求，年轻人对许多工程领域（信息技术，纳米技术，生物技术）的兴趣日益增长，证实了这一趋势。在历史发展过程中，工程活动根据社会的要求变得越来越复杂，其成功实施需要高水平的专业知识，具有创造性的思维技术取向。在这种情况下，能够颠覆原始的，出乎意料的想法，以及工程师能够以高质量和安全的水平对解决方案进行技术实施的能力，是其工作效率和可靠性的重要标准。从这个意义上讲，在专业培训阶段跟踪工程思维发展的一般模式可以使您反映其功能，同时考虑概要（专业化）并为将来的工程师改进培训计划。

关键字：工程师，工程活动，工程创造力，创造力，可靠性，专业思维，专业图表

**Abstract.** *Scientific interest in the specifics of modern engineering activity, its psychological characteristics is due to the significance of the results of engineering work. Their active introduction into almost all spheres of society's life determines its special status and position among other types of professional activities. This trend is confirmed by the demand for engineering personnel in the labor market, the growing interest of young people in a number of engineering areas (information technology, nanotechnology, biotechnology). Over the course of historical development, engineering activity has become more complicated in accordance with the demands of society, and its successful implementation required a high level of specialized knowledge, a technical orientation of thinking with a creative component. In this situation, the ability to invert original, unexpected ideas, as well as the possibility of technical implementation of the solution conceived by the engineer at a high-quality and safe level are important criteria for the efficiency and reliability of his work. In this sense, tracking the general patterns of the development of engineering thinking at the stage of professional training allows you*



*to reflect its features, taking into account the profile (specialization) and improve the training programs for future engineers.*

**Keywords:** *engineer, engineering activity, engineering creativity, creativity, reliability, professional thinking, professiogram.*

Today the profession of an engineer plays one of the main roles in the life of society. Technical inventions created by modern engineers constantly satisfy social needs, become tools for solving global problems, as well as issues related to national security (military engineering). The availability of modern technologies and their implementation in various spheres of human activity and various labor sectors make a number of engineering areas especially valuable (operation, maintenance). These types are most often found in the labor activity of an engineer and testify to the close connection of his labor with technology, technical systems.

The variability of engineering professions is determined by the intensive development of the scientific and technological process and, as a result, the demand of the labor market for engineering personnel of new specializations, as well as the almost continuous adaptation of professions to these conditions within the already existing types of labor activity. An example is the presence of a wide profile of engineering specialties related to computer technology (IT engineer, architect of living systems, development engineer, 3D printing engineer). This pattern can be traced in the classical versions of engineering work, which is partly dictated by the introduction of technical innovations and computerization of all industrial sectors. One of the objective reasons for this is the intensive transformation of the very sphere of engineering work, which is expressed in the almost continuous updating of the current list of specialties. At the same time, one of the leading trends is the integration in a specific type of professional activity of psychological content, previously presented in separate, independent types of activity [6].

The features of the work of an engineer are most fully reflected in the following definition: "An engineer is a specialist with a higher technical education, who uses scientific knowledge to solve technical problems, manage the process of creating technical systems, design, organize production, and introduce scientific and technical innovations into it" [4]. The concept indicates that in a number of leading professional competencies of an engineer, a special position is occupied by the ability to create, design, organize, and the ability to rely on scientific knowledge. Taken together, all of the above competencies can be combined with the word "create", that is, an engineer is a "creator of technology" Creativity in the activities of an engineer manifests itself from the moment of a conscious choice of his goal for the technical needs of the production cycle and society as a whole. The entire multi-stage process (from the need to solve a problem to the creation of an innovative technical model for industrial production) is called engineering creativity and

is distinguished by a special internal organization.

However, not all products of the professional activity of an engineer, as exemplified by a specific type of engineering profession, are directly a technical object, even if there is a direct relationship to technology and its systems (design engineer: the result of labor is a graphic 3D model, drawing). This category includes engineering specialties related to programming, biosystems (biotechnology), nanoengineering, environmental engineer. Obviously, the ways to achieve high performance results in each specific case depend on a specific set of psychological characteristics of a professional, where thinking takes one of the first places.

The following are the leading features of engineering activities that leave an imprint on the psychological portrait of a new generation engineer, as well as affect the manifestation of a specific mentality:

1) the versatility of an engineer, which consists in the need to perform professional duties that go beyond the general awareness of technology and technical processes (management, planning, management, etc.) [8];

2) the need for an integrated application of classical forms of engineering activity to obtain optimal labor results (design and invention);

3) attention to the issues of professional training at all stages of professionalization as an important condition for leveling or reducing the risks of reproduction of erroneous actions [1];

4) the formation of an optimal set of psychological criteria for the reliability of an engineer's labor, including individual psychophysiological, psychological indicators;

5) the requirement of the ability to quickly apply a complex of technological, natural science, social and humanitarian knowledge to solve engineering projects, in which the speed of inclusion in the process of solving problems is ensured by individual psychological characteristics.

On the example of the production environment, the division of labor of an engineer occurs on a functional basis (production engineers, research engineers, systems engineers, production operations). Such diversity and multifunctionality require a special approach to the study of an engineer as a subject of professional activity [5]. The process of manifestation of the psychological uniqueness of the cognitive sphere of a future specialist at the stage of professional training as a period in which the "reserve" of professional reliability is formed through the acquisition of knowledge and competencies becomes especially interesting [1].

As mentioned above, modern engineering activity is a labor in which a new technical system is created and mechanisms are developed for the process of managing this system. It differs significantly from technical activity, which has a performing character, and is based on scientific knowledge, experience, intuition and "guesswork". An engineer, carrying out his activities, acts as an initiator-ex-

perimeter, based on two types of knowledge: natural science and technical. The fundamental point is the transition of engineering activity into the sphere of technical creativity, based on scientific knowledge and the ability to design. Proof of the creativity of an engineer is found in the nature of technical creativity in the transition from abstract thinking (the image of a technical object) to production practice. In its final form, this is demonstrated in a six-step cycle when working on a project (invention, design, design, engineering research, technology, organization and management of the process, operation and evaluation of equipment) [7].

Of course, a large number of related engineering specialties are represented on the labor market in the areas of construction, computer technology, chemical technology, electrical engineering and power grids, including areas related to the extraction of natural resources (we have not given it as an example). However, the features of mental activity (analytical thinking, spatial-figurative, logical), together with other cognitive processes in all documents, are on the first lines of psychograms, which can be traced in various versions of the generalized professionogram of an engineer. The study of the types of thinking and the ability to creative activity, as a resource for future reliability in work at the stage of vocational training in a higher educational institution, is becoming an important task [6]. It is here that the development of the main elements of the structure of engineering thinking (rational, sensory-emotional and axiological) takes place. Taking into account the above, it can be concluded that logical thinking, a complex of specialized knowledge, ingenuity and creativity are the key determinants of professional engineering thinking.

Under the influence of a positive attitude to work, the formed professional thinking makes it possible to study and transform the world around us, depending on the goals and needs of professional activity, the meaningful orientations of a person [3]. The specificity of the diverse connections between the activity and the personality of a professional is determined by the peculiarities of the manifestation of mental regulation and the operational characteristics of thinking [2].

Regarding engineering activity, its warehouse, it should be noted that engineering thinking by domestic researchers is considered as a continuous socio-mental process associated with activities and its main components: polytechnic, integrative-simultaneous (the ability to versatile solution of applied problems), productive, team-based. The leading features of professional engineering thinking are continuity, national mentality, and social orientation. The frequency and direction of the professional tasks solved by the engineer determined three vectors that distinguish his thinking: artistic, practical, scientific.

Experts also note that engineering thinking is a special kind of professional thinking, through which innovative, safe, trouble-free and breakthrough technologies are developed that increase the efficiency of the production cycle, facilitate

the work of technical personnel and reduce the economic costs of production. Requirements for the safety and reliability of equipment raise the issues of labor reliability during its operation, as well as the professional reliability of the engineer as a whole.

An important stage for the development of the main elements of the structure of engineering thinking (rational, sensory-emotional and axiological) is training in a higher educational institution. It is during this period that primary professional skills are honed and the features of mental activity are manifested, depending on the focus of engineering on the specificity of the leading professional tasks and functions that will be solved by young specialists at the enterprise (workplace). Knowledge about the specifics of the qualitative and quantitative composition of the indicators of engineering thinking, their analysis allows timely and quickly find the best ways to level production risks, erroneous actions [9]. Of particular interest are various studies of the formation of engineering thinking, its warehouse among the student body in specialized educational institutions.

At the Tver State Technical University, a study was carried out to determine the contours of technical thinking, taking into account its leading components. The locus of attention included second-year students of the faculties - information technology and construction (general specialized subjects in the selection for training: physics, mathematics, Russian). The total number (contingent) is 144 people, the age category is 18–21 years old.

*Research methods and techniques.* Psychodiagnostic tools were composed of three methods:

1. Methodology for diagnosing the type of thinking (author - Rezapkina G.V.). Through the scales proposed to her, the originality of thinking, the leading components, the level of expression of creativity are determined.

2. Bennett's technical comprehension test. The proposed stimulus material allows you to identify the development of technical abilities in the adult and youth contingent.

3. Methodology for the diagnosis of personal decision-making factors Kornilova T.V. The results show the severity of the leading components in the decision-making process (willingness to take risks or rationality).

Statistical and mathematical processing of psychodiagnostic data was carried out using the SPSS-18 program. The statistical methods used are descriptive statistics.

*Research results.* Determination of the prevailing type of thinking in the student sample of specialties in technical areas made it possible to establish a number of regularities: a) two types of thinking are most pronounced: substantively effective (5.6) and visual-figurative (5.4); b) verbal-logical (4.0) and abstract-symbolic thinking (3.9) are less pronounced; c) the level of the ability to think outside the

box (5.1) - an irreplaceable quality for designing and creating everything new, corresponds to the level of expressiveness of quality "above average".

The almost equal degree of manifestation of the first two types of thinking in the process of mastering engineering specialties testifies to its synthetic nature. The necessary professional knowledge (for a successful entry into the working environment in the future) is acquired by students mainly through direct acquaintance with the subjects of the production process (machines, computers, apparatus, etc.), which occurs in practical classes, during practical training (consolidation of theoretical material). Reliance on images and representations contributes to the implementation of engineering projects on paper, for example, in the construction sector - the development of an architect. It should be noted that the maximum level of creativity, according to the methodology key, is 8 points. The obtained level for the sample corresponds to the value "above average". Creativity as the ability to think creatively and make extraordinary decisions is characteristic of young engineers. A vivid expression of creativity is possible with their direct participation in technical developments and the attention of the teaching staff to the manifestation of initiative.

The data of diagnostics of formation and manifestation of technical abilities are of particular interest. The final result corresponds to 51.6 points (high level). This level of expressiveness of technical abilities is typical for both boys and girls. Low and medium abilities are characteristic of a single study participant. Developed technical ability is the leading criterion for showing that students have an understanding of the subject area in which they will be working. Students are ready to understand technology, implement technological processes.

The study of the rational component of engineering thinking among students of a technical university revealed the following features: the scale of rationality corresponds to an average statistical value of 6.7 points; risk readiness scale - 4.1 points. The first indicator is approaching the average level of quality, the second value is included in the range "below average". Students of technical specialties show rationality in the decision-making process, tend to think about behavior and actions, and have a constructive attitude towards criticism from society.

*Conclusions.* As the results of the study of the foundations of professional engineering thinking of students studying in technical areas have shown, at the stage of mastering knowledge about the subject area, it is characterized by the following patterns:

1. An important condition for the formation of engineering thinking in the process of professional development of a future specialist is active preparation for admission to a higher educational institution through the assimilation of specialized subjects (mathematics, physics, chemistry, computer science). Mastering the basis of knowledge in the necessary disciplines at a high and stable level becomes

a guarantee of overcoming obstacles associated with new forms of organizing educational activities, and a positive attitude towards the chosen profession.

2. A rational attitude to the knowledge acquired, an understanding of its importance for successful employment, testifies to a responsible attitude towards the subject and object of the future professional sphere, increased attention to the theoretical basis.

3. Most of the students demonstrate the applied and theoretical orientation of mental activity, which is due to the need to quickly merge into the future professional world after graduation. Success in this case is achieved by participation in industrial practices, activity in laboratory and practical classes, which determine the way of processing information, logic and techniques of engineering thinking.

4. Engineering thinking is presented as a systemic type of thinking that includes elements of creative activity and is part of the structure of the reserve of professional reliability. The direct influence of engineering activity on the quality of life of society makes the development of this problem urgent.

*Conclusion.* Specific features of the content of engineering work, its different types, become factors that determine the set of requirements for the personality of an engineer, knowledge, skills, abilities, as well as its psychological foundations. Together with professional thinking, they are acquired and honed from the student's bench and polished at other stages of professional development. The presence of professional thinking can be traced in the choice of approaches when performing work duties and testifies to the professionalism of the employee. An attempt to determine the originality of engineering thinking and to trace its dynamics at the stage of training serves as a necessary basis for adjusting the trajectories of training engineering personnel for the modern economy.

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恶性肿瘤周围区域炎性淋巴样浸润的研究的预后价值（文献综述）  
**PROGNOSTIC VALUE OF THE STUDY OF INFLAMMATORY  
LYMPHOID INFILTRATE OF THE PERITUMOROUS ZONE OF  
MALIGNANT NEOPLASMS (LITERATURE REVIEW)**

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综述提出了研究淋巴样浸润在各种部位的恶性肿瘤的周围区域中的预后价值的问题的状态。

关键词：恶性肿瘤；癌周区；淋巴样浸润

**Abstract.** *The review presents the state of the problem of studying the prognostic value of lymphoid infiltrate in the peritumorous zone of malignant neoplasms of various localizations.*

**Keywords:** *malignant neoplasms, peritumorous zone, lymphoid infiltrate.*

Currently, the dominant approach in pathological anatomy is the approach to the study of the predominantly parenchymal component of malignant neoplasias, which was formed, first of all, for diagnostic purposes, but it can be significantly expanded due to the study of tissue reactions occurring in structures located near the tumor [1]. In addition, the prognostic value of inflammatory infiltration of the peritumorous zone [PZ] carcinomas has been studied much less than that of the intratumorous zone. Several studies have shown that an increase in the number of lymphocytes in PZ tumors was associated with a better prognosis for patients [2].



In other studies, it was shown that the density of PZ infiltration by immune cells is interrelated with the progression of the neoplasm. According to these authors, tumor-associated cytokines have an effect on lymphocytes, inhibiting their antitumor properties. The ability of immune cells to acquire new properties promoting tumor progression is allowed [3,4].

This review presents data on the study of the prognostic value of lymphoid infiltration in PZ tumors of some localizations.

Research by Vieira F.L. et al. (2008) found that the most extensive population of lymphoid cells in PZ squamous cell carcinoma of the oral cavity were T-lymphocytes, among which CD8+ cells (cytotoxic T-lymphocytes) predominated, relative to CD4+ T-lymphocytes, B-lymphocytes were the second type of infiltration cells - the one in number [5].

In PZ ovarian cancer, a high expression of CD3+ cells was found in unfavorable carcinomas, and a higher number of CD4+ cells was noted in tumors with a favorable prognosis. The absence of CD20+ B-lymphocytes was associated with the absence of metastases to the lymph nodes [6].

In colorectal cancer, postoperative survival of patients was significantly more associated with a low level of infiltration with PZ CD8+ T-lymphocytes than with a high level of these cells ( $p = 0.01$ ). The authors conclude that the content of CD8+ T cells in PZ indicates their antitumor effect in patients with colorectal cancer [7]. Song E. et al. (2000) found that the expression of the Fas ligand on the membrane of peritumorous lymphocytes is interrelated with the apoptotic index of tumor cells [8]. Data from Nakagawa K. et al. (2015) showed that the 5-year postoperative survival in colorectal carcinoma in patients with high infiltration of PZ by regulatory T cells (Tregs) was 74.8%, while in patients with low infiltration Tregs PZ was 40.3% ( $p < 0.01$ ) [9]. According to Xu F.Y. et al. (2003) PZ lymphoid infiltration in colorectal cancer was an independent prognosis factor [10].

An increase in the number of CD20+ peritumoral lymphocytes in soft tissue sarcomas was associated with a short survival of patients after surgery ( $p = 0.03$ ). In multivariate analysis, the high content of CD20+ lymphocytes in the PZ ( $P = 0.03$ ) was an independent factor of poor prognosis. Similar relationships were not found for CD3+, CD4+ and CD8+ lymphocytes [11].

In skin melanoma, a high number of peritumoral lymphocytes was associated with low levels of Clark carcinoma grading ( $p = 0.001$ ) and lower mitotic tumor activity ( $p = 0.01$ ). A trend was found for longer survival in cases with a high lymphocyte count in the PZ ( $p = 0.07$ ) [12].

Liu L et al. (2016) showed that peritumoral CD8+ T cells were predictive factors of postoperative survival in patients with pancreatic carcinoma, but no correlations with clinical and morphological prognostic factors were found [13].

The density of peritumorous lymphocytic infiltrate in squamous cell skin can-

cer was correlated with the age of patients and the degree of malignancy and tumor differentiation, but it was not correlated with the survival of patients [14].

In hepatocellular carcinoma, the density of distribution of peritumoral Tregs (T-regulatory lymphocytes) positively correlated with the density of distribution of mast cells ( $r = 0.35$ ;  $p < 0.001$ ). Tregs, especially in combination with mast cells, had better predictive value than mast cells alone [15].

The density of lymphoid infiltrate in the PZ in kidney cancer was associated with such important prognostic factors as stage ( $r = 0.31$ ); Fuhrman degree of anaplasia ( $r = 0.57$ ); tumor size ( $r = 0.34$ ) and the presence of metastases ( $r = 0.42$ ) [16,17]. The number of peritumoral Tregs in PZ in kidney cancer positively correlated with intratumoral COX-2 expression ( $r = 0.34$ ;  $p < 0.001$ ). The number of peritumoral Tregs was associated with TNM stage ( $P = 0.001$ ) and tumor size ( $p = 0.002$ ). Multivariate analysis showed that a high number of peritumoral Tregs was an independent predictor for shorter patient survival [18].

Squamous cell lung cancer with metastases to regional lymph nodes in the PZ tumor was characterized by a predominance of CD4+, CD8+ and CD20+ lymphocytes [19].

According to M.A. Senchukova. et al. (2015) in gastric cancer, focal low density of distribution of CD20+ B-lymphocytes in the PZ was significantly associated with the early stages of the disease and was not associated with long-term results of treatment, and the presence in PZ of pronounced infiltrates with multiple lymphoid follicles from CD20+ cells was associated with a diffuse type of gastric cancer and a poor prognosis [20]. Tomchuk O.N. (2016) showed that pronounced CD20+ B-lymphocytic infiltrates were present in the PZ of large tumors ( $> 5$  cm) and in multiple metastases of gastric cancer [21].

In breast cancer, depending on the increase in the degree of tumor malignancy in the PZ, the number of CD4+ cells and CD20+ B-lymphocytes increased, with the formation of follicle-like structures without germinal centers, while the number of NK cells, CD8 cells and CD56 cells (natural killers) decreased [22]. Menegaz RA et al. (2008) found that the phenotype of PZ inflammatory infiltrate lymphocytes is associated with tumor size. A significant decrease in peritumoral CD3+ T lymphocytes was found in tumors larger than 2 cm, compared with carcinomas smaller than 2 cm [23].

The density of the inflammatory infiltrate in the PZ of laryngeal cancer was the highest in high-grade carcinomas, the infiltrate was characterized by a large number of CD20+ B-lymphocytes, sometimes with a tendency to the formation of follicle-like formations without germinal centers. The number of CD4+, CD7+, CD8+ and CD56+ cells increased with an increase in the clinical stage of the disease. An interrelation was also revealed between the density of the inflammatory infiltrate in the PZ and the size of the neoplasm [24].

Thus, the data obtained in the study of the prognostic value of peritumous lymphoid infiltrate of malignant carcinomas are few and contradictory, and therefore this issue needs further study.

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怀孕的蠕虫病

HELMINTHIASIS IN PREGNANCY

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本文讨论了孕妇的蠕虫病病程，蠕虫感染对孕妇和胎儿病程的影响，并指出了用于驱除孕妇的药物。

关键词：蠕虫病，as虫病，肠生病，妊娠

**Abstract.** *This article discusses the course of helminthiasis in pregnant women, the effect of helminth infestation on the course of pregnancy and the fetus, and also indicates the drugs intended for deworming pregnant women.*

**Keywords:** *helminthiasis, ascariasis, enterobiosis, pregnancy*

**Relevance**

The relevance of this topic is due to the fact that helminthiasis is an important and common disease, which almost every person has become infected at least once in their life. According to the World Health Organization (WHO), more than 4.5 billion people are affected by parasitic diseases in the world. At least 25% of the world's population suffers from helminthic invasions. On the territory of the Russian Federation, there is an annual incidence of more than 1.5 million people.

**Purpose**

To assess how much the issue of helminthiasis during pregnancy has been studied to date; identify if there are regulatory documents.

### **Materials and methods**

Literature searches have been carried out over the past 10 years, with PubMed and Elibrary serving as the primary databases. 10 sources of literature were analyzed, on the basis of which a comparative analysis was carried out.

### **Introduction**

An active increase in helminth infection is mainly observed in developing countries with low socio - economic living standards. But, nevertheless, the issue of helminthiasis is relevant for developed countries as well. In the Russian Federation, the growth of this disease is associated with an increase in the number of domestic animals in people living in urban apartments, and the growth is due to high environmental pollution, low awareness and underestimation of the negative impact of helminthiasis on the human body, including the body of a pregnant woman [7]. Many people lack habits such as hand washing, careful handling of raw vegetables and fruits, which are the main determining factors for the high prevalence of helminthiasis. Therefore, it is very important to educate the population in order to ensure the long-term and sustainable spread of helminthiasis [8].

The human body is a favorable environment not only for habitation, but also for the reproduction of helminths. The human body is parasitized by 3 main classes: nematodes, trematodes and cestodes [7].

The very moment of infection and the further stay of helminths in the host's body remains unnoticed. This is due to the fact that when helminths enter the body, they suppress T-cell immunity and adsorb host proteins on their surface, resulting in a kind of defense against the host's immune system [7].

The body of a pregnant woman is an equally favorable environment. It should be noted that it is he who will be preferred by the helminth to any other organism [3]. During pregnancy, there is a change in the immune status of the pregnant woman, at this moment the immune system is aimed at combating inflammation, so helminths (like the fetus itself) are not recognized as antigenically foreign organisms [3].

In the modern literature, information on the spread of helminthiasis among pregnant women is scarce [5]. Nevertheless, on the basis of the available information, it can be concluded that most often pregnant women are infected with ascariasis (15–35%) and enterobiasis (2–12%) [6].

### **Clinical manifestations**

Different types manifest themselves with characteristic symptoms that distinguish them from each other. But, nevertheless, their common clinical signs can be distinguished [7].

All common clinical symptoms can be subdivided into the following syndromes [7]:

1) *Dyspeptic syndrome* - pain in the epigastric region of unclear etiology, nausea, vomiting.

2) *Anemic syndrome* - iron deficiency anemia, not amenable to drug therapy, in addition, as the gestational age progresses, IDA increases; B12 - deficiency anemia associated with the fact that in the process of vital activity helminths absorb a large amount of vitamins, including B12.

3) *Intoxication syndrome* - weakness, drowsiness, dizziness; arterial hypotension associated with the influence of the waste products of parasites on the nervous system of a pregnant woman.

These symptoms are regarded by a pregnant woman as manifestations of toxicosis in the first half of pregnancy [3].

Distinctive manifestations of *ascariasis* are the development of bronchial asthma (due to the fact that ascaris larvae can enter the pulmonary circulation and airways) and intestinal obstruction (due to the fact that mature individuals can lead to blockage of the intestinal lumen) [7]. In addition, ascariasis is characterized by damage to the biliary system, since during pregnancy the level of hormones (estrogens and progesterone) increases, affecting the sphincter of Oddi, which ensures the migration of ascaris into the bile ducts [10].

*Enterobiasis* is characterized by itchy skin in the anal area, so a pregnant woman's sleep is disturbed and her health worsens [2].

### **The course of pregnancy**

Helminthiasis have an adverse effect on the course of pregnancy [7]. 1 trimester of pregnancy may be accompanied by early toxicosis, threatened abortion and spontaneous abortion [6]. In the 2nd trimester, the likelihood of developing placental insufficiency prevails. In the 3rd trimester, fetoplacental insufficiency, fetal growth retardation and intrauterine hypoxia are also possible [6, 7].

In the postpartum period, bleeding is noted that is not associated with obstetric pathology. Bleeding is associated with the fact that helminthic invasion leads to a change in the enzymatic function of the liver, which affects the blood coagulation system [7].

### **Influence on the fetus**

In the study of Bodny E.I. the clinical situation of ascariasis in a pregnant woman is considered. This observation confirmed the hypothesis of the possibility of a transplacental route of infection with ascariasis [1].

The effect on the fetus in ascariasis is due to the effect of an alpha-chemotrypsin and trypsin inhibitor, which have embryotoxic and teratogenic properties [5].

Helminthiasis lead to a deficiency of vitamins with antioxidant properties (vitamins A, E, C) [3]. Thus, with their lack, the body's resistance to negative influences decreases and, as a consequence, a violation of the laying of the systems and organs of the fetus is observed [5].



Do not exclude the possibility of the passage of ascaris larvae with blood flow through the placental barrier, which leads to the development of intrauterine infection. The lungs of the fetus are the most vulnerable, therefore, the development of intrauterine pneumonia is most often observed [5].

### **Diagnostics**

Diagnostics is aimed at identifying the pathogen (ELISA for detecting antibodies to ascaris antigens; scraping from perianal folds to detect pinworm eggs) and at identifying and assessing the severity of organ-specific lesions (ultrasound of the liver, pancreas, EGD, liver scintigraphy) [3,7].

### **Therapy**

At the moment, there are a large number of anthelmintic drugs, but most of them are contraindicated in pregnancy. Deworming is accompanied by the death of parasites, which leads to the development of severe toxic complications, therefore, the use of anthelmintic drugs should be combined with the use of laxatives in order to remove dead parasites from the intestines.

The combined use of anthelmintic drugs with vitamins A, C, E, with preparations of folic acid and iron is recommended [5].

Drugs that do not interfere with the normal course of pregnancy include piperazine adipate. Its advantage lies in the fact that this drug paralyzes the muscles of nematodes, that is, peristalsis contributes to their exit from the body of a pregnant woman. In addition, it should be noted that piperazine adipate does not kill parasites, but paralyzes them, so their decay products will not be absorbed into the bloodstream and cause the development of toxic complications [7].

In foreign literature sources, there are studies that consider the use of a drug such as Praziquantel by pregnant women. However, surveillance to identify any adverse effects of treatment is still ongoing [9].

### **Conclusion**

Analysis of literature sources showed that the presence of helminthiasis in pregnant women is the cause of severe complications during pregnancy, such as toxicosis of the first half of pregnancy, placental insufficiency, spontaneous abortions at different gestational periods, chronic fetal hypoxia, developmental delay and premature birth. In addition, to date, a clear algorithm for managing patients in this category has not been developed. First of all, this is due to the lack of clinical recommendations in obstetrics and gynecology on the management of pregnant women with helminthiasis, and there are no sections on the management of pregnant women and their delivery in clinical guidelines and research studies for infectious disease doctors and helminthologists. Therefore, we consider the problem of helminthiasis in pregnant women to be relevant and controversial today.

No third party interests.



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疫苗接种：赞成和反对  
**VACCINATION: FOR AND AGAINST**

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本文讨论了当前的疫苗预防问题，关于拒绝让儿童加入有组织儿童团体的问题，以及医生应如何与接种疫苗的反对者合作。

关键字：预防疫苗，疫苗接种，疫苗接种日历，儿童

**Abstract.** *This article deals with current issues of vaccine prophylaxis, questions about the refusal of admission of a child to children's organized groups, and how a doctor should work with opponents of vaccinations.*

**Keywords:** *vaccine prophylaxis, vaccination, vaccination calendar, children.*

**Relevance:** in medicine today, vaccination is considered an economically profitable and effective measure related to the prevention of infectious diseases among the population. This is a recognized fact, but still the attitude towards vaccine prophylaxis around the world remains ambiguous. This is largely due to the very contradictory information about the vaccine prophylaxis. A negative role is played by constant discussions in the media on this topic, as a result of which a negative attitude towards vaccination began to form among many parents and a complete denial of the opinion of doctors and scientists. This led to a massive refusal of vaccinations and, as a consequence, an increase in the incidence, in some cases reaching an epidemic level. In this regard, the work in the field of health education of the population in the field of vaccine prophylaxis acquires extreme relevance in our time.

**Purpose of the study:** according to the latest literature sources, to study the importance and significance of vaccine prophylaxis infectious diseases among children, to justify the need for vaccine prophylaxis.

**Materials and methods:** theoretical analysis of literary sources and normative documentation.

**Results and its discussion:** in the Russian Federation, all vaccinations are carried out in accordance with the National Calendar of Preventive Vaccinations (tab. 1), which regulates the timing and procedure for introducing preventive vaccinations [1,6]. In addition, there is a regional calendar of preventive vaccinations, which additionally includes vaccinations that can be delivered depending on the epidemiological situation in the region. This calendar includes vaccines against 24 infections.

