# SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

## 上合组织国家的科学研究：协同和一体化

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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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# THE CREATION OF A EUROPEAN ARMY OR THE TRANSFORMATION OF NATO: THE SOLUTION TO D. TRUMP'S VICTORY IN THE US PRESIDENTIAL ELECTION

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抽象的。 作者探讨了北方军区现阶段北约发展转型的替代方案，并对欧洲新军队的组建预测发表了自己的看法，这支新军队将不依赖于美国和北约， 能够独立确定其威胁的程度以及旧世界国家参与“第三级摊牌”的情况“

关键词：人工智能、大数据、工业 4.0、神经算法、超级智能、矩阵、生成人工智能、北约、俄罗斯、美国、北方军区、军工联合体、空间。

***Abstract.*** *the authors explore an alternative to the development and transformation of NATO at the current stage of the Northern Military District and express their opinions on the forecasts for the formation of a new European army, which will not be dependent on the United States and NATO and will be able to independently determine the level of its threats and the participation of its Old World states in "third-level showdowns" "*

***Keywords:*** *AI, Big Data, Industry 4.0., neural algorithms, superintelligence, matrix, generative AI, NATO, Russia, USA, Northern Military District, military-industrial complex, space.*

The current transformation of the global arms market reflects the ideas of local conflicts in the air, which in their increasing intensity can lead to regional and inter-country battles, and if prolonged, provoke mass chaos of total confrontation between the countries of the collective West and the rising South, focusing on integration associations and bringing peace a calmer state, a comfortable peace between peoples and the idea, laid down over millennia, of equal access of each state to the benefits of civilization and to a fair redistribution of gross and regional products between all participants in the labor, capital and technology markets.

And the existing new Russian strategic planning and goal setting outlines the place of each international actor in such a polycentric and mutually responsible world. Against this same background, the buffoonery and cynicism of the main "guardians" of the collapsing global world order, the Americans, clearly manifests itself in Joe Biden's failed message to the US Congress in March, which included most of the time about the development of American affairs in Ukraine and was replete with "wishes" not to lose to Russia and personally V. Putin, as the main trigger, irritant and antagonist of the reviving NATO, was shown the proximity of the changes that were brewing in geopolitics. And this move by a "democrat" and "philanthropist", who is eager to be re-elected for a new presidential term in the United States, shows the true meaning of the developing militarism of the exodus of Americans from Afghanistan that has not completely died out (where Great Britain is now dreaming of new scenarios for the "great game" not only with Russia and with China throughout Central Asia), expanding the normal life of island China, the island of Taiwan, which received 1,200 American "Green Berets" in the form of instructors and a number of weapons to carry out its "own", independent of China, but entirely within the framework of NATO's foreign policy strategy of putting pressure on the influence of the Celestial Empire in the Asia-Pacific region, politics, a system of measures to clamp down on the development of the Red Dragon in the center of the global Asian economy in the form of a new reincarnation of TTIP (instead of the "Platonic idealists of the West" themselves and their satellites), squeezing out of the coupling wars by the "hawks" of the US Congress and the North American military-industrial complex , who are not ready to continue to rely on ICT solutions and gadgets from the Big Five of Chinese big tech. Further, although the Americans did not provide the required funds or a sufficient number of weapons to Independence, they still, although only in words for now, care about their proxy, designed to systematically, and in the long term, weaken Russia's position in the world and slow down the implementation of its imperial ambitions in the pan-Slavic union, at a minimum, in influencing Europe and preventing the growth of classical values against the backdrop of the LGBT agenda, the ongoing population reduction by globalists and transhumanists. There is also the Palestinian issue and the Houthi problem, which gave our RAO Russian

Railways the opportunity to intensify transportation by tens of percent in volume growth and build new logistics chains for those who do not want to become victims of further Middle Eastern escalation. Therefore, 10% of the world's maritime trade is already traveling, partly even in fact, and the rest, in theory, along our railway routes, will soon be joined by about 7 million barrels of petroleum products and crude oil itself, passing through Bab al-El The Strait of Mandeb, given the increase in costs due to constant attacks and the general toxicity of waterways for leading logistics carriers (delivery times increased by at least 2 weeks when using alternative routes for fuel and energy consumers in the region) [2].

At the same time, the successes of the Armed Forces of the RF Ministry of Defense crushed the myth of "deeply layered defense" under the leadership of NATO instructor officers, commanders of the Armed Forces of Ukraine, which are increasingly losing their national character and becoming a native army of "meat assaults" and "endless counter-offensive". And these trends are already leading Turkey, the Gulf countries and the EU to search for ways to freeze the conflict and to a potential revision of the "red lines" and to a sound position on Crimea, which previously were the main points of conflict growth for the fight against Russia. And these spring trends show that the world, like a steam boiler, can splash out in any direction and in any direction a pair of unsolvable problems, long-standing grievances, which, even with the departure of the NKAO to Azerbaijan, have not become less relevant, conformist stable or have never been lost demand for finding compromises in resolved contradictions. Not at all, Armenia is rushing from the CSTO to NATO structures, Turkey is increasingly being eliminated by steps in multi-vector diplomacy and is trying to maintain the balance of power for the construction of Great Turan on the ruins of the Ottoman Empire, living the Ata-Turk's dream of its own greatness and self-sufficiency [3].

At the same time, the reconciled parties of the Shiites and Houthis, Iran and Saudi Arabia, after the historical assistance of China, moved to the stage of Palestinian sympathy and throwing their proxies into the battle into the new political infrastructure of the anti-Israeli secret confrontation. And some, understanding the possible anger of the "Arab street" in the event of the onset of hostilities in Lebanon or the impossibility of peace negotiations between Hamas and the IDF, are preparing for a "third option", not Anglo-Saxon doing nothing, following the results of the overdue declaration of Lord Balfour, whose portrait was doused with red paint by Arab students in a British museum. [4]

Therefore, the strategy for the further development of mankind is again approaching balancing on the brink of old grievances and unfreezing traditional conflicts, pushing through the old hegemonic agenda by various metropolises, especially after squeezing them out of Africa and with the ongoing global growth in arms sales (2nd place in the global arms market since 2024, it has been occupied

by the French Republic (due to the supply of combat aircraft to Qatar, India and Egypt, deliveries go to 64 countries, 42% to Asia and Oceania, 34% to the Middle East, 30% of the imports of all Indian weapons were taken by French military-industrial complex companies) and pushing us to 3rd place), with the development of the legal market for weapons and defense systems in 2022 to 597 billion US dollars. At the same time, in the United States, revenue for the same period fell by 8% (with the supply of W and ME to 107 countries, with 31% in Asia and Oceania, and 28% in the EU), and military-industrial complex companies in the Middle East and those working with them in a couple of PMCs showed an increase of tens of percent, according to the Swedish institute SIPRI. And this American trend towards a decrease in revenue has been going on since 2021 and amounts to 3.5%, which is associated with a drop in the income of American defense industry enterprises (42 of them are in the world ranking and 51% of the total volume of orders in the world was earned by them). At the same time, they earned 302 billion US dollars, which is 7.9% lower than in 2021, and EU companies over the same period grew, but not by much, by 0.9%, to 121 billion US dollars, even , despite the flurry of orders for the Armed Forces of Ukraine in the Northern Military District. At the same time, the entire defense potential of the EU, according to J. Borrell, is up to 90% in 2-3 European countries, the annual turnover of the EU military-industrial complex does not exceed 70 billion euros, and it employs only 500 thousand people, which will lead to that personnel reform and digitalization, and additional investment of all defense assets in Europe will be urgently needed. Today, according to him, it can only provide up to 40% of the needs of European defense, which means the Anglo-Saxons will continue to impose their weapons on the Old World (up to 78% was the number of purchases of military equipment outside the eurozone countries), and exports themselves weapons reached 50% in 2021 of the produced quantity of military products for export. At the same time, EU imports of American military equipment reached 55% in 2019-2023 (they grew by 94%), and the number of weapons from the New World increased by 20% during the same period [2;3].

Russia itself entered the TOP-100 for 2022 with two domestic companies: Rostec State Corporation - 16.8 billion US dollars (10th place) and OJSC OSK - 3.95 billion US dollars (36th place), with total Russian revenue enterprises participating in military-technical cooperation in the amount of 20.8 billion US dollars, which is 12% lower than in 2021. At the same time, data on traditional representatives of the Russian military-industrial complex, which were previously participants in the TOP-100, such as Russian Helicopters, High-Precision Complexes and Ruselectronics, became impossible to analyze and forecast due to classified information in the field of state defense orders (GOZ) and the ongoing reorientation of cooperation chains with the BRICS and EAEU countries. Moreover, the

Swedes cannot now easily find out this either in UNCTAD statistics or in WTO reporting, where we report regularly, but after the abolition of the preferential regime for our "high-tech" with the start of Russia's SVO in Ukraine in the WTO, we do not show real products ongoing cooperation, import substitution and glocalized clustering at the borders of Russia and in the territories of our allies in BRICS, SCO and CSTO [2;6].

Moreover, since 2019, the Russian Federation has supplied energy and high-voltage equipment to 31 countries, in 2022 - to 14 countries, in 2023 - 12 countries. The largest share of Russia's exports of high-voltage and high-voltage materials was to the countries of Asia and Oceania (68%), to the Middle East - 13% and to Africa - 10%. The largest buyers of our military-industrial complex products were India -34%, China -21% and Egypt -7.5% [3;7].

These prerequisites for consolidating the basis of our state maturation and the formation of actions to expel certain exposures to specialists from the IMF and the US Federal Reserve, who come to certain financial, credit and investment funds and organizations, set for us national priorities for our own goal setting and building chains of "creative industries" in behavioral economics by Daniel Kahneman and Richard Thaler [8]. They are increasingly strengthened and focused on the sphere of created high-tech products and the partial involvement of external ICT and military-industrial-industrial-bigtech actors in our previously formed foundations in electronics, and in materials science, and in the military-industrial complex with spacecraft and in the updated satellite constellation "Glonass" and for military orbital constellations of aircraft of various altitudes for use and special purposes [9].

If we return to overcoming our "fears" by growing the size of the domestic military-industrial complex and changing our share in export supplies of existing new products or traditional units of military equipment, then we can evaluate the "Swedish ten" in addition to the USA, France and Russia according to the following parameters: China – decrease in the growth of the military-industrial complex by 5.3%, world market share -5.8%; 5th place - Germany: decrease by 14% and 5.6% world market share; 6th place - Italy: growth by 86% and the share of the global market of W and ME - 4.3%; 7th place - Great Britain: decrease by 14%, share 3.7%; 8th place - Spain: decrease by 3.3%, and a share of 2.7% of the global military equipment market; 9th place – Israel, decrease by 25% and share of 2.4%; 1st place - South Korea: growth by 12% and 2% share of the global market for W and ME [2;3].