**Table 1. Calendar of preventive vaccinations (in accordance with the Order of the Ministry of Health of the RF of 24.04.2019, № 243n)**

Age	Vaccination name
Newborns (first 12 months)	Hepatitis B 1 vaccination
3-7 days	Tuberculosis (BCG-M or BCG)
1 month	Hepatitis B 2 vaccination
2 months	Hepatitis B 3 vaccination (children at risk)
3 months	Diphtheria, whooping cough, tetanus, polio, haemophilus influenzae (first vaccination)
4,5 months	Diphtheria, whooping cough, tetanus, polio, haemophilus influenzae (second vaccination)
6 months	Hepatitis B 3 vaccination, diphtheria, whooping cough, tetanus, poliomyelitis, hemophilic infection (third vaccination)
12 months	Hepatitis B 4 vaccination (children at risk) Measles, rubella, mumps
18 months	Diphtheria, whooping cough, tetanus, poliomyelitis, hemophilic infection (first revaccination)
20 months	Poliomyelitis (second revaccination)
6 years	Measles, rubella, mumps (revaccination)
6-7 years	Diphtheria, tetanus (second revaccination)
7 years	Tuberculosis (BCG) revaccination
14 years	Diphtheria, tetanus, polio (third vaccination) Tuberculosis (BCG) revaccination
Adults	Diphtheria, tetanus (every 10 years) revaccination
Children from 1 to 18 years old, adults from 18 to 55 years old, not previously vaccinated	Hepatitis B
Children from 1 to 18 years old, girls from 18 to 25 years old, not sick, not vaccinated, vaccinated once against rubella	Rubella

Children from 6 months old, students of grades 1-11, students of higher and secondary vocational educational institutions, adults working in certain types of professions and positions (medical and educational institutions, transport, utilities, etc.), adults over 60 years old	Flu
Children aged 15-17 and adults under 35 who have not been sick, not vaccinated and have no knowledge of measles vaccinations	Measles

At the moment, the National Vaccination Schedule includes vaccinations against 12 infections:

- viral hepatitis B,
- tuberculosis,
- pneumococcal infection,
- diphtheria,
- whooping cough,
- tetanus,
- polio,
- hemophilic infection (Hib),
- measles,
- rubella,
- parotitis,
- flu.

All of these vaccinations must be given to every child, if he has no medical contraindications for vaccination. At the moment, vaccine prophylaxis prevents a huge number of deaths and protects children not only from those diseases that are provided for by the national vaccination calendar, such as diphtheria, pertussis, tetanus, polio and measles, but also such as pneumonia and rotavirus infection. These are two infectious diseases that are the leading cause of death in children under 5 years of age.

Vaccine preventable diseases can be especially dangerous for young children. No one can guarantee whether a child will survive the infection in a mild form or in a severe and with serious complications [3,8].

Without vaccines, a child is at risk of serious illness, pain, disability and / or even death from diseases such as measles and pertussis — these are life-threatening diseases for the child [5,10].

Currently, in the Russian Federation, there is an increase in the incidence of measles - 3.5 times, whooping cough - 1.9 times - most of the cases are children under 14 years old. This is largely due to the refusal of parents to vaccinate their

children.

Vaccination — is the safest way to help your child acquire immunity to vaccine-preventable diseases. The development of acquired immunity to infection after vaccination is associated with a much lower risk to the health of the child than immunity after an infectious disease. It is impossible to get infected from the vaccine. Inactivated vaccines contain killed microbial particles or their fragments that cannot cause disease. Live vaccines contain weakened microorganisms that also cannot cause disease [4,5,9,10].

According to the World Health Organization (WHO) Regional Office for Europe, routine immunization against diseases such as polio, tetanus, diphtheria, whooping cough, measles and mumps saves the lives and health of more than 3 million children worldwide every year. But, despite all this, pediatricians are increasingly faced with the refusal of parents to vaccinate their child, referring to the fact that vaccinations are contraindicated for them.

Paying attention to this, one should remember what contraindications there are to vaccinating a child.

**Absolute contraindications for vaccination [1]:**

- Severe reaction to a previous similar vaccination (temperature from 400, convulsions, edema more than 8 centimeters in diameter, anaphylactic shock, severe allergic reactions);
- Malignant neoplasms, immunodeficiency states of the body;
- The period of pregnancy and lactation.

**Temporary contraindications [1]:**

- flu or SARS with fever (vaccinated no earlier than 2 months after recovery);
- chronic diseases (vaccination of a child is possible after the approval of his attending physician);
- prematurity (the child is vaccinated only after he reaches 2 kg);
- immunosuppressive therapy (at this time, you cannot vaccinate);
- after a blood transfusion or the introduction of immunoglobulins (vaccination is possible no earlier than 3 months later).

Observance of the rights of citizens and responsibility for refusal to vaccinate are also topical issues today.

What is the threat to parents who refuse to vaccinate their child?

Restriction of the rights of citizens in case of refusal to immunize can be allowed only in order to protect their own health and can be expressed:

- In the temporary refusal of admission: for work, children's organized groups, educational institutions, etc. during an epidemic of diseases.
- In the temporary refusal to leave citizens to countries requiring vaccinations according to international rules. The legislation of the Russian Federation does not

provide for punishment for refusal to vaccinate (in accordance with the FL of the RF of September 17, 1998, № 157-FZ "On immunization of infectious diseases") [1,6].

Also, parents very often face the question of whether doctors have the right to vaccinate a child without their consent?

Not. For vaccination, parents must sign an informed voluntary consent, and only if it is available, doctors administer the vaccine to the child. Even if quarantine is declared in your region or city in the midst of an epidemic, no one has the right to force or without your consent to vaccinate a child (clauses 1-2 of article 5 of the Federal Law N 157-FZ). Note that after 15 years of age, grown-up children are recognized as independent citizens of the Russian Federation in matters of medical intervention and can themselves make a decision on vaccination, part 2 of article 54 of the Federal Law No. 323-FZ.

The question that has been actively discussed today was and remains, will the child be taken to kindergarten / school without vaccinations?

Many parents are convinced that their child will not be taken anywhere without a vaccination card, but this is a misconception. The state is obliged to ensure every person the right to education and its general availability (clause 2 of article 41 of the Constitution of the RF) [2,7]. Therefore, they are obliged to take a child to educational institutions, regardless of the presence or absence of vaccinations. A child can be removed from classes only during the quarantine period, that is, during an unfavorable epidemiological situation.

The question of how a doctor should work with vaccine opponents is still open.

One of the important criteria by which parents determine whether to vaccinate their child or not is how thoroughly and convincingly the doctor motivated them the need for immunization, and how well he dispelled their doubts. When convincing the effectiveness of vaccination, the physician should avoid using medical terminology that is difficult for patients to understand. In some cases, the case for a lot of medical research supporting the safety of vaccines is very compelling. The description of the clinical picture of diseases is, as a rule, a powerful incentive for immunization, because many parents simply do not imagine the full severity of diseases from which the vaccine can protect, considering the fear of them to be greatly exaggerated. If, after all the convictions, the parents are resolutely against vaccination, then the life and health of the child remains on their conscience [3,8].

**Conclusions:** One of the most important problems in modern society is the rejection of vaccinations. The emergence of the anti-vaccine movement is primarily associated with the massive discussion of this topic on the Internet, newspapers, and television. As a rule, the people participating in the discussion are not doctors, most often they are bloggers, writers or people of other specialties who have nothing to do with medicine. In this regard, there is a decrease in the

general level of knowledge of the population about diseases, their complications and methods of prevention. It is worth noting that the need for vaccine prophylaxis should be explained at the level of district pediatricians, and for this the doctor must be able to prove his point of view and convey it to the parents.

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医疗前阶段用于诊断危险因素和癌症的机器人复合体

## THE ROBOTIC COMPLEX FOR THE DIAGNOSIS OF RISK FACTORS AND OF CANCER AT THE PRE-MEDICAL STAGE

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注解。创建带有程序的机器人复合体（RC），该程序用于采访主要肿瘤的插图（根据病理形式是否相似），便携式USB显微镜内置在柔性软管中，并且复合体可以传播病理学信息更改触摸屏的可见位置。为了检测有色素的痣和表面扩散的黑色素瘤的早期迹象的激活，将其用picrofuxin染色（2020年3月16日的发明专利第2716811号）。这项调查是在1638名具有触摸屏上男女轨迹的患者中进行的。RC的使用使我们怀疑 $9.03\% \pm 1.3$ 的患者色素沉着性痣，皮肤，口腔，甲状腺和淋巴结肿大的激活，其中 $31.08\% \pm 1.8$ 的患者可以在进一步检查中确认肿瘤病理学。在空腹的情况下，有107位患者在Helik-Scan上进行了“呼气测试”，该程序内置于RC程序中。固定在触摸屏上扫描“呼吸管”中的颜色变化，在其中的29个中，在10个单位以上检测到了幽门螺杆菌病。满载。17例被诊断为1和2级化生，4例为胃溃疡，3例为恶性。综合大楼程序的检查结果和建议通过On线发送给全科医生。

关键词：机器人综合体，带插图的调查，“呼气测验”，USB显微镜，picrofuxin。

**Annotation.** Creation of a robotic complex(RC) with a program for interviewing with illustrations (by the type of whether there are similar forms of pathology) of major tumors, a portable USB microscope built into a flexible hose and the body of the complex for transmitting pathological changes of visible localizations to the touch screen. To detect the activation of early signs of pigmented nevi and



*superficially spreading melanomas, they were stained with picrofuxin (Patent for invention No. 2716811 of March 16, 2020 ). The survey was conducted in 1638 patients with a trajectory for men and women on a touch screen. The use of RC allowed us to suspect the activation of pigmented nevi, tumors of the skin, oral cavity, thyroid gland, and enlarged lymph nodes in  $9.03\% \pm 1.3$  patients, of which  $31.08\% \pm 1.8$  were able to confirm oncopathology on further examination. In the presence of complaints from the stomach on an empty stomach, 107 patients underwent a "breath test " on a Helik-Scan , built into the RC program. The color change in the "breathing tubes" was scanned with fixation on the touch screen, in 29 of them, helicobacteriosis was detected above 10 units. with a load. 17 patients were diagnosed with grade 1 and 2 metaplasia, 4 with gastric ulcer, and 3 of them with malignancy. The results of the examination by the program of the complex with recommendations were sent via an On-line connection to the general practitioner.*

**Keywords:** robotic complex, survey with illustrations, "breath test", USB microscope, picrofuxin.

And although malignant tumors are extremely diverse and difficult to diagnose, a lot is known about the risk factors and mechanisms of cancer development, so that now in most cases, not only timely diagnosis and treatment, but also taking an active position in assessing the specific risk, successfully conduct prevention. The doctor should conduct a systematic examination of the patient not when something "hurts", but regularly, when nothing hurts, taking into account the risk groups, gender and age when contacting the doctor for any reason.

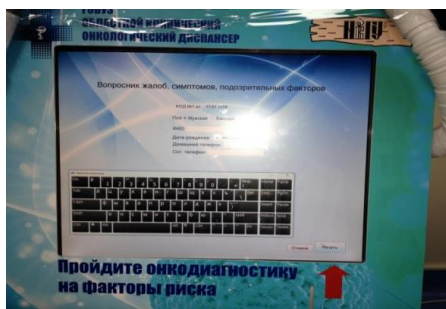
Early forms of cancer are preceded by a long period of carriage of oncogenic viruses, *Helicobacter pylori* and dysplasia, which can be established and cured. With a large flow of information during mass screening, asymptomatic signs of an early focus of developing cancer in organs and systems, the doctor's time limit, often limited to one question "What is Bothering you?". Naturally, asymptomatic pathological processes with this approach, against the background of concomitant diseases, go into the background. And this is the weakest link in primary diagnostics, which requires the creation and implementation of digital technologies that increase "oncological alertness" at the primary stage [1,2].

The goal is to find solutions to the problems of increasing the effectiveness of detecting oncological pathology and risk factors by using a robotic complex for a system survey-examination of the main localizations to reduce the time spent by the doctor prior to his appointment.

**Material and methods.** Robotic intelligence is a technique that allows you to implement algorithms for multi-purpose and system analysis in an expert program. The study of the effectiveness of the robotic complex was carried out on the basis of the created program of a system survey with illustrations, a touch screen,

magnifying diagnostics (including a portable USB microscope with an LED) of visual localities (skin, oral cavity), determination of the "respiratory urease test", evaluation, formation of recommendations for further tactics and transfer to the doctor for an appointment.

Previously, a large-format digital television screen is installed in the waiting hall of the polyclinic, which is associated with the prevention program and explains the tasks of the need to pass the robotic complex ( like a slide show). The survey program of the robotic complex is carried out on the touch screen. At the beginning, the passport data is filled in Fig. 1 (a).



a)



б)

**Fig 1. Touch screen: a) keyboard for filling in passport data;  
b) Questions with illustrations of pigmented tumors**

Then follow the questions on the main localizations with illustrations of (melanoma and non-melanoma) tumors (Fig. 2b), precancerous skin conditions, risk factors and other conditions, organ systems, lifestyle and habits

For example:

1. Do you have any skin problems ( sores, cracks, or others?) formations that have recently:

1. Yes, it is possible to change the shape, color or size

2. Yes, there was a tumor spreading over the skin, in places with raised edges other changes, sometimes itching



3. Yes, there is an ulcer on the skin that does not heal for more than 3-4 weeks\*

4. Yes, there is a formation in the form of a skin-colored plaque with a depression in the center, raised shiny pearlescent edges

5. Yes, there are, but I do not know how to evaluate

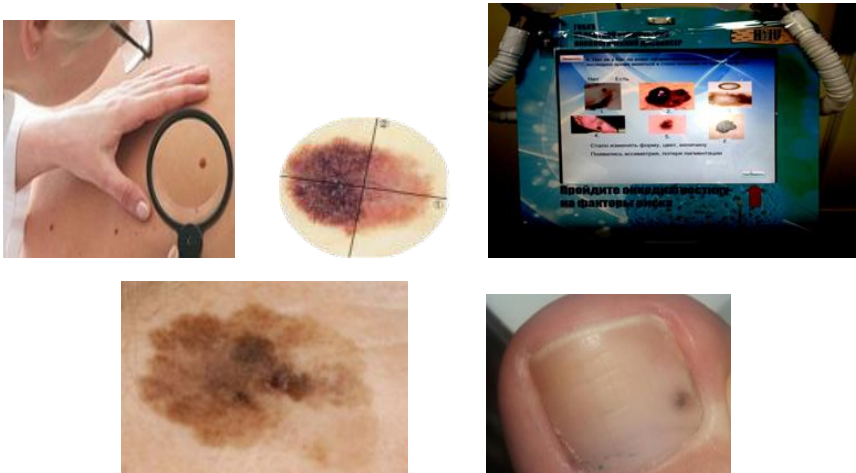
6-Yes, there are several signs

7. No, nothing



**Fig.2.** Precancerous changes and basal cell forms of cancer

2. Do you have a pigmented spot(s) in the area of the face, back, neck, including the nail bed (without bruising) or other places, including under magnification ?  
o Yes o No



**Fig.3.** Do you have a pigmented spot(s) in the area of the face, back, neck, including the nail bed or other places, including under magnification?

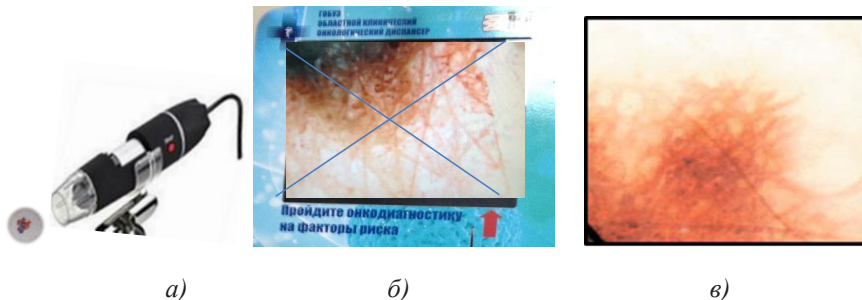
Given the extremely high rate of advanced cases of oral cancer, we integrated a portable USB microscope with an LED into a flexible hose that enters the side of the body of the robotic complex to transmit pathological changes in the skin and oral cavity to the touch screen. Suspicious areas can be zoomed in or out on the screen to detect signs of malignancy.



**Fig. 4.** Examination of the oral cavity (under the tongue)

On the front panel of the case, a ring is fixed for a container with disposable spatulas in sterile bags in order to displace the mucous membrane of the cheek and tongue for examining the hidden places of the oral cavity.

Для точности оценки пигментных невусов произведена замена увеличительной лупы и зеркала на USB портативный цифровой микроскоп с предварительной окраской пикрофуксином на 7-10 мин [3], позволяющим после впитывания через эпителий выявлять нарушения ромбовидности коллагеновых волокон, появление пигментных глобул и др. выявить первые признаки трансформации пигментного невуса в меланому на экране компьютера.

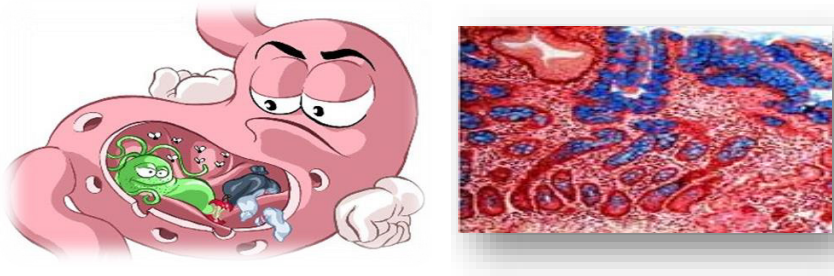


**Рис 5.** Пигментные образования под микроскопом с окраской пикрофуксином: а) USB микроскоп  $\times 100$ ; б) Волокна ромбовидно отходят от простого невуса; в) коллагеновые волокна отходят хаотично с точечными включениями

The survey organizer is a specially trained nurse operator or midwife of the examination room, which includes a robotic system and code registration. The nurse operator helps to answer questions, signs or factors that cause difficulties for the patient. The survey trajectory is based on gender and clarifying factors .

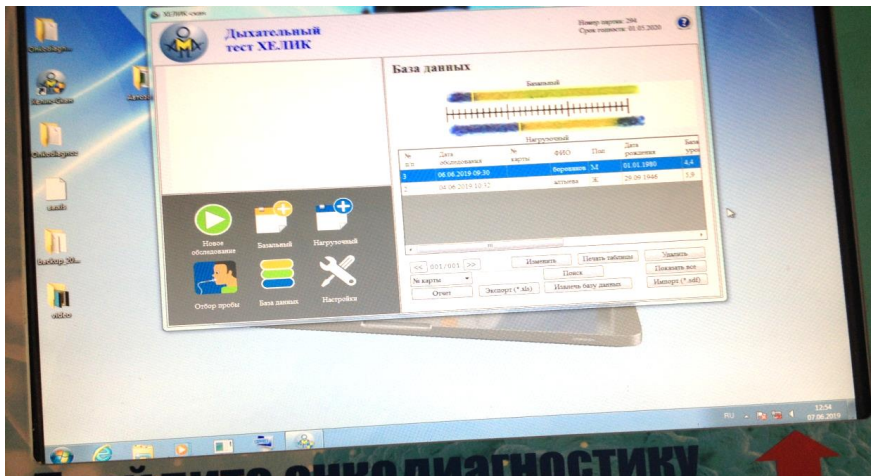
As you know, stomach cancer occupies a leading place among other malignant tumors. The proven cause of stomach diseases is the bacterium *Helicobacter pylori*. In the presence of the slightest complaints from the stomach and other

digestive organs, it is recommended to conduct a sensitive "breath test" based on the "Helik-Scan" (AMA company), built on the front panel of the robotic complex.



**Fig. 6.** Stomach with Helicobacteriosis

Two "breath tests" were performed on an empty stomach : before taking urea (basal test) and after (with exercise). In case of infection with Helicobacter pylori, a second test (with a load of urea or urea) on the screen, the blue bar in comparison with the basal test significantly increased in proportion to the percentage of ammonia in the exhaled air. The program in the "on line" mode reflected the change the length of the second sample on the screen, respectively, is the infection of the stomach with Helicobacter pylori.



**Fig.7.** Results of patient P., 42 years old

In Figure 6-On the right in the upper rectangle, two yellow stripes are visible (the upper one-one end turned blue after basal respiration -4.9 units; the lower one-after exercise-10.8 units).

**Results.** The studies were conducted in 1,638 patients who applied to the regional clinical oncology dispensary on the "Open Day" and after advertising exhibitions. The use of the robotic complex is suspected: tumors of the skin, oral cavity, thyroid gland, enlarged lymph nodes in (148 patients)  $9.03\% \pm 1.3$ , of which (46 patients)  $31.08\% \pm 1.8$  with further examination, oncopathology was confirmed, including 3 patients with melanoma, 5 with basal cell carcinoma and in one case with thyroid cancer and in two with oral cancer. In addition, 8 patients were found to have melanoma-like nevi.

*Table 1. Survey results with illustrations and chromo microscopy*

Localization	Number of patients with suspected pathology	Installed	
		Precancerous changes, milano-dangerous nevi	Malignant diseases tumors
Skin	16	8	8
Oral cavity	11	9	2
Lymph Nodes	19	19	-
Shields. iron	44	43	1
Moloch. iron	58	56	2
Total	148	135 (8,2%)	13 (0,79)

58 patients with complaints of certain phenomena of stomach discomfort were given a "breath test" for 6 minutes the next day, 29 of them had helicobacteriosis above 10 units. with a load. All these patients underwent fibrogastroscopy (FGS) with biopsy for atypical cells and *Helicobacter pylori* for reliability. 17 patients had metaplasia of the 1st or 2nd degree, 4 had gastric ulcer and 3 of them had malignancy.

All results of the RC program via the local Internet system and recommendations for further tactics should be sent to the attending physician, who, after the necessary additional examination of the patient, established the final diagnosis or referred to the necessary specialist.

### Discussion

The RC and preliminary results described in this paper, taking into account the methods of targeted survey with illustrations used in the screening of persons who



applied in terms of experimental examination, showed that the detection rate of malignant tumors was  $0.79 \pm 1.2\%$ , precancerous changes and melanoma-threatening pigmented nevi  $8.2 \pm 2.2\%$ . For the accuracy of the assessment of pigmented nevi, the magnifying glass was replaced with a USB portable digital microscope with pre-staining with picrofuxin. Moreover, the melanoma can not be injured and perform a biopsy.

The use of a Helik scan in a complex digital program allows you to determine the causes of gastric discomfort. When the level of *Helicobacter pylori* infection exceeds 10 units, eradication and fibrogastroscopy are required, in which the detectability of grade 1-2 metaplasia and peptic ulcer disease was 64.7%, including malignancy in 3 cases.

### Conclusions:

1. Conducting explanatory preventive work on digital television screens like a "slide show" in the halls of polyclinics increases the cancer literacy of patients, the purposefulness of passing their dispensary examination and the need for screening.
2. The results of the introduction of the robotic complex at the pre-medical stage allows you to save the time of a general practitioner for a systematic examination and identification of cancer risk factors and early forms of cancer ( $0.79\% \pm 1.2$ ), precancerous changes and melanoma-prone pigmented nevi  $8.2 \pm 2.2\%$ , the treatment of which is less expensive.
3. Digital intelligent examination is a real breakthrough in the primary diagnosis of risk factors and early forms of cancer, requiring adaptation for each polyclinic and even FAP with some improvement of the program and organization of production of robotic complexes.

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烧伤毒血症期间呼吸与血液参数之间的相关关系  
**CORRELATION CONNECTIONS BETWEEN RESPIRATION AND  
BLOOD PARAMETERS DURING BURN TOXEMIA**

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抽象的。在毒血症的前10天，呼吸频率（RR）的昼夜节律的中值水平保持在第1天的指标水平，并且相对于所有年龄的患者，呼吸趋势都有增加的趋势。正在进行的强化治疗和及时纠正的贫血显示，在补充学龄儿童的血液参数不足方面尚不足。当炎症反应主要表现为间质细胞数量的增加时，揭示了婴幼儿上皮细胞数量对RR的直接影响。在学龄儿童中，学前儿童的1个和2个亚组以及学龄前儿童的2个亚组中的单核细胞数量被证明是影响昼夜节律RR的中值的指标。学龄前儿童和学龄儿童的年龄相关特征也许是在外周血中单核细胞增加引起的代偿反应发展中的主要作用。在成年患者的第4组和第5组中，发现在凝结的第二阶段高凝对RR有刺激作用的趋势，而在第一亚组的7岁以下的儿童和61岁以上的人群中，存在凝结的趋势呼吸增加，PI降低。

关键词：相关性，呼吸，血液，烧伤毒血症

**Abstract.** *In the first 10 days of toxemia, the level of the mesor of the circadian rhythm of the respiratory rate (RR) remained at the level of the indicator on day 1, with a tendency to increased respiration relative to the age norm in all patients. The ongoing intensive therapy with timely correction of anemia revealed an insufficiency in replenishing the deficit of the studied blood parameters in school-age children. The direct influence of the number of metamyelocytes in infants on RR was revealed, when the inflammatory reaction was mainly expressed in an increase in the number of metamyelocytes. In school-age children, the number of monocytes*



*in 1 and 2 subgroups of school and in subgroup 2 of preschool children turned out to be an indicator influencing the value of the mesor of the circadian rhythm RR. Perhaps the predominant role in the development of compensatory reactions of an increase in monocytes in the peripheral blood is an age-related feature of preschool and school children. A tendency to the stimulating effect of hypercoagulation in the 2nd phase of coagulation on RR was found in groups 4 and 5 of adult patients, while in children under 7 years of the first subgroup and people over 61 years of age, there was a tendency to increased respiration with a decrease in PI.*

**Keywords:** correlations, respiration, blood, burn toxemia

**Relevance.** Being one of the reasons for the clinical features during the burn shock, toxemia subsequently, from the third day, comes to the fore, as it were, and becomes the leading factor in the course of the disease until the 8-9th day of the disease. It is characterized by pronounced clinical signs and distinct changes in metabolism. Clinical observations reveal anemia and increased hypoproteanemia. Diuresis in most seriously ill patients on the 3rd day reaches 4 - 6 liters. At the same time, in this regard, the amount of urea, residual nitrogen in the blood and electrolytes in plasma are normalized. The gradual return of incomplete protein breakdown products to the bloodstream mainly determines the clinical course and pathophysiological disorders in the body at the stage of burn toxemia. The beginning and end of the clinical course at this stage of the disease do not have clear outlines, and this, obviously, indicates the gradual development of its driving mechanisms. At the same time, there is penetration from the wound surface into the bloodstream of microbial bodies and their toxins, but it seems that in these first 8-9 days of the disease, they do not determine the course of the disease. The leading place in therapy for burn toxemia belongs to drugs that increase the reactivity of the body, reduce the toxic effect of protein breakdown products and regulate metabolic processes. Infusion therapy in this period of the disease gradually loses its purpose as a factor for improving hemodynamics. Sensitization reactions are often observed at this stage of the disease [1,2]. In the stage of toxemia, the highest mortality rate of patients is found. Toxemia dies, about 37% of all die from burns. Death usually occurs in individuals with the most common deep lesions. From burn shock, mainly elderly people and children die, sometimes even with relatively limited lesions, while in the stage of burn toxemia, young people, the healthiest, who can be removed from the shock state even with very extensive lesions [3, 4]. However, due to the lack of data on the assessment of age-related characteristics of compensatory changes in external respiration during burn toxemia, we set a goal to study the changes in the correlations of respiration and generally accepted laboratory blood parameters during the period of toxemia in severely burned patients.

**Purpose. To study** the correlations between the respiratory rate and laboratory parameters of the study during the period of burn toxemia.

**Material and research methods.** The results of hourly monitoring of the respiratory rate (RR) and data of laboratory and biochemical blood tests of patients admitted to the Department of Combustiology of the Republican Scientific Center of Emergency Medicine due to burn injury in the first ten days after injury were studied. After recovery from shock, anti-inflammatory, antibacterial, infusion therapy, correction of protein and water-electrolyte balance disorders, early surgical, delayed necrectomy, additional parenteral nutrition, syndromic, symptomatic therapy were carried out. Changes in the RR circadian rhythm were studied by monitoring the hourly continuous recording of respiratory rate indicators in 107 patients with severe thermal burns in six age groups - group 1, 31 patients aged 6 months - 3 years, group 2 - 25 patients aged 3.1-7 years, Group 3 25 patients - 7.1-18 years old, 4 - 12 patients 19-40 years old, 5-7 patients 41-60 years old, 6 group - 7 patients 61-78 years old. The division into groups was dictated by the well-known features inherent in each age group, described in detail in the literature. The indicators in each pediatric group were differentiatedly studied in three subgroups, depending on the severity of the burn injury according to the duration of intensive care in the ICU. Children were in the ICU from 4 to 10 days - 1 subgroup, 2 subgroup from 11 to 20 days, 3 subgroup from 21 to 50 days. After recovery from shock, anti-inflammatory, antibacterial, infusion therapy, correction of protein and water-electrolyte balance disorders, early surgical, delayed necrectomy, additional parenteral nutrition, syndromic, symptomatic therapy were carried out. In groups - 1 group 12 patients aged 20-40 years, 2 group - 7 patients aged 41-60 years, group 3, 6 patients - 61-78 years old. The division into groups was dictated by the well-known features inherent in each age group, described in detail in the literature.

As shown in Table 1, the main factors affecting the severity of the condition of children with thermal burns of infancy were age (the younger the child, the more severe the condition), the area of damage to the skin surface of grade 3B, and the IF index.

The average age of children with severe burns in the age group from 3.1 to 7 years (group 2) ranged from 3.9 to 5 years (tab. 1). There were no significant differences between the groups and in the index of the area of the 2-3A burn, and amounted to  $37.3 \pm 14.7\%$  in 1 subgroup,  $47.9 \pm 17.1\%$  in 2, and  $59.2 \pm 12.2\%$  in 3. However, a statistically significant difference was found in the area of grade 3B burns in subgroups 1 and 3, which in the most severe group of children exceeded the grade 3B burn in group 1 by 11 times ( $p < 0.05$ ) and was 6 times greater than in subgroup 2. In accordance with the severity of the condition, the duration of intensive therapy in ICU conditions in subgroup 2 was more than in the first by 62% ( $p < 0.05$ ), in subgroup 3 more than three times longer ( $p < 0.05$ ) than in the

first. The determining the duration of treatment in the hospital in groups 1, 2 and 3 were such indicators as the size of the burn area of the 3B degree, the Frank index, the duration of intensive care in the ICU. Thus, age, IF index, area of grade 3B thermal damage served as objective indicators of the severity of thermal burns and made it possible to predict the duration of intensive care in the ICU and inpatient treatment of pediatric patients.

**Table 1.**  
*Characteristics of patients admitted with thermal burns*

Sub-groups	Groups	Age	Area of 2-3A degree burn in %	3 B degree	IF, units	In ICU, days
1	Group 1	19.3±6.2 months	32.7±9.8	0.1±0.03	33.4±10.1	6.8±1.8
2		14.2±4.6 months.	24.8±7.4	9±2.8	48.4±11.28	12.8±1.3
3		10.1±2.1 months.	26.7±2.2	6±2.7	71.3±8.4	26.3±2.4
1	Group 2	4.7±0.8	37.3±14.7	3.1±4.4	42.5±15.7	8.1±1.3
2		4.0±0.1	47.9±17.1	18.1±12.2	85.1±28.7	13.1±1.9
3		4.4±0.6	59.2±12.2	36.7±13.3	127.5±33.3	27.3±3.2
1	Group 3	11.4±3.2	41±11	6.6±6	57±11	7.3±1.1
2		15±2	55.1±14.4	4.8±3.5	86.3±15.7	12.7±1.1
3		9.7±1.5	25.8±11.4	22.5±6.6	95.8±19.1	28.8±4.8
	Group 4	27.3±5.6	59.4±13.5	21.3±13.3	119.4±38.4	22.4±14.6
	Group 5	50.7±7.1	54.3±16.5	11.9±8.9	92.5±20.8	13.3±2.4
	Group 6	71.3±7.0	40.8±5.8	21.7±6.7	86.7±12.8	18.8±9.5

As can be seen from Table 1, the age groups of adult patients were significantly different and averaged  $27.3 \pm 5.6$  years in group 1,  $50.7 \pm 7.1$  years in the second, and  $71.3 \pm 7.0$  years in the third. The total area and the area of deep burn damage to the skin did not differ significantly. The highest index of IF was revealed in group 1, which determined the longest duration of intensive therapy in ICU conditions in the youngest group 1.

**Discussion of research results.****Table 2.**

*Dynamics of the mesor of the circadian rhythm of respiration in burn toxemia depending on age (RR per minute)*

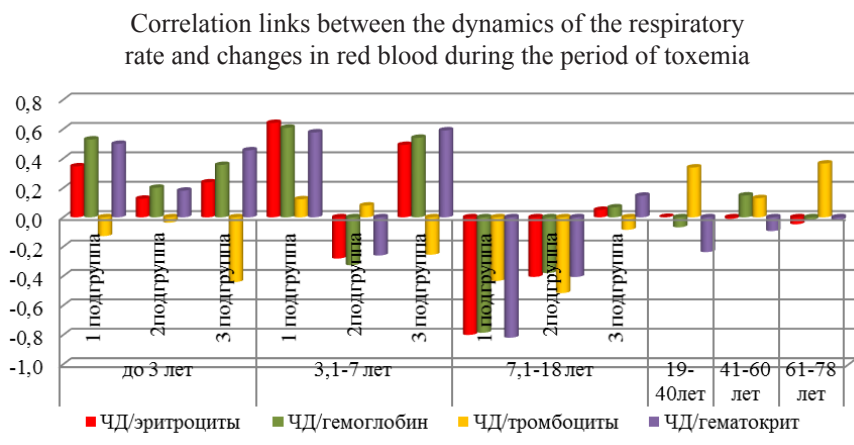
	Age group 1			Group 2			Group 3			Group 4	Group 5	Group 6
	6 months-3 years			3.1-7 years			7.1-18 years					
Days	Subgroup 1	Subgroup 2	Subgroup 3	Subgroup 1	Subgroup 2	Subgroup 3	Subgroup 1	Subgroup 2	Subgroup 3	19-40 years	41-60 years	61-78 years
1	35.0 ±2.1	31.9 ±0.7	36.5 ±0.8	28.1 ±1.4*	27.3 ±0.6*	28.7 ±1.1*	21.3 ±0.8'''	20.7 ±0.5'''	25.0 ±3.8	20.5 ±0.6	19.6 ±0.3	21.4 ±0.4
2	30.2 ±0.2	29.1 ±1.0	32.6 ±0.8	27.8 ±0.4*	25.5 ±0.7*	28.1 ±0.3*	21.2 ±0.3'''	21.3 ±0.4'''	22.4 ±0.4'''	20.4 ±0.2	19.4 ±0.2	20.2 ±0.4
3	30.2 ±0.4	31.1 ±0.8	31.9 ±1.1	26.2 ±0.5*	25.1 ±0.5*	27.9 ±0.5*	21.1 ±0.2'''	20.7 ±0.3'''	22.8 ±0.3'''	20.6 ±0.2	19.4 ±0.2	20.3 ±0.4
4	29.7 ±0.3	30.6 ±0.3	35.6 ±0.4	26.2 ±0.4*	28.2 ±0.5*	27.7 ±0.4*	22.1 ±0.4'''	20.8 ±0.3'''	23.3 ±0.4'''	20.5 ±0.6	19.7 ±0.2	20.2 ±0.3
5	29.9 ±0.4	31.2 ±0.5	34.2 ±0.7	25.0 ±0.3*	26.9 ±0.5*	27.3 ±0.4*	22.3 ±0.3'''	21.1 ±0.4'''	23.2 ±0.4'''	20.3 ±0.2	19.5 ±0.3	20.3 ±0.3
6	30.2 ±0.5	31.6 ±0.6	33.8 ±0.4	26.6 ±0.4*	26.3 ±1.0*	28.2 ±0.6*	22.3 ±0.2'''	21.1 ±0.5'''	23.0 ±0.3'''	20.5 ±0.2	20.1 ±0.3	19.9 ±0.4
7	30.5 ±0.4	31.8 ±0.5	33.1 ±0.4	24.9 ±0.5*	27.1 ±0.5*	27.8 ±0.8*	23.0 ±0.7	21.0 ±0.4'''	23.6 ±0.3'''	20.9 ±0.3	20.1 ±0.3	19.5 ±0.3
8	29.4 ±0.5	30.6 ±0.5	33.9 ±0.5	26.5 ±0.4*	26.2 ±0.4*	27.6 ±0.3*	22.1 ±0.9'''	21.3 ±0.6'''	23.9 ±0.4'''	20.7 ±0.2	20.3 ±0.3	20.3 ±0.5
9	29.5 ±0.6	30.0 ±0.3	33.2 ±0.7	25.6 ±0.7*	27.7 ±1.1*	27.3 ±0.5*	23.8 ±0.7'''	22.4 ±0.5'''	23.0 ±0.5'''	20.4 ±0.2	20.0 ±0.4	21.1 ±0.6
10		30.1 ±0.5	32.5 ±0.6		27.9 ±0.5*	27.3 ±0.5*		21.8 ±0.5'''	23.2 ±0.3'''	21.1 ±0.3	19.5 ±0.5	21.4 ±0.5

\*-reliable relative to the subgroup of the same name of group 1

'''-reliable relative to the indicator of the same name subgroup of group 2

As can be seen from the data presented in Table 2, on the first day, the RR indicator of the mesor of the circadian rhythm indicated a tendency towards increased respiration relative to the age norm in all patients. During the first 10 days of toxemia, no significant dynamics of the mesor of the RR circadian rhythm was revealed. That is, in children of group 2, RR was 20% less in day 1 than in group 1, and in group 3 it was 25% less. In the 4,5,6 groups of adults, the indicators of the

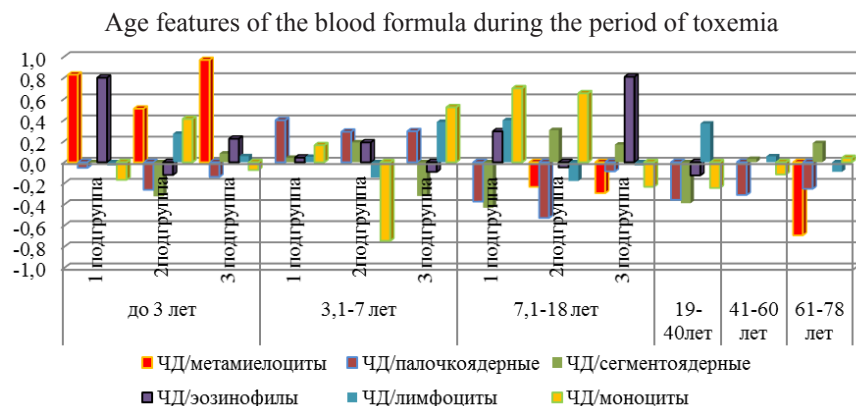
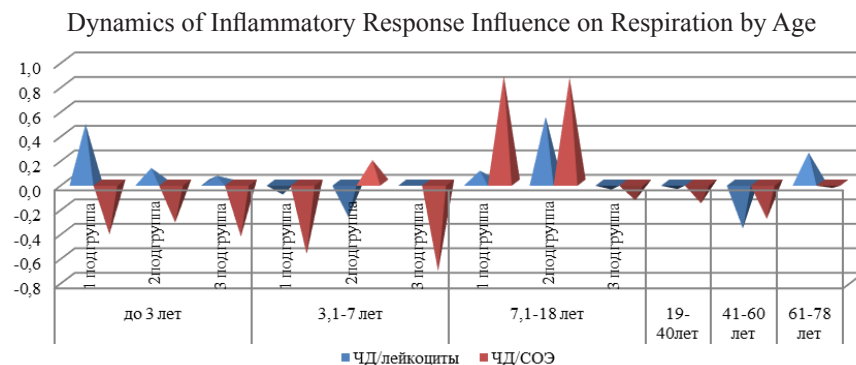
mesor of the circadian rhythm RR did not differ significantly from the indicator in school-age children. Thus, during the period of toxemia, the age-related difference in the RR indicator in 1, 2 and 3 age groups remained. There were no significant differences depending on the severity of burn injury in subgroups 1,2,3.



*Fig.1*

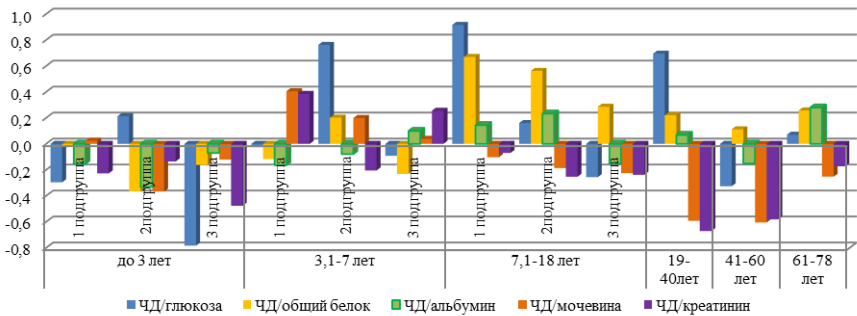
The deficit in the number of erythrocytes led to the emergence of a reliable inverse correlation of the indicator with RR, that is, in subgroup 1 and to a lesser extent in subgroup 2 of children of group 3, a further decrease in the number of erythrocytes, hemoglobin, hematocrit would cause an even greater compensatory increase in respiration due to an increase in hemic hypoxia ( fig.1). Thus, the ongoing intensive therapy with timely correction of anemia, according to the views of the attending physicians, revealed an insufficiency in replenishing the deficit of the studied blood parameters in school-age children.

A direct effect of the number of metamyelocytes in infants on RR was revealed (fig. 2), when the inflammatory reaction was expressed in an increase in the number of metamyelocytes. In school-age children, the indicator influencing RR was the number of monocytes in subgroups 1 and 2 and in subgroup 2 of preschool children. Perhaps the predominant role in the development of compensatory reactions of an increase in monocytes in the peripheral blood is an age-related feature of preschool and school children.

*Fig.2**Fig.3*

A significant inverse was found in subgroup 3 of preschool children and a direct correlation between changes in ESR and RR in subgroups 1 and 2 of school age children. That is, the direct compensatory value of the activity of the respiratory system during the systemic inflammatory response of the body was revealed in children of group 3, which was apparently due to the insufficient effectiveness of anti-inflammatory, stress-limiting therapy (fig. 3).

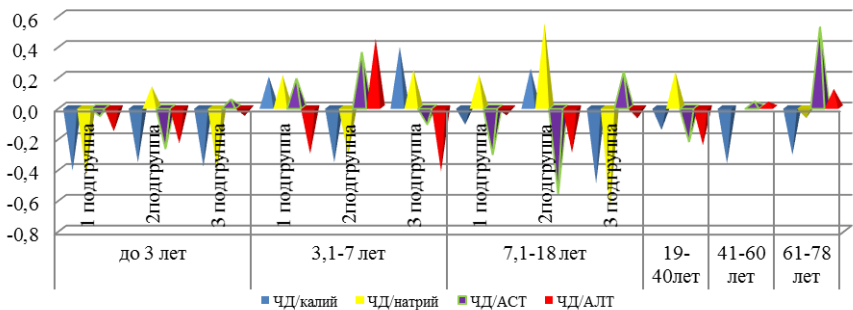
### Effect of onco-osmotic components on the respiratory rate depending on age



**Fig.4**

The stimulating effect of blood glucose concentration on RR was observed only in subgroup 1 of patients in group 3 (fig. 4). In children of the 3rd subgroup of the 1st group, a negative correlation was found between the blood glucose level and RR, possibly due to a tendency to hypoglycemia, which caused a compensatory rapid breathing to correct the energy deficit state due to insufficient carbohydrate load in the parenteral nutrition. To correct the latter, it is necessary to increase the introduction of carbohydrates, taking into account the highest level of hypermetabolism in burns  $26.7 \pm 2.2\%$ , grade 3B  $6 \pm 2.7\%$ , IF  $71.3 \pm 8.4$  units under the age of 3 years.

### Dependence of the respiratory rate on electrolytes, enzymes by age



**Fig.5**

As can be seen from the data presented in fig. 5, only in the third subgroup of school-age patients, a decrease in the concentration of sodium in the plasma would cause an increase in respiration, indicating an imbalance in the electrolyte composition of the plasma.

#### Influence on respiration of changes in indicators of the hemocoagulation system

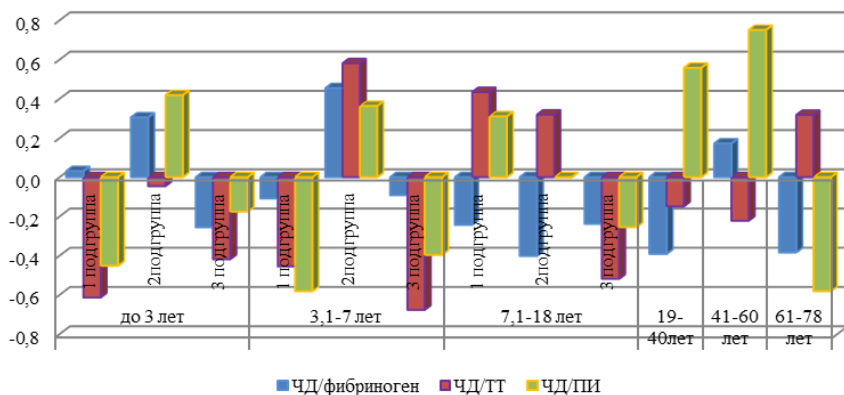


Fig.6

A tendency to the stimulating effect of PI growth (hypercoagulation in phase 2 of coagulation) on RR was found in groups 4 and 5 of adult patients, while in children under 7 years of the first subgroup and people over 61 years of age, there was a tendency for increased respiration with a decrease in PI (fig. 6). A decrease in the level of TT also caused a tendency to increase respiration in 1.3 subgroups of infants, in subgroups 1 and 3 of preschool age, and in subgroup 3 of school age. The change in the level of fibrinogen had a slightly smaller effect on respiration. Thus, in general, the compensatory value of an increase in the activity of the respiratory system was revealed with a tendency to hypocoagulation in the 2nd and 3rd phases of blood coagulation. This can be understood as an adequate syndromic correction by the volume of anticoagulant, infusion therapy, correction of rheological disorders of the blood in the first 10 days of burn toxemia.

**Conclusions.** In the first 10 days of toxemia, the level of the mesor of the circadian rhythm RR remained at the level of the indicator on day 1 with a tendency to increased respiration relative to the age norm in all patients. The ongoing intensive therapy with timely correction of anemia revealed an insufficiency in replenishing the deficit of the studied blood parameters in school-age children. The direct influence of the number of metamyelocytes in infants on RR was revealed,



when the inflammatory reaction was mainly expressed in an increase in the number of metamyelocytes. In school-age children, the number of monocytes in 1 and 2 subgroups of school and in subgroup 2 of preschool children turned out to be an indicator influencing the value of the mesor of the circadian rhythm RR. Perhaps the predominant role in the development of compensatory reactions of an increase in monocytes in the peripheral blood is an age-related feature of preschool and school children. A tendency to the stimulating effect of hypercoagulation in the 2nd phase of coagulation on RR was found in groups 4 and 5 of adult patients, while in children under 7 years of the first subgroup and people over 61 years of age, there was a tendency to increased respiration with a decrease in PI.

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鸢尾鸢尾形态生物学特性的比较分析。 在布拉戈维申斯克 (阿穆尔州) 的园林绿化中的应用

**COMPARATIVE ANALYSIS OF MORPHO-BIOLOGICAL  
CHARACTERISTICS OF IRIS LAEVIGATA FISCH. AND  
APPLICATION IN LANDSCAPING OF BLAGOVESHCHENSK (AMUR  
OBLAST)**

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抽象的。鸢尾属 (*Iris* L.) 属鸢尾科 (*Iridaceae* Juss) 家族, 被认为是布拉戈维申斯克 (Blagoveshchensk) 城市园林绿化的有前途的植物之一。该属包括大约300种, 分布在北半球, 俄罗斯和邻国。该属的代表是开放的, 阳光充足的地方的植物, 在阴暗和沼泽的地区只发现了一些。虹膜具有良好的耐寒性, 早期开花和装饰性。它们在花的形状和颜色, 开花的时间方面是多种多样的, 并具有各种生物学和生态学特征。

该研究的目的是观察鸢尾鸢尾的生长和发育特征。 (光滑的虹膜), 并在布拉戈维申斯克 (Blagoveshchensk) 绿化环境中比较这种自然生长的物种, 以扩大植物的范围。

本文介绍了鸢尾鸢尾的生物学特性的比较特征。鸢尾科Juss。在文化和自然中成长。在文化上, 该物种生长在FSBEI远东SAU示范区。作为观察的结果, 发现在鸢尾鸢尾的培养条件下。两个星期后, 它进入了生长期, 丁香化和开花。优质的农具对植物的形态生物学特性有积极的影响。无论在文化上还是在自然中, 开花期的持续时间均为17天。在整个生长季节中, 这种植物都保留了很高的装饰效果, 这使其可用于绿色建筑。

关键词: 鸢尾花家庭, 鸢尾花鸢尾, 物候观测, 生物特征研究, 装饰性, 园艺。

**Abstract.** *The genus Iris L. belongs to the Iridaceae Juss family and is considered one of the promising plants for urban landscaping in Blagoveshchensk. The genus includes about 300 species, distributed in the Northern Hemisphere, in Russia and neighboring states. Representatives of this genus are plants in open, sunny places, and only a few are found in shady and swampy areas. Irises have good winter hardiness, early flowering and decorative properties. They are diverse in the shape and color of the flower, the timing of flowering, and have various biological and ecological characteristics.*

*The aim of the research is to observe the characteristics of growth and development of Iris laevigata Fisch. (smooth iris) in culture and compare this species growing in nature, to expand the range of plants, in the landscaping of Blagoveshchensk.*

*The article presents a comparative characteristic of the morbo-biological characters of Iris laevigata Fisch. Of the family Iridaceae Juss. growing in culture and nature. In culture, this species grows on the demonstration plot FSBEI Far Eastern SAU. As a result of the observations, it was found that under the conditions of the culture of Iris laevigata Fisch. two weeks later it enters the growing season, butanization and flowering. A good agrophone has a positive effect on the morpho-biological characteristics of the plant. The duration of the flowering period both in culture and in nature is 17 days. Throughout the growing season, the plant retains a high decorative effect, which characterizes it as promising for use in green building.*

**Keywords:** *Iris family, Iris laevigata Fisch., Phenological observations, biometric studies, decorativeness, gardening.*

The successful solution of landscaping problems depends on many conditions, among which the selection of an assortment of ornamental plants is one of the most important. The main goal in the selection of ornamental plants is the formation of stable phytocenoses, actively performing ecological functions, achieving an abundance of greenery and the duration of flowering [5].

The passion for floriculture in the modern world allows people to maintain a connection between generations (after all, our ancestors also loved and knew how to grow flowers, we inherited a lot from them), enjoy communication with nature, draw strength for life and creativity [2].

Currently, the most relevant and popular among the population are plants with bright flowers, abundant and long flowering. Ornamental crop production in most regions is based mainly on an assortment of annual flower crops. A small assortment of plants is used, a lot of effort is put in, new annuals are planted every year using seedlings.

Meanwhile, there are quite a few wild and varietal plants of the iris family, which are very beautiful in their qualities and are used in a small assortment for landscaping territories [10].

Creating conditions for long-term growth, flowering and fruiting of perennials of the iris family consists in good care when growing them. It is necessary for the favorable development of their root system (rhizomes, corms, tubers) and buds of plant growth renewal. Thus, the rapid development of these perennials and their high decorative effect are achieved [3].

In recent years, active individual housing construction has been going on in the Amur Oblast, so there is a need for green landscaping of plots, parks and squares.

This requires ornamental plants, among which representatives of the iris family occupy a special place [5].

The aim of the research is to observe the characteristics of growth and development of *Iris laevigata* Fisch. (smooth iris) in culture and compare this species growing in nature, to expand the range of plants, in the landscaping of Blagoveshchensk.

The genus *Iris* L. belongs to the Iridaceae Juss family and is considered one of the promising plants for urban landscaping in Blagoveshchensk (Amur Oblast) [13]. The genus includes about 300 species, distributed in the Northern Hemisphere [12], in Russia and neighboring states. Representatives of this genus are plants in open, sunny places, and only a few are found in shady and swampy areas [1]. Irises have good winter hardiness, early flowering and decorative properties. They are diverse in the shape and color of the flower, the timing of flowering, and have various biological and ecological characteristics [4].

*Iris laevigata* is an ornamental flowering perennial, its abundance in accessible places of natural growth is significantly reduced, mainly as a result of human economic activity, collection for bouquets.

Iris smooth (*Iris laevigata* Fisch.) Plant with a creeping rhizome, forming a loose turf, 75-100 cm high. The stem is hollow, cylindrical. The leaves are xiphoid, purple-red at the base, longer than or equal to the peduncle. The rhizome is covered with fibrous remains of dead leaves. Blooms in June. Planting depth 15-20 cm [11].

*Iris laevigata* Fisch. has been growing in culture on the demonstration site since 2017. According to the methodology of the GSI [7], to study short-rhizome perennial plants, it is necessary to have five rhizomes; this method was also used to assess decorativeness. Phenological observations were carried out according to the method of phenological observations in botanical gardens [8]. The experimental data were processed using Microsoft Office Excel 2007.

Blagoveshchensk has a continental variant of a temperate monsoon climate. The continentality of the climate is manifested in a large annual (43°C) and daily (10-15°C) temperature amplitude. The monsoon of the climate is expressed in the direction of seasonal winds, active cyclonic activity and a large amount of precipitation in the warm season. Summers are hot with a significant amount of sunshine. Winters are cold, dry, with a thin snow cover. The growing season lasts 150-165 days. The frost-free period is 134 days [6].

Spring in 2020 was early and moderately warm. The transition of the average daily air temperature through 0°C to positive values was noted in the southern regions of the Oblast on March 24-29, which is 2-11 days earlier than the average long-term dates. The average air temperature for the season exceeded the multi-year norm by 1-2° and amounted to 4-10°C. During the period, significant changes

in temperature were noted. Spring was quite humid, May was characterized by a large amount of precipitation. In general, 41-131 mm of precipitation fell during the season.

Agrometeorological conditions for carrying out agrotechnical measures were predominantly favorable.

Summer in the southern regions of the Oblast came on May 27, which is 2-5 days earlier than the multi-year dates. The average daily air temperature steadily crossed + 15°, i.e. the meteorological summer has arrived. Summer weather was unstable, June and August were cold and rainy, July was hot and dry.

During the summer season, periods of cold snaps were replaced by intense warming. The second decade of July was unusually hot. The air warmed up to 32 ... 38° during the day, temperature records were recorded at many meteorological stations. A significant cooling with a decrease in average daily air temperatures relative to the climatic norm by 3-5° was observed on August 19, 20. As a result, the average air temperature for three summer months was within the multiyear norm and amounted to 16 ... 20°.

In autumn, a stable transition of the average daily air temperature through + 15° in the southern regions took place later than the multi-year dates from 2 to 11 days - September 10-17. Thus, the duration of the summer period in the southern regions turned out to be longer from 4 to 13 days, the duration was 97-113 days [9].

In general, the agrometeorological conditions of 2020 were favorable for the growth and development of ornamental plants, which allowed them to go through all phenological phases.

*Iris laevigata* Fisch. grows on the FAE demonstration site, Far Eastern SAU, and has been in the collection since 2017, first bloomed in 2019. The carried out phenological observations according to the method showed that in 2020 the re-growth in the culture began on May 4, and in *Iris* smooth growing in nature on the territory of the Ivanovo district on April 30 (tab. 1).

**Table 1** Phenological phases of *Iris laevigata* Fisch., 2020

Phenological phases	<i>Iris laevigata</i> Fisch. grows in the demonstration plot of SAU Far Eastern SAU	<i>Iris laevigata</i> Fisch. grows in nature (in meadows), the territory of the Ivanovsky district
Regrowth	4.05	30.04
Budding	13.06	30.05
The beginning of flowering	15.06	2.06
Mass bloom	23.06	9.06
End of flowering	2.07	19.06

The budding phase in plants on the territory of the demonstration plot was noted on June 13, and in nature on May 30. The beginning of flowering two weeks earlier came in iris growing in a meadow in the Ivanovo Oblast. Mass flowering was observed after 8 days both in nature and in culture.

Thus, phenological phases in iris that grow naturally occur earlier than in plants that grow on the territory of the SAU demonstration plot. The difference between the beginning of the phenological phases of development in plants growing in different conditions from 5 (beginning of regrowth) to 17 days (end of flowering). At the same time, the duration of the flowering period both in culture and in nature is 17 days.

The end of flowering did not lead to the loss of decorativeness by the plants. Ripening seed pods, until the end of the growing season, gave the plant a unique look.

The comparative biometric analysis of iris smooth showed that the array of measurements is presented as an arithmetic mean with a standard deviation (table 2).

Plants growing in the natural environment are inferior to those cultivated in the demonstration plot in terms of biometric indicators. So *Iris laevigata* Fich. growing in culture stood out by the height of the plants and the length of the leaf, which is 20 cm of the growing species in nature. The diameter of a flower in culture exceeded plants in the natural environment by 1 cm.

**Table 2** Biometric observations *Iris laevigata* Fich.

<b>Biometric indicators</b>	<b><i>Iris laevigata</i> Fich. growing in the demonstration plot of SAU Far Eastern SAU</b>	<b><i>Iris laevigata</i> Fich. growing in nature (in meadows), the territory of the Ivanovsky district</b>
Plant height, cm	100±5.8	80±5.4
Sheet length, cm	95±2.7	75±2.9
Sheet width, cm	2±0.1	1.5±0.1
Flower diameter, cm	10±1.2	9±1.1
Outer perianth lobes (length/width), cm	8±0.7/4±0.3	7±0.4/3.5±0.2

Decorativeness is assessed according to the following indicators: plant habit, abundance of flowering, decorative leaves, flower color, flower size, flower shape, general condition. The rating system is five-point, from 0 to 5. According to the indicators that determine decorativeness to the greatest extent.

When assessing the decorativeness of a plant, depending on the significance of the trait, a specific conversion factor was established for each species. Each sign

of decorativeness is assessed within a five-point scale. In the future, the points (for each attribute separately) are multiplied by the conversion factor (the degree of significance of the attribute) and the result obtained, which is the final assessment of the attribute, is entered into the corresponding column of the decorativeness assessment card (tab. 3)

**Table 3** – Scale for assessing ornamental and economic-biological characteristics *Iris laevigata* Fich

Feature	0/5*	K**	0/100***
Decorative features			
Flower color and its stability (strength, brightness, stain)	5	3	15
Number of petals (density)	5	1	5
Flower size (large, medium, small)	5	2	10
Inflorescence (the number of flowers is dense, loose)	5	2	6
Number of simultaneously opened flowers	5	2	6
Peduncle quality (strength, straightness)	5	2	10
Abundance of flowering	5	1	5
Plant condition	5	1	5
Originality of the species	5	2	6
Overall score			68
Economically valuable features			
Flowering duration	5	2	10
Drought tolerance	5	1	4
Winter hardiness	5	1	10
Disease and pest resistance	5	1	5
Resistance to adverse weather conditions	5	2	8
Intensity of vegetative reproduction	5	1	5
Overall score			32
Total			100

\* Assessment of a feature according to a five-point system \*\* K - a conversion factor depending on the significance of a feature \*\*\* Assessment of a feature according to a 100-point system

Reduce the decorative effect of *Iris laevigata* Fich. during the period of mass flowering, unfavorable meteorological conditions, such as wind and rain, can occur, as a result of which the stems break, lodging of plants is observed. Plants resistant to these factors are rated at five points, with damage up to 20% - four points, up to 40% - three points, up to 60% - two points, over 80% - one point.

According to the results of the assessment, the species is promising for use in green construction. It is winter-hardy, not damaged by diseases and pests, and reproduces well vegetatively.