Therefore, geopolitical storms and the unfreezing of "old grievances" and "appetites grown from fantasies," often groundless, revanchist or neocon fueled, which is now especially visible in the Baltic countries, as well as in the statements of newly minted NATO members – Finland and Sweden, become the main the

task of imperial goal-setting for the development by Russia of its military-industrial complex, space and science, the system of primary, vocational technical and higher education, which gives a chance for leadership in the world of integration platforms and the polycentric development of equal states of the post-colonial world definition and Russian strategic position in them. This should be taken as a basis, from the standpoint of building the contours of the anti-Western, as a result of its aggressive policy against us, and with the ever-deepening "turn to the East", capable of forever changing our raw material maxims to innovative and high-tech development, making foreign policy discourse a maneuver of taking into account our national sovereign interests and finding a worthy place in Industry 4.0., the upcoming space odyssey and the triumph of AI and superintelligence, which can save us from our own madness, help in cleansing humanity from the suicidal ideas of total war and in oblivion of the unfulfilled dreams of the UN SDGs for a "future of equal opportunities" ", living all the people on the planet. [4;9]

Ideas to jump out of the Marshall Plan, which is finishing off Europe, or to evade the Admiral Manahan Monroe Doctrine, which is deadly for the Old World, will continue to pop up from the mouths of European leaders, as was the case under Angela Merkel and Francois Hollande, who dreamed of their own security forces maintaining a stable world within the Schengen zone and the Maastricht Accords. The latter were ignored, and in order to "reason the rebellious," the "yellow vest" movement "accidentally" appeared in France, achieving the last rudiments of sovereignty and common sense. And hatred of Russia, which is sending the French colonies to a bright and independent future, devoid of a French protectorate, after the rupture of the agreement of 1961, which secured the indefinite use of the colonies by French companies under the rule of Paris and in a web of paralyzing instructions with Quai D'Orsay. And the process of national liberation of Africa from the greedy conquerors of the country of the Franks, which has already led to their complete loss of control over the Central African Republic, Mali, Burkina Faso and Niger and preparations for an uprising and direct anti-Francophone rebellion in the remaining, not completely economically free lands, such as in Chad, Senegal, Benin and Ivory Coast... [10]

And China is still our assistant and partner here, but the ability to act proactively and find a compromise in import substitution and in the development of our own scientific schools using the example of Chinese "unicorns" or "hidden champions" fleeing from the EU to the Celestial Empire will make our competencies more unique for Russia, production becomes more innovative and sustainable, and the world becomes stable and safer [11].

The desire to find use for the legionnaires of the French Legion in the European new military forces today comes down to shouts from Washington, saying that NATO should distance itself from the official combatants in Ukraine in the form

of an official force, and Emanuel Macron himself is recommended, for the future, to consult his crazy and irresponsible initiatives that are pushing the entire military and logistics infrastructure of Europe for the purposes of Russian aerospace forces and hypersonic missiles.

The very desire for peace by the historical ethnic groups of the Eurasian space, order in the emerging "European house", from General Charles de Gaulle to Gorbachev's romantic initiatives, must be revised, and after restoring the balance of power before the collapse of the USSR, erasing the "red lines" of the insatiable neocons in the Old World, has been returned to the unified harmonization of philanthropic initiatives capable of returning Europe to its pre-war independence and freedom of choice from the dictates of supranational institutions of global governance, to support sovereignizing intentions for its post-Covid restoration under the flags of its own peoples and true democracies, not tainted by the ideals of eugenics and transhumanism.

The possible arrival of Donald Trump, who has repeatedly proven his ability to make America strong and great, will lead to reform of NATO and will give new strength to European security within its own borders and in conjunction with national leaders who are already coming to power in Europe on the wave of growing nationalism and the anti-globalist agenda of "overseas dreamers" and reasoners.

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# 俄罗斯和中国法律规定的遗嘱形式
# THE FORM OF A WILL UNDER RUSSIAN AND CHINESE LAW

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注解。 本文对俄罗斯和中国的继承立法对遗嘱形式的要求进行了比较分析。考虑俄罗斯联邦民法典和中华人民共和国民法典中关于执行遗嘱处分的规定。研究结果表明，俄罗斯和中国的立法有许多相似之处，但同时又存在特殊性。 中华人民共和国民法典中关于遗嘱形式的一些规定与俄罗斯民法典的规范相比，更具进步性，更多地考虑到现代社会的科学技术发展水平。 联邦。 看来，完善俄罗斯继承立法有必要借鉴中国立法者的经验。

关键词：继承、遗产、遗嘱、遗嘱人、继承法、世袭继承。

***Annotation.*** *The article provides a comparative analysis of Russian and Chinese inheritance legislation establishing requirements for the form of a will. The provisions of the Civil Code of the Russian Federation and the Civil Code of the People's Republic of China governing the execution of testamentary dispositions are considered. As a result of the study, it was concluded that Russian and Chinese legislation have many similar features, but at the same time they differ in their specificity. Some provisions of the Civil Code of the People's Republic of China on the form of a will are more progressive in nature and take more into account the level of scientific and technological development of modern society in comparison with the norms of the Civil Code of the Russian Federation. It seems that it is necessary to take into account the experience of the Chinese legislator to improve Russian inheritance legislation.*

***Keywords:*** *inheritance, heritage, will, testator, inheritance law, hereditary succession.*

China and Russia are not only neighboring countries, but also strategic, political and trade partners. Friendly, interpersonal ties between our countries are rapidly developing. Therefore, synergy and integration of legislation are of particular importance in Russian-Chinese relations. The issue of disposing of one's property in the event of death worries everyone. Many Chinese citizens live in Russia and many Russian citizens are also in China. Knowledge of the peculiarities of making a will in these countries seems important and necessary.

Previously, inheritance legal relations in China were regulated by the Law on Inheritance, which has now lost force due to the adoption of the first Civil Code of the People's Republic of China in 2020, having actually merged with it [1]. The rules on inheritance by will are contained in Chapter 3, Part 6 (book) of the Civil Code of the People's Republic of China [2]. Chinese inheritance law surprisingly combines the features of the continental (Romano-Germanic) legal system with common law (Anglo-Saxon), and also includes the provisions of traditional ancient Chinese and socialist law. Russian inheritance law belongs to the Romano-Germanic legal system; most of the rules are borrowed from the German Civil Code, but continuity with Soviet and pre-revolutionary civil legislation is maintained.

According to the Civil Code of the Russian Federation, a will, as a general rule, must be notarized or certified by an authorized person specified in the law, which is equivalent to a notarial form [3]. In general, the role of a notary in registering inheritance rights in Russian inheritance law is very significant compared to Chinese law. Some types of testamentary dispositions must be certified only by a notary to give them legal force. Thus, only a notary can certify a joint will of spouses, a closed will, a will on the creation of an inheritance fund, and an inheritance agreement.

Unlike Russian legislation, the Civil Code of the People's Republic of China allows a simple written form of a will without notarization. According to Article 1134 of the Civil Code of the People's Republic of China, a handwritten will must be drawn up and signed by the testator, indicating the year, month and day. It does not require certification by a notary or witnesses to be valid. A citizen can draw up a notarized will through a notary office (Article 1139 of the Civil Code of the People's Republic of China), but can also resort to other possibilities that the Code provides him. In particular, according to Article 1136 of the Civil Code of the People's Republic of China, a will can be drawn up in printed form in the presence of witnesses who certify it with their signatures [4].

Only an individual with full legal capacity can draw up a will, both according to the Russian and Chinese Civil Codes. At the same time, both in Russia and in China, the testator is given the right to bequeath his property to any person, both included in the list of heirs by law and not one of them, both individuals and legal entities and public entities, as well as to bequeath an inheritance an inheritance fund (trust), which will be created only after the death of the testator.

What Russian and Chinese inheritance legislation also has in common is the establishment of identical requirements for witnesses to a will. They cannot be:

- a notary or other person certifying a will;
- the person in whose favor a will is drawn up or a testamentary refusal is made, the spouse of such a person, his children and parents;

- citizens who do not have full legal capacity;
- illiterate;
- citizens with physical disabilities that clearly do not allow them to fully understand the essence of what is happening;
- persons who do not sufficiently speak the language in which the will is drawn up, with the exception of the case when a closed will is drawn up;
- spouse when making a joint will of the spouses;
- parties to the inheritance agreement (clause 2 of article 1124 of the Civil Code of the Russian Federation).

A feature of Chinese inheritance law is the ability to draw up a will in forms unfamiliar to Russian inheritance law. Thus, according to Article 1137 of the Civil Code of the People's Republic of China, a testamentary disposition can be executed in the form of an audio recording or video recording, i.e. the testator can record the text of the will on a dictaphone or make a video recording, and witnesses must be present. An important requirement for such a will is that the testator and witnesses must record their names or images, as well as indicate the year, month and date of preparation in audio and video recordings. This method of preparing a testamentary disposition is very practical and can be easily applied using a smartphone.

Another form of will, unfamiliar to Russian inheritance law, provided for by Chinese inheritance law, is the oral form. Although this form has been used for a long time in the Anglo-Saxon legal system. Article 1138 of the Civil Code of the People's Republic of China stipulates that in an emergency situation, a testator may make an oral will in the presence of witnesses. After the critical situation has been resolved, if the testator is able to make a will in writing or an audio-visual recording, an oral will is considered invalid [5].

In a critical situation, Russian inheritance legislation also allows for deviations from the usual procedure for drawing up a testamentary disposition, but is still more conservative. So, according to paragraph 1 of Article 1129 of the Civil Code of the Russian Federation, a citizen who is in a situation that clearly threatens his life, and due to the prevailing emergency circumstances, is deprived of the opportunity to make a will in accordance with the usual rules of the Civil Code, can express his last will in relation to his property in simple written form. In this case, the presence of two witnesses is mandatory, and the testator must write and sign such a document with his own hand, and it must be clear from its contents that it constitutes a will. Just as in the Civil Code of the People's Republic of China, such a will loses force if the testator, after the cessation of emergency circumstances, does not take advantage of the opportunity to make a will in any other form provided for by the Civil Code of the Russian Federation. However, unlike Chinese inheritance law, in the event of the death of the testator, his heirs, in order to receive the in-

heritance property, must, within the period established for acceptance of the inheritance, apply to the court to confirm the fact of the will in emergency circumstances. This conservatism of the Russian legislator is explained by the desire to protect its citizens from fraudulent actions, but it is, however, very impractical, since in a dangerous situation a person may simply not have paper and a pen at hand, not to mention the presence of two witnesses. It would be more acceptable to establish in the Civil Code of the Russian Federation the possibility of making a will in the form of an audio or video recording, by analogy with the norms of the Civil Code of the People's Republic of China. Then, using an ordinary smartphone, which, as a rule, citizens always carry with them, it is easy to draw up a testamentary disposition. To protect against fraud, such a will can be verified for authenticity in court, through an examination. In addition, it seems acceptable to establish in Russian civil legislation the possibility of drawing up a will in electronic form (in the form of an electronic document), and to use blockchain technologies to protect against unauthorized interference of third parties in the text of the will [6].

Summarizing the comparative analysis of the regulation of the form of a will under Russian and Chinese inheritance legislation, we can conclude that Russian and Chinese legislation have many similar features, but at the same time they differ in their specificity. Some provisions of the Civil Code of the People's Republic of China on the forms of testamentary dispositions are more progressive in nature and take into account the level of scientific and technological development of modern society in comparison with the norms of the Civil Code of the Russian Federation. It seems that the experience of the Chinese legislator should be taken into account by the domestic legislator; it should be studied and considered for the possibility of application to improve Russian inheritance legislation.

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# 俄罗斯联邦儿童家庭权利的保障
# GUARANTEES OF A CHILD'S RIGHTS TO A FAMILY IN THE RUSSIAN FEDERATION

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注解。 本文探讨了现行立法中规定的儿童基本权利，包括家庭权利。 作者指出了俄罗斯社会现阶段发展中的孤儿问题。 考虑了儿童家庭权利的法律保障，并提出了将没有父母照顾的儿童安置在监护（托管）、寄养家庭或优先儿童安置形式（收养）下的机制。

关键词：儿童权利、儿童人身权利、儿童权利保障、儿童安置、儿童对家庭的权利、孤儿、监护和托管机构、法院、检察官、父母。

***Annotation.*** *The article examines the fundamental rights of the child, including family rights, enshrined in current legislation. The author identifies the problems of orphanhood at the present stage of development of Russian society. The legal guarantees of the child's family rights are considered and mechanisms for implementing the placement of children left without parental care under guardianship (trusteeship), a foster family, or a priority form of child placement – adoption are proposed.*

***Keywords:*** *rights of the child, personal rights of the child, guarantees of the rights of the child, placement of children, rights of the child to a family, orphan child, guardianship and trusteeship authority, court, prosecutor, parents.*

Recognition of children's need for special protection is one of the basic ethical principles shaping human rights. The need to protect children's rights arises from the fact that children are the most vulnerable category of the population. The child does not have the opportunity to independently protect his rights, therefore the state and society must provide him with the necessary protection and support. Moreover, the protection of children's rights is an integral part of social development and democratic governance. The desire to ensure the protection of children's

rights contributes to the formation of civil society, increasing the level of legal culture and the general culture of the population.

Children have received special status and legal protection under the UN and regional human rights treaties due to their vulnerability. They enjoy the same human rights and fundamental freedoms as adults. However, the child represents a special category in the concept of «humanity».

Every child in the future is an adult, so it is very important, even in childhood, to provide each child with attention, care, to instill in him the most important moral qualities, adherence to the rules of behavior in force in society, and respect for the law.

The rights and freedoms of the child form the basis, the core of his constitutional and legal status. The status of a child itself should be understood as a set of rights and obligations established by the state in the appropriate legal form. At the same time, the child is simultaneously endowed with general (constitutional), sectoral, special (tribal) and individual legal statuses. But it is the constitutional status of the child that is decisive and generalizing for other, derived statuses of the child.

In the modern world, every state strives to ensure the protection and protection of the fundamental rights and interests of the child, regardless of his gender, age, nationality, and social status. The observance of equal opportunities for the realization of children's rights is monitored by various social institutions, including educational institutions, guardianship and trusteeship authorities, and courts.

The increased attention of the state to ensuring the protection and protection of the rights of children is explained by the fact that they do not have full legal capacity, cannot fully exist without an adult, independently protect their rights and defend their own interests.

We should not forget that the problems of society regarding the knowledge and development of oneself are closely related to the inability of society to show real concern for the psycho-physiological state and development of children, a lack of understanding of the importance of this process for the future of not only an individual subject, but also of society as a whole, the state itself.

A child is a person who has not reached the age of majority and does not have full legal capacity. The Family Code of the Russian Federation gives a rather brief definition of a child: «a child is a person under 18 years of age (the age of majority)» [3].

At the same time, the legislation distinguishes two categories: a minor child (a person who has not reached 14 years of age) and a minor child - a child who is in the age group of 14-18 years.

In general, all child rights can be classified into:

– rights ensuring the physical integrity of the individual;

– rights that promote individualization of the individual;

– rights aimed at the inviolability of the inner world of the individual and his interests;

– rights aimed at the socialization of the child;

– rights aimed at protecting the property interests of the child.

The state establishes guarantees of the basic rights and freedoms of minors, enshrining them in various legal acts.

Protecting the interests of children in the family implies freedom to choose a place of residence, receive necessary medical care, the opportunity to receive an education, freedom to choose religion and many other rights. Guarantees of the child's rights to a family in the Russian Federation are officially established by the Constitution of the Russian Federation, which states that «Childhood, motherhood and paternity, family, maternity capital, pensions and employment are protected by the state» [2].

One of the main guarantors of the protection of the child's rights to a family in the Russian Federation are social protection institutions, such as centers for social assistance to families and children, orphanages, shelters, etc. Such institutions exist to help children who find themselves in difficult life situations by providing them with temporary accommodation and the necessary medical and psychological support.

However, it must be taken into account that these institutions are intended for emergency situations when a child finds himself in a difficult life situation and cannot return to his parents. First of all, it is necessary to strive to preserve the child's family, which is sometimes difficult.

This is due to many factors, ranging from economic difficulties to a lack of information on how to build healthy and strong family relationships. One of the main factors influencing the preservation of a family is the economic problem. In an unstable economy, many young families cannot provide themselves with a decent standard of living and a regular income, which can ultimately lead to conflicts and family breakdown.

Another factor is the lack of proper information on how to keep a family together. In Russia, there are many stereotypes and prejudices about what an ideal marriage should be like and what spouses should do to keep the family strong and happy. But the reality is often quite different, and some families may face challenges they don't know how to overcome.

Another important factor is the lack of social support from the state. For example, the lack of funds to provide social services to families suffering from domestic violence can lead to aggravation of the situation and even destruction of the family.

To solve the problems of preserving families in Russia, it is necessary to take comprehensive measures that will be aimed not only at improving the economic

situation, but also at increasing the level of awareness of families on how to maintain their family relationships, as well as at providing social support to families that are experiencing difficulties . Only in this way can conditions be created for families to become stronger and more stable in Russia.

Thus, in the Russian Federation, legal guarantees of the rights and freedoms of minors are enshrined in the Constitution of the Russian Federation, the Family Code of the Russian Federation, the Civil Code of the Russian Federation, the Federal Law «On Basic Guarantees of the Rights of the Child in the Russian Federation» dated 24 July 1998 № 124-FZ [4] and a number of other regulations -legal acts. Providing guarantees for the rights of minors is one of the purposes of the legislation of the Russian Federation [1].

According to the opinion of M.I. Burnaeva, the unhindered provision of rights and freedoms to minors, as laid down in the legislation, is a legal guarantee of the protection, protection and implementation of the rights of the child [5, p. 37].

Current issues that require attention are the state of legal regulation in the field of protection of orphans and children left without parental care, the possibility of integrating into the practice of the activities of government institutions that provide support to orphans and the families that take them into care, the most successful technologies, tested in the non-state sector, as well as openness and accessibility of information about the state of affairs in the field of orphanhood.

The study showed the following:

– the state spends quite serious resources on the maintenance and upbringing of orphans and children left without parental care. The most significant funds are needed to support children in boarding schools - in hospital conditions;

– the composition of regions with the lowest and highest unit costs of maintaining 1 child in an orphanage is close to the composition of the constituent entities of the Russian Federation with extreme (high and low) values of the cost of living for children in orphanages;

– the cost of keeping a child in social rehabilitation centers, where children stay temporarily (and then either return to their birth family or are moved permanently to institutions for orphans and children left without parental care), turns out to be significantly lower: per year after These centers receive a fairly large flow of children.

High level of social well-being of the family – the family is prosperous and does not need help or control from authorities and other structures.

Average level of social well-being of the family – the family needs help and control from authorities and other structures in order to solve their problems, increase the level of social well-being and prevent the level from falling to a low level. Children are not removed from the family, the family is under constant control and assistance is provided to them.

Low level of social well-being of the family – children are removed from family to family, where they are temporarily cared for by professionally trained parents. If this is not possible, the children are in special care. Institutions, while issues with parents are being resolved (they are provided with assistance in solving their problems – finding a job, curing social illnesses, etc.), the issue of deprivation of parental rights is being resolved if the problems are not resolved. Children return to their birth family when the parents fulfill the conditions established in the system of proposed criteria (minimum – average level).

The following mechanism for placing children by priority is proposed:

1) to a blood family;

2) to a related family;

3) to the family at the local level, among the child's relatives and friends;

4) to a family at the regional level;

5) to the family at the federal level.

This procedure is more favorable for children (subject to the same conditions and requirements for guardians and adoptive parents).

It is necessary to apply special mechanisms for selecting children and parents, which would involve assessing their needs, psychological compatibility, their capabilities (including psychological potential), as well as introducing responsibility for the adoptive parent when returning the child; establishing restrictions or prohibitions on accepting other children if the adoptive parent has already returned the child.

Despite the existence of legislative acts, the implementation of guarantees of the child's rights to a family in Russia remains a problem that requires an immediate solution.

Thus, one of the main problems is the lack of modern and competent measures to respond to violations of children's rights. For example, it is necessary to take measures for the social rehabilitation of a child who has become a victim of domestic violence.

Another problem is the low level of legal culture among the population, which leads to a low level of awareness of parents about the rights and responsibilities in relation to their children.

Also, the lack of decent housing for minors forced to remain without parental care or living in dysfunctional families is becoming an increasingly common problem.

Despite the existence of problems in ensuring guarantees of the rights of the child, there are also ways to solve them.

So, to solve these problems, we propose the following measures:

– improving the legislative framework and existing government programs aimed at protecting the child's rights to a family;

– organization of social services that can provide the necessary assistance to parents in overcoming difficulties in raising children;

– development of a system of mediation and consultation for parents, as well as ensuring their access to social and legal services;

– provision of housing to minors without parental care or living in a difficult family situation in accordance with the regional program;

– development of a rational and reasonable payment scheme that will enhance the efficiency of spending budget funds to improve the level of social well-being of the family;

– it is necessary to raise the issue of the possibility and feasibility of making changes to the civil legislation of the Russian Federation in terms of securing the right of children who have reached the age of 14 to bequeath property, which children can dispose of independently, without the permission of parents, adoptive parents, or a trustee in accordance with clause 2 of Art. 26 of the Civil Code of the Russian Federation [6] (earnings, scholarships and other income), namely, add paragraph 4, paragraph 2 of Art. 26 of the Civil Code of the Russian Federation and stated as follows:

«…have the right to bequeath property and dispose of it at their own discretion, without the need to obtain permission from their parents, adoptive parents or guardian.».

This provision of the law will contribute to the development of legal independence and protection of the interests of minors in the field of inheritance relations. Children can leave property at their own discretion, taking into account their wishes and interests, without restrictions from their parents, adoptive parents or guardian.

Thus, guaranteeing the child's rights to a family in Russia requires special attention and targeted actions on the part of the state and society. It is important to realize that their solution is impossible without the joint efforts of the state, parents, teachers and psychologists.