### Conclusions

Thus, under the conditions of the culture of *Iris laevigata* Fisch. two weeks later it enters the growing season, butanization and flowering. A good agricultural background has a positive effect on the morpho-biological characteristics of the plant. Throughout the growing season, the plant retains a high decorative effect, which characterizes it as promising for use in green building.

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诱变诱变在遗传研究中的应用

回顾 – 第二部分

## THE USE OF INDUCED MUTAGENESIS IN GENETIC RESEARCH REVIEW – PART TWO

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这篇综述文章根据同时出现的量子理论和基因理论显示了遗传学理论方向发展的时间顺序，这些理论由于普通法而得到进一步的和解。I. A. 研究的作用微观遗传学中的Rapoport，涉及对生物遗传材料的结构和功能组织的精细水平的研究。在综合科学的交汇处，开阔的视野可以渗透到物质世界现象的深处，这导致了I. A. Rapoport发现化学诱变剂和化学诱变现象。纳米生物技术的迅速发展目前证实了I. A. Rapoport在科学的跨学科综合方面提供了一个研究纳米结构并对其进行操纵的机会，这对于医学，生物技术和其他科学分支而言非常有趣。现代科学家预测，量子力学和遗传学之间的相互作用将更加紧密，因为正是在这两种以分立单元运行的科学共同作用的领域中，纳米技术的许多紧迫问题才有望得到解决。化学诱变方法学Rapoporta为遗传原子论，生物技术和材料科学的思想发展做出了革命性的贡献，扩大了它们的原始材料规模。

关键词：诱变，遗传变异，选择，微遗传学，量子物理学，纳米生物技术，材料科学

**Abstract.** *The review article shows the chronology of the development of the theoretical directions of genetics on the basis of quantum and gene theories that arose simultaneously and received further rapprochement due to common laws. The role of research by I.A. Rapoport in microgenetics, concerning the study of fine levels of the structural and functional organization of the genetic material of organisms. At the junction of the integrated sciences, wide horizons open up for penetrating into the depths of the phenomena of the material world, which led I.A. Rapoport to the discovery of chemical mutagens and the phenomenon of chemical mutagenesis. The rapid development of nanobiotechnology currently*

*confirms the validity of I.A. Rapoport in the aspect of interdisciplinary synthesis of sciences and provides an opportunity to study nanostructures and manipulate them, which is of interest for medicine, biotechnology and other branches of scientific knowledge. Modern scientists predict a closer interaction of quantum mechanics and genetics, since it is in the field of joint action of these two sciences, operating with discrete units, that a number of urgent problems of nanotechnology are expected to be solved. I.A. Rapoport's methodology of chemical mutagenesis makes his revolutionary contribution to the development of the ideas of genetic atomism, biotechnology and materials science, expanding the scale of the source material for them.*

**Keywords:** *mutagenesis, genetic variability, selection, microgenetics, quantum physics, nanobiotechnology, materials science.*

## **Introduction**

The use of the method of experimental mutagenesis in plant breeding has made a great contribution to the theory of genetics, to the development of genetic breeding methods, the development of microbiology and raw agricultural products, as well as health problems [21-23]. Currently, studies in the field of artificial induction of mutations show the effectiveness of their use in solving problems of protecting the external environment from pollution [9]. In this regard, the task of managing the processes of variability comes to one of the first places in theoretical research and practical selection, and the construction of genotypes becomes a fundamental problem of these processes [6].

## **Induced mutagenesis in the development of theoretical genetics**

*If an idea doesn't seem crazy at first,  
then it is hopeless (A. Einstein)*

The year 1900 in natural science was marked by the birth of two great theories: quantum and genetic, which established two fundamental features of the material world - discreteness and discontinuity. The discoveries of the electron, the portioning of electromagnetic energy, the discovery of X-ray quanta, the phenomena of radioactivity, as well as the phenomena of heredity paved the way for the dominance of atomistic views in the theory of the structure of matter. A great contribution to the development of the ideas of genetic atomism was made by the experimental and theoretical studies of I.A. Rapoport. These studies have shown that the same patterns operate in genetic systems as in microphysics: atomism, high ordering of discrete units, their divisibility into other orders of discontinuity, abrupt transitions from one state to another [5].

These conclusions were preceded by I.A. Rapoport, as well as practical and  
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theoretical achievements of other scientists. G. Möller, for example, was the first to show that the finest hereditary structures of chromosomes can change abruptly under the influence of X-rays - thus, there are transformations of some genes into others. The discovery of the possibility of accelerating the mutational process in all its various forms has given researchers a powerful method that makes it possible to put concretely some of the most difficult questions of modern genetics [6, 22].

A.S. Serebrovsky and N.P. Dubinin successfully used this method in solving theoretical problems of genetics, and by the end of the 30s of the 20th century, the creation of a general theory of the occurrence of mutations, the so-called "target theory", was completed [1, 3, 16].

In the 40s of the last century, an intensive study of the mutagenic action of organic compounds began. The discovery of I.A. Rapoport and S. Auerbach in 1947, the mutagenic activity of ethyleneimine and diethyl sulfate further contributed to the wide scope of work on the induction of mutants in plants. Studies on chemical mutagenesis, which were initially carried out on *Drosophila*, were, however, of broader importance in the development of the problems of mutagenesis, since they served as the basis for the widespread use of chemical agents in studies of mutagenesis in various living organisms [17, 22].

I.A. Rapoport in the field of hereditary and phenotypic variability is largely due to the fact that he was able to integrate the fundamental sciences for these purposes: genetics, physics and chemistry. At the junction of integrated sciences, wide horizons open up for penetration into the depth of phenomena, which led I.A. Rapoport to his main discoveries [21]. Rapoport's discovery of chemical mutagens and the phenomenon of chemical mutagenesis are among the greatest discoveries of the XX century, for which he was nominated for the Nobel Prize. I.A. Rapoport discovered about 300 strong chemical mutagens that cause hereditary variability, and weaker - several times more, with which he also worked a lot. Iosif Abramovich called the most effective chemical substances supermutagens [19-21]. I.A. Rapoport found that the specificity of the spectrum of action of chemical mutagens is caused by the ensemble of physicochemical properties inherent in each substance, as well as by the richness of combinations in the mutagen molecule of radicals directly involved in the formation of valence bonds with the attacked gene [8].

It was found that the selectivity of the action of a chemical mutagen is associated with the characteristics of the metabolism of the biological system: the sensitivity of individual stages of the life cycle to the agent, the presence or absence of enzymes that inactivate the functional group of the mutagen, the permeability of cell membranes, etc. Mutations taken into account at the level of the organism are the result of a complex of phenomena at different levels of organization of genetic systems - from molecular to organismal and population. The specificity

of the organism in mutagenesis as a whole manifests itself as a reflection of the action of the mechanisms of organismic homeostasis, based on the functioning of the genetic and physiological protective-restorative systems of the organism [21, 22]. The specificity of the manifestation of mutations depends not only on the type of the influencing factor (mutagen) and the genetic characteristics of the target, but also on the modifying effect of external conditions when the mutagen affects the body [17], as well as on the growing conditions of M-1.

The specificity of the action of supermutagens at the cellular and molecular levels is associated with their chemical affinity for certain structures of the genetic material of the cell, precursors of DNA and protein synthesis (triplets, nucleotides, amino acids) and certain regions - chromosome loci due to the fact that the dipole moments of the molecules of chemical mutagenic substances correspond to the dipole moments of certain molecular structures of the cell [10-12, 19, 20]. In the formation of ideas about specificity, it is important that when using the most efficient alkylating mutagens I.A. Rapoport in moderate doses, they are able to enter into alkylation (methylation) reactions with DNA bases. In this case, the euchromatin-heterochromatin ratio can change towards an increase in the amount of heterochromatin (epigenetic processes), which, apparently, is one of the reasons for the emergence of highly adaptive properties [18, 21].

Non-hereditary variability has also been deeply studied by I.A. Rapoport. He discovered a large number of chemical compounds that cause modifications (morphoses), in particular, phenocopies that mimic mutations. Among the modifiers, the most interesting is a highly effective physiologically active substance, an antioxidant, para-aminobenzoic acid (PABA) [20]. By activating the enzyme DNA polymerase, PABA causes repair - restoration of chromosomes damaged by ionizing radiation or high doses of chemical mutagens [2]. PABA has been widely used in agriculture since the 1980s on cereals, vegetables and forage crops, in domestic and farm animals, in which immunity, survival, weight and fertility are increased. PABA is also used in forestry, cell culture, tissue culture. It is used in gerontology and in the treatment of eye diseases. Such a broad positive effect of PABA on various taxonomic objects is mainly based on the activation of a wide range of vital enzymes, which are often depressed under the influence of unfavorable conditions, and on the restoration of damaged chromosomes. In this regard, PABA is especially effective in those cases when the external conditions are unfavorable [20].

At the annual All-Union meetings on chemical mutagenesis, held by I.A. Rapoport at the ICP USSR AS from 1966 to 1990, in his traditional reports on theoretical issues of genetics, he substantiated the need to study more subtle levels of the structural and functional organization of genetic material. In this regard, he predicted the convergence of genetics with quantum physics in the very near future. At the time, these statements caused confusion among most of the audience,

since the idea itself seemed paradoxical. Many years later, the executive editor of the book "Iosif Abramovich Rapoport - scientist, warrior, citizen", professor V.G. Mitrofanov, wrote in the preface to it: "... the originality and novelty of his ideas were not always and not immediately appreciated by contemporaries properly, because ideas outside the dominant paradigm of most people, as you know, are not perceived" [7]. In this context, we have cited A. Einstein's statement as an epigraph to this article.

Here are some more fragments from the works of S. Zakhidov, O.G. Stroeveva and other authors for the purpose of a synopsis of the topic raised.

The fundamental provisions of this line of research were published in the book by I.A. Rapoport "Microgenetics" (1965), the circulation of which in the same year was completely destroyed by order of the authorities. Only thanks to the efforts of his followers and like-minded people and, mainly, his wife and associate I.A. Rapoport, professor O.G. Stroeveva, the book "Microgenetics" received a second life in 2010 and the possibility of its "entry into scientific use, pushed back by 45 years" [10].

"Microgenetics" is the first experience of an interdisciplinary approach to understanding the phenomenon of life. "Microgenetics", and then all subsequent theoretical works of I.A. Rapoport gave the keys for obtaining deep knowledge about the structure and function of hereditary information, including from the standpoint of thermodynamic science [4].

Microgenetics is a new direction in genetics concerning the structure, properties and functioning of the apparatus of heredity, which are considered in the light of certain physicochemical constants and laws of thermodynamics at the level of autocatalysis monomers (nucleotides, triplets and amino acids) using chemical mutagens as test bodies. "Microgenetics is related to classical genetics (macrogenetics - in Rapoport's terminology) as quantum physics - to classical physics" [10, 13].

"Rapoport postulated: quantum mechanics and genetics have a strong theoretical relationship. Both study complex discrete sets, ... subordinate to one "ideal scheme", to the same laws, and wholly belonging to the system of natural atomisms, in which the classical hierarchy (ideal nesting) prevails. Discreteness endowed both fermionic and gene systems with stationarity. In the genetic system, as in the quantum system, there is uncertainty. For example, it is difficult to predict in which gene a mutation will occur" [5, 10].

In the microgenetic material of almost all living forms, one and the same extremely strict standard for the composition of the ensemble of amino acids and nucleotides is observed. This limited set of structural members remains almost unchanged throughout the long history of the development of living things. Zero entropy, which is maintained only in triplets and nucleotides within genes, far

surpasses all molecules in order of order. Therefore, free nucleotides and triplets without the participation of a template cannot create a gene structure, although once this happened or occasionally occurs in a spontaneous order. In general, genetic matter is capable of changing state without losing its privileged structure and stationarity. This is the thermodynamic peculiarity of the microgenetic apparatus [4, 10].

According to experts in the field of nanotechnology, DNA and protein molecules can become the basis for the creation of hybrid, mixed nanomaterials with new unique properties. It is also proposed to use double-stranded DNA molecules as important elements for microcircuits and to replace inorganic semiconductors with them [4]. The rapid development of nanobiotechnology today confirms the validity of I.A. Rapoport in the aspect of interdisciplinary synthesis of sciences and provides an opportunity to study nanostructures and manipulate them.

The nanoscale is unique because the fundamental properties of the elements of the nanoworld depend on their size to an extent that they do not depend on any other scale. At the molecular level, new physical and chemical properties emerge, determined by the behavior of atoms, molecules and nanocomplexes. Biological nanoobjects with linear dimensions of 1-100 nm include protein molecules, DNA, RNA, cytoskeletal polysaccharides, membrane channels, an intracellular signaling system, etc. DNA autoreplication can be considered a nano-phenomenon [14].

Russian scientists from the Institute of Bioorganic Chemistry of the Russian Academy of Sciences were the first to develop a technology for the automatic assembly of nanoparticles using molecules of some proteins isolated from rod-shaped bacteria. Nanoparticles collected in this way are of interest for medicine and biotechnology. Drug molecules and radioactive particles can be attached to these nanoparticles for the diagnosis and treatment of cancer. A radioactive isotope, fluorescent particle, drugs, toxins can be embedded in a nanoparticle [15]. The positive therapeutic effect of using protein nanoparticles with antimicrobial properties is largely due to the fact that they easily overcome the blood-brain barrier and fight infection already "in the field". This cannot be achieved with conventional antibiotics [14]. Fundamental results on the creation of nanostructures based on nucleic acid molecules containing molecules of "guests" were recently obtained by the laboratory of Yu.M. Evdokimov at the Institute of Molecular Biology. V.A. Engelhardt RAS. The authors believe that such nanostructures hold great promise for practical application in various fields of science and technology, from optics and electronics to medicine and ecology. It is in nanotechnology that the interests and methods of physics and chemistry, biology and materials science are closely intertwined ... because the peculiarity of nanoscience and nanotechnology is their interdisciplinarity [5].

Thus, "the new time will certainly push quantum mechanics and genetics to

an even greater convergence, since it is in the field of joint action of these two sciences, operating with discrete units, that a number of urgent problems of nanotechnology, a new representative of high technologies, are expected to be solved. And in this regard, Rapoport's methodology of chemical mutagenesis could make its revolutionary contribution by expanding the scale of the source material" [5].

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通过结合能源来谨慎使用水资源的替代技术

**ALTERNATIVE TECHNOLOGY FOR THE CAREFUL USE OF WATER  
RESOURCES BY COMBINING ENERGY SOURCES**

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抽象的。本文讨论了植物-微生物系统中能量的替代使用问题，该系统用于微生物对土壤的富集。该文章探讨了豆类植物与根瘤细菌和蓝绿色藻类的相互作用。这有助于合理利用水和土壤资源。

描述了麦芽的体外培养和根上的硝化细菌的研究。假定豆科植物根部的细菌在其DNA中。还研究了磁体，铜，二氧化硅，木炭，碳纤维对细菌的影响。揭示了这些物质对细菌的生长有什么影响。注意到碳纤维的显着影响和二氧化硅的小影响。

注意到微藻复合物对土壤的有益作用以及藻类快速增加其生物量的独特能力。在向水中添加二氧化硅纳米粒子的过程中，光合作用被激活，这使得植物能够合成更多的叶绿素。植物生长得更好，并且对不利的环境因素更具抵抗力。

本文探讨了蓝藻和藻类在土库曼斯坦盐渍土的自清洁中的特殊作用以及池塘中微藻的快速生长方法。在进行研究的基础上，提出了在农工联合体中合理利用水资源的替代技术方案。

关键词：植物病原体，拮抗作用，土壤盐碱化，固氮菌，微藻类复合体，蓝藻，纳米颗粒。

**Abstract.** *The article deals with the problem of alternative use of energy in plant-microbial systems which use for soil enrichment by microbes. The article deals with interaction of legumes with nodule bacteria and blue-green algae. This contributes to the rational use of water and soil resources.*

*Researches on the cultivation of malt in vitro and nitric bacteria on the roots are described. It is assumed that the bacteria of legumes on their roots are in their DNA. The effect of a magnet, copper, silicon dioxide, charcoal, carbon fiber on bacteria was also studied. It was revealed what effect these substances have on the growth of bacteria. A significant influence of carbon fiber and a small influence of silicon dioxide was noted.*

*Beneficial effect of the microalgae complex on the soil and unique ability of algae to rapidly increase their biomass was noted. Activation of photosynthesis during the addition of silicon dioxide nanoparticles to the water, thanks to which plants synthesize more chlorophyll was revealed. Plants grew better and were more resistant to adverse environmental factors.*

*The article deals with special role of cyanobacteria and algae in self-cleaning of saline soils in Turkmenistan and rapid method for growing microalgae in the ponds. Based on the conducted research, an alternative technological scheme for the rational use of water resources in the agro-industrial complex is proposed.*

**Keywords:** *phytopathogens, antagonism, soil salinization, azotobacter, microalgae complex, cyanobacteria, nanoparticles.*

The production of high-quality agricultural products is one of the most important tasks of the plant industry. An equally important circumstance is the need to preserve soil fertility, maintaining the environmental purity of agricultural production, resource saving. To fully utilize the potential of natural fertility of soils and plants, it is necessary to introduce adaptive forms of crop production, during which the plants were provided by the basic resources of the biological communities (vegetable-microbial systems) of the plants were protected from phytopathogens, stress resistant. One of these communities is the interaction of leguminous crops with nodule bacteria, which do not enter into antagonistic relations between themselves and complement each other [11,12].

**Purpose of the study.** Examine the technology of careful use of water resources through the combined use of alternative energy sources.

#### **Material and methods of research.**

On the basis of literary data, analyzed by scientific papers, by effective use of earth and water resources of agro-industrial complexes, improve the ameliorative state of soils, with the help of bacteria (azotobacteria, cyanobacteria) creating a special environment "soil-forming microbes", revealed the possibility of more careful use of water resources, soil, which can contribute to the prevention of the

yield of groundwater on the surface and restoration of saline lands [9,10,12].

Referring to the above data, various methods and technologies from special bacteria (azotobacteria, phosphobacteria, etc.) are created and implemented, and algae, which create a special environment of "soil-forming microbes", which contributes to the preservation of soil and water energy. Industrial cultivation and use of these most bacteria and algae opens up more opportunities in solving problems arising in the development of the global agro-industrial complex.

When writing the article, the following methods and technological methods were used. Biology of higher plants in vitro cells and biotechnology based on them: Textbook / Butenko R.G. / - M.: FBK-PRESS, 1991. - 160 P [1].

In order to carefully use terrestrial and water resources, the stated studies can be used in the preparation of projects aimed at solving the problems of barthings with the ice-based land and the use of enriched water in the complex "Helobopiat

For the purpose of the careful use of earth and water resources, the stated studies can be used in the preparation of projects aimed at solving the problems of bows with the oscolonation of land and the use of enriched waters in the complex "Helobopiat"

– Technology of microclonal reproduction of plants. / Kalinin F.L., Kushnir G. P., Sarnatskaya V.V. / – Kiev: Science, Dumka, 1992. – 232 P. [2].

– Basics of biotechnology processing of agricultural products. Methodical instructions for laboratory and practical training / Belookova O.V., Belotokov A.A. - Troitsk, 2015. – 84 P. [5].

– In vitro microprium technology: educational and methodical. Manual / Timofeeva S.N, Smolkin Yu.V., Apanasova N.V., Yudakova O.I. / – Saratov, 2016 – 38 P. [11].

### **Research results.**

Specialists of the Center for Technologies of the Academy of Sciences of Turkmenistan are working on the technology of obtaining and reproducing bacteria that fix nitrogen from the air in the tubers of the roots of legume plants grown in local conditions.

Non-vegetable bacteria supply a nitrogen bean plant. The plant uses this associated nitrogen and, in turn, delivers the carbon-containing organic substances with nodule bacteria.

After harvesting legumes, the underground part remains in the soil, overtakes, nitrogen falls into the soil enriching it with nitrogen.

Conducting experimental studies in the laboratory conditions from the nodules of the roots of beans, alfalf and malt, grown by the method of "In-Vitro", specialists of the Center for Technologies of the Academy of Sciences of Turkmenistan, nitrogen-intimating bacteria were obtained. Which are the main indicator of experimental experimental experiments during the ripening and growth of

experimental plants. Currently, relying on the results of studies, conducted, with leguminous plants, scientists are assumed that nitrogen is formed in the nodule of plants, not due to contact with the soil, but is laid into DNA of these plants. It is the nepulats of leguminous plants that are able to record atmospheric nitrogen and translate it into forms that are available for assimilation by plants (nitrates).

When conducting laboratory studies on the leaves and stems of malt bacteria were not allocated. After that, the roots of the malt grown by the "In-Vitro" method were cut out and already in new roots, anew grown malt, by the same method, bacteria forming nitrogen were found. Therefore, it is assumed that bacteria of legume plants are in their DNA, which form their roots (figure 1).



**Figure 1-** The malt grown by "in-vitro" method and bacteria isolated from it

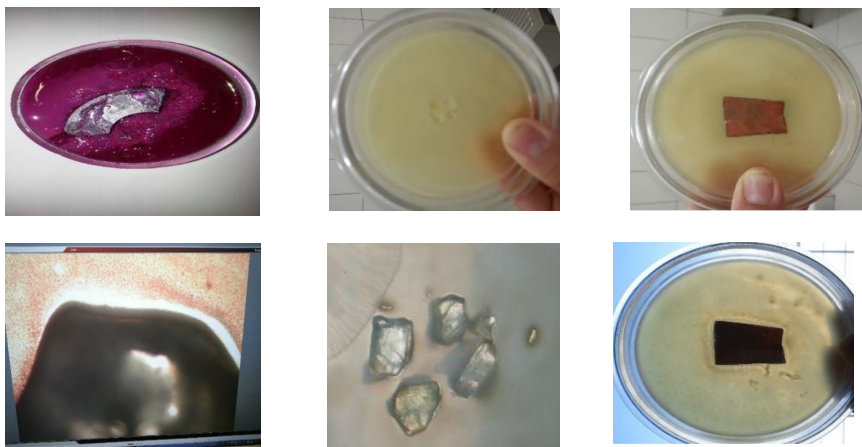
It is known that the amelioration is descended by washing waters in saline lands, which contributes to their recovery, it is also one of the main possibilities for improving the natural balance of land soil in irrigated conditions. It should be inclined that the effectiveness of these mercumions increases by 20-30% when using magnetized water on saline lands [4].

In the laboratory conditions during the research, the effect of the magnetic field on bacteria was studied, the magnet was placed in Petri bowl, while the slowdown of the growth of bacteria in the reach of its field was recorded. In subsequent studies, the impact on copper bacteria, silica, charcoal dioxide and glass fiber was studied. It was revealed, which effects have these substances on the growth of bacteria that silicon dioxide has a slight effect on the growth of bacteria and a considerable influence of carbon fiber (figure 2).

In the conditions of irrigated land, the yield of the soil depends on many factors and one of them is irrigation with water with enriched composition.

Numerous irrigation studies conducted by water irrigation by water algolized microalgae allows us to assert the favorable effect on the soil of the latter [6.9].

In strengthening the composition of irrigated waters in natural conditions, the number of and types of single-cell algae play an important role. This gives new perspectives in the concept of relationship between water enriched with microalgae and irrigated soil.



**Figure 2 - Research Investigation of the development of bacteria under the influence of the magnet**

Algae, which is part of irrigation waters, in its structure contain special bacteria (nitrogen-fixing phototrophic bacteria, green algae, cyanobacteria), creating a special medium of microbes for generating active substances and powered by carbon dioxide, which these microbes are isolated using the energy of the Sun (photosynthesis). In the process of photosynthesis (the formation of organic substances from inorganic substances by exposure to sunlight on plants, which contains chlorophyll) algae can quickly accumulate active substances in themselves. Another feature of the inherent algae is their ability to quickly increase their biomass and allocate bactericidal substances of intake soil.

For this reason, the Agriculturists (D.A. Sulaiman and H. B. Singh from India, H.A. Vathanb from Japan) Living near water places, such as the ocean, the sea, lakes and reservoirs in one voice, claim that adding algae in Sowing land showed a distinctive healing effect. This is also evidenced by Russian scientists [3,6,9].



According to methods and technologies of cultivation, biologically active algae of freshwater, lakes and seas, work is actively working in microbiologists. Thus, given the sufficient provision of water by algae, especially in irrigated areas, it is possible to provide a meliorative effect of saline soils. As part of irrigated water, it is proposed to use phosphorus, organic matter and other additives including trace elements. Not bad help for the rapid development of algae microalgae are animals, poultry wastewater, as well as the wastewater of the food industry are rich in organic and mineral substances [6.9].

The studies have noted the activation of the photosynthesis process during fabrication of plants by adding micronano particles of silicon to the composition of water. It turned out that such plants synthesize more chlorophyll and other photosynthetic pigments, such as carotenoids and phytoestrogen, in addition, in the vegetable tissues, more biologically active substances, such as isoflavonoids and hydroxycaric acids. As a result of the studies, it was noted that the plants were not only increased faster, but also more resistant to diseases and other adverse environmental factors. [7, 8].

In this direction, azotobacteria, "biodendaving" and micronano particles of silicon dioxide, created in the laboratory, which were made to the composition of the irrigated waters used for the irrigation of sowing grounds were made.

After that, referring to the results of the study, the influence of the process of photosynthesis on the development of the expected fruits and algae is performed its performance (figure 3).



**Figure 3.** Development of beans and algae irrigated by water with "bio additives"

Relying on the results obtained, the importance of impregnation with phosphorus, silicon dioxide and other additives was noted.

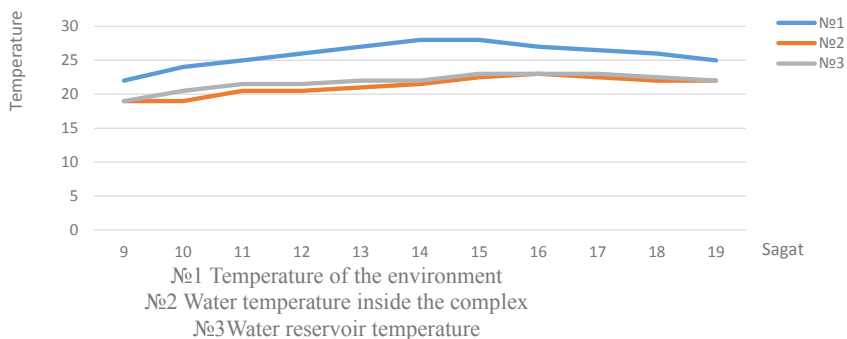
Based on the developed single technological scheme of the effective use of Earth and water, especially 10-20 centimeter surface layer of water reservoirs and lakes enriched with nitrogen and phosphorus and with developed phytoplankton. Phytoplankton with water pump is collected in a special floating reservoir (figure 4).

After that, "Bio additive" in micro-nano, prepared on the basis of a sulfur mixture with biomass residues (cotton branch, wrench, ferry and other) which are an alternative view of fuel and silicon dioxide in micro-nano size in certain proportions.



**Figure 4.** View of a special tank for growing algae

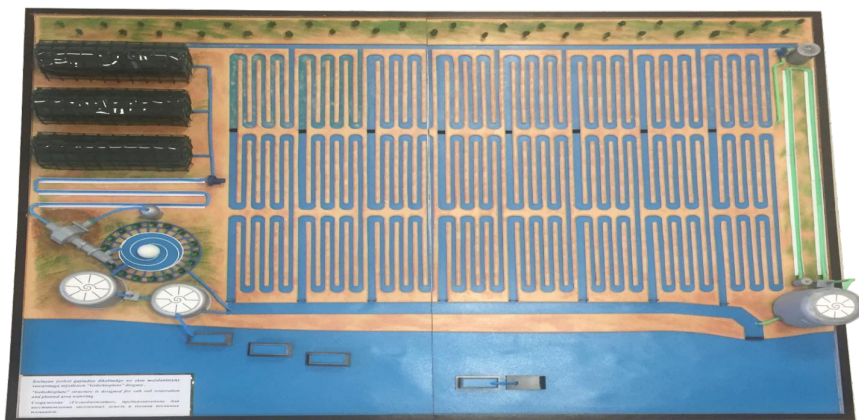
Algae in the reservoir are provided by "saprophistic" bacteria, that is, by bacteria creating a special microbes and providing favorable conditions for the development of algae. In addition, under the influence of water waves, the tank is swaying, and the favorable temperature is maintained with sun rays, which favorably affects the development of algae. After that, the activated algae from the reservoir is added to the composition of the enriched water in the Helobiograph complex, activating the process of photosynthesis under the influence of sun rays, "saprofite" bacteria and their generating carbon dioxide are reused into the composition of the mixture.



**Figure 5.** Harmonicity of water temperature in the tank



Based on the studies, a single technological scheme of the careful use of water resources of the agro-industrial complex and the return of saline lands was developed (figure 6).



**Figure 6 - Helioplato complex**

**Conclusions.** For the purpose of the careful use of earth and water resources, the stated studies can be used in the preparation of projects aimed at solving the problems of bows with salinity of land and the use of enriched waters in the "Heliobioplato" complex.