The protection and guarantee of the child's rights to a family in Russia is a fundamental principle of a democratic and humane society. Confidence that all necessary measures to protect and combat violations of the child's rights to family are taken at the state level provides confidence in the future of our country.

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保护儿童对家庭的宪法权利的形式

# FORMS OF PROTECTION OF THE CONSTITUTIONAL RIGHTS OF A CHILD TO THE FAMILY

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注解。 当前，保护儿童家庭生活的宪法权利仍然是现代社会的紧迫问题之一。 这个问题不仅对孩子本身很重要，对整个社会也很重要，因为孩子的成长和发展是未来社会的基础。 这篇科学文章探讨了保护儿童家庭宪法权利的各种形式。

关键词：儿童权利、儿童人身权利、儿童权利保护、儿童安置、儿童家庭权利。

***Annotation.*** *Currently, the protection of children's constitutional rights to family life remains one of the pressing issues of modern society. This problem is important not only for the children themselves, but also for the entire society as a whole, since the upbringing and development of a child is the basis of the future society. The scientific article examines various forms of protecting the constitutional right of a child to a family.*

***Keywords:*** *children's rights, personal rights of the child, protection of children's rights, placement of children, child's rights to a family.*

Family is the main social phenomenon in the life of every child. It is the family that creates the conditions for his development, gives him love and respect, and brings health and education benefits. But sometimes the constitutional rights of the child are violated in the family, which can lead to insufficient development and damage to psychological health. In such cases, it is necessary to protect the constitutional rights of the child in relation to the family.

According to art. 2 of the Constitution of the Russian Federation, man, his rights and freedoms are the highest value. Recognition, observance and protection of human and civil rights and freedoms is the responsibility of the state» [2].

Protecting the rights of minors is a pressing and important issue in modern Russian society. Currently, the number of violations of the rights of children and adolescents has increased significantly, which requires increased attention from legislation and the law enforcement system.

Caring for children is the key to the prosperity of society and the state. Moreover, such care should come from both parents and the state itself. The state implements a social policy regarding childhood and motherhood, which is aimed at the formation of citizens and the development of society.

One of the main problems in protecting children's rights is insufficient awareness of the public and population about crimes committed against minors. Many people are unaware of existing regulations and laws that are designed to protect children's rights, as well as how to raise awareness about aggression or violence against children.

The rights of minors in our country are protected through a social mechanism, which refers to methods, forms, means and types of assistance from the state and society to minors, which are aimed at creating decent conditions for the life and development of children, as well as realizing their potential in all spheres of society. Social mechanisms also include legal mechanisms, that is, legal support. The social mechanism is the entire system of state support, which can be determined by the level of socio-economic development of the country.

Legal protection is the protection of the rights and legitimate interests of a minor by legal means. This is, first of all, a set of normative legal acts that determine the legal status of minors and establish the basic provisions on the activities of the system of bodies working with children. All areas of children's lives are subject to legal protection.

Russian legislation provides for administrative and judicial procedures for the protection of the personal non-property rights of the child. The use of one method or another depends on the nature of the violation.

Both in legal science and in practice, the main element of the protection of human rights and freedoms is legal forms of protection. It is worth noting that in science there are often discussions regarding the identification of the concepts of «form» and «method» of protection.

The form of protection is usually understood as the special activity of those authorized by those bodies for the protection of rights, namely the performance of certain actions aimed at establishing factual circumstances, applying the rules of law, determining the method of protection, and subsequently making an appropriate decision. Accordingly, it can be stated that the method shows how the protection of rights occurs, and the form is the very production of protection.

In accordance with art. 56 of the Family code of the Russian Federation, a child has the right to protection. The child has the right to protection of his legitimate

interests and rights, this is stated in paragraph 1 of art. 56 of the Family code of the Russian Federation [3].

In accordance with art. 8 of the Family code of the Russian Federation, guardianship and trusteeship authorities and law enforcement agencies protect the rights of the child in an administrative manner. On the part of law enforcement agencies, the prosecutor's office and internal affairs bodies will advocate for the protection of children's rights.

The protection of the rights and legitimate interests of a minor is also carried out by the guardianship and trusteeship authority. Guardianship and trusteeship authorities identify children left without parental care - this is stated in art. 121 of the Family code of the Russian Federation. Such children are accommodated based on how the child was left without parental care, and even after the placement of the child, the guardianship and trusteeship authorities exercise control over the upbringing, education of children and their maintenance.

Guardianship and trusteeship authorities are responsible for protecting the rights and legitimate interests of minor children who find themselves in difficult life situations. They are actively working to identify children who have lost parental care and are being placed in orphanages or foster families. An important task of the guardianship and trusteeship authorities is to organize care and provide decent living conditions for the child. In addition, they monitor his upbringing and education so that the child receives the necessary support and is prepared for an independent life in the future. All measures related to arrangement and control are taken taking into account the personal characteristics and needs of each child.

The most important problem in implementing effective state policy in the field of guardianship and trusteeship is the insignificant attention on the part of regional authorities to the problem of a high level of institutionalization. Institutionalization is the placement of orphans and children without parental care in residential institutions.

This method of placing minors is characterized by enormous budgetary costs. Despite this, the lack of stable connections between children and the outside world due to the closed nature of such institutions gives rise to numerous psychological traumas among boarding school students.

Consequently, the annual increase in the number of children in boarding schools indicates the lack of effectiveness of the deinstitutionalization policy, which involves the development and encouragement of family forms of placement for minor children. However, special attention should be paid to the fact that in the Federal Law of the Russian Federation «On Guardianship and Trusteeship» [8] in paragraph 2 of art. 16 establishes the possibility of establishing guardianship or trusteeship relations on the basis of concluding an agreement on compensated terms.

In addition to special structures, such as guardianship and trusteeship authorities, there are other organizations that care about protecting the rights of the child.

These include, for example, NGOs working in the field of protecting children's rights and their social adaptation.

If a child's rights are violated, there are a number of mechanisms to protect them. First of all, you need to contact the relevant authorities, such as law enforcement agencies or guardianship authorities. If there is evidence of a violation of the child's rights, you can also go to court.

It is important to note that children have the right to self-protection and can seek help from more adults or special organizations. If necessary, his interests and rights may be protected by his legal representative or his appointed guardian. In addition, guardianship and trusteeship authorities monitor compliance with the rights of emancipated children and can intervene if any violations occur. In any case, an emancipated child has the opportunity to independently resolve his issues and make decisions regarding his life and future.

Emancipation is a new basis for recognizing a minor who has reached the age of sixteen as fully capable. To do this, it is enough for minors to have a permanent income under an employment contract or to carry out entrepreneurial activities.

To obtain emancipation, the consent of the minor is required, since from that moment he ceases to be a child from the point of view of society, law and justice. Emancipation also requires consent from parents or other legal representatives. If parents or legal representatives do not give consent, then by a court decision. The purpose of emancipation is to free a minor from the need to obtain consent from parents or legal representatives to enter into any transactions [6, p. 48].

Article 28 of the Civil Code displays an interesting gradation of the legal capacity of minors based on their age [4]. For the first time, a distinction was made between incapacity at the age of up to six years and from six to fourteen. Until the age of six, a child is completely deprived of legal capacity. In the period from six to fourteen years of age, he has the right to enter into small household transactions, that is, transactions with a small amount for cash, the purpose of which is to satisfy personal needs, for example, the purchase of a soft carbonated drink. When a child reaches the age of six, he can independently dispose of the funds provided to him for a specific purpose or for free disposal, with the consent of his legal representative.

After analyzing the current legislation, two forms of protection of human rights and freedoms were established: jurisdictional and non-jurisdictional.

The jurisdictional form of protection is the activity of state or state-authorized bodies that have law enforcement powers to protect violated or disputed rights [7, p. 265].

The most common and frequently used form of defense is judicial. It is also enshrined in Part 1 of Article 46 of the Constitution of the Russian Federation, which guarantees everyone the opportunity to defend their rights and freedoms in court.

Judicial procedure is a mechanism for protecting the rights and interests of which allows you to resolve all disputes on issues relating to minors. The court considers various types of cases, for example, those related to the origin and maintenance of the child, accompanying the child to educational institutions and healthcare, the psychological state of the child, etc.

The non-jurisdictional form of protection involves the actions of citizens and non-governmental organizations to protect the rights and interests protected by law, which they carry out independently, without contacting state and other competent authorities. Such actions are called self-defense.

First of all, to protect the constitutional rights of a child to a family, it is necessary to prevent domestic violence. Unfortunately, in Russia the problem of violence against children still remains relevant. In Russia, over the past three years, the number of minors recognized as victims of crime has increased by 19.5%.

In 2020 there were 94.8 thousand, in 2021 – 112.3 thousand, and in 2022 – 113.3 thousand. This follows from the updated data of the Ministry of Internal Affairs of the Russian Federation, posted in the Unified Interdepartmental Information and Statistical System (EMISS) [5]. The following measures can be taken to combat this problem:

1. Creation of specialized centers for victims of domestic violence. These centers provide psychological and legal assistance to children and families.

2. Tougher penalties for child abuse. According to the UN Convention on the Rights of the Child [1], all children have the right to protection from domestic violence. Research shows that increasing sentencing can reduce violent crimes against children.

3. Training social workers and medical specialists to detect domestic violence. Training should include methods for identifying cases of domestic violence and mechanisms for preventing violence.

4. Media campaigns aimed at raising awareness of the problem of violence against children and their protection.

5. Mandatory courses for parents in which they learn to treat their children without violence and speak to them as equals.

Another form of protection of a child's constitutional rights to a family is decent living conditions. If a family cannot provide a child with decent living conditions, then the state must help him. For example, in Russia there is a system of state social payments designed to provide housing and social support to low-income families with children. The state can also provide orphans with placement in orphanages, where they will be provided with everything they need.

Another form of protecting a child's constitutional rights to a family is providing him with access to education. Russia has compulsory general education, which should be available to all children regardless of their social status. If a family can-

not provide a child with access to education, the state must help him. For example, in Russia there is a system of benefits for low-income families who can receive benefits for the education of their children.

To solve problems related to the protection of the rights of minors, it is proposed:

– improve the system for responding to violations of children's rights. Data show that only 30% of cases of violation of children's rights are recorded and brought to court. This indicates that the current response system is ineffective and does not sufficiently protect the interests of children;

– it is necessary to develop effective mechanisms for coordinating the activities of various bodies involved in the protection of children's rights in order to avoid duplication of work and ensure a timely response to violations;

– expanding the use of modern technologies to protect children's rights. For example, the creation of a centralized electronic database that will contain information about the health status and living conditions of each child will allow a quick response to violations and prevent the occurrence of a dangerous situation;

– the priority way to protect the rights of the child should be not administrative and legal, but judicial protection of the rights of children, especially those who have lost parental care.

Taken together, legal and institutional guarantees determine the foundations of the constitutional and legal status of a child in the Russian Federation, primarily his basic rights and the ways and mechanism of their legal protection.

Now the mechanism for protecting the constitutional rights of the child in Russia is developing and improving by:

1) introducing international standards in the field of protecting the rights of the child;

2) preparation and adoption of new legislative acts that will regulate public relations in the field of protecting the rights of the child;

3) further humanization of national legislation to ensure the rights of the child;

4) improving the competence, forms, and methods of activity of authorized state bodies that are entrusted with the responsibilities of protecting the rights of the child in the Russian Federation;

5) comprehensive use of the achievements of legal science to improve current legislation and law-making practice in the field of protecting children's rights.

In conclusion, we can say that protecting the constitutional rights of a child to a family is an important task that requires an integrated approach. It is necessary to create conditions to prevent domestic violence, ensure decent living conditions for children and access to education.

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# 船舶法律地位的趋势
# TRENDS IN THE LEGAL STATUS OF A SHIP

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注解。 当前，建立和完善现有的国际和国家海上航行使用无人机法律规范的问题已经出现。 本文分析了“海洋自主水面舰艇”一词的定义和分类。 结论是，有必要继续为其引入海上航行创造全面的法律支持。

关键词：海上自主水面船舶、监管规定、国际标准、俄罗斯法律。

***Annotation.*** *At present, the problem of creating and improving existing international and national legal norms governing the use of unmanned aerial vehicles in maritime navigation has arisen. The article analyzes the definition and classification of the term «marine autonomous surface ships». It is concluded that it is necessary to continue to create a comprehensive legal support for their introduction into maritime navigation.*

***Keywords:*** *marine autonomous surface ships, regulatory regulation, international standards, Russian law.*

Today, the marine industry is one of the key the global economy, it accounts for over 80% of all world transport. Projects that would have seemed fantastic in the past are now very real and will become an integral part of everyday life. The idea of automated, unmanned vessels is a good example.

According to a study by the innovative consulting company Thetius, today about 50 companies worldwide are actively working on marine autonomous technologies, it is predicted that by 2025 the world market will be more than triple - to 5.3 billion dollars.

The development of sea transport using autonomous navigation has been rapidly developed. December 19, 2023 from the port of Ust-Luga - went on the first voyage in the mode of remote control, using means of autonomous navigation (a-Navigation), the sea ferry «General Chernyakhovsky». The vessel serving the maritime line between the Leningrad and Kaliningrad regions arrived at the port of Kaliningrad on 21 December 2023. «General Chernyakhovsky» has passed about 500 nautical miles in autonomous mode. The ferry was operated from the Remote Control Centre for the part of the offshore route.

Autonomous shipping has become a reality, and the question is raised of redesigning norms reflecting new developments in science and technology in maritime transport, which occupy a special place in the legal system. In this regard, it would be relevant to consider whether the emergence of the MASS requires simple adaptive regulation, or rather represents a turning point requiring the creation of new directions for regulation.

The Commercial Navigation Code of the Russian Federation (FMC) defines «ship» as «self-propelled or non-self-propelled floating structure used for commercial navigation» (art.7, para.). The analysis of norms of foreign and Russian domestic legislation, conducted by A.S. Scaridov, allows us to assert that the term «ship» is practically not disclosed, and if a definition is given, it is usually based on the objectives of a specific regulatory act». The status of a ship is defined by the author as the set of rights and obligations attributable to the State or the shipowner by virtue of international legal obligations to organize the use of ships in maritime spaces, taking into account their legal regime» [1]

The first attempts to address the problem of autonomous ships were made by the International Maritime Organization (IMO) at the 99th session of the Committee for the Safety of Navigation (MSC) on 16-25 May 2018. «Maritime Autonomous Surface Ships (MASS)» is defined as a ship that can operate to some extent independent of human interaction. To facilitate the process of determining the statutory scope of the degree of self-sufficiency, it is noted that a vessel may operate with one or more degrees of self-sufficiency during a single voyage.

IMO MSC has defined four levels of autonomy. [2]

Degree one: a ship with automated processes and decision support. Seafarers are on board to manage and control ship systems and functions. Some operations can be automated, sometimes they do not require control, but sailors on board are ready to take control at any time.

Degree two: A remotely controlled vessel with a crew on board a vessel is controlled and controlled from a control point outside the controlled vessel. On board are crew members who can take control and control of the ship's systems and functions.

Degree three: A vessel with external control, without crew on board-the vessel is controlled and controlled from a control point outside the controlled vessel. There are no sailors aboard.

Degree four: A fully autonomous vessel - the ship management system is capable of making its own decisions and determining actions.

In order to ensure the safe operation of autonomous seagoing vessels, a number of legal problems need to be addressed, in particular with regard to the legal status of persons in charge of these technical units. [5] For international harmonization and clarification of the meaning of the terms "master", "crew", "responsible

person", "remote-controlled vessel and fully-controlled vessel"A joint MSC/LEG/FAL MASS Working Group has been set up, as well as considering functional and operational requirements for the remote control centre and the remote operator. [6]

In 2022, IMO made significant progress in developing a targeted instrument to govern the operation of MASS. The work of the MSC continued on the adoption of the optional MASS Code from 2025, which will enter into force as a mandatory MASS Code after gaining experience of its application by January 1, 2028. Initially, this Code will apply to cargo vessels only during development, and will eventually apply to passenger vessels when finalized and made mandatory. [6]

Russia actively participates in the elaboration of approaches to the international regulation of MASS, which is carried out by IMO, promoting its own standards and taking into account the results of the international discussion on issues regulating MASS within IMO.

In 2019, Russia launched a large-scale project to introduce technological and remote navigation, which includes the creation of legal conditions for the operation of MASS. The Russian Maritime Register of Shipping (RS) has developed the Regulation on the Classification of Marine Autonomous and Remotely Operated Surface Ships (MASS), which entered into force on 1 August 2020.

To categorize remotely and autonomously operated surface vessels, a composite designation is introduced, which characterizes the ability to operate a ship on the high seas and in cramped conditions: narrows, mooring places, ports: <at sea> < confined conditions>.

At sea: MS, M C ds, RC mc, RC, AC and when maneuvering in confined conditions: MS, MC ds, RC ms, RC ms, RC, AC.

MS - Manual control; person on board

MC ds - Manual control with decision support; person on board

RC mc - Remote control with transition capability

manual; person on board

RC - Remote control; no person on board

AS - Autonomous control; no person on board

Examples of composite vessel category designation: AC-MS (AC - autonomous at sea and MS - manual control at the passing narrow channels and at the entrance to the port), or RCmc-M C ds (RC mc - remote control with the ability to switch to manual when moving into the sea and MCds - manual control with support for decision making during passing narrow channels and at the entrance to the port).

Russia was the first in the world to start a national experiment on the operation of the MANC, as well as remote-controlled surface vessels. The formation by the Russian Federation of national regulation of autonomous seagoing vessels will ensure their wide application under the Russian flag by shipping companies. How-

ever, the use of autonomous ships in international maritime navigation creates a number of regulatory gaps. «It should be noted that the regulatory issue of autonomous ships is quite complex, affecting many parties to commercial shipping». [7] Significant legislative and technical work will be required to modify the existing legal system so that it can ensure the safe operation of autonomous ships. «This should take into account the global and international nature of maritime traffic and the priority of international regulation in this field». [8] With the introduction of the MASS International Code, a review of national and international legal frameworks is needed.

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# 在特殊教育机构中对有健康和发展问题的学生进行艺术治疗技术和惩教工作的可能性

# THE POSSIBILITY OF ART THERAPEUTIC TECHNOLOGIES AND CORRECTIONAL WORK WITH STUDENTS WITH HEALTH AND DEVELOPMENT PROBLEMS IN SPECIAL EDUCATIONAL INSTITUTIONS

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注解。 本文讨论了让特殊寄宿学校的学生参与创造性活动的艺术治疗机会。考虑了艺术方向领域课堂上的方法、技巧和工作形式。 一个名为"舞蹈疗法"的方向，以通过舞蹈释放肌肉紧张为基础，详细描述了情绪表现与肌肉生理张力变化相互作用的事实。

关键词：特殊学校的惩教工作、艺术治疗、有视觉分析器问题的学生的创造性实施、舞蹈治疗、为中等和高等教育机构的特殊惩教学校学生实施艺术创造力的机会。

***Annotation.*** *The article discusses art therapeutic opportunities for involving students studying in special boarding schools in creative activities. Methods, techniques and forms of work in classes in the field of artistic orientation are considered. A direction called "Dance Therapy", which is based on the release of muscle tension through dance, is described in detail and the fact of the interaction of emotional manifestations with changes in muscle-physiological tone.*

***Keywords:*** *correctional work in special schools, art therapy, creative implementation of students with problems of the visual analyzer, dance therapy, opportunities for artistic creativity to implement the preparation of students of special correctional schools for secondary and higher educational institutions.*

A person receives the predominant number of sensations of the external world through vision. As soon as you close your eyes, the light, the shapes of objects, the blue of the sky, the green of the grass disappear. Everything around is plunged into darkness, the ability to navigate disappears, the person becomes helpless.

A child with health problems in the field of vision recognizes himself as a disabled person and this leads to the appearance of isolation and negativism, therefore one of the main and important tasks of the correctional work of teachers of special schools is the neutralization of negative personality traits at the initial stage of education.

This can be realized through the development of cognitive interests, creative initiative, independence, and the formation of an active life position that allows students with visual problems to be included in the life of society as not only full-fledged, but also creatively active members.

From the first lessons of education in schools with a correctional focus, it is necessary to attach great importance to creative activity, the development of creative abilities, coordination and motor activity. By creative activity of students we mean not so much the substantive result itself, i.e. The creation of children's works is a creative process aimed at developing the skills and abilities of artistic and aesthetic perception in students - empathy for works of art, as well as awakening on this basis the abilities for productive self-expression in one form or another of creative activity. While children are studying in a correctional educational institution, many functions are improved, including the motor analyzer. Also, various classes in the field of artistic creativity can develop cognitive abilities, ensure the acquisition of special knowledge, and develop skills in the field of art education. All this is compensation and correction.

Music, visual arts, and dancing are especially important, as they have a beneficial effect on mental processes, improve coordination of movements, and much more. As a result of such activities, the child's ideas about the world around him and about art expand. Also, in the context of learning art, tactile perception develops, it becomes more subtle and dissected, which is also very important for the visually impaired, especially for those with profound visual impairments.

Such activities develop attention and improve its forms and types. Particularly important for students with developmental and health problems is the development of involuntary attention, which develops in classes using creative tasks.

In the special literature on the issues of training and education of children with problems of the visual analyzer, a number of specific features of their physical and mental development, caused by distortion of visual perception and systematic movement deficits, have been identified. They are characterized by a distorted perception of objects and their location. The consequence of relying on inaccurate visual perception is an insufficient supply of objective and spatial features:

position, direction, distance, size, shape of objects, etc.; complexity of analysis and synthesis of the information received; a fragile connection between the perception of spatial features and their verbal designations, as well as the absence of a representation, an image behind what is spoken or perceived. Therefore, the meanings of words are often impoverished. A significant decrease in vision negatively affects, first of all, the process of perception, which is characterized by great slowness, narrow vision, decreased accuracy, as well as on imagination, visual-figurative thinking.