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在工业家禽养殖中使用Brokarsept进行卵孵化的质量控制和经济评估  
**QUALITY CONTROL AND ECONOMIC EVALUATION OF THE USE  
OF BROCARSEPT IN THE INCUBATION OF EGGS IN INDUSTRIAL  
POULTRY FARMING**

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抽象的。在家禽育种和养殖企业中，使用杀菌剂Brokarsept进行了消毒质量的研究，该杀菌剂是一种复杂的有机化合物，其中包含两种活性物质（AS）的复合物，其中一种具有杀菌和溶角蛋白的作用，第二种具有杀菌，杀病毒和杀菌作用。Brokarsept包含具有长链CH自由基的新化合物作为主要的AS，在俄罗斯联邦没有类似物。揭示了该药物的有效的杀菌，杀病毒和杀真菌作用。研究了使用时的浓度。使用Brokarsept药物恢复生产设施和技术设备的经济效率已经确定。

关键词：管理，控制，质量，防腐剂，速溶菌，卫生，杀菌作用，培养箱，设备，孵化蛋，家禽。

**Abstract.** *In poultry breeding and breeding enterprises, studies of the quality of disinfection were carried out using the antiseptic Brokarsept, which is a complex organic compound containing two complexes of active substances (AS), one of which has a bactericidal and keratolytic effect, and the second has a fungicidal, virucidal and bactericidal effect. Brokarsept contains, as the main AS, a new chemical compound with a long-chain CH radical, which has no analogues in the Russian Federation. An effective bactericidal, virucidal and fungicidal effect of the drug was revealed. Studied the concentrations when using it. The economic efficiency of using the Brokarsept drug for the rehabilitation of production*

*facilities and technological equipment has been established.*

**Keywords:** *management, control, quality, antiseptic, brokarsept, sanitation, bactericidal action, incubator, equipment, hatching eggs, poultry.*

### **Introduction**

Maintaining veterinary and sanitary welfare in poultry farms is the main factor in increasing poultry productivity. Currently, various types and methods of processing premises, poultry and hatching eggs are used in the production of poultry products. The correct choice of disinfection technology in the process of in vivo formation of productivity reduces production costs and allows you to get high-quality and safe products.

The effective implementation of disinfection measures is largely determined by the state of veterinary science and practice of using disinfectants. In this regard, veterinary science is faced with the task of finding new highly effective disinfectants.

Brokarsept 10% concentration is a whitish-yellowish liquid with a viscous consistency. Forms polymer foam on shaking. Working solutions were prepared from a 10% substance by diluting it with tap water. From one liter of the substance, 1000 liters of 0.01% concentration can be prepared. Antiseptic according to GOST 12.1.007-76g. does not have an irritating and allergic effect, is non-toxic, does not have a pungent odor, does not corrode metal equipment, does not destroy rubber, plastics, fabrics. Brokarsept on the treated surface forms a polymer film that serves as a barrier for microflora and provides a prolonged bactericidal effect for a month. The guaranteed shelf life of the antiseptic is 3 years.

### **Material, methods and research results**

Studies on the use of antiseptic Brokarsept were carried out in incubators of poultry enterprises of the Stavropol Territory, Rostov and Lipetsk regions. Before processing the incubation eggs, the inner walls of incubators, trays, and carts were wet-treated by a single spraying of an aqueous solution of Brokarsept at 0.2; 0.1; and 0.05% concentration. Working solutions of the antiseptic were prepared using tap water at a temperature of 20°C.

For wet processing of objects of veterinary supervision of the hatchery, including hatching eggs, imported devices for receiving aerosol of American production were used, as well as a spray gun connected to a compressor or household sprayers of the "Automax" type.

For the reorganization of the hatchery, four batches of one thousand Loman Brown eggs were selected, which, after sorting, were placed in trays and placed in trolleys. The first batch of incubation eggs of egg chickens were wet treated with a 0.05% aqueous solution of Brokarsept. The second batch was treated with a 0.5%

solution, the third with a 0.1% solution. A control batch of hatching chicken eggs was disinfected six times with formaldehyde vapor: the first time 2 hours after receiving; 2nd after sorting eggs in the warehouse; 3rd after sorting in the hatchery; 4th 6 hours after the start of incubation; 5th before transferring embryos to hatch; 6th in hatchers. The incubator and equipment, where eggs of the control lot are to be incubated, were also treated with formaldehyde vapor. Two to three hours after wet treatment and aeration at room temperature, the carts with the incubation egg were placed in incubators pretreated with 0.2% Brokarsept solution.

It should be noted that after wet processing of trays, inner walls of incubators, carts, hatching eggs, their surface is covered with a thin polymeric protective film, which serves as an additional barrier for pathogens of bacterial infection. Washes from the surface of the shell of hatching eggs of egg chickens and the walls of incubators to control the quality of disinfection of objects of veterinary inspection were taken before treatment, and then 7 and 18 days after processing and incubation of eggs at the rate of 20 samples for the detection of *Escherichia coli*, *Salmonella* and *Staphylococcus aureus*.

The results of hatching chickens and the quality of sanitation of hatching eggs of Loman Brown chickens and technological equipment of the hatchery are presented in Table 1. From the results of the studies given in Table 1 it can be seen that after a single sanitation of hatching eggs and objects of technological supervision of the hatchery 0.05%; 0.1% and 0.2% aqueous solution of the Brokarsept drug, the surface of the eggshell and processing equipment was disinfected from the causative agents of *Escherichiosis*, *Salmonellosis* and *Staphylococcosis*, while in the control batch of eggs with six times disinfection of eggs with formaldehyde vapors of the causative agents of *Escherichiosis* and *Salmonellosis*, *salmonellosis* *staphylococcosis* was isolated throughout the incubation.

During the incubation period of the control batch of eggs, there was an increase in the number of samples, by the end of the incubation period in which the causative agents of bacterial infection were isolated. Treatment of pilot batches of eggs and veterinary inspection facilities of the hatchery with Brokarsept 0.05; 0.1% and 0.2 concentration showed that all concentrations of Brokarsept had a pronounced bactericidal effect during the entire incubation period, which indicates a prolonged action of the drug, which was not noted in the control with six times the use of formaldehyde vapors.

The hatching of young poultry in experimental batches of eggs was 3.0-3.4% higher than in the control due to the absence of microbial contamination during incubation of eggs and against this background, a decrease in the mortality of embryos in the following days of incubation of eggs. The safety of Loman Brown chickens up to 20 days of age in the experiment was also higher by 1.4-2.1%, which serves as a barrier for microflora and has a bactericidal effect up to one month.

**Table 1.** Results of hatching Loman Brown chicks and quality of hatchery equipment remediation after treatment with Brokarsept antiseptic

Study period	Brokarsept, % (n=1000)			Formaldehyde vapor (control)n=1000
	0.05	0.1	0.2	
	Colibacillus			
Before processing eggs and objects	in 2 samples	in 2 samples	in 2 samples	in 3 samples
	Salmonella			in 2 samples
	in 3 samples	in 2 samples	in 1 sample	
	Staphylococcus aureus			
	—	—	in the 1st sample	in the 1st sample
After processing after 7 days	No causative agents of bacterial infection have been identified			Colibacillus in 2 samples salmonella in the 1st sample staphylococcus in the 1st sample
After processing after 18 days	No causative agents of bacterial infection have been identified			E. coli in 4 samples salmonella in 3 samples staphylococcus aureus in 2 samples
Chick hatching,%	85.8 <sup>x</sup>	85.9 <sup>x</sup>	85.5 <sup>x</sup>	82.5
Broiler safety up to 20 days,%	99.2 <sup>x</sup>	99.3 <sup>x</sup>	99.1 <sup>x</sup>	97.6

Note: x-results are statistically significant compared to control  $p < 0.001$ .

### Conclusion

As a result of the experiment carried out in production conditions, it was established that the Brokarsept drug in various concentrations (0.05-0.2%) has a pronounced bactericidal effect against gram-positive and gram-negative microorganisms and a prolonged bactericidal effect during the entire period of incubation of eggs due to the formation on the surface eggs and the processed surface of a thin polymer film, which makes it possible to recommend Brokarsept for introduction into industrial poultry farming.

The economic effect of the introduction of Brokarsept in the industrial poultry industry will amount to more than 250 thousand rubles per 1 million incubated eggs, and will also create a comfortable environment in the hatchery for operators to work during the reorganization of facilities and technological equipment of the hatchery.

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小型腐烂湖（西伯利亚西南部和贝加尔湖东部地区）全新世剖面中埋藏有机物的来源和成因

**SOURCES AND GENESIS OF BURIED ORGANIC MATTER IN HOLOCENE SECTIONS OF SMALL LAKE SAPROPELS (SOUTHERN WEST SIBERIA AND EASTERN BAIKAL AREA)**

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抽象的。我们考虑通过多种有机地球化学指标来识别湖相沉积物中埋藏有机物的来源和成因的方法学方法：生物学分析数据（基于层层沉积物底部沉积物层的分层测定的生物分层）；烃生物标志物（正常脂肪族烃（正构烷烃）的分子组成，蛋白质复合物的氮化合物等）；C / N比反映了生物生产者的生化组成的差异。生物学分析（生物分层）的结果表明，奥奇基湖形成了浮游生物的腐殖质（植物和浮游植物，有机质的原生源）长达10,760年，而沼泽地带的水生苔藓和腐殖质苔藓则来自沼泽地（有机质的非连续来源）。在Minzelinskoe湖，低水沼泽淹没阶段（5905年前）形成了腐烂的豌豆。从3980年前到现在，已经形成了大型植物腐殖质。

关键词：腐烂湖，有机质成因，生物生产者，烃类生物标志物，生物分层，有机质的真实来源

**Abstract.** *We consider methodological approaches to the identification of the sources and genesis of buried organic matter in lacustrine sediments by a number of organogeochemical indicators: data of a biological analysis (biostratification based on layer-by-layer determination of organic relics in bottom sediment sections); hydrocarbon biomarkers (molecular composition of normal aliphatic hydrocarbons (n-alkanes), nitrogen compounds of a protein complex, etc.); and C/N ratio reflecting a difference in the biochemical compositions of bioproducers.*



*The results of biological analysis (biostratification) show that planktonogenic sapropel (phyto- and zooplankton, the autochthonous source of organic matter) in Lake Ochki formed for 10,760 years, and sphagnum and hypnum moss were supplied from the bogged shores (allochthonous source of organic matter). In Lake Minzelinskoe, peaty sapropel formed at the stage of a flooded lowland bog (5905 years ago); since 3980 years ago and till the present, macrophytogenic sapropel has formed.*

**Keywords:** lake sapropel, genesis of organic matter, bioproductors, hydrocarbon biomarkers, biostratification, autochthonous source of organic matter

### **Methodical approach to revealing sources and genesis of buried organic matter in the stratified Holocene sequences of lacustrine sapropels**

**Complex biological analysis (biostratification).** Revealing sources and genesis of lacustrine sapropels of organic matter (OM) within the stratified Holocene sequences is best performed by direct method of quantitative layer-by-layer counting of remains of organisms (**complex biological analysis – biostratification**) according to the methodical approach which was put forward by N.V. Korde, who is the well known expert in biostratification and typology of sapropels of small lakes in the European part of Russia and Eastern Baikal Region [6]. The data of the integrated biological analysis allow us to judge not only about sources of organic matter, but achieve a deciphering of sedimentation conditions in the geological past (Holocene and Late Glacial). In this regard, the direct method of biostratification should be recognized as prioritized and most reliable for the purposes of revealing sources and genesis of organic matter of lacustrine sapropel sequences buried in the Holocene. In conjunction with this method, generally accepted organic-geochemical indicators may be used: hydrocarbon biomarkers (normal aliphatic hydrocarbons such as *n*-alkanes), components of protein-carbohydrate conjugate, hydrogen (HI) indices, and the ratio  $C_{org}/N_{org}$  [8].

**Hydrocarbon biomarkers.** The traditional method for study of molecular organic matter composition of oil source rocks is pyrolysis in the version of Rock-Eval (RE-pyrolysis) and the method of Chromato-Mass-Spectrometry (Pyr-GC MS), which, due to its simplicity and reliability began to be widely used for study of immature organic matter in samples of soils and recent lacustrine sediments [2]. This is based on the fact that pyrolysis of organic matter sample of recent sediment may be represented as a complex process comprised of a series of consecutive stages of decomposition of some organic matter components differing in nature and thermal stability and, consequently, in temperature intervals of their decomposition. As a result, a pyrogram of sample may be approximated by the sum of “simple” pyrograms of separate organic matter components. The method of deconvolution (factorization) of some experimental organic matter pyrograms

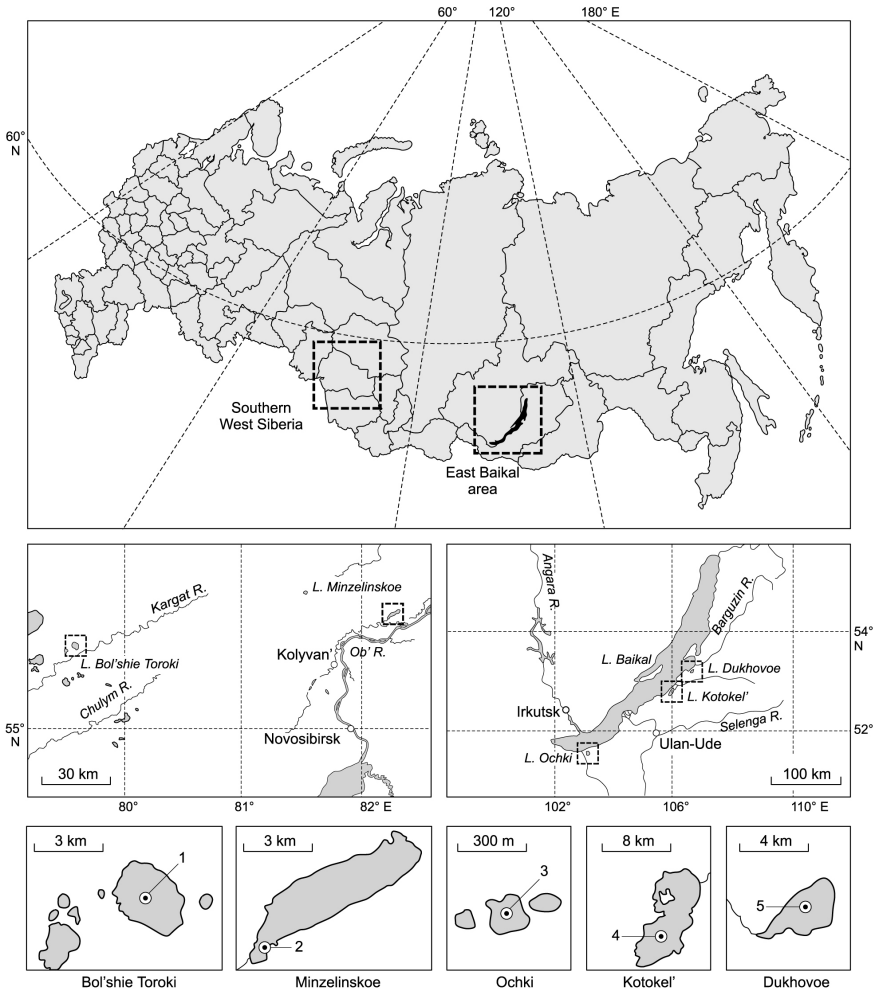
into pyrograms of separate organic matter components proposed in [9] allows the contribution of each organic matter component in recent sediments to be estimated quantitatively.

One of the most important relict hydrocarbons retaining their biochemical structure are *hydrocarbons of the hopane series*. In immature organic matter of recent sediments, biohopanes (products of diagenetic chain biosynthesis of hopanoid of bacteriohopanepolyol transformation) predominate. In immature organic matter of recent sediments, biohopanes (products of diagenetic transformation chain) predominate. Biosynthesis of hopanoids occurs in both aerobic and anaerobic bacteria as well as in some types of sulfate reducers and methanophores [1]. *Steranes*, saturated tetracyclic hydrocarbons  $C_{27}$ – $C_{35}$ , along with hopanes, are also the most important relict biologically marking hydrocarbons [11].

One of main factors of OM transformation at the early stages of diagenesis is its fermentative processing by microorganisms. From biochemical OM components, proteins are the least stable. Further, in order of increasing stability, are hydrocarbons, lignin, and lipids. The preservation of individual chemical components is defined by their structure. Thus, usually the long-chain and isoprenoid *n*-alkanes are transformed to a lesser extent than oxygen and nitrogen-bearing functional groups or unsaturated carbon-carbon bonds [10].

**The ratio of organic carbon to organic nitrogen C/N** reflects differences in the biochemical composition of organisms and gives a possibility of approximately (due to uncertainty of the degree of diagenetic OM transformation) judging the genesis of organic matter of bottom sediments [14]. It is known that higher terrestrial plants are depleted in nitrogen and have a high C/N (20–40) value [12]. This ratio for diatomic plankton is 5.5–7.0 [4] and for Baikal phytoplankton (*Melosira baicalensis*) it is close to 10 [15]. The lowest C/N value (4.0–4.5) (Vinogradov, 1938) is typical of zooplankton; even lower value is C/N (2.8–3.4) [13].

**Subjects of research.** For our research, we selected typical small lakes with organic-mineral sapropel types in the south of Western Siberia (Bolshie Toroki and Minzelinskoe) and typical small lakes in the Eastern Baikal Region with organic sapropel type (Kotokel', Dukhovoe, and Ochki) (Fig. 1).

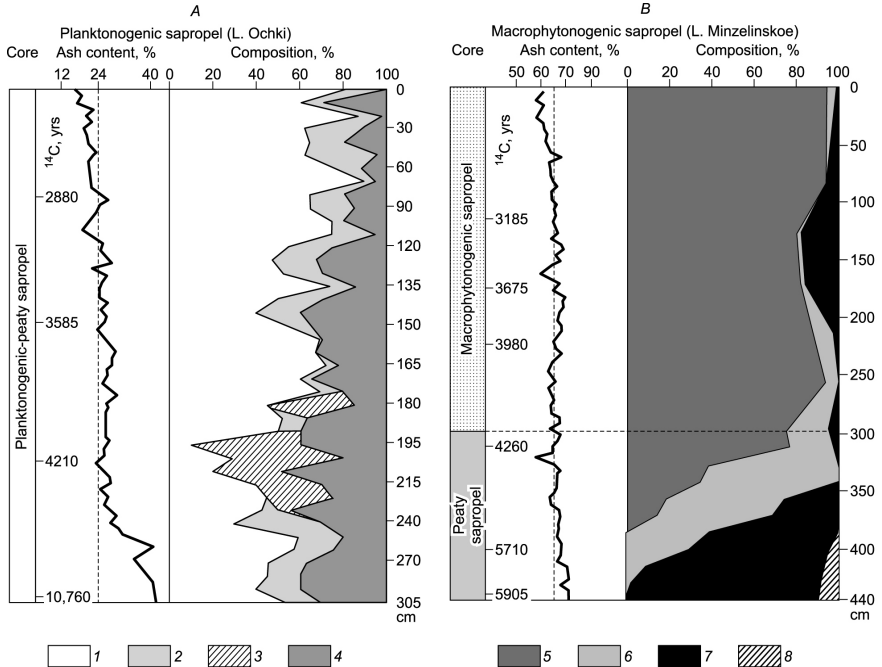


**Fig. 1.** Schematic location map of lakes of the south of Western Siberia (Bol'shie Toroki, Minzelinskoe) and lakes in the East Baikal Region (Kotokel', Dukhovoe, and Ochki). Locations of boreholes are shown below

For sapropel lakes, high rates of sediment accumulation, organogenic deposits reflect well the biogeochemical processes; they contain a lot of paleontological material for purposes of biostratification, in addition dated by the radiocarbon method. This study is based on the material collected by authors during field seasons of 2011–2013. Long cores of lacustrine sediments with undisturbed stratification were obtained as a result of vibratory drilling of the lake bottom to the underlying rocks: Bol'shie Toroki (1.8 m), Minzelinskoe (5 m), Ochki (4.5 m), Dukhovoe (7 m), and Kotokel' (14 m). Drilling of lacustrine sediments was carried out by standard methods, but with the help of equipment created in Sobolev Institute of Geology and Mineralogy, SB RAS on the initiative of Dr. A.K. Krivonogov. This equipment has been repeatedly tested in many lakes. The drilling rig is compact, sectional, motor-borne, consists of a pneumatic pontoon with displacement tonnage about 5 tons, derricks with elevated mechanisms, drill rod set of total length 30 m. The vibration principle is applied: the modified Livingston piston drill allowing columns of the undisturbed sediment 2 m in length and 7.5 cm in diameter to be taken. The applied vibration drilling technology makes it possible to uncover the entire lacustrine sediments and to penetrate underlying rocks by 15–20 m [7]. Study of the entire Holocene sequences of deposits gives a better insight into conditions of a lacustrine sedimentogenesis throughout the whole period of the Holocene and Late glaciation, as well as the probable change of organic matter sources of organic matter inputs, and, consequently, different organic matter genesis in stratified layers of sedimentary strata.

**Biostratification of sapropel deposits.** For study in detail of supply sources and genesis of buried (fossilized) organic matter in detail throughout the depth of stratified sequences, the following lakes have been selected: Lake Ochki in the Baikal Region and West Siberian Lake Minzelinskoe. The direct method of quantitative layer-by-layer calculation of preserved remains of organisms has been selected as a priority method according to the Korde approach (Korde, 1960, 1968), and based on the obtained results of biological analysis a biostratification of deposits of these lakes has been given.

**Lake Ochki.** The biostratification of the sapropel Holocene sequence of Lake Ochki (Fig. 2A) revealed heterogenic origin of organic matter: remains of phyto- and zooplankton as autochthonous source of organic matter, and humus flakes, remains of green algae (*Drepanocladus*), and Sphagnum as allochthonous organic matter source. The amount of plankton residues in the upper sequence part (0–190 cm) varies within 90–40% with the tendency of their increase in depth. In the layer 195 cm, their minimum (10%) is marked. In the lower part of deposits (200–305 cm) there is a gradual increase in the content of plankton residues to 40–60%.



**Fig. 2.** Biostratification of Holocene sapropel sequences of Lakes Ochki (A) and Minzelinskoe (B) according to the data of complex biological analysis performed by T.A. Kopoteva (Institute of Water Problems, FEB RAS). 1, plankton; 2, green mosses; 3, sphagnum mosses; 4, humus flakes; 5, macrophytes submerged; 6, hypnum mosses; 7, macrophytes semisubmerged (helophytes); 8, mollusk shells

Of three components attributed to allochthonous organic matter, the most representative are humus flakes, the content of which tends to increase in the sequence depth. So, if the amount of humus flakes in the upper one-meter sediments rarely exceeds 20%, then it reaches 40–50% in horizons of the lower part of the sequence. The humus substance is rough due to its enrichment with residues of tissues of vascular peatforming plants (cotton grass and sedges). Remains of mossy vegetation almost always take part in formation of lacustrine sediments. Nevertheless, the attention is drawn to an interval of bottom sediments (180–230 cm), in which, unlike the overlying and underlying layers, remains of not green, but Sphagnum moss are found in significant quantity (up to 50%). Pollen of coniferous trees is sporadically met throughout the whole core of sediment. Thus, during 10,760 years, planktogenous sapropel (autochthonous source of organic matter) was predominantly formed in Lake Ochki, and from marshy shores, residues of

tissues of green mosses, Sphagnum, and humus substances were supplied into lacustrine sediments (allochthonous organic matter source).

**Lake Minzelinskoe.** The biostratification of the Holocene sequence in Lake Minzelinskoe (Fig. 2B) also points to the heterogeneous origin of organic matter: remains of submerged (hydrilla, water soldier) and semisubmerged (typha, bulrush) macrophytes (autochthonous organic matter source), remains of green mosses (allochthonous organic matter source). The upper strata of sediments up to the horizon 300 cm are represented by macrophytogeneus sapropel, which under a microscope looks like structureless of amorphous gray mass. Taken shape remains of submerged macrophytes (so-called “soft” aquatic vegetation: hydrilla and water soldier, are not preserved in the sapropel sequence and these are represented by amorphous detritus (to 80%). On the contrary, remains of “hard” aquatic vegetation (semisubmerged macrophytes: (typha, bulrush)) are preserved and vary within 2–7%. Aggregates of benthonic diatoms such as Pinnularia are present.

From the horizon 300 cm, macrophytogeneus sapropel is underlain by peaty (hypnaceous) sapropel of chocolate brown color of the high decomposition degree (to 50% and more). The fraction of remains of hypnum (green) mosses (*Drepanocladus aduncus*) is gradually increases from 15% in the horizon 300 cm to 50–60% in the horizon 335 cm. Within the core interval 335–360 cm, the peaty sapropel is almost black and has a high degree of decomposition (about 70%). Macrophyte remains (thipa, water soldier) are found in amount 60–70%, and hypnum mosses are found in amount 40–30%. In the core interval 360–366 cm, the peaty sapropel has a very high decomposition degree (85–90%).

There are many fragments of mollusk shells of the Planorbidae from 0.8–1.0 mm to 2.5–3.0 m in diameter, as well shells of small bivalve mollusks (Bivalvia). The fraction of hypnum moss remains is 30%. Within the core interval from 396 to 440 cm, the decomposition degree of sapropel varies from 90 to 99%. Their composition is dominated by remains of semisubmerged macrophytes such as Typha and more rarely bulruch, remains of hypnum mosses are singular, and shell fragments are abundant.

It is assumed that swamping began in the time period dated at 5905 years, in the southwestern part of Lake Minzelinskoe, which is currently a shallow bay with flooded shores. The high-ash mass of sapropel rich in humus (interval 440–420 cm) and saturated with mollusk shells indicates that, seemingly, it was a shallow water body heavily overgrown with macrophytes. Then, formation of heavily watered lowland bog began along with accumulation of peaty hypnum sapropel with predominant *Drepanocladus aduncus*. In the subsequent time periods (3980 and 3185 years), due to rise of water level in the lake, a lowland march was flooded and the shallow bay formed with predominance in the capacity of the main sources of autochthonous organic matter of submerged macrophytes and, to a lesser degree

phyto- and zooplankton. The process of formation of macrophytogeneus sapropel in the lake continues also in the present time.

Thus, according to the data of complex biological analysis and based on the biostratification of the Holocene sequences of Lakes Ochki and Minzelinskoe, sources of input and genesis of buried organic matter of two biological types of sapropels (planktonogenic and macrophytogeneus) have been revealed, which are confirmed by the data of material organic matter composition obtained with using scanning electron microscope (SEM).

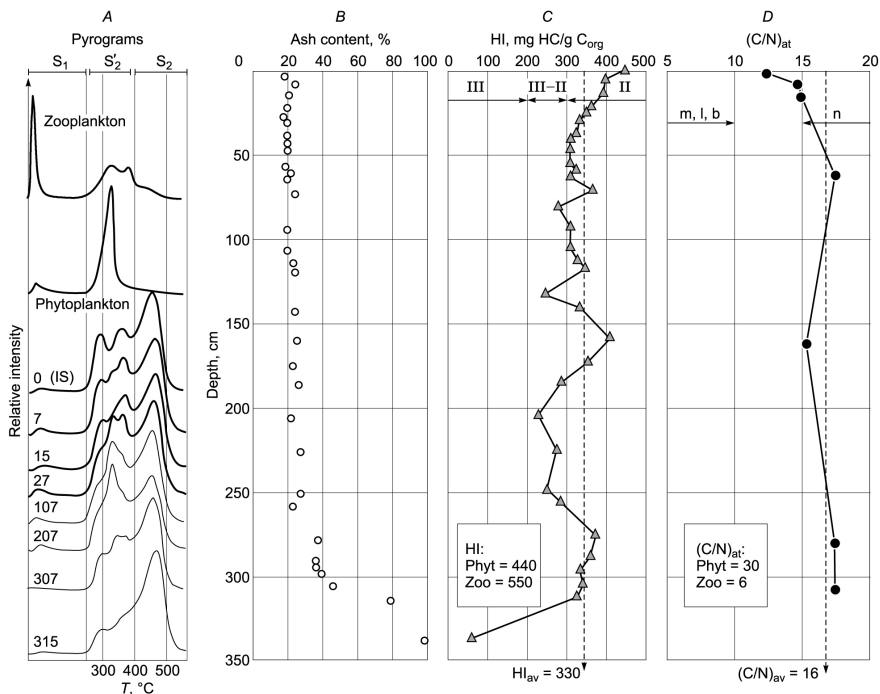
**Data of pyrolytic analysis of organic matter.** In pyrograms of sediments (Fig. 3A), beginning from incoherent sediment (IS) the predominance of a high-temperature “kerogen” peak is clearly seen at  $T_{\text{peak}} \approx 460^\circ\text{C}$  to the depth of 307 cm. The fraction of hydrocarbons (HC), released at this peak relative to their total content remains practically constant to the depth of 279 cm and then it increases downward. This growth corresponds to decrease of labile, less stable compounds in the organic matter composition and, consequently, to increase of the degree of its diagenetic transformation.

The peculiarity of pyrolysis of bioproducts and organic matter of sediments of Lake Ochki (Fig. 3A) is in the sharp dissimilarity of pyrograms of bioproducts and organic matter from pyrograms of bottom sediments: if the thermal decomposition for the former occurs mainly to  $400^\circ\text{C}$  (peaks  $S_1$  and  $S'_2$ ), then the temperature of the maximum decomposition rate for the latter is shifted to higher temperatures. This indicates that it is already at the initial stage of diagenesis in the incoherent sediment during microbial treatment of biomacromolecules and they are transformed into geomacromolecules of kerogen. The content of organic matter is rather constant within the interval of sediments 0–250 cm and is about 80, the ash content is, correspondingly, 20% (Fig. 3B), however, the data of pyrolysis and elemental analysis demonstrate qualitative changes of organic matter (Fig. 3C, D). It is known (Tissot and Welte, 1978), that the value of the hydrogen index (HI) of organic matter are defined by the content of hydrogen in its composition: the more hydrogen, and, consequently, the higher the H/C ratio is, and the higher is the HI value, characterizing, in such a way, oxidation/reduction of organic matter. The HI and (C/N) at values for phyto- and zooplankton, as well as their mean values for the sediment are given (in Fig. 3C and 3D). The most oxidized organic matter is observed at the base of the sapropel strata (339 cm). This may be due to both the oxidative sedimentation conditions and the oxidation processes during early diagenesis, for example, owing to contacts with aerated groundwaters [9].