Visually impaired children also tend to overestimate their visual capabilities. Children with visual impairments need systematic, targeted training in the ability to navigate in space (research by V.A. Kruchinin, E.B. Ostrovskaya, L.I. Plaksina, V.V. Sverlov, L.A. Semenov, L.I. Solntseva, N.I. Khopreninova, etc.).

A systematic lack of movement significantly affects the condition and functioning of the musculoskeletal system. For example, violations of posture in visually impaired children are recorded much more often than in children who do not have such problems. Visually impaired children are characterized by weakness of the muscular system and decreased tone. Difficulty in spatial orientation affects the motor functions of the body as a whole. When vision is impaired, significant changes occur in the development of motor functions, namely in speed, coordination, accuracy, pace, and proportionality of movements. When working visually, visually impaired children become very tired, this, in turn, causes a decrease in mental and physical performance.

However, leading typhlopedagogues believe that low vision, which has a serious impact on the physical and mental development of the individual, is generally not decisive; competently organized, based on rich compensatory opportunities, training and education contributes to the full socialization and self-realization of the individual in society (V.P. Ermakov, G.A. Yakunin, V.P. Kashchenko, N.B. Lurie, etc.).

Dance therapy is based on the expression of certain feelings and experiences through the body. This type of music-movement therapy is based on the unity of music and movement, on active motor activity accompanied by music. The basis of dance therapy is the release of muscle tension through dance. The fact of the interaction of emotional manifestations with changes in muscle-physiological tone was noted in his studies by the famous physiologist V.M. Sechenov. Relieving physical stress through dance or special rhythmic exercises creates the conditions for the expression of a person's feelings, thoughts and emotions. A flexible, disinhibited body turns out to be more capable of a wide range of emotional experiences and the release of negative emotions.

Movements to music also provide correction of communication disorders. Music regulates movement and provides clear representations of the relationships between time, space and movement.

The breadth of manifestations of rhythm underlies many areas of dance use. The sense of rhythm is fundamentally active in nature and is always accompanied by motor reactions. The essence of motor reactions is that the perception of rhythm causes a variety of kinesthetic sensations. This is a muscular contraction of the tongue, head muscles, jaws, toes; tension arising in the larynx, head, chest and limbs; simultaneous stimulation of antagonist muscles, causing a change in phases of tension and relaxation without changing the spatial position of the organs. It is noted that dance has a positive effect on general tone, motor skills, general psycho-emotional state, and training of mobility processes in the central nervous system.

Classes in a choreographic group develop mental functions such as attention (concentration, volume, stability, distribution), memory (visual, auditory, motor).

When developing the content of a methodology for the development of motor skills and the motor sphere, it is necessary to have special diagnostic tools, determine components, criteria, and indicators of the development of the motor sphere in visually impaired schoolchildren, which allow one to judge the dynamics in the development of motor skills.

**The main components of the development of the motor sphere:**

- muscle tone,
- motor coordination,
- orientation in space.

**The main indicators of muscle tone are:**

- performing movements at a given pace;
- performing exercises with a certain amplitude;
- concentration and muscle relaxation;
- endurance;
- flexibility.

**Indicators of motor coordination development:**

- performing movements by individual muscle groups (simultaneously, alternately, separately);
- concentration and relaxation in a given rhythmic pattern;
- development of the vestibular apparatus;
- controllability of body movement.

**Leading indicators of orientation in space:**

- the ability to move in a given direction;
- the ability to perform group rhythmic movements in a given dance pattern.

When working with visually impaired children in the process of staging dances learned in classes, the following points should be taken into account:

- select musical material with a clear rhythmic pattern and a pronounced strong beat;

- when creating dance compositions, use simpler movements;
- to master dance movements, select a more convenient tempo (allowing, if necessary, to slow it down);
- determine the duration of the dance composition, taking into account the age and psychophysical characteristics of students.

Sometimes students with bright natural talent, but lack of strong-willed manifestations, often achieve lower heights than those who are less gifted, but focused on overcoming difficulties in the name of their goal.

The authors of the article, having sufficient experience of working in a correctional school, consider it advisable to implement a personality-differentiated approach, as well as individual methods of working with each student (taking into account starting opportunities, living conditions in the family), individual selection of repertoire throughout the entire period of study, use special exercises, specific didactic means (taking into account the main and concomitant diseases), as well as drawing up individual cards and conducting monitoring studies, which trace the development of not only special skills, abilities, but also the improvement of mental characteristics of the cause-and-effect relationships of personal and artistic development . It is advisable to have a differentiated approach to assessing the level of training at a certain stage for each student, i.e. in special attention to the degree of overcoming all difficulties, to the level of aesthetic and creative growth, focused on professional education.

The main predicted result of such students' activities in the field of art education is the establishment of such a child as an equal member of society, having the right to a full education. Including the artistic one, this gives him the right to enter secondary vocational education and higher education institutions.

An important role is played by the participation of students of correctional educational institutions in festival and competitive activities. Starting from school-wide and district competitions, they can reach the All-Russian and International levels, subject to individual approaches to learning and great efficiency to achieve their goals. Communication with their peers at similar events with students from other educational institutions contributes to the new creative development of these students, serves as an incentive for the development of musical, artistic and technical potential, an incentive to study current topics and new technologies, and of course is established as a full and full member of society.

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# 残疾儿童教育活动的组织特点
# FEATURES OF THE ORGANIZATION OF EDUCATIONAL ACTIVITIES FOR CHILDREN WITH DISABILITIES

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抽象的。 文章论述了组织残疾儿童教育活动的特点。 对“包容”、“残疾人”和“适应教育计划”等术语进行了分析。 HL 的类型被识别和分析。 国家和社会有目的地提供共同学习的机会，提供一切必要的条件来满足残疾学生的基本需求。

关键词：包容性、包容性教育、残疾人、适应性教育计划。

***Abstract****. The article discusses the features of organizing educational activities for children with disabilities. Terms such as "Inclusion", "Person with disabilities" and "Adapted educational programs" are analyzed. Types of HL are identified and analyzed. The state and society purposefully provide the opportunity for joint learning, providing everything necessary to fulfill the basic needs of students with disabilities.*

***Keywords:*** *inclusion, inclusive education, person with disabilities, adapted educational programs.*

The state identifies one of its social policy priorities as the introduction of inclusion in education in order to provide conditions for the full education and training of schoolchildren with disabilities. Inclusion conditions are able to adequately take into account the characteristics of children with special needs. The emergence of inclusion in the educational process means a number of characteristic reasons. Which can be described as "social order"[1] of society, which indicates a high level of economic, legal and social development. This stage is characterized by a rethinking of society's attitude towards people with disabilities and recognition of not only the equality of their rights, but also an awareness of their responsibility to ensure equal opportunities in areas of life, including in education.

[1] See: Tikhomirova, L.F. Difficulties in implementing inclusive education for children with disabilities and ways to overcome them // Yaroslavl Pedagogical Bulletin. – 2013. – No. 2. – P. 78-81.

L.S. Vygotsky played a major role in the development of inclusive education in Russia. The scientist's ideas have not lost their relevance in modern education. An important thought by L.S. Vygotsky expressed in his work "Issues of raising blind, deaf-mute and mentally retarded children" that society considers external defects (blindness, intellectual disability, deafness), without noticing the main thing - the social essence. "Any physical defect - be it blindness, deafness or congenital dementia - not only changes a person's attitude to the world, but, above all, affects relationships with people"[2]. The scientist also completely rejects the use of traditional teaching methods for children with disabilities. The main goal of training, L.S. Vygotsky puts "put it into practice"[3], overcome those deviations in behavior that determine his behavior in society. L.S. In his studies, Vygotsky defines social compensation for a defect as the main task of pedagogy in the upbringing and education of children with disabilities, saying that every child has a reserve of healthy potentials that can be safely used.

The central idea of inclusion in education is the exclusion of any discrimination, as well as ensuring equal treatment of all people with special educational needs. Let us consider and analyze the definition of "inclusion" from the perspective of scientists.

Zh.A. Levshunova, N.V. Basalaeva, T.V. Kazakov consider inclusion as a long-term strategy, but not within a specific area of work, but as an interdisciplinary approach to organizing the activities of the educational process as a whole[4].

L.V. Kuznetsova defines inclusion as a multifactorial process that includes the need to change (restructure) all levels of human functioning, starting with replacing the priority of students' average indicators with the priority of the diversity of schoolchildren's potentials[5]. Inclusion is the process of shaping people's consciousness towards the trend of equality and recognition of the potential of children with different educational opportunities, thanks to a combination of different approaches in organizing the educational process.

The Russian Federation aims to ensure accessibility of the educational process for all students, taking into account their educational and individual capabilities. Article 2 273-FZ "On Education in the Russian Federation" affects a separate category of students with disabilities, for whom inclusive education is provided.

[2] Vygotsky, L.S. Issues of raising blind, deaf-mute and mentally retarded children. – M., 2010. – P. 102.

[3] See: Vygotsky, L.S. Issues of raising blind, deaf-mute and mentally retarded children. – M., 2010. – P. 102.

[4] See: Levshunova, Zh.A., Basalaeva, N.V., Kazakova, T.V. Inclusive education: a textbook for students of higher educational institutions studying in the field of preparation: 03/44/05 – "Pedagogical education", 03/44/02 – "Psychological and pedagogical education". – Krasnoyarsk, 2017. – P. 68.

[5] See: Kuznetsova, L.V. Building a "culture of inclusion" – preventing the risks of inclusive education // School book. – 2010. – No. 1. – P. 37-43.

The current Federal Law "On Education" requires that any educational institution must admit and educate a child with disabilities. Preparedness in teaching children with disabilities should consist of providing a barrier-free environment and special training for teachers. It is inclusive education that takes into account the process of general learning, ensuring its accessibility. Inclusive education helps to increase the child's personal capabilities, ensures the formation of such qualities as mutual respect, willingness to help, tolerance and, most importantly, the ability of persons with disabilities to live independently in society. Let us consider and analyze the term "Inclusive education".

L.P. Fetalieva defines inclusive education as: "the process of development of general education"[6]. This learning process is determined by accessibility for students with special educational needs, in terms of adaptability to the various needs of children. It is worth saying that schoolchildren use the knowledge acquired in the educational process in different ways.

E.V. Kovalev, M.S. Staroverova argue that the term "Inclusive education" is not entirely correct. The authors use the concept "Inclusive education and upbringing"[7]. E.V. Kovalev, M.S. Staroverova give the following definition: "a logical stage in the development of the education system in any country in the world"[8]. The authors come to a common opinion that inclusion in education is an important chronological and ideological continuation of interactive education.

So, inclusion in education is a specially designed educational mechanism that ensures the child's participation in it. Inclusive education is also important because a child with special educational needs is surrounded by ordinary peers, which develops his/her socialization skills. What is important is that joint learning with children with special educational needs is relevant in modern education, and contributes to further socialization and the development of cognitive and communicative competence.