**The C/N ratio as a marker of sources of autochthonous and allochthonous organic matter.** According to the data [3] with the  $\text{C/N} \leq 12$  ratio, organic matter of the autochthonous origin predominate in bottom sediments of small lakes over allochthonous organic matter in its proportion from 12 to 40–47. In other publica-

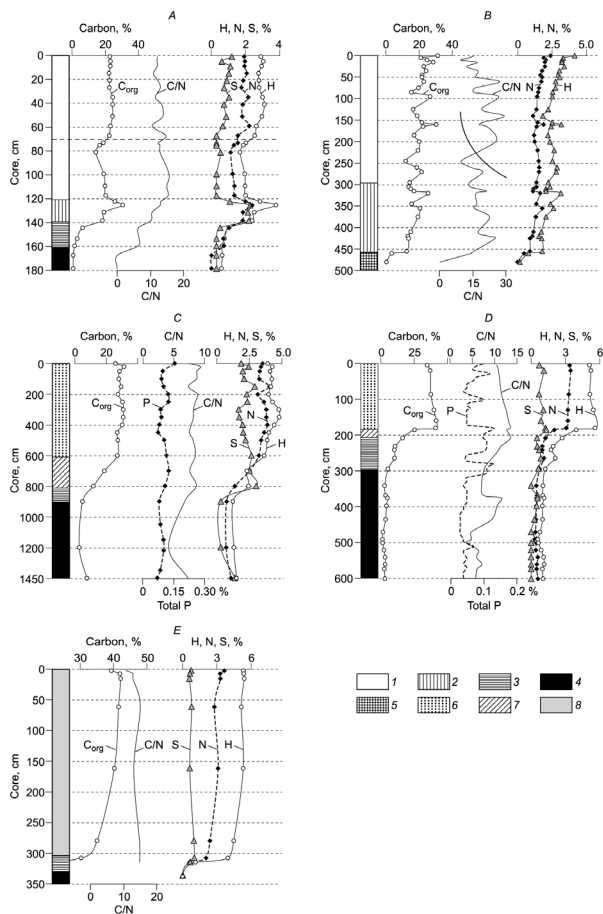


tions [5], the authors place emphasis on the fact that in small lakes, the influence of the input factor of allochthonous organic matter into common organic matter has an impact on the whole bottom area as a consequence of this C/N value is higher than 10 in sediments of small lakes. The distribution of C/N values within stratified sapropel sequences of typical macrophyte Lakes Bol'shie Toroki and Minze-linskoe (Fig. 4A, B) as compared with typical phytoplankton Lakes Kotokel', Dukhovoe, and Ochki (Fig. 4B, D, E) are significantly different.



**Fig. 3.** Pyrograms of zooplankton, phytoplankton, and samples of sediment from Lake Ochki (A). Figures in the pyrograms correspond to the depths (cm) of analyzed sediment samples. IS, incoherent sediment. Along the y-axis the intensity of a signal of flame-ionization detector normalized at temperature of the maximum release rate of hydrocarbons (HC). Given in graphs are: the values of ash contents (B), hydrogen index (HI) (C), and atomic ratio  $(C/N)_{at}$  for phytoplankton and zooplankton (D). HI was calculated by the formula  $HI = \Sigma HC \times 100 / C_{org}$ , where  $\Sigma HC$  is the total amount of pyrolytic hydrocarbons ( $S_1 + S'_2 + S_2$ ) (mg HC/g of sediment);  $(C/N)_{at}$  has been calculated from the data of element analysis for HC of marine (m), lacustrine (l), and bacterial (b) genesis and land plants (p), respectively





**Fig. 4.** Vertical distribution profiles of organic carbon (Corg), H, N, S, P, and C/N in the Holocene sediments of Lakes Bol'shie Toroki (A), Minzelinskoe (B), Kotokel' (C), Dukhovie (D), and Ochki (E). 1, Macrophytogenic sapropel; 2, peaty sapropel; 3, organic-mineral sediment; 4, underlying clays; 5, underlying sands; 6, planktonogenic sapropel; 7, high ash planktonogenic sapropel; 8, sapropel of mixed genesis (planktonogenic-peaty)

In Lake Bol'shie Toroki and Minzelinskoe, the C/N values vary in the sequences of macrophytogeneuous sapropel from 10 to 15. In layers of peaty sapropel, the C/N values are slightly greater, and they vary within the range 15–18. In general, for the whole sapropel strata of Lakes Bol'shie Toroki and Minzelinskoe,

the C/N values fall into the range of C/N values for organic matter of just as aquatic (submerged and semisubmerged macrophytes), so of terrestrial vegetation (sedges, cotton grass, and mosses). As a whole, the C/N values in the sapropel sequence of Lake Minzelinskoe are higher than those in Lake Bol'shie Toroki. This can be explained by heterogeneity of organic matter of sapropel from Lake Minzelinskoe in which, according to the data of biological analysis, the share of allochthonous organic matter (remains of hypnum moss) is rather high.

As a whole, the C/N values in the sapropel sequence of Lake Minzelinskoe are higher than those in Lake Bol'shie Toroki. This can be explained by heterogeneity of organic matter of sapropel from Lake Minzelinskoe in which, according to the data of biological analysis, the share of allochthonous organic matter (remains of hypnum moss) is rather high. The shores of this lake are heavily swamped in contrast to shores of Lake Bol'shie Toroki. Lake Kotokel' is characterized by the lowest C/N values, which vary in depth of the 8-m sapropel sequence from 7.4 to 9.3 (average over the sequence is 8.2), that falls into the range of C/N values for marine and lacustrine plankton. In Lake Dukhovoe, the C/N values vary in the 180 cm sequence of planktonogenic sapropel from 5.7 to 8.6, falling into the range of C/N values for marine and lacustrine plankton. Thus, it can be concluded that the main source of sapropel organic matter of Lakes Kotokel' and Dukhovoe is phytoplankton. In Lake Ochki, the C/N values in the depth of the sapropel sequence (0–310 cm) vary within 0.8–14.9, on the average 13.6. Quite high C/N values are explained by the material composition of sapropel: mixed (along autochthonous organic matter formed mainly by phytoplankton, the share of allochthonous organic matter, represented by remains of moss is also high). Thereby, in studied typical macrophyte lakes in the south of the West Siberia (Bol'shie Toroki and Minzelinskoe), in sapropel sequences, high content of organic matter of allochthonous origin has been established (the average values are  $C/N \geq 12$ ), the source of which are mainly semisubmerged macrophytes (bulrush, thipa). In typical phytoplankton lakes of the eastern Baikal Region (Kotokel', Dukhovoe, and Ochki), organic matter of mainly autochthonous origin ( $C/N < 12$ ) predominate, with phytoplankton as the source. When using this organic-geochemical index of the contribution of autochthonous and allochthonous material into the composition of bottom sediments (C/N), it should be understood that it is approximate due to the uncertainty of the degree of diagenetic transformation of organic matter.

### **Conclusions**

West Siberian Lakes Bol'shie Toroki and Minzelinskoe in which the main role in formation of organic matter in recent biocoenoses belong to aquatic higher plants (macrophytes), are assigned to the typical macrophyte lakes. In the lakes of the Baikal Region: Dukhovoe and Kotokel', organic matter formation in recent biocoenoses was mainly due to microscopic algae of phytoplankton. In Lake

Ochki, the main role is played by phytoplankton during synthesis of autochthonous organic matter; the contribution of also allochthonous organic matter source such as sphagnum and hypnum mosses is significant.

Having studied the problem of sources and genesis of organic matter buried in stratified sequences of lacustrine sediments, it is advisable to use the proposed complex of organic-geochemical indicators for more reliable conclusions.

Having studied the problem of sources and genesis of organic matter buried in stratified sequences of lacustrine sediments, it is advisable to use the proposed complex of organic-geochemical indicators for more reliable conclusions. As a priority, we propose to apply the direct method of quantitative layer-by-layer calculation of preserved remains of organisms and based on the data of biological analysis to give the structure of a bog body and biostratification of sediments. The authors first represent the biostratification of sapropel deposits of Lake Ochki (the Baikal region) and Lake Minzelinskoe (south of West Siberia).

The molecular composition of normal aliphatic hydrocarbons (*n*-alkanes) and components of protein-carbohydrate complex is recommended to be used as biomarkers of sources and genesis of buried organic matter, which are defined as complex molecular “imprint” of previously living organism formed from biochemical components. Investigation of bioproducts and sapropel from Lake Ochki by pyrolytic methods in versions RE-pyrolysis has shown that the main autochthonous organic matter source in the lake was phyto- and zooplankton.

The ratio organic carbon/organic nitrogen (C/N) is recommended for use for approximate estimation (due to uncertainty of the degree of diagenetic organic matter transformation) of the proportion of organic matter shares of the terrigenous (allochthonous) and aquagenic (autochthonous) genesis in lacustrine sediments.

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## 改善酸性土壤的理化性质

## IMPROVEMENT OF PHYSICAL AND CHEMICAL PROPERTIES OF ACIDIC SOILS

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抽象的。当在圆柱中建模时，发现使用白云石粉时土壤酸度降低是由于其改性剂（ $H^+$  和  $Al^{3+}$  离子）被改良剂碳酸根离子的碱水解过程中形成的羟基离子（ $OH^-$ ）中和。  $Ca^{2+}$  和  $Mg^{2+}$  离子取代了中和的  $H^+$  和  $Al^{3+}$  离子，成为可交换的阳离子。在强酸和强酸弱聚集土壤上，其中大部分  $H^+$  和  $Al^{3+}$  离子位于吸收性复合物的外表面上，在低浓度的液相和  $Ca^{2+}$  和其中有  $Mg^{2+}$  离子（几个  $mg\text{-eq} / l$ ）。同时，观察到一些含石灰的改良剂的高效果。在强，中，弱酸性的强聚集土壤上，位于土壤团聚体外表面的可交换  $H^+$  和  $Al^{3+}$  离子在低浓度液相（约  $4\text{ mg-eq} / l$   $Ca^{2+}$  和  $Mg^{2+}$  的情况下）被  $OH^-$  离子中和。）。高浓度的二价阳离子（数十毫克当量/升）将聚集体内的  $H^+$  和  $Al^{3+}$  离子从 PPC 置换出来。最终，由于溶解性改良剂的碳酸根离子的水解度增加，被置换的离子最终也被羟基离子中和。含石灰的改良剂和石膏在更聚集的土壤上的组合使用比其引入层更深地改善了酸性，并提高了石灰改良剂的利用率。

关键词：酸性水土质土壤的层状层，柱，白云石粉，石膏，水解酸度，碳酸根离子的水解，改良剂的利用率。

**Abstract.** *When modeling in columns, it was found that a decrease in soil acidity when using dolomite flour occurs due to the neutralization of its agents ( $H^+$  and  $Al^{3+}$  ions) with hydroxyl ions ( $OH^-$ ) formed during alkaline hydrolysis of ameliorant carbonate ions. Instead of neutralized  $H^+$  and  $Al^{3+}$  ions,  $Ca^{2+}$  and  $Mg^{2+}$  ions become exchangeable cations. On strongly and very strongly acidic weakly aggregated soils, in which the bulk of  $H^+$  and  $Al^{3+}$  ions are located on the outer surface of the absorbing complex, the binding of acidity agents by hydroxyl ions occurs at a low concentration of the liquid phase and  $Ca^{2+}$  and  $Mg^{2+}$  ions in it (several  $mg\text{-eq/l}$ ). At the same time, a high effect of some lime-containing ameliorants was observed. On more aggregated strongly, moderately, and weakly acidic soils, exchangeable  $H^+$  and  $Al^{3+}$  ions located on the outer surface of soil aggregates are neutralized by  $OH^-$  ions at a low concentration of the liquid phase (about  $4\text{ mg-eq/l}$   $Ca^{2+}$  and  $Mg^{2+}$ ). The intra-aggregate  $H^+$  and  $Al^{3+}$  ions were*

*displaced from the PPC by high concentrations of divalent cations (several tens of meq/l). The displaced ions, ultimately, were also neutralized by hydroxyl ions due to an increase in the degree of hydrolysis of the carbonate ions of the dissolving ameliorant. The combined use of lime-containing ameliorants and gypsum on more aggregated soils improves the acidic properties deeper than the layer of their introduction and increases the utilization rate of the lime ameliorant.*

**Keywords:** *illuvial horizons of acidic soddy-podzolic soils, columns, dolomite flour, gypsum, hydrolytic acidity, hydrolysis of carbonate ions, utilization rate of ameliorant.*

Soil acidity is a genetic property associated with climate and soil formation conditions on carbonate-free soil-forming rocks, the intensity of agricultural soil use and the ecological state of the environment (biosphere). It increases with the growth of falling and infiltrating precipitation, in areas of technogenic pollution (industrial enterprises for the production of fertilizers, non-ferrous metallurgy enterprises, chemical plants) and acid rain. The intensification of agricultural production has a great influence on it. With the increasing use of mineral fertilizers, soil acidification increases, since the absorption of ammonium and potassium ions, calcium and magnesium cations during plant growth and development occurs in exchange for hydrogen ions, which leads to an increase in the content of  $H^+$  ions in the soil absorbing complex. In organic and organomineral fertilization systems, the process of soil acidification slows down, but is not completely eliminated.

A noticeable drop in soil fertility is observed when its  $pH_{CS}$  falls below 5.3-5.5. In this case, on soils with a low content of organic matter, the content of exchangeable aluminum, mobile forms of iron, sharply increases. manganese, etc. According to the research of N.S. Avdonin [1], when the soil contains 3-5 mg/100 g of mobile aluminum, its toxic effect on the root systems of cultivated crops is observed, their yield may decrease by 30% or more. The content of exchangeable aluminum above the indicated value deeper than the arable layer does not allow the root systems of plants to actively develop and use moisture and nutrients from them during acute and dry periods of crop vegetation, especially during critical ones. Ultimately, this reduces their productivity, the efficiency of the development of intensive technologies for the cultivation of agricultural crops.

Considering the enormous destructive effect of mobile aluminum on the soil, soil biota, cultivated plants, as well as on animals and humans (aluminum disease, sclerosis due to Al accumulation in the brain), it is recommended to include this indicator among the indicators for determining the zones of the ecological state of the soil cover (tab. 1 ). There are zones of ecological norm, ecological risk (areas with a noticeable decrease in productivity, but with the possibility of restoring their ecological stability), ecological crisis (restoration of stability is associated

with high costs) and ecological disaster or catastrophe (zones requiring radical improvement). The use of territories of zones of norm and risk should be carried out on the basis of intensive agricultural technologies. To increase the thickness of the root layer, it is important to reduce the acidity of the sub-humus horizons of acidic soils. Reclamation of soils in zones of ecological crisis and disaster should be carried out with the support of the Federal authorities.

**Table 1** - Assessment of the ecological state of soils by the content of mobile aluminum, mg/100 g of soil [2]

Acid soil horizons	Ecological zones			
	norms	risk	crisis	disaster
A <sub>ARA</sub>	< 1	1-4	4-8	> 8
Under humus	< 1	> 8	> 8	> 8

To eliminate soil acidity, starting with K.K. Gedroyts, the use of lime fertilizers is generally accepted [1, 3-4].

In 1980, for the chemical reclamation of soils, including acidic soils, mixtures of lime with phosphogypsum were proposed [5]. The mechanism of their action on changing the properties of AUC was not discussed. Recent studies have shown that it depends on the degree of acidity and aggregation of the absorbing complex [6-7]. Therefore, on soil samples of different degrees of acidity and aggregation (tab. 2), in columns with separated layers, the interaction of ameliorants with AUC was studied at infiltration of 0.5 annual precipitation norm and higher.

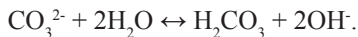
**Table 2** – Physicochemical characteristics of samples of illuvial horizons of sod-podzolic soils used for model studies (Vladimir Oblast)

№ of cut	Layer depth, cm	Humus, %	S	H <sub>II</sub>	H <sub>ex</sub>	Al <sub>ex</sub> , mg/100 g soil	pH <sub>CS1</sub>	Particle content, %	
			meq/100 g of soil					<0.001 mm	<0.01 mm
1, Pechuga	45-57	0.34	6.90	9.10	4.16	35.4	3.66	25.4	38.4
2, Shepelevo	54-66	0.27	6.90	3.14	1.10	2.50	4.04	13.3	22.7

Notes: S – sum of absorbed bases; H<sub>H</sub> – hydrolytic acidity;

H<sub>EX</sub> – exchange acidity.

On very strongly acidic and strongly acidic weakly aggregated soils (tab. 3), a decrease in acidity occurs due to hydroxyl ions (OH<sup>-</sup>), formed by the interaction of CO<sub>3</sub><sup>2-</sup> ions with water. The latter are one of the products of CaCO<sub>3</sub> (lime) dissolution in water, that is, the formation of Ca<sup>2+</sup> and CO<sub>3</sub><sup>2-</sup> ions. The interaction of CO<sub>3</sub><sup>2-</sup> with water in this case proceeds mainly according to the reaction:



The resulting OH<sup>-</sup> ions bind hydrogen ions to slightly dissociated (H<sub>2</sub>O) and aluminum ions to form slightly soluble (Al(OH)<sub>3</sub>) compounds. The places of bound H<sup>+</sup> and Al<sup>3+</sup> ions are occupied by C ions Ca<sup>2+</sup> (Mg<sup>2+</sup>).

Thus, the utilization rate of dolomite flour (DF) in the columns, introduced in half and full doses of hydrolytic acidity, varied from 0.93 to 0.81 for its decrease (tab. 3), and gypsum was 0.183.

**Table 3 - Completeness of interaction of ameliorants with AUC of sod-podzolic soil**

Option	Column layer, cm	pH <sub>WAT</sub> <sup>*</sup> soil: water 1:0.5	V, %	Undissolved carbonates, meq / 100 g of soil	Ameliorant utilization rate, %
Control	0-10	4.70	43.9	Did not contribute	-
	10-20	4.68	45.4		
	20-30	4.58	42.9		
	30-40	4.46	41.9		
Gypsum in a layer of 0-20 cm at 1.05 H <sub>H</sub>	0-10	4.72	50.5	Did not contribute	18.3
	10-20	4.34	45.8		
	20-30	4.33	44.6		
	30-40	4.37	44.1		
DF in a layer of 0-20 cm at 0.52 H <sub>H</sub>	0-10	5.20	72.4	None	93.2
	10-20	5.38	72.2	>>	
	20-30	4.78	45.0	Did not contribute	
	30-40	4.62	43.0		
DF in layer 0-20 cm at 1.05 H <sub>H</sub>	0-10	6.11	88.1	None	80.8
	10-20	6.21	89.3	>>	
	20-24	-	61.9	Did not contribute	
	24-30	-	46.1		
	30-40	4.56	43.4		

Even at a higher (by an order of magnitude) concentration of Ca<sup>2+</sup> and Mg<sup>2+</sup> ions (tab. 4) in the filtrates (liquid phase), the decrease in hydrolytic acidity in the case of gypsum is lower than that with dolomite flour, as evidenced by the utilization rates of ameliorants.

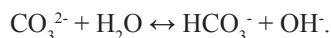


**Table 4 - Concentration of the sum of  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  cations in portions of the filtrate, mg-eq/l**

Test variant	№ of portion							Average
	1	2	3	4	5	6	7	
Control	1.25	0.91	0.96	1.20	0.81	0.95	1.33	1.05
0,52 $\text{H}_\text{H}$ DF	1.83	0.73	1.40	1.02	0.72	0.72	0.72	1.13
1,05 $\text{H}_\text{H}$ DF	2.18	1.40	1.20	1.46	1.61	0.92	1.36	1.46
1,05 $\text{H}_\text{H}$ of gypsum	18.4	53.8	63.6	51.7	-	-	-	50.0
0,52 $\text{H}_\text{H}$ DF + 0,52 $\text{H}_\text{H}$ of gypsum	19.3	49.8	30.8	38.6	-	-	-	36.4

At a maximum concentration of bivalent cations of 2.18 mg-eq/l on strongly acidic soils,  $\text{OH}^-$  ions interacted with absorbed  $\text{H}^+$  and  $\text{Al}^{3+}$  ions, most of which were located mainly on the outer surface of the absorbing soil complex. This follows from the results of work [8]), in which a more intense destruction of the soil structure with an increase in soil acidity was observed. Equilibrium pH values in the liquid phase were set in the range of 5.1-6.2. The reclamation effect of the lime-containing ameliorant is established mainly in the layer of its introduction. On very strongly acidic soils, the combination of dolomite flour (DF) and gypsum compared to DF did not contribute to a further increase in the DF utilization factor.

On strongly, medium and weakly acidic, **more aggregated soils**, the main agent for neutralizing soil acidity - carbonate ions - interacted with water according to the reaction:



In this case, the hydroxyl ions interacted mainly with the surface located hydrogen and aluminum ions, and the hydrolysis of  $\text{CO}_3^{2-}$  proceeded through the first stage. The concentration of divalent cations  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  in the liquid phase (up to 4 mg-eq/l) was insufficient for reaggregation of the AUC and displacement of intra-aggregate ions of hydrogen and aluminum. The equilibrium values of  $\text{pH}_{\text{WAT}}$  (1:0.5) of the samples after the interaction of the ameliorant with the soil were about 6.0 when using a dose equivalent to 0.66 of the hydrolytic acidity, and 1.31  $\text{H}_\text{H}$  - about 6.4 and higher. The coefficient of use of the dissolved ameliorant to reduce  $\text{H}_\text{H}$  was 0.5-0.6. In this case, the reclamation effect of the DF dose (0.66  $\text{H}_\text{H}$ ) was observed in the application layer (0-20 cm), and its 1.31  $\text{H}_\text{H}$  dose was also observed in the deeper layer of 20-30 cm (tab. 5).

**Table 5** - Influence of doses of dolomite flour on the physicochemical properties of different layers of columns of horizon  $B_1$  of sod-podzolic soil of light loamy granulometric composition

Layer depth, cm	H <sub>H</sub>	S	H <sub>H</sub> + S	H <sub>EX</sub>	T, %	Al <sub>ex</sub> , mg/100 g	pH <sub>WAT</sub> 1:0,5
	meq/100 g of soil						
1. Control							
0-10	2,82	6,4	9,22	0,66	69,4	2,25	5,60
10-20	3,50	5,8	9,30	0,82	62,4	3,00	5,09
20-30	2,97	6,6	9,57	0,62	69,0	2,50	5,46
30-40	2,80	6,4	9,20	0,60	69,6	2,52	5,47
2. 2.06 mEq of DF per 100 g of soil in 2 layers (0.66 H <sub>H</sub> , 7.21 mEq/column)							
0-10	2,10	8,8	10,9	0,08	80,7	0,45	6,10
10-20	1,92	8,2	10,1	0,05	81,0	0,25	5,95
20-30	3,32	6,2	9,52	0,75	65,1	1,89	5,26
30-40	3,50	6,0	9,50	0,77	63,2	2,79	4,99
3. 4.12 mEq of DF per 100 g of soil in 2 layers (1.31 H <sub>H</sub> , 14.42 mEq/column)							
0-10	1.75	9.0	10.75	0.04	83.7	0.18	6.36
10-20	1.57	8.8	10.37	0.02	84.9	None	6.55
20-30	1.92	7.5	9.42	0.20	79.6	0.63	6.07
30-40	2.80	6.4	9.20	0.57	69.6	2.16	5.51

On soils of light loamy granulometric composition, the combination of lower doses of dolomite flour and gypsum, applied in 2 layers of  $2/3 H_H$  each, compared with dolomite flour alone, also led to a further decrease in  $H_H$  and exchangeable acidity, exchangeable aluminum in layers deeper than the applied layer (20-40 cm), a slight increase in  $pH_{WAT}$  (tab 6). The latter did not contradict the growth of absorbed bases from 6.0-6.2 to 6.55-7.10 meq/100 g of soil. This was also observed with a combination of a dose of DF  $2/3$  of hydrolytic acidity and gypsum  $1/3 H_H$ .

Under the influence of a gypsum dose of  $1.31 H^H$  in the upper soil layer of 0-20 cm, a decrease in hydrolytic acidity was not established, but in the 20-40 cm layer it increased. In comparison with the control column without the ameliorant (tab. 5), the decrease in pH was 0.5 units. However, in the 0-20 cm layer, the amount of exchangeable bases increased, in the 0-30 cm layer, exchangeable acidity decreased. This indicates that a high concentration of calcium ions displaces hydrogen ions of a different nature (intra-aggregate) from the PPC.

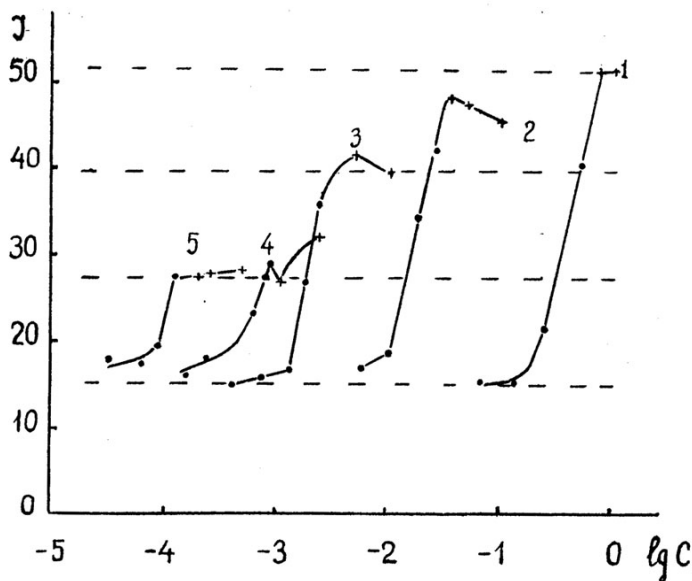
**Table 6 - Influence of doses of dolomite flour and gypsum on the physicochemical properties of different layers of the columns of horizon B1 of sod-podzolic soil of light loamy granulometric composition**

Layer depth, cm	H <sub>H</sub>	S	H <sub>H</sub> + S	H <sub>EX</sub>	T, %	Al <sub>ex</sub> ,	pH <sub>WAT</sub>
	meq/100 g of soil					mg/100 g	1:0,5
4.12 mEq of gypsum per 100 g of soil in 2 layers (1.31 H <sub>H</sub> , 14.42 mEq/column)							
0-10	3,06	7,00	10,1	0,28	69,3	3,06	5,15
10-20	2,71	6,80	9,51	0,32	71,5	3,42	4,97
20-30	3,59	6,30	9,89	0,38	63,7	3,69	4,91
30-40	3,73	6,50	10,2	0,59	63,7	2,97	5,00
2.06 mEq/100 g of soil DF and gypsum in 2 layers (7.21 mEq/column)							
0-10	1,92	8,68	10,6	0,06	81,9	0,50	5,52
10-20	1,75	8,38	10,1	0,03	82,7	0,45	5,77
20-30	2,30	7,10	9,40	0,37	75,5	1,53	5,45
30-40	2,70	6,55	9,25	0,51	70,8	2,43	5,16
2.06 mEq of DF and 1.03 mEq of gypsum per 100 g of soil in 2 layers (7.21 + 3.60 mEq)							
0-10	1.92	8.70	10.6	0.17	82.1	0.27	6.08
10-20	1.84	7.60	9.44	0.12	80.5	0.20	6.12
20-30	2.71	6.80	9.51	0.55	71.5	2.52	5.34
30-40	2.94	6.75	9.69	0.67	69.7	2.98	5.24

This is confirmed by the author's research on the mechanism of coagulation of sol isolated from the eluvial horizon of the solonetz by cations of various valences (figure). It can be seen that its coagulation is associated with the interaction of the studied cations with different numbers of functional groups of the sol, which leads to a complete or partial loss of its charge. With an increase in the concentration of K<sup>+</sup> and H<sup>+</sup> ions, the charge of 3 functional groups is neutralized, and the concentration of aluminum ions - one, calcium ions - one or more. Obviously, the coagulation of the sol by divalent and trivalent cations occurs due to the strong binding of certain functional groups of the sol by them.

And in the case of interaction of gypsum with the absorbing complex of soddy-podzolic soil (tab. 6), at a high concentration of Ca<sup>2+</sup> ions in the liquid phase, their strong bond with certain places of the AUC (acidic functional groups) occurs, which leads to the displacement of hydrogen ions into the liquid phase, the degree of saturation with bases, reaggregation of AUC and subsequent coagulation of soil colloids. In the case of the combined use of dolomite flour and gypsum, these displaced hydrogen ions are bound by hydroxyl ions formed during the hydrolysis

of  $\text{CO}_3^{2-}$  not only at the 1st, but also at the 2nd stage. This makes it possible to increase the utilization rate of dolomite flour (lime-containing ameliorant) to reduce the hydrolytic acidity not only in the layer of DF and gypsum application, but also deeper than it (tab. 7).



**Figure 9** - Change in the intensity of light scattering by the sol isolated from the eluvial horizon of the solonetz versus the logarithm of the ion concentration ( $\text{g-ion/l}$ ) [9]:

1 -  $\text{K}^+$ , 2 -  $\text{H}^+$ , 3 -  $\text{Mg}^{2+}$ , 4 -  $\text{Ca}^{2+}$ , 5 -  $\text{Al}^{3+}$ .

+ - designations corresponding to visually observed coagulation of the sol.

When dolomite flour was used in doses of 0.66 and 1.31  $\text{H}_{\text{TP}}$ , the coefficient of its use to reduce hydrolytic acidity in the 0-20 cm layer was 0.56 and 0.36, respectively, and for the entire 0-40 cm soil layer - 0.30 and 0.49, the degree of hydrolysis of  $\text{CO}_3^{2-}$  - 55.7 and 54.0% (tab. 7). In this case, hydrolysis at the 1st stage ( $\text{CO}_3^{2-} + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{OH}^-$ ) proceeded completely (100%), and at the 2nd stage ( $\text{HCO}_3^- + \text{H}_2\text{O} \leftrightarrow \text{H}_2\text{CO}_3 + \text{OH}^-$ ) - by 11.4 and 8.0%. The degree of hydrolysis of carbonate ions was determined by the  $\text{pH}_{\text{WAT}}$  of the soil (1:0.5) in soil layers of 0-10 and 10-20 cm columns after interaction with ameliorants.