Let us list the principles of an inclusive educational environment:

– The principle of early inclusion (a child with disabilities is included in the socialization process from an early age in order to form his social interaction in the future).

– The principle of providing correctional assistance to persons with disabilities.

– The principle of individualization in the educational space (it is necessary to take into account the individual and physical learning abilities of persons with disabilities).

[6] Fetalieva, L.P. Modern view of inclusive education // World of science, culture, education. – 2018. – No. 4 (71). – P. 214.

[7] Ibid. – P. 215.

[8] Ibid. – P. 216.

– The principle of tolerance towards learning subjects in conditions of inclusion[9].

Federal Law of June 30, 2007 No. 120-FZ on amendments to certain legislative acts of the Russian Federation on the issue of citizens with disabilities, the words “abnormal children”, “deviations in development” used in legal acts, are changed by the term “health limitations» HL.

In the federal law of the Russian Federation, the term student with HL is defined as: an individual with acquired physical or psychological disabilities, confirmed by a psychological-medical-pedagogical commission and interfering with learning without the creation of additional conditions[10].

O.A. Kozyreva, defines the term students with HL as follows: “children with HL in mental and physical development”[11]. The scientist also emphasizes that these deficiencies have significant deviations from normal development (physical and mental), which were caused by a serious acquired or congenital defect, and also require special educational conditions.

So, the term children with “disabilities” means a mental or physical defect (confirmed by a commission) that limits the acquisition of knowledge and interferes with the educational process without the creation of special conditions.

The Federal State Educational Standard (FSES) defines the types of disabilities corresponding to adapted basic educational programs (ABEP) for students with HL. Let’s list them.

1. Deaf.
2. Visually impaired.
3. Disorders of the musculoskeletal system.
4. Mental retardation.
5. Severe speech impairment.
6. Autism spectrum disorders.
7. Mental retardation disorders[12].

These types of HL are the most common. It is important for educational organizations to provide children with disabilities with the most productive and com-

[9] See: Simaeva, I.N., Khitryuk, V.V. Inclusive educational space: SWOT analysis // Bulletin of the Immanuel Kant Baltic Federal University. – 2014. – No. 5. – P. 31-39.

[10] See: Kozyreva, O.A. Analysis of the definition of “person with disabilities” // Quality. Innovation. Education. – 2017. – No. 37 (81). – pp. 148-151.

[11] Ibid. – P. 151.

[12] See: Order of the Ministry of Education and Science of the Russian Federation of June 3, 2013 No. 466 (Collected Legislation of the Russian Federation, 2013, No. 23, Art. 2923; No. 33, Art. 4386; No. 37, art. 4702; 2014, No. 2, art. 126; No. 6, art. 582) “On approval of the federal state educational standard for primary general education of students with disabilities” [Electronic resource] // Garant.ru [Electronic resource]: electronic database. – URL: https://base.garant.ru/70862366/ (access date: 02/12/2023). - Cap. from the screen.

petent process of education and training and, most importantly, to socialize such children.

Let's consider the classification of educational organizations by type of HL.

These types of HL are the most common. It is important for educational organizations to provide children with disabilities with the most productive and competent process of education and training and, most importantly, to socialize such children.

Let's consider the classification of educational organizations by type of HL.

1. I type. Aimed at teaching deaf students.

This type of educational organization ensures the implementation of several tasks at once: educational, general education, correctional. In the process of studying in educational organizations of type I, which is important, from the age of 12 the student undergoes labor training. Training takes 12 years, during this period the child completes the school curriculum up to the 8th grade of a general education school. The maximum class size is 12 students. An important place in correctional-compensatory and rehabilitation educational work is determined by the formation and development of verbal speech and verbal-logical thinking. In the education of deaf children, the emphasis is on the development and preservation of the student's residual hearing. The basis of teaching deaf students is practical activity, thanks to which: general and speech development occurs, the formation of independence, activity in communication with other people.

2. II type. Aimed at teaching hard of hearing and late-deafened students.

This type of educational organization ensures the implementation of several tasks at once: educational, general education, correctional. In teaching hard of hearing and late-deafened children, emphasis is placed on overcoming the consequences of hearing loss and speech underdevelopment of children. The teaching methods used in type II educational organizations maximally stimulate the child for active speech activity. Thanks to this, lip reading/facial expression skills and the development of auditory perception are formed. Children studying in type II schools are divided into 2 groups: students with minor speech impairments and students with severe underdevelopment of the speech apparatus as a result of impaired auditory function. Training – 12 years. Maximum class size – 12 students.

3. III type. Aimed at teaching blind students.

This type of educational organization ensures the implementation of several tasks at once: educational and general education. This type of educational institution teaches totally blind students or students with minimal residual vision. The priority is to preserve and develop residual vision. Students with completely absent vision use tactile-kinesthetic and auditory methods of perceiving educational material in their educational work. The teaching is based on raised-dot Braille. It is also important to understand that the education of blind children should be based on interpersonal contacts not only with sighted peers, but also with adults. Two

types of schools are organized for blind students: ten-year (8 classes of education in the volume of a standard comprehensive school) and twelve-year (secondary education). The maximum class size is 12 students.

4. IV type. Aimed at training visually impaired students.

This type of educational organization ensures the implementation of several tasks at once: educational, general education, correctional. The IV type of educational organization is distinguished by its focus on compensating for visual impairments, as well as restorative work for defective vision (if possible). The following is used in teaching: visual relief material intended for perception by sight and touch; audio libraries (recordings of educational material, fiction); special optical equipment (magnifying glasses, lenses, voice recorders, etc.). Training for 9-11 years. The maximum class size is 12 students.

5. V view. Aimed at training students with severe speech pathology.

This type of educational organization ensures the implementation of several tasks at once: educational, general education, correctional. The institution is aimed at students with intact hearing and intelligence, but with severe speech pathology (for example, stuttering). The main task of a type V educational organization is to correct defects in oral/written speech, as well as their consolidation in practice. Training for 9-11 years.

6. VI view. Aimed at training students with musculoskeletal disorders.

This type of educational organization ensures the fulfillment of several tasks at once: educational, general education (taking into account the health status of children). The central task of a type VI educational organization is to overcome movement disorders as much as possible and prepare students for independent life, including work. Students use specialized equipment (ramps, desks with sides, helmets and spacesuits to secure the torso). The maximum class size is 16 students.

7. VII view. Aimed at training students with mental retardation.

This type of educational organization ensures the implementation of several tasks at once: educational, general education, correctional. During educational work, students undergo comprehensive treatment and rehabilitation work. Also joint/individual correctional classes to overcome deficiencies in psychophysical development. The maximum class size is 18-20 students.

8. VIII view. Aimed at teaching students with mental retardation.

This type of educational organization ensures the implementation of several tasks at once: educational, general education, correctional. An important task of educational institutions of the VIII type is the mental, physical and moral development of the student. In teaching children with mental retardation, an individual approach is common, designed to overcome secondary developmental defects of the child[13].

[13] See: Zaitseva, I.A., Kukushkin, V.S., Larin, G.G. Corrective pedagogy: a textbook for students of pedagogical specialties at universities. – M., 2004. – P. 202.

So, having examined the entire classification of educational organizations by type of disability, we emphasize the versatility and diversity of educational institutions for various health disorders of students. Each type of educational organization is aimed at educational, training and, most importantly, correctional work with children with disabilities for further independent existence in society.

Let's consider and analyze the term "Adapted educational program" (AEP).

L.V. Lyatifova, considers the term "Adaptation educational program" as a document listing special educational conditions for obtaining maximum results in meeting the educational needs of a child with disabilities in the process of education and upbringing[14].

S.V. Shchetinina, leaning on Art. 2 of the Federal Law, defines the term "Adapted educational program" as follows: an educational program intended for training persons with disabilities, taking into account their characteristics (mental, physiological, individual), if necessary, providing correctional activities and social adaptation[15]. Consequently, AEP is an important condition in educational activities that provides training and education for children with disabilities.

Having analyzed and generalized the specifics, we will determine the features of organizing the educational activities of children with disabilities:

1. Taking into account the characteristics of a student with disabilities, as well as the state of speech ability in the process of formation and development of the child's communication skills.

2. Mandatory inclusion of the student in educational activities that are motivated, positive, according to the physical/psychological capabilities of the student.

3. Support for the student at the stage of selecting means of communication for further communication with society.

4. Formation and encouragement of the development of interest in the active and independent activities of the student.

5. Ensuring free communication with ordinary people, in order to overcome the fear of communication and the language barrier.

Thus, the following concepts were considered: "inclusion", "inclusive education", "health limitations", "adapted educational programs". A classification of educational institutions by type of disability was given. Recommendations for pedagogical means of organizing cognitive-communicative learning activities for children with disabilities have also been identified.

[14] See: Lyatifova, L.V. Adapted educational program for primary and basic general education // Young scientist. – 2014. – No. 19 (78). – pp. 576-578.

[15] See: Shchetinina, S.V. Regulatory framework and algorithm for the development of adapted educational programs for higher education // Higher education today. – 2019. – No. 1. – P. 65-71.

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# 英语写作声音
# ENGLISH SOUNDS IN WRITING

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抽象的。 本文致力于研究俄罗斯联邦教育机构英语课堂教学工作者的教育活动中英语元音的图形拼写问题。 作者确定了音素图形拼写的主要方式，即用于形成相关声音的字母、字母组合和标点符号。

关键词：双元音、双元音、教育活动、英语、图形拼写、单元音、教育工作者。

***Abstract.*** *The article is devoted to the study of the problem of graphic spelling of English vowel sounds in educational activities of the pedagogical worker in English classes at educational institutions in the Russian Federation. The author identifies the main ways of graphic spelling of the phonemes, namely letters, combinations of letters and punctuation marks used in the formation of the sounds in question.*

***Keywords:*** *diphthongoids, diphthongs, educational activities, English, graphic spelling, monophthongs, pedagogical worker.*

First classes of English at the overwhelming majority of educational institutions in the Russian Federation make pedagogical workers solve a lot of vital issues while training their students within the main language aspects that are listening, speaking, reading and writing (such aspects as interpretation and translation are being omitted here since they are in the domain of a limited number of specialized Russian universities; for this reason transliteration, being a way of rendering lexical units in writing, is not the subject of our research). Writing universally seems to be the most complicated aspect in its mastering due to the fact that it is directly connected with grammar, lexicology, phonetics, punctuation, spelling and stylistics. One complexity of writing is “phonetics [12] vs spelling”

problem. In short, we mean a case when one letter or a group of letters contained in various lexical units [1] has several ways to be pronounced, e.g.: vowel letter *a* in the following lexical units: *plaque [a:], cradle [eɪ], adorn [ə], gall [o:], acrid [æ], Bologna [jə], vintage [ɪ], garish [ɛə], swab [ɔ]*; consonant letter *s*: *episode [s], fusion [ʒ], controversial [ʃ], liaison [z], Asia [ʃ]* or *[ʒ], CIS [es]* [5], [8]*;* double *oo*: *flood [ʌ], nook [ʊ], tattoo [u:], floor [o:], brooch [əʊ]*; a group of vowel and consonant letters *ough*: *through [u:], sought [o:], dough [əʊ], rough [ʌf], cough [ɔf], thorough [ə];* a combination of consonant letters *ch*: *avalanche [ʃ], chime [tʃ], ochre [k], Greenwich [dʒ]* [9], [10], [11].