**Table 7 - Efficiency of using dolomite flour and its mixtures with gypsum**

Option (№ of column)	Column layer, cm	H <sub>н</sub> , meq/100 g of soil	Coefficient of use of dolomite flour in the soil layer 0-20 cm/ degree of hydrolysis CO <sub>3</sub> <sup>2-</sup>	Total utilization rate of dolomite flour/degree of hydrolysis CO <sub>3</sub> <sup>2-</sup>
2. 2.06 mEq of dolomite flour per 100 g of soil in 2 layers (7.21 mEq/column)	0-10	2,10	<b>0.56/55.7</b>	0.30/55.7
	10-20	1,92		
	20-30	3,32		
	30-40	3,50		
3. 4.12 mEq of dolomite flour per 100 g of soil in 2 layers (14.42 mEq/ column)	0-10	1,75	0.36/54.0	<b>0.49/54.0</b>
	10-20	1,57		
	20-30	1,92		
	30-40	2,80		
4. 2.06 mEq/100 g of soil of dolomite flour and gypsum in 2 layers (7.21 mEq)	0-10	1,92	0.64/82.8	<b>0.83/82.8</b>
	10-20	1,75		
	20-30	2,30		
	30-40	2,70		
5. 4.12 mEq of gypsum per 100 g of soil in 2 layers (14.42 mEq/column)	0-10	3,06	0.07*	Increase in H <sub>н</sub> by 8.3 %
	10-20	2,71		
	20-30	3,59		
	30-40	3,73		
6. USD 2.06 mEq. flour and 1.06 mEq of gypsum per 100 g of soil per layer (7.21 + 3.71 mEq)	0-10	1,92	0.62/74.2	<b>0.65/74.2</b>
	10-20	1,84		
	20-30	2,71		
	30-40	2,94		
* - gypsum utilization rate				

Adding the same dose of gypsum to DF ( $2/3 H_H$ ) increased the utilization factor of DF in the 0-20 cm layer from 0.56 to 0.64, and in the 0-40 cm layer - to 0.83. In the latter case, this is due to a significant decrease in  $H_H$  and deeper than the layer of ameliorants. Adding gypsum to the same dose of DF at a dose of  $1/3 H_H$  led to an increase in the utilization rate of the former in the 0-20 cm layer to 0.62, and in the 0-40 cm layer - to 0.65. With the combined use of DF and gypsum, the reclamation effect increased with an increase in the dose of gypsum. When only gypsum was applied at a dose of  $1.31 H_H$ , only 7% of this ameliorant was used to reduce  $H_H$  in the 0-20 cm layer, and even its increase by 8.3% was observed in the entire 0-40 cm layer.

On gray forest soils of the Upper Volga region, with infiltration through the column of 0.5 and total annual precipitation rates and an increase in the DF dose from single to double (in  $H_H$ ), the utilization coefficient of dissolved DF increased from 65.4 to 75.7%, and with a combination of single and double doses of DF with gypsum ( $0.5 H_H$  each) - from 79.6 to 108%, respectively.

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在阿穆尔河南部地区农业气象条件下对中国CALLISTEPHUS CHINENSIS (L.) 的研究，以用于美化环境

**STUDY OF CALLISTEPHUS CHINENSIS (L.) IN  
AGROMETEOROLOGICAL CONDITIONS IN THE SOUTHERN ZONE  
OF THE AMUR OBLAST FOR THE PROSPECT OF USING IT IN  
LANDSCAPING**

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本文介绍了在阿穆尔州南部农业气象条件下研究中国Callistephus chinensis (L.) 品种的结果，以期将一年生植物用于美化环境。已经确定了最有前途的品种。

关键词：中华Callistephus chinensis品种气候条件装饰性抗性

**Abstract.** *The paper presents the results of studying the varieties Callistephus chinensis (L.) in the agrometeorological conditions of the south of the Amur Oblast, for the prospect of using annual plants in landscaping. The most promising varieties have been identified.*

**Keywords:** *Callistephus chinensis, cultivar, weather conditions, decorativeness, resistance*

The study of the range of floral and ornamental plants for use in landscaping settlements has recently been the most relevant. Variety study makes it possible to identify the most promising varieties that have a number of decorative qualities that are resistant to weather and climatic conditions of a particular region [1, 2].

One of the most popular ornamental crops in a number of regions of Russia is *Callistephus chinensis* (L.). *Callistephus chinensis* (L.) belongs to the *Asteraceae* family, genus *Callistephus*. The plant is represented by 44 varieties. Currently, there are more than 4000 varieties in the world [3].

*Callistephus chinensis* (L.) is a herbaceous, upright plant. The stem is green or reddish in color, covered with tough, short hairs. Branching of the main stem begins during budding, sometimes earlier. The most strongly branched tall and dwarf asters, less average [3]. Each shoot ends with one inflorescence. The bulk of the roots is located at a depth of 15–20 cm, some of the roots penetrate into the soil to a depth, so the aster is well supplied with water and nutrients.

*Callistephus chinensis* (L.) is photophilous, requires open, sunny areas, tolerates light partial shade. Prefers moderate temperature and humidity of air and soil. Seedlings and inflorescences tolerate short-term frosts down to minus 3°C. High temperatures lead to a decrease in terry and worse seed setting. *Callistephus chinensis* is not drought-resistant, requires regular, abundant watering, but excessive moisture and frequent precipitation lead to the defeat of plants by fusarium.

Not picky about fertility, more decorative on light, well-drained, sufficiently fertile, non-acidic soils. During the growing season, the plant needs additional feeding: at the very beginning of flowering and before the formation of buds. In the year of planting, it does not tolerate the introduction of organic fertilizers.

A very valuable property of *Callistephus chinensis* (L.) is its easy survival rate after transplantation, even in a flowering state. This is due to the fact that damaged roots during planting are easily restored, which allows planting seedlings of various ages, as well as successfully transferring plants to a new place even in the budding and flowering phase [4].

Since this ornamental plant grows well on any soil and tolerates partial shade quite easily, as well as small spring and autumn frosts, it becomes popular in horticulture [5]. Currently, more and more new varieties of *Callistephus chinensis* (L.) appear. Among them are curb low-growing varieties that have earlier flowering periods. From plants, you can compose landscape flower arrangements of long flowering up to 40-60 days. They are also valued for their exceptional durability when cut and used in floristry [6].

In addition to its decorative properties, aster has medicinal properties. Plants contain a huge amount of biologically active substances, flavonoids, coumarins. The plant is actively used in folk medicine as an antipyretic and anti-inflammatory agent, a natural mucolytic [7].

Today, the following is of interest: on the basis of which varieties of *Callistephus chinensis* (L.) can abundant and lush flowering be achieved during the short warm season of the Amur Oblast. Due to the peculiarities of the climatic conditions of the region, primary attention should be paid to drought-resistant and cold-resistant varieties, varieties of the earliest flowering period, which is important in a short summer, and the study of the possibility of obtaining seed in the conditions of the region.

In the Far Eastern region, varieties of some varieties of asters, in particular, low-growing varieties, with an early flowering period appeared relatively recently, with the advent of the achievements of Russian breeding on the basis of domestic agricultural firms. The relevance of the research topic arose from the need to diversify the range of summer houses used for landscaping urban spaces that are most resistant to local agrometeorological factors.

The aim of the research is to study the influence of sowing dates on plant pro-



ductivity and decorative qualities of *Callistephus chinensis* (L.) cultivars under agrometeorological conditions in the south of the Amur Oblast. The research was carried out at the experimental site in 2019.

Weather conditions in 2019 were extremely difficult and deviated from multi-year data for all observed parameters. The duration of the warm period was 96-99 days, the sums of temperatures deviated from the long-term values downward by 65-130°C. On some days, temperatures dropped to 9°C, absolute maximums were 28-35°C. Precipitation was frequent, with an intense rainstorm, sometimes with hail. During the summer, we celebrated 30-40 days with rain up to 50% more than normal. The dangerous phenomenon of "waterlogging of the soil" was noted.

The objects of the study were: cultivars Erfurd dwarf, Carpet, Little lady.

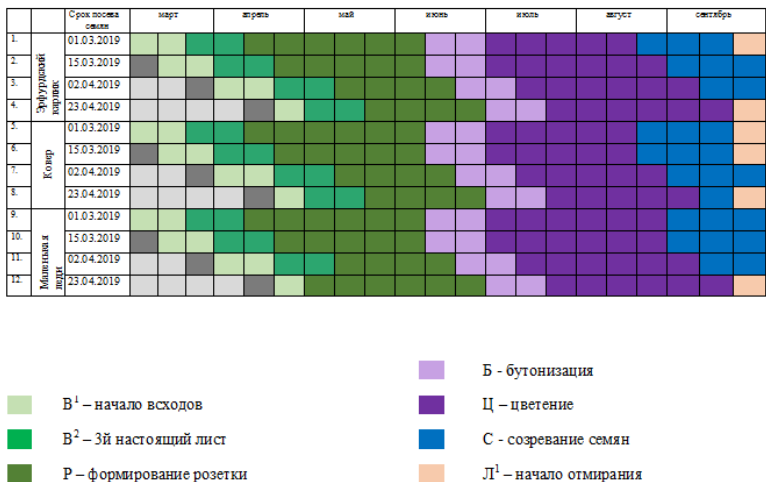
The research program included field experience. Phenological observations and biometric measurements of *Callistephus chinensis* (L.) plants, resistance to external environmental factors were noted during the entire growing season. The study was carried out according to generally accepted methods (the method of "Phenological observations in gardens and parks" [8], "Methodology for setting up experiments with fruit, berry and flower-ornamental plants".(1982).

The scientific novelty consisted in the optimal selection of *Callistephus chinensis* (L.) varieties for the climatic conditions of the south of the Amur Oblast.

Plants of the studied varieties were grown by seedlings. The seeds were sown indoors on several dates, in seedling containers on 1 March; March 15, April 2 and April 23. For seedlings, the following composition of the soil mixture was used: 2 parts of garden soil, 1 part of peat, 1 part of coconut substrate.

Plants dived into separate containers in the phase of 1-2 true leaves. Seedling care consisted of watering and loosening the soil. Seedlings were transplanted into the ground in the second half of May on May 23, the layout of plants was 25 x 25 cm. Care for adult plants consisted of loosening, weeding, systematic watering during dry periods.

The summer of 2019 was rainy, therefore, to prevent fusarium infection, they were treated with phytosporin and sodium humate in June-July, but 4% of the plants were affected by this disease. The affected plants were removed from the test plot. During the research, the dates of plant development were noted (fig. 1)



**Figure 1 – Phenological spectrum of plant development**

Seedlings appeared 4-5 days after sowing on all dates. The earliest and most friendly seedlings were of the Carpet cultivars. The beginning of flowering at sowing on March 1 and 15 was recorded in the Erfurt dwarf cultivar from June 28 to 30, with late sowing on April 2 and 23 from July 12 to 26. Carpet and Little Lady - with early March sowing of seeds, the beginning of flowering was celebrated from 1 to 4 July, with late sowing - from 13 to 30 July. The beginning of mass flowering was noted from the moment of blooming 50% of all flowers on a given plant or group of plants: Erfurt dwarf from July 22-23, Carpet - July 25-27, Little Lady - July 27-28, with early sowing of seeds. When sowing seeds from April 2, the mass flowering date was noted for the Erfurt dwarf on August 4, Carpet - August 7-8, Little Lady - August 15. With a sowing period of April 23 - August 24-25, August 27-28 and August 29-31, respectively, by cultivar. The end of flowering is considered the moment of the final loss of the inflorescence of its decorative quality (even if there are still some non-wilted flowers that no longer have a decorative effect). These dates fell for all varieties of early sowing in the second and third decades of August, for late sowing dates shifted by every 10 days. In the Erfurt dwarf and the Little Lady, the loss of decorativeness was noted at the sowing date of April 2, September 10-12, Carpet - August 26-30. With a late sowing date on April 23, Erfurt dwarf and Little Lady - September 18-21, Carpet - September 8-10.

Thus, in the agrometeorological conditions of 2019, the flowering time of plants was 51-62 days. Long flowering time for cultivars Erfurt dwarf and Little Lady - 60-62 days regardless of the time of sowing seeds, shorter flowering time

for cultivar Carpet, it was 51-52 days.

The possibility of obtaining high-quality seed material of *Callistephus chinensis* (L.) directly depends on the place of cultivation, weather conditions, the level of agricultural technology and the characteristics of the selected varieties. It was revealed that under the conditions of the south of the Amur Oblast, with a plant nutrition area of  $25 \times 25$  cm, the maximum maturation of seeds was shown by plants of the first and second sowing dates in all studied varieties (sowing 03.01.2019 and 03.15.2019). About 60-70% of seed ripening was noted in plants of the third sowing date on April 2, plants of the last sowing date on April 23 did not give ripe seeds.

The decorativeness of the plants was assessed. According to V. Kotov's classification, *Callistephus chinensis* (L.) plants, depending on the height of the bush, are divided into four groups: dwarf varieties should have a bush height of up to 20 cm, undersized - 21-30 cm, medium-sized - 31-60 cm, tall - 61- 80 cm, and giant ones - more than 80 cm. According to the characteristics of producers, all selected groups (varieties) belong to undersized (height from 21 to 30 cm). In conditions of high humidity in the rainy summer of 2019, the Erfurt dwarf variety reached a height of 50-55 cm, Carpet - 40-45 cm, Little Lady - 30-35 cm. Accordingly, they all showed themselves as medium-sized in the south of the Amur Oblast.

The shape of the bushes can be pyramidal, columnar, oval, wide strong and wide spreading. The Erfurt dwarf had a broad, robust bush shape; Carpet and Little Lady - a spreading fragile bush shape.

According to the flowering time, the varieties are divided into early (from early July to mid-September), medium (from late July to October), late (from mid-August to frost). According to the characteristics of the varieties declared by the producers, Carpet and Little Lady should begin to bloom in July and, accordingly, can manifest themselves as early or medium. The Erfurt dwarf variety is declared as very early - flowering should begin in June. In the course of the study, it was revealed that the Erfurt dwarf under local conditions showed early flowering times, but not very early ones. Carpet varieties correspond to the declared (early or medium) flowering periods. The Little Lady cultivars have a pronounced average flowering time.

The studied varieties belong to semi-double and double varieties. Erfurt dwarf - about 70% double and 30% semi-double inflorescences. Carpet - about 50% terry and the same number of semi-double inflorescences. Little lady - about 60% double and 40% semi-double inflorescences.

In the color of the inflorescences, the varieties range from white to dark red, and from white to dark purple. One of the varieties of the Carpet group (cultivar type) has the rarest yellow color found.

By the size of the inflorescence, plants are classified with small (up to 4 cm in

diameter), medium large (up to 6 cm in diameter), large (8-10 cm in diameter), giant (about 10 cm in diameter). The studied varieties had an average inflorescence size of 6 cm, respectively, they all belong to medium-large varieties.

According to the direction of use, there are varieties of shear, casing, pot and universal. Cutting varieties are distinguished by particularly spectacular large inflorescences on long and strong peduncles. Casing varieties, as a rule, have a compact habit, a large number of inflorescences, and bloom profusely and for a long time. The studied grades are casing grades.

To describe the studied plants, the classification of N.A. Petrenko, according to which plants are divided into three large classes. Classes are divided into types depending on the structure of the inflorescences, types into groups or varieties, differing not only in the structure of the inflorescences, but also in their shape, as well as in the habit of the bush. Varieties within a group (variety type) differ mainly in the color of the inflorescences.

The decorativeness of the studied plants was assessed during the period of mass flowering according to the most important decorative characteristics: the number of branches of the 1st and 2nd order, the length of the peduncle, the number of flowers on the peduncle, the size and shape of the inflorescence, the resistance of the inflorescences to unfavorable meteorological conditions, decorativeness in cut.

Each sign of decorativeness was assessed within a five-point scale. The result obtained is the arithmetic mean of the assigned points for each indicator and was the final assessment of the characteristic.

The most decorative variety was shown by the Erfurd dwarf variety, whose inflorescences had a rich red or dark pink color. Inflorescence baskets are mostly terry. Peduncles are straight, leafy, of sufficient length for cutting. Stable in all weather conditions. The cultivar showed the longest flowering period of 60-61 days.

The variety Carpet showed good resistance to diseases in conditions of high humidity, but the inflorescences were not resistant to such conditions, which manifested itself in the loss of their decorative effect. Also, a loss of decorativeness was noted in the inflorescences of the Yellow carpet variety under arid conditions at elevated temperatures and high insolation, which was manifested by fading and a strong loss of decorativeness at the end of mass flowering.

The Little Lady cultivar had an average decorative score, had the smallest number of flowers on the peduncle -1-2, the inflorescence was double and semi-double, moderately resistant to high temperatures and humid conditions.

Thus, the cultivars *Callistephus chinensis* (L.) were studied in the southern zone of the Amur Oblast. All studied cultivars have a sufficient flowering period, which is important for a short growing season in the south of the Amur Oblast. At an early date of sowing, full-fledged seed material was obtained for seedlings.

The most promising variety is the Erfurd dwarf variety, which showed the greatest resistance to agrometeorological conditions of the growing season and received the highest assessment for decorative features. This variety can be used to expand the range of annual flower crops when landscaping Oblast territories.

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面向中等职业教育学生管理者的文档管理信息系统原型的开发  
**DEVELOPMENT OF A PROTOTYPE OF A DOCUMENT  
MANAGEMENT INFORMATION SYSTEM FOR A CURATOR OF  
STUDENTS OF SECONDARY VOCATIONAL EDUCATION**

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抽象的。 本文考虑了对信息系统形成初步要求, 开发授权表单原型以及与任务交互的形式的问题。 对SBPEI IO “安加尔斯克工业经济学院”的硬件和软件进行了技术分析, 结果表明了开发的相关性。 考虑数据访问控制系统。 概述了对交互式软件包进行授权的主要情况。 描述了用于信息系统与任务交互的软件模块的原型。

关键字。 前提条件, 物理数据模型, 原型, 访问控制系统, 授权表, 请求。

**Abstract.** *The paper considers the issue of forming preliminary requirements for the information system and the development of a prototype of the authorization form and the form of interaction with the task. A technical analysis of the hardware and software at the SBPEI IO "Angarsk Industrial and Economic College" was carried out, and as a result, the relevance of the development was indicated. The data access control system is considered. The main situations for authorization to the interactive software package are outlined. A prototype of a software module for the interaction of an information system with a task is described.*

**Keywords.** *Prerequisites, physical data model, prototype, access control system, authorization form, request.*

Modern corporate systems, both present on the market and emerging, are aimed at managing the business processes of any enterprise, without exception. There is a wide selection of IT products, consulting firms and specialists in the market. The question arises about the further direction of the development of enterprise information systems. The most dynamically developing area of corporate information systems at the moment are business analysis systems and systems

for working with a client [1, 2]. At present, any information system is not only a system for storing and processing information, but also an interactive complex of interaction between all users.

As a result of the analysis of business processes in SBPEI IO "Angarsk Industrial and Economic College", one of the conclusions was that there is no software tool that can automate the process of document flow between curators and administrators, for example, deputy director for educational work, dormitory teacher, educational unit etc.

As a result of the analysis of hardware and software in the educational organization, the following conclusions were drawn:

1. In the technical school, all curators and administrative workers are provided with workstations, united into the customer's local network.

2. The educational organization has a structural unit (information and computing center), one of the tasks, according to the Regulation on the Information and Computing Center, is "the development, implementation and maintenance of information systems to support the main processes of the educational organization (educational process, scientific research, administrative control)" [3].

All of the above indicates the relevance of the development of an information system for document flow for the curator of secondary vocational education. In the course of analyzing the architectures of building an information system, a client-server architecture was chosen, since it allows you to create multi-user information systems.

In the process of developing an automated information system, the following were developed:

1. data warehouse;
2. user interface for interacting with the data warehouse.

The physical model of the data warehouse is shown in figure 1.

The data warehouse is implemented in MS SQL SERVER 2017, in which 10 tables are created, namely:

- Student;
- Parents;
- Parents' phones;
- Phones of students;
- Family composition;
- Activity;
- Chronic diseases;
- Items;
- Academic performance;
- Specialties.

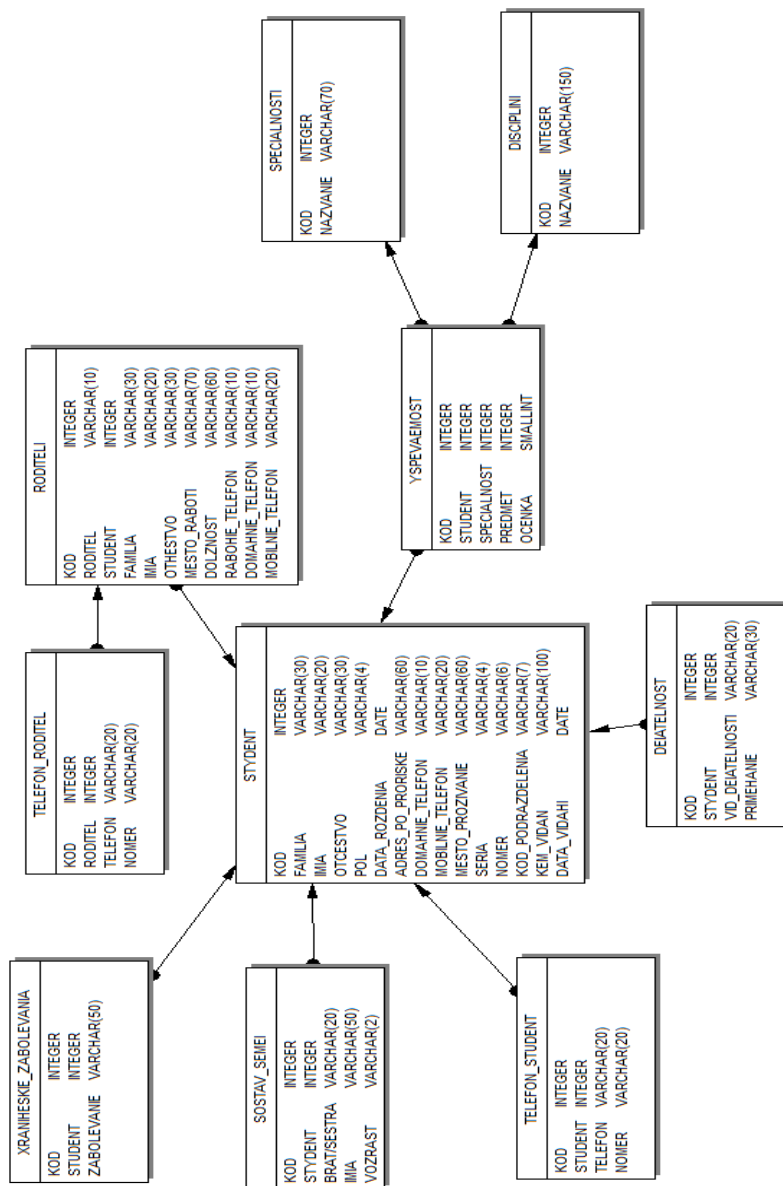


Figure 1 -Physical data warehouse model



The user interface for interacting with the data warehouse is implemented in the MS Visual Studio 2019 tool environment.

As part of the development of an automated information system, the following tasks were implemented:

1. a data access control system has been developed;
2. the system provides storage of various kinds of information;
3. the system provides an analysis of business processes and their indicators according to various criteria - temporal and quantitative;
4. the system provides an analysis of business processes in the context of specific performers of process operations;
5. the system ensures the formation of documents, including as a result of the operational analysis of information;
6. the system ensures the prompt exchange of documents;
7. the system provides accounting for individual objects of business processes.

Data access control system.

Access control is a function of an open system that provides security technology that allows or denies access to certain types of data, based on the identification of the subject who needs access and the data object that is the target of access [4, 5].

The main access control mechanisms are identification and authentication. A prototype of the form is shown in figure 2.

In information systems in use today, Username and Password are the most common form of authentication. Usernames and passwords are gradually being replaced by more sophisticated authentication mechanisms.

*Figure 2 - Login form prototype*

After successful identification and authentication, the user or system gets at its disposal exactly those resources to which the system or user has the right to access, as well as what actions will be allowed to be performed (launch, view, create, delete or change), this is called permission [6].

While implementing a secure registration and authorization method, the following had to be handled:

1. in case of an unsuccessful attempt to authorize the user, the following must be foreseen:

- if there is no entered login in the system, allow user registration with subsequent authorization;
- if the login already exists in the system, check the correctness of the password entry.

2. if the user is already registered in the system and authorized in it, redirecting him to the form of the corresponding program module;

3. when registering in the database, all user data and password are recorded (in md5 encryption). There are validation rules for each of all fields.

4. when registering an account, it must be checked for uniqueness;

5. all incorrect user actions are accompanied by error messages;

6. delimitation of access rights to the information system is determined only by the administrator. By default, the user is logged in by default as an operator.

As part of the work with information about students, it is necessary to provide for storage, processing with records of students. The form for working with the list of students is shown in figure 3.

The software module that implements work with information about students allows you to organize work with database records (edit an existing record, add a new record, delete a record). The program module includes the ability to generate a report on progress by group, the ability to group records according to various criteria.

Фамилия	Имя	Отчество	Пол	Дата рождения	Адрес по прописке	Место п
Пензина	Карина	Сергеевна	Жен.	06.12.1998	Ирк. Обл., г. Ангарок, 178 - 7 - 49	Ирк. ОБ
Маслов	Андрей	Игоревич	Муж.	27.01.1999	Ирк. Обл., г. Ангарок, 17 - 6 - 227	Ирк. ОБ
Гусев	Михайл	Сергеевич	Муж.	30.11.1999	Ирк. Обл., г. Усолье -Сибирское, пр Коопзавтов 38 - 16	Ирк. ОБ
Беленко	Владимир	Сергеевич	Муж.	22.03.1995	Ирк. Обл., г. Ангарок, пр. Лেনеноый 12 -84	Ирк. ОБ
Куница	Юрий	Сергеевич	Муж.	10.03.1995	Ирк. Обл., г. Ангарок, 15 - 9 - 19	Ирк. ОБ
Агатипов	Иван	Владимирович	Муж.	25.08.1999	Ирк. Обл., г. Усолье -Сибирское, пр Красный партизан 36 - 20	Ирк. ОБ
Оефелов	Евгений	Анатольевич	Муж.	18.05.1999	Ирк. Обл., г. Ангарок, 94 - 105 -61	Ирк. ОБ
Мироненко	Александр	Павлович	Муж.	29.10.1999	Ирк. Обл., г. Ангарок, Лквартал 3 - 18	Ирк. ОБ

Родитель	Фамилия	Имя	Отчество	Место работы	Должность
Мать	Пензина	Ольга	Васильевна	МБОУ СОШ №36	Учитель
Отец	Пензин	Сергей	Васильевич	ГАУ ДПО ИО "РЦИРПО"	зав. Отделов оценки качества и экспертизы

Редактировать

Добавить студента

Успеваемость

Figure 3 - Form "Students"

The form "Progress" displays the grades received by the student. Figure 4 shows the "Performance" form.

Дисциплины Специальности

**Фамилия** Пензина

**Имя** Карина

**Отчество** Сергеевна

**Специальность** Программирование в компьютерных системах

Предмет	Оценка
Физическая культура	Зачет
ОБЖ	4
История	5
Литература	4
Математика: алгебра и начало математического анализа; геометрия	5
Русский язык	4

Добавить Сохранить

Navigation buttons: Previous, First, Last, Next

*Figure 4 - Form "Progress"*

On the "Edit record" form, you can edit existing data about a student or add information about a new student.

Figure 5 shows the "Edit record" form.

Студент

Фамилия

 Пензина 

Имя

 Карина 

Отчество

 Сергеевна 

Пол

 Жен. 

Дата рождения

 06.12.1998

Адрес по прописке

Ирк. Обл., г. Ангарск, 178 - 7 - 49

Фактическое место проживания

Ирк. Обл., г. Ангарск, 211 - 3 - 5

Номера телефонов

Мобильный телефон

Номер телефона

 8(914)923-26-46 

Добавить

Телефон	Номер
Мобильный телефон	8(914)923-26-46
Домашний телефон	54-37-41

Заболевания

Название

Добавить

Название

Семья

Занятость студента

Сохранить

Добавить

И

←

→

⏮

⏭

Figure 5 - Editing a record

The next of the main tasks of developing an information system for the workflow of a curator of students of secondary vocational education is the organization of interactive interaction between curators and the administration. To solve this problem, a prototype was developed, shown in figure 6.

Название задачи

Срок выполнения

Учасники

Обсуждение

Прикреплённые документы

Возможности по взаимодействию

Figure 6 - Prototype of the form of interaction with the task

Assuming the implementation of interactivity in the information system, the following should be provided:

1. Organization of discussion of the most important issues.
2. Ability to add and download various documents.
3. Determination of the participants and time frames for the tasks.

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用于制造外套的毡的性能研究  
**INVESTIGATION OF THE PROPERTIES OF FELT FOR THE  
MANUFACTURE OF OUTERWEAR**

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抽象的。在设计毡制品时，选择设计，形式，装饰解决方案和其他材料的问题仍未解决。由于主要是手工生产，因此没有用于预测性能的方法。在外套的制造中，仅在确保物理和机械性能方面解决了这些问题。

对毛毡制成的外套的主要要求是：

- 暴露于外部环境时保持产品的形状和特性；
- 在操作过程中对产品进行保养的能力。

基于对产品制造，操作和维护过程中性能变化的实验数据的分析，生产毡外衣很重要。

本文的目的是研究毡的特性，以提供所需的操作特性。外衣和毛毡的结构和技术必须设计为符合要求的 *у с л о в и я м* 操作条件。

本文建议使用实验方法研究毛毡的物理和机械性能，分析和综合服装设计和制造过程的方法，并获得有关用丝绸制成的毛毡外衣的操作性能的新信息。

关键字：毡，纤维，丝绸，羊毛，表面密度，外套，帽子，修女的羊毛，断裂伸长率，无纺布。

**Abstract.** *When designing felted products, the issues of choosing the design, forms, decorative solutions, and additional materials remain unresolved. Due to mainly artisanal production, there are no methods for predicting properties. In the manufacture of outerwear, these issues are resolved only in terms of ensuring physical and mechanical properties.*

*The main requirements for outerwear made of felt are:*

- *preservation of the shape and properties of the product when exposed to the external environment;*

- the ability to provide care for the product during operation.

*The production of felt outerwear based on the analysis of experimental data on changes in properties during the manufacture, operation and care of the product is relevant.*

*The purpose of the article is to study the properties of felt to provide the required operational characteristics. The construction and technology of outerwear and felt must be designed to meet the required operating conditions.*

*The article suggests using experimental methods for studying the physical and mechanical properties of felt, methods for analyzing and synthesizing the processes of designing and manufacturing clothing, and obtaining new information about the operational properties of outerwear made of felt with silk.*

**Keywords:** *felting, fibero, silk, wool, surface density, outerwear, hats, nun's wool, breaking elongation, non-woven fabric.*

Felt is a non- woven textile fabric made from wool fibers, with high bending and tear resistance. Despite the fact that it is one of the oldest, most widely used and convenient materials, the manufacturing technology has not changed much. Prolonged physical exposure is the first and still relevant по сегодняшний день method of producing felt.

Felting is an invention of nomads, the most ancient textile manufacturing technique on Earth, which has entered the global culture. Archaeologists date the appearance of the first felted products to 8000 years of age, its production belongs to the earliest and most universal types of domestic industry. For centuries, this unusual material has served the nomadic peoples of the Earth, helping them survive in the most difficult climate conditions of the steppes and mountains. Over time, felting began to be used for making clothes and shoes. Large felting workshops appeared. In the mid-19th and early 20th centuries, felting presses and felting machines were invented. Felling was carried out by squeezing and rolling wool or by mechanical action of special needles that tangled wool fibers.

Unique, environmentally friendly, versatile, with the potential to improve felt attracts the attention of technologists, designers, fabric artists, designers, fashion designers all over the world. And this attention is not only an interest in reviving and promoting the traditional craft of making felt, but also an economic interest. Today, more and more young people are joining the business of felt, despite the great work that its production requires.

There are three technologies for making felt:

- flat technology used to produce details of clothing, carpets, panels, materials for yurts, blankets;

- seamless method or hollow shape technology, which involves cutting out the solid frame of a clothing model or, most often, small products that are covered with combed wool, and the felting process is carried out in the same way;

- volumetric technology allows you to make spherical objects – balls, fruit dummies, toys.

Wool is the only fiber that has rollability. It is caused by a combination of scaliness of the wool, which creates an unequal coefficient of friction (greater in the direction of the root than the tip of the hair) and contributes to the directional movement of the fibers, and elasticity, which allows the fibers to intertwine and then contract under mechanical action in conditions of humidity, temperature and acidic or alkaline environment, which makes it possible to When rolling, the product shrinks over the area. This increases the density and strength of the product. The maximum density created by the roller is 0.55 g / cm<sup>3</sup> (the density of the sole of felt boots is 0.42 g/cm<sup>3</sup>). A further increase in density causes the product to fall apart due to the rupture of overstressed fibers.

All operations are performed manually, because automation, although it saves time, but it is more harmful, in particular, by breaking off the hairs, thereby reducing the strength. For knowledgeable people, automation is a real source of evil for felt production. In addition, handmade items are always in price, and there is always a demand for them.

Almost all nonwovens, including felt, can be given various properties with the help of additives: antistatic properties, UV resistance, hydrophobicity, hydrophilicity, increase and decrease vapor and water permeability, paint in any color, apply a drawing without problems, perform embossing.

And the assortment of felt products, the advantage of which is naturalness, is very diverse. There are markets for souvenirs, products, and felt clothing both inside and outside the country. In terms of the quantity and quality of products made from felt, the scope of their application, it can rightly be called unique. It is made from:

- both designer and outdoor clothing, which provides high thermal insulation properties;
- hats – in summer they protect from the sun, in winter-from the cold (bath caps – they are easier to breathe under steam);
- shoes-home slippers – are almost a basic necessity and a year-round product. The ability to absorb moisture and let it pass through itself, determine the use in the manufacture of winter shoes, valenok - they are easy to walk, in, their feet "live" in them-they breathe, do not sweat and do not freeze, and the antibacterial properties of the material do not allow microorganisms to develop during long wear.;
- bags, cases, souvenirs, toys.

In the narrow segment of products made from natural raw materials, felt products occupy their proper place. Stylish and eco-friendly things are always in the price.



Felt is equally in demand in agriculture, and in medicine (as an allergen, helps in treating arthritis and heart disease; it turned out that it is useful to work with this material to children suffering from developmental delay, since there is a constant hand massage that stimulates fine motor skills of fingers), hygiene, cosmetics, construction, electronics, electronics, harness manufacturing, furniture manufacturing, mechanical engineering. Its main advantage over traditionally used materials is a pleasant appearance, ease of cutting, and the absence of allergic reactions when in contact with human skin.

For a long time, felt consisted only of wool fibers. In recent years, the use of additional fibers and fabrics has become widespread. The addition of felt additional fibers, fabrics, and threads to felt, the most common of which is silk, improves its consumer and aesthetic properties [3].

During an experiment Simonyan A.A., consisting of 6 experiments, the felt part was modified by introducing an additional layer of silk material into the canvas over four layers of wool fibers. And the force at uniaxial stretching of the sample before breaking and the relative elongation at break were studied. Factors such as the surface density of felt and the surface density of silk material were also changed. The variations in the factors of the same age group are shown in Table 1.

**Table 1.** Levels of variation of factors

Factors	Variation levels			Variation interval
	-1	0	+1	
Surface density of silk, dens., g/ m <sup>2</sup>	190	205	220	15
Number of felt layers, N.	4	5	6	1

The levels of variation were: - surface density of felt Ms from 220 to 380 g / m" with an interval of 80g/m<sup>2</sup>; - surface density of silk M (dv)5 from 15 to 21 g / m with an interval of 3g/ m<sup>2</sup>.

The results of experiments on the breaking load and elongation at break of two samples of felt with different surface densities in combination with two different types of silk are presented in Table 2.

**Table 2.** Results of tests for breaking load and elongation at break of felt samples

№	Full name	Sample	Breaking load	Elongation at break	Surface density
1	Felt 1	1	12,5	53	220
		2	13	61	
		3	12,5	62	
		mid.mean	12.67	58.67	
2	Felt 1 Silk 1	1	15	78	235
		2	14,5	76	
		3	14,5	77	
		mid.mean	14.67	77	
3	felt 1 silk 2	1	31	81	241
		2	35	92	
		3	35,5	92	
		mid.mean	33.83	89.33	
4	Felt 2	1	26	77	380
		2	25	86	
		3	22	70	
		mid.mean	24,33	77,67	
5	Felt 2 Silk 1	1	35	90	395
		2	34	95	
		3	31	90	
		mid.mean	33,33	91,67	
6	felt 2 silk 2	1	33	90	401
		2	33,5	95	
		3	33	90	
		mid.mean	33,17	91,67	

Analysis of the properties of parts made of felt with additional materials, carried out as a result of experiments, showed that the, presence of a layer of silk material in felt has a significant effect on its physical and mechanical properties.

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UNet和wUNet对手机上的实时计算进行了模型优化

## THE UNET AND WUUNET MODELS OPTIMIZATION FOR REAL-TIME COMPUTATIONS ON MOBILE PHONES

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抽象的。 在本文中，我们对通过Pytorch和Keras框架训练的翻译神经网络进行了分析，使其成为使用TFLite的手机计算结构的最佳选择，以及适用于理论计算优化的技术

关键字：GPU，量化，浮点数，PyTorch，Keras，TFLite，膨胀卷积，双缩减卷积层

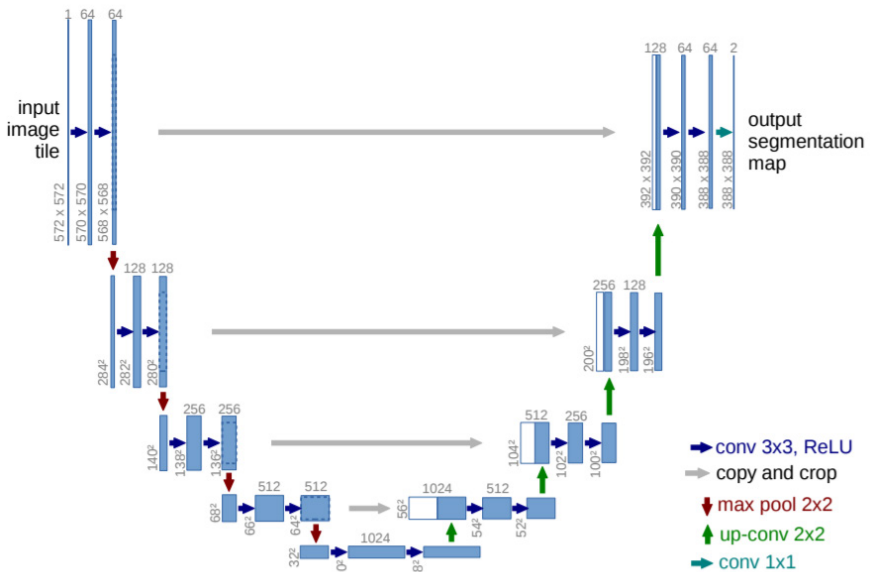
**Abstract.** *In the paper we provide an analysis of translation neural networks trained via Pytorch and Keras frameworks into optimum for mobile phones calculating structure using TFLite and appropriate techics of theoretical optimization of calculation*

**Keywords:** *GPU, quantization, floating point number, PyTorch, Keras, TFLite, dilated convolutions, double-reduced convolutional layers*

Special attention is currently being paid to the problem of preventing natural disasters. Forest fires are the most common catastrophe causing serious damage to the Russian economy. It should be noted that the most often guilty in the occurrence of these phenomena is a person and careless handling of fire. Also, one cannot ignore the fact that our country has vast forests, and there is not enough professional personnel to monitor them. Therefore, the scientific community is faced with the task of developing automated means of protecting and counteracting forest fires. One of the promising areas of computational cybernetics is the development of new methods of detection and analysis behind flames. In case of forest fires, the supply of water to the flame without taking into account its structure is ineffective, therefore it is necessary to develop an algorithm for extracting the zones of fire vulnerability on video.

As part of a study in the field of choosing the best mobile software and hardware system for fire safety tasks [1], a modern android smartphone was chosen in view of its optimal photo capabilities for color rendering of the flame and the presence of a mobile video processor.

In order to qualitatively improve the results of flame detection, approaches to flame segmentation were applied using modern convolutional neural networks of the UNet class [2], shown in fig. 1, and its modification was developed for the problem of segmentation of objects of the same kind on the basis of wUUNet [3], which is two UNet blocks (binary and refining multiclass) closely interconnected by throughput connectors, shown in fig. 2. Objects of the same kind within the framework of our task are the contours of the flame, and the sign that distinguishes the types of flame from each other is the color (Yellow, orange and red). This division was made in order to follow the rule of extinguishing a fire in the lower zone of the flame with a temperature of 600K [4], which corresponds to the red color in the video.



*Fig. 1. – UNet neural network model architecture*



The first comparison involves UNet models developed on the PyTorch and Keras frameworks, the computation time of which is shown in tab. 1:

**Tab. 1** – comparison of UNet models trained in Pytorch and Keras

Model	Average time $\bar{t}$ ms, (FPS)	$\sigma$ (std)	min(t), ms. (FPS)	max(t), ms. (FPS)
UNet Pytorch	180.58 (5.5 FPS)	<b>6.59</b>	147 (6.8 FPS)	217 (4.60)
<b>UNet Keras</b>	<b>158.49 (6.31 FPS)</b>	6.96	<b>128 (7.81 FPS)</b>	<b>181 (5.52 FPS)</b>

From this table it can be seen that the model trained in Keras is faster on average than Pytorch. This is due to the fact that Keras uses the Tensorflow background related to the mobile computing library and the translation chain consists of the usual translation of the Keras model -> TF Lite, while in order to translate the Pytorch model to TF Lite, you need to go through several stages: Pytorch -> ONNX -> TensorFlow -> TF Lite, which contributes to sub-optimal model translation. Thus, it is optimal for mobile computing to use models trained on the Keras framework.

The following comparison is used between UNet models using sparse convolutions [6] and not. The thinning convolution technique is shown in fig. 4



(a) General convolution (kernel  $3 \times 3/\text{rate} = 1$ )      (b) Dilated convolution (kernel  $3 \times 3/\text{rate} = 2$ )

**Fig. 4** – Standard (a) and sparse convolutions (b)

From the theoretical point of view, the use of sparse convolutions can multiply the computational complexity, but in practice this is not the case, since GPU memory, like massively parallel computations, work efficiently only in the case of using continuous ranked memory access, and in the case of sparse convolutions, it is taken every second element horizontally and vertically. Comparative indicators are presented in tab. 2.

**Tab. 2** – comparison of UNet models with and without sparse convolutions

Model	Average time $\bar{t}$ ms, (FPS)	$\sigma$ (std)	min(t), ms. (FPS)	max(t), ms. (FPS)
UNet Dilated	240.53 (4.16 FPS)	7.15	206 (4.85 FPS)	264 (3.78)
<b>UNet</b>	<b>158.49 (6.31 FPS)</b>	<b>6.96</b>	<b>128 (7.81 FPS)</b>	<b>181 (5.52 FPS)</b>

The second way to optimize the model is to halve the convolutional layers: instead of 64,128,256,512, use 32,64,128,256 layer convolutions, respectively. Based on the tab. 3 this method effectively improves the execution time of the neural network:

**Tab. 3** – comparison of UNet and wUUNet models in standard and light versions

Model	Average time $\bar{t}$ ms, (FPS)	$\sigma$ (std)	min(t), ms. (FPS)	max(t), ms. (FPS)
wUUNet	240.53 (4.16 FPS)	7.15	206 (4.85 FPS)	264 (3.78)
UNet	158.49 (6.31 FPS)	6.96	128 (7.81 FPS)	181 (5.52 FPS)
<b>wUUNet light</b>	<b>147.96 (6,76 FPS)</b>	<b>6.88</b>	<b>123 (8.13 FPS)</b>	<b>168 (5.95 FPS)</b>
<b>UNet light</b>	<b>75.01 (13,33 FPS)</b>	<b>10.78</b>	<b>51 (19.60 FPS)</b>	<b>116 (8.62 FPS)</b>

Thus, it was found that it is effective to use a two-fold reduction in the layers of the neural network. This option allows even a dual wUUNet model to run faster on average than a standard UNet. The strategy of using sparse convolutions is not efficient in the context of computing on mobile processors.

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离散数学问题中词集和结构化编码的完整性

## COMPLETENESS OF THE WORD SET AND STRUCTURED CODING IN PROBLEMS OF DISCRETE MATHEMATICS

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抽象的。 本文提供了已知结果的简要概述, 以及有关单词集合的完整性和信息编码问题的新结果, 这些信息保留了要编码的集合的结构特性。 一些问题在离散数学中是众所周知的, 但是提出了新的和尚未解决的老问题。 考虑了识别一组单词的完整性及其复杂性的算法问题。

关键字。 离散数学, 符号序列, 完整性, 单词, 布尔 $n$ 维立方体, 结构化编码, 离散函数, 嵌入, 代码。

**Abstract.** *The article provides a brief overview of the known results, as well as new results on the problem of completeness of the set of words and the coding of information, which preserves the structural properties of the set being encoded. Some problems are well known in discrete mathematics, but new and unsolved old problems are presented. Algorithmic issues of recognition of the completeness of a set of words and its complexity are considered.*

**Keywords.** *discrete mathematics, symbolic sequences, completeness, words, boolean  $n$ -dimensional cube, structured coding, discrete functions, embeddings, codes.*

A set  $S$  of words in a finite alphabet  $A$  is called complete if any infinite sequence of letters from  $A$  contains at least one word from  $S$  as a subword. In this case, it is said that the set of prohibition words  $S$  blocks any infinite sequence of letters of the alphabet  $A$ . Investigations of the completeness of a set of words and problems on avoiding by symbolic sequences of a set of "forbidden" subwords were initiated by the author back in the 70s, and in general form the problem of completeness was formulated in a small note [1] and in the talk "Non-repetitive sequences" made at the Joint Russian-German mathematical colloquium in 1979 in Rostock (Greiswald). In [1], the relationship between the formulated complete-

ness problem and problems from various areas of discrete mathematics is noted. The usefulness of studying combinatorial problems about symbolic sequences in their geometric interpretation on de Bruijn graphs is noted. In particular, for efficient algorithmic recognition the completeness properties of a finite set of words. A result of V.A. Krainev on the boundedness of the length of non-repetitive in the strong sense binary sequences is presented (more details below). Guidelines for further research are given.

The author's interest in this topic and the general formulation of the completeness problem arose after he had solved two combinatorial problems. The first is the problem of the Hungarian mathematician P. Erdős about the existence of an infinite symbolic sequence in a finite alphabet that does not contain two consecutive repeating segments with the same composition of letters in them. The construction of an infinite non-repetitive symbolic sequence was found, which avoids the prohibition of such repetitions [2,3]. For the problems of non-repetitive sequences, we managed to make rather deep progress in understanding the difficulties of studying the border of transition from completeness to incompleteness. In this respect, an interesting result on the finiteness of the length of words in a binary alphabet for a set of stronger prohibitions, when the absence of repetitions of subwords equal in the frequency composition of letters in them is required, and this is true for any number of repetitions [4]. The geometric interpretation of these problems is interesting. In particular, the question posed by the author back in the 70s. Is there an infinite path in the positive direction of the unit vectors of an integer lattice of dimension  $n$  that does not contain  $k$  points lying on one straight line? For  $n = 2$  and any  $k > 2$ , the answer is no. For an alphabet of cardinality  $n > 3$  and arbitrary  $k$ , the problem has not been finally solved.

Research on the combinatorics of nonrepeated sequences has a long history. Thus, the studies of the Norwegian mathematician A. Thue on problems of algorithmic solvability in associative calculus were carried out at the beginning of the last century. In the 1920s, these are the works of M. Morse on topological dynamics. In these works, the possibility of a simple constructive assignment of endless non-repetitive sequences was used. Later, in the 60s, interest was revived in the study of various variations of the property of "strong non-periodicity", irregularity, pseudo-randomness of symbolic sequences, the complexity of their definability and computability, which is associated with intensive research during this period of the mathematical foundations of Computer Science, cybernetics and applied problems of computer science [5, 6].

The second problem, which served as a source of interest and formulation of the completeness problem, is known in the mathematical literature as the "Snake-in-the-Box Problem". A snake is a simple path (or cycle) in a boolean  $n$ -cube that does not contain chords, that is, it is a generated subgraph of an  $n$ -cube. The ques-

tion of the maximum length of such a path arose in the study of local algorithms for minimizing Boolean functions represented by formulas in disjunctive normal form [6]. The problem of the maximum length of a chain and a cycle was investigated by the author in the interpretation of words with prohibitions, when paths in a hypercube of dimension  $n$  are encoded by symbolic sequences in an  $n$ -letter alphabet with prohibitions on subwords. Moreover, finding the order of magnitude of the maximum cycle length and its construction are essentially based on the existence and construction of an infinite "control" sequence, also with restrictions-prohibitions of a special form on its subwords [7]. A lot of new information about publications and applications on the Snake-in-the-Box problem can be found on the Google search engine. Including the search with the help of modern computer technologies for "long snakes" in hypercubes of small dimensions.

When examining the completeness of a set of words, two types of questions arise. First, it is the study of the completeness of specific finite or infinite sets of prohibitions and the construction of prohibition-avoiding symbolic sequences in the case of incompleteness of the set of words. Second, research on general questions. For example, the construction of algorithms for recognizing completeness, their complexity, studying the completeness of constructively defined classes of infinite sets, describing the set of words and sequences free from prohibitions, its cardinality, estimates of the maximum length of words free from prohibitions, the growth function of the number of words of length  $n$ . At present, research is intensively developing in the area called, in the broader context of the problems under consideration, "combinatorics of words" [8, 9]. Words and symbolic sequences are the object of research in the theory of formal languages [10], the theory of information coding and compression, symbolic dynamics, the theory of automata, the mathematical foundations of cryptography and programming. The problems of analyzing the structure and studying the properties of strings of symbols arise in many areas of natural sciences. Finding effective algorithms for solving these problems is a topical area of research, which has been the subject of a large number of publications.

Let  $S$  - be a complete set, that is, the set  $\hat{S}$  of prohibition-free words, of course.

Let's introduce the functions

$$L(\hat{S}) = \max_{X \in \hat{S}} |X|,$$

$$L(n) = \max_S L(\hat{S}),$$

where, in the first case, max over all words free from prohibitions, and the second maximum over all complete sets of words  $S \subset A^n$ .

**Theorem.** [11]  $L(n) = C(n) + n - 1 = |A|^{n-1} + n - 2$ , where  $C(n)$  - the greatest length of a simple path without chords in a de Bruijn graph of order  $n$ .

Consider  $M(n) \sim |A|^n / n$ , where  $S$  - complete set,  $S \subset A^n$

**Theorem.** [12]  $M(n) = \frac{1}{n} \sum_{d|n} \varphi(n/d) |A|^d$ , where  $\varphi$  - Euler's function.

Notice, that  $M(n) \sim |A|^n / n$ , and if  $|A| = 2$ , then  $M(10) = 108$ . Thus, any set of length 10 binary words containing less than 108 words is avoidable, and this boundary is exact, that is, there is a set of 108 words of length 10 blocking any infinite binary sequence.

The next two theorems give algorithms for recognizing the completeness of word sets  $S \subset A^n$ .

**Theorem.** The completeness of any set  $S \subset A^n$  is recognizable with a complexity of order  $|S| \cdot n$ .

**Evidence.** Using the interpretation of the completeness problem on de Bruijn graphs  $B_m^n$  it is easy to prove the equivalence of the following statements:

- 1)  $S$  full set of words;
- 2) the set  $V(S)$  cuts all the contours of the graph  $B_m^n$ ;
- 3) the subgraph of the graph  $B_m^{n-1}$ , formed by the set of arcs  $E(B_m^{n-1}) \setminus E(S)$  is acyclic;

where  $V(S)$  and  $E(S)$  - the sets of vertices of the graph  $B_m^n$  and arcs of the graph  $B_m^{n-1}$ , which correspond to the words of the set  $S$ . The equivalence of statements 1-3 is based on the correspondence between words  $X$  of length  $|X| \geq n$  and directed paths in graph  $B_m^n$ , passing through the vertices corresponding to subwords of length  $n$  of word  $X$ . The equivalence of statements 2 and 3 is true, since the graph  $B_m^n$  is an edge graph for  $B_m^{n-1}$  by the definition of de Bruijn graphs. Thus, recognition of the completeness of the set of words  $S$  can be replaced by checking the absence of directed contours in the subgraph formed by the set of arcs  $E(B_m^{n-1}) \setminus E(S)$ .

Checking the completeness of the set  $S$  we can consider  $|S| \geq |A|^n / n$ , since otherwise  $S$  is incomplete by the definition of the function  $M(n)$ . Therefore, we have

$$|E(B_m^{n-1}) \setminus E(S)| = |A|^n - |S| \leq O(|S|(n-1)) \quad (1)$$

It remains to note that checking the acyclicity of a directed graph, for example, depth-first search algorithm is possible with a complexity of the order of the sum of the numbers of its vertices and arcs. Together with inequality (1) and Statements 1-3, this proves the theorem.

Let us now clarify the question of the boundary of the lengths of prohibition-free words of the set  $\hat{S}$ , formulating it in this way. Let  $l$  be some natural number,

$S$  a complete set of words, that is, the set  $\hat{S}$  is bounded. Does  $\hat{S}$  have a word that is longer than  $l$ ?

**Theorem.** The problem of recognizing the existence in  $\hat{S}$  of a word of length at least  $l$  is NP-complete.

Thus, recognition of the boundedness of the lengths of words that avoid the set of forbidden subwords is possible with complexity  $|S| \cdot n$ , and the question of localizing this boundary has a qualitatively different complexity.

Here is an interesting unsolved problem that was posed by the author in his early works on the completeness of the set of words. Let's introduce the function

$$f(m, n) = \max |S_1| / |S_2|,$$

where  $m = |A|$ , and the maximum is taken for all pairs  $\{S_1, S_2\}$ ,  $S_1 \subseteq A^n$ ,  $S_2 \subseteq A^n$  complete irreducible sets (that is, such that the deletion of any word from which leads to incompleteness). There are complete irreducible sets whose cardinality is not minimal. For example, the set of 7 words  $\{0000, 0001, 1001, 0101, 0110, 0111, 1111\}$  is complete and irreducible, but not minimal, since  $M(4) = 6$ .

**Problem.** How large can be the difference in cardinalities of complete irreducible sets? How does the function behave (for example, in  $n$  for a fixed  $m$ )  $f(m, n)$ ? Accurate estimates of its growth would significantly clarify the structure of complete word sets [11-13].

Let us explain the idea of another algorithm for recognizing the completeness of a set of words presented in [14]. Despite the simplicity of the algorithm, it turns out to be useful in the following ways. Certain invariant transformations are applied to the set of words  $S$  as a result of which we obtain a chain of sets "derived from while preserving their property to be a complete or incomplete set. In this case, at each step of the algorithm, the description of the resulting set of inhibitions is reduced. After a finite number of steps according to the result, we definitely have the answer "yes, complete" or "no". Thus, we obtain not only a more compact description of the original set of prohibitions, but also an efficient "encoding through prohibitions" of the set  $\hat{S}$  of words free of the prohibitions  $S$ .

It is natural to pose questions of the completeness of the set of words not only in relation to the set of all words, but also in relation to any infinite set of  $M$  words and  $\omega$  – words (words of infinite length). The set of prohibitions  $S$  is complete with respect to  $M$ , if  $P(\omega) \cap S \neq \emptyset$  for any  $\omega$  - word from  $M$ , where  $P(\omega)$  - is the set of all subwords of the  $\omega$  - word. If  $P(\omega) \subset M$  for any  $\omega \in M$ , then the set  $M$  is called closed. This agrees with the usual definition of a closure operator by the operation of including in  $M$  all subwords of each of its words. In such a case, the set of "objects" closed by joining all "subobjects" is also called hereditarily closed.

**Theorem.** For any hereditarily closed infinite  $M$  and arbitrary  $S$ , the following is true

- a)  $\hat{S}$  – closed set of measure 0;
- b) there is  $\omega$  – word, such that  $P(\omega) \subset M$ ;
- c)  $S$  is complete with respect to  $M$  if and only if  $S \cap M$  is a finite set;
- d) in any infinite  $S$ , complete with respect to  $M$ , there exists a finite  $S' \subset S$  also complete with respect to  $M$ ;
- e) there exist infinite sets  $S$  and  $M$ , such that  $S$  is complete with respect to  $M$  and remains complete after removing from  $S$  any of its finite subset.

Note that, generally speaking, the theorem is not true for sets  $M$ , that are not hereditarily closed.

As can be seen from the theorem, some properties actually repeat the completeness of prohibitions with respect to a finite set of all words in an arbitrary finite alphabet. However, in this case, it is essential to fulfill the property of hereditary closedness of the set, in relation to which the problem of completeness is considered.

Above we have already spoken about the usefulness of the "language of prohibitions" when coding sets, in particular, describing problems of embedding graphs in hypercubes and their solution. For example, these are the problems of existence and construction of Hamiltonian cycles in a hypercube with various restrictions-prohibitions on their structure, the Snake-in-the-Box problem, embeddings of integer lattices into hypercubes [15], trees, graphs of computational structures. We consider embeddings in hypercubes as encodings of objects (graphs) that preserve certain structural properties of the encoded objects in the image-code and call them structured encoding [16,17]. With this approach, the universality of the  $n$ -dimensional cube is of great importance, as a set of words of length  $n$  in a finite alphabet, which can be endowed with various types of structures of geometric, algebraic, ordinal, or metric type: a graph, a partially ordered set, an integer lattice, an abelian group, a metric vector space with Hamming metric, torus metric or other metrics. This versatility makes it possible to model the structures of nested sets in a code-image in a hypercube of various types, preserving the necessary properties of the original encoded structures in the code.

Note that structured coding, assuming that the display preserves different types of properties, allows you to recognize and correct "errors" in the image by checking and analyzing the implementation or non-fulfillment of the properties stored by the display (generalized concept of error-correcting coding). The problems of coding data while preserving their structural properties also arise in connection with the implementation of a hypercube architecture in computing systems, in which the information interaction of microprocessors is determined by their connection into the structure of an  $n$ -dimensional cube. For such networks, questions

arise of information exchange, parallelization of computations, and a number of other problems of mapping data structures to the structure of a computer network. For example, full or partial preservation in codes of the metric structure of the original set during its isometric or locally isometric embedding into a hypercube. An important applied aspect of structured coding is that it allows you to conveniently and quickly work with the elements of the original set already in their machine codes using operations interconnected with the structure of a computer network. This speeds up data processing and increases the computation speed.

Various classes of mappings defining embeddings of discrete metric spaces were considered in [16,17]. These are isometric and locally isometric mappings, embeddings "with stretching" of distances, a parametric family of mappings of bounded distortion, a discrete analogue of homeomorphic embeddings. The latter presupposes the introduction of an analog of the continuity of the mapping for the discrete case, when the mapping "does not break close points of a metric space, and does not transfer distant points to close ones". In [17], definitions are given in various versions: parametric maps of bounded distortion, definitions in topological terms of discrete neighborhoods, in particular, a discrete analogue of homeomorphic embeddings. By varying the parameters and type of mappings, we obtain different classes of nestings that determine the type of structured coding that preserves, in a strong or weak form, the necessary structural properties of the encoded set.

The considered directions of research and the results obtained were reported at international conferences, seminars and schools in Russia and foreign countries in different periods, starting from the end of the 70s.

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