To avoid bewildering in writing among students and to ensure that they will learn to write well is one of the primary tasks of the pedagogical worker in the initial and further stages of teaching English. This publication is a humble attempt to unfold our experience in classifying the modes of graphical spelling of 20 English vowels, temporarily omitting the consonant sounds [6], [7]. The relevance of the research work arose in the light of insufficient coverage of the multiple ways of graphical spelling of vowel and consonant phonemes and their combinations in textbooks currently applied in the educational process. Our research is based on the material of various extracts taken for our consideration from pieces of fiction, periodicals, textbooks, the Internet. We also dealt with corporate letters, movie subtitles, pieces of advertising; off-line and on-line dictionaries; reference books to contemporary English pronunciation [13]. We examined the parts of English speech and their transformations regarding case, degree, mood, number, tense and voice categories. It seemed natural for us to view abbreviations, acronyms, clipped words, interjections, loan words, etc, paying particular attention to such toponyms as geographic names, corporate names, days of the week, months, nationalities, people's names, patronymics and sur-names, social networks, astronyms, types of drinks, meals and food, etc. In the pages that follow are to be found specimens depicting English vowels.

**Monophthongs**

Vowel sound [Λ] can be represented by English letters *o* (e.g., *dozen [ˈdΛzn]*), *u* (*thus [ðΛs]*), *w (WTO [dΛbljuːtiːˈəʊ])* and by groups of letters *oe* (*does [dΛz]*), *oo* (*blood [blΛd]*), *ou* (*double [ˈdΛbl*), *uh* (*uh-huh [ΛˈhΛ])* or *[ʊˈhʊ]*). Sound [Λ] can be put in the opening (*oven [ˈΛvn]* or *[ˈΛvən]*) and central (*flood [flΛd]*) position of lexical units. One does not meet it in the neutral and ending position of lexical units. Monophthong [Λ] is represented by two vowel letters (*o, u)*, one consonant letter *(w*), three groups of vowel letters (*oe, oo, ou*). In one case, this phoneme is made in graphic spelling by a group of a vowel and a consonant letters (*uh*).

Vowel sound [a:] can be represented by letters *a* (*disater [dɪzˈa:stə]*), *e* (*ensemble [a:nˈsa:mbl]*), *r* (*R&D [a:(r)ənˈdi:]*) and by groups of letters *ah* (*Ah [a:]*), *al* (*almond [ˈa:mənd]*), *ar* (*arc [a:k]), are* (*aren't [ˈa:nt]*), *arre* (*bizarre [bɪˈza:]*),

*au* (*laugh [la:f]*), *ear* (*hearth [ha:θ]*), *er* (*sergeant [ˈsa:dʒənt]*), *ir* (*memoir [memˈwa:]*), *oi* (*turquoise [ˈtə:kwa:z]*), *ois* (*bourgeois [ˈbuəʒwa:]*), *uar (guard [ga:d])*. Sound [a:] can be put in the neutral (*Ah [a:]*, opening (*ask [a:sk]*), central (*barley [ˈba:lɪ]*) and ending (spa *[spa:]*) position of lexical units. Monophthong [a:] is represented by two vowel letters (*a*, *e)*, one consonant letter *(r*) and 12 groups of letters (*Ah, al*, *ar, are, arre, au, ear, er, ir, oi, ois, uar*). In two cases, this phoneme is made in graphic spelling by groups of vowel letters (*au, oi*), in ten cases by groups of vowel and consonant letters (*Ah, al*, *ar, are, arre, ear, er, ir, ois, uar*).

Vowel sound [ɪ] can be represented by letters *a* (*image [ˈɪmɪdʒ]*), *e* (*depart [dɪˈpa:t]*), *e* or *i* (*enquire/inquire [ɪnˈkwaɪə]*), *i* (*inlet [ˈɪnlet]*), *o* (*women [ˈwɪmɪn]*), *u* (*busy [ˈbɪzɪ]*), *y* (*hymn [hɪm]*), by French letter *é* (*protégé [ˈprɔtɪʒeɪ]*) and by groups of the letters *ae* (*palaeontology [pælɪɔnˈtɔlədʒɪ]*), *ai* (*fountain [ˈfauntɪn]*), *ay* (*Friday [ˈfraɪdɪ]*), *ea* (*Guinea [ˈgɪnɪ]*), *ee* (*yankee [ˈjæŋkɪ]*), *ehea* (*forehead [ˈfɔrɪd]*), *ei* (*forfeit [ˈfo:fɪt]*), *eig* (*sovereign [ˈsovərɪn]*), *eo* (*pigeon [ˈpɪdʒɪn]* or *[ˈpɪdʒən])*, *ey* (*kidney [ˈkɪdnɪ]*), *ia* (*marriage [ˈmærɪdʒ]*), *ie* (*kerchief [ˈkə:tʃif]*), *ui* (*guild [gɪld]*), *wi* (*Greenwich [ˈgrɪnɪdʒ]*).

Sound [ɪ] can be put in the opening (*ink [ɪŋk]*), central (*climate [ˈklaɪmɪt]*) and ending (*plenty [ˈplentɪ]*) position of lexical units. One does not meet it in the neutral position. Monophthong [ɪ] is represented by seven vowel letters (*a, e, i, o, u, y, é*) and 14 groups of letters (*ae, ai, ay, ea, ee, ehea, ei, eig, eo, ey, ia, ie, ui, wi*). In 11 cases, this phoneme is made in graphic spelling by groups of vowel letters (*ae, ai, ay, ea, ee, ei, eo, ey, ia, ie, ui*), in three cases by groups of vowel and consonant letters (*ehea, eig, wi*).

Vowel sound [ɔ] can be represented by letters *a* (*wrath [rɔθ]*), *e* (*entrepreneur [ɔntrəprəˈnə:]* or *[a:ntrəprəˈnə:])*, *o* (*inoculate [ɪˈnɔkjuleɪt*) and by groups of letters *ach* (*yacht [jɔt]*), *au* (*sausage [ˈsɔsɪdʒ]*), *ea* (*Sean [ʃɔn]), ho* (*honest [ˈɔnɪst]), oh* (*John [dʒɔn]*), *ou* (*lough [lɔh])*, *ow* (*knowledge [ˈnɔlɪdʒ]).* Sound [ɔ] can be put in the opening (*onto [ˈɔntu:]*) and central (*pond [pɔnd]*) position of lexical units. One does not meet it in the neutral and ending position of lexical units. Monophthong [ɔ] is represented by three vowel letters (*a*, *e, o*) and seven groups of letters (*ach, au, aw, ea, ho, oh, ou*). In three cases, this phoneme is made in graphic spelling by groups of vowel letters (*au, ea, ou*) and in four cases by groups of vowel and consonant letters (*ach, aw, ho, oh*).

Vowel sound [o:] can be represented by letters *a* (*gall [go:l]*), *o* (*sanatorium [sænəˈto:rɪəm]*) and by groups of letters *al* (*stalk [sto:k]*), *aor* (*extraordinary [ɪksˈtro:dənərɪ]*), *ar* (*swarm [swo:m]), au* (*taunt [to:nt]*), *augh* (*naught [no:t]), aw* (*thaw [θo:]), awe* (*awesome [ˈo:səm]), hau* (*haut* or *haute [o:t]*), *oa* (*broad [bro:d]), oar* (*hoard [ho:d]), oor (floor [flo:]), or* (*enforce [ɪnˈfo:s]), ore* (*pore [po:]*), *orps* (*corps [ko:]*), *ort* (*rapport [ræˈpo:]*), *ough* (*ought [o:t]*), *our* (*four*

*[fo:]*), *wor* (*sword [so:d]*). Sound [o:] can be put in the neutral (*or [o:]*), opening (*all [o:l]*), central (*walk [wo:k]*) and ending (*door [do:]*) position of lexical units. Monophthong [o:] is represented by two vowel letters (*a*, *o*) and eighteen groups of letters (*al, aor, ar, au, augh, aw, awe, hau, oa, oar, oor, or, ore, orps, ort, ough, our, wor*). In two cases, this phoneme is made in graphic spelling by groups of vowel letters (*au, oa*) and in sixteen cases by groups of vowel and consonant letters (*al, aor, ar, augh, aw, awe, hau, oar, oor, or, ore, orps, ort, ough, our, wor*).

Vowel sound [ʊ] can be represented by letters *o* (bosom *[ˈbʊzəm]), u* (*bull [bʊl]*) and by groups of letters *oo (*nook *[nʊk]), ou (haute couture [əʊtkʊˈtjʊə]), oul (should [ʃʊd])*. Sound [ʊ] can be put in the opening *(Ugh [ʊh])* and central (*butcher [ˈbʊtʃə]*) position of lexical units. One does not meet it in the neutral and ending position of lexical units. Monophthong [ʊ] is represented by two letters (*o*, *u*) and three groups of letters (*oo, ou, oul*). In two cases, this phoneme is made in graphic spelling by groups of vowel letters (*oo, ou*) and in one case by a group of vowel and consonant letters (*oul*).

Vowel sound [æ] can be represented by letters *a* (*acrid [ˈækrɪd]*), *i* (*meringue [məˈræŋ]*) and by groups of letters *ai* (*plait [plæt]*), *a'a* (*ma'am [mæm]*), *ua* (*guarantee [gærənˈti:]*). Sound [æ] can be put in the opening (*act [ækt]*), central (*pad [pæd]*) and ending (*Nah* or *Nahh [næ]*) position of lexical units. One does not meet it in the neutral position. Monophthong [æ] is represented by two letters (*a*, *i*), two groups of vowel letters (*ai*, *ua*) and a combination of a vowel letter and the apostrophe (*a'a*).

Vowel sound [e] can be represented by letters *a* (*ate [et]* or *[eɪt]*), *e (peril [ˈperəl]), u (bury [ˈberɪ]), f (FOB [efəʊˈbi:]), l (LTD [elti:ˈdi:]), m (BMW [bi:emˈdʌblju:]), n (NGO [endʒi:ˈəʊ:]), s (SOS [esəʊˈes]), x* (x-ray *[ˈeksreɪ]*), *z* (ZT *[zed'ti:]*), by French letter *é* (*apéritif [əˈperəti:f]*) and by groups of letters *ai* (*said [sed]*), *ea* (*pleather [ˈpleðə]*), *eg* (*phlegm [flem]*), *ei* (*leisure [ˈleʒə]*), *eo* (*jeopardize [ˈdʒepədaɪz]*), *ie* (*friend [frend]*), *ue* (*baguette [bæˈget]*). Sound [e] can be put in the opening (*embassy [ˈembəsɪ]*) and central (*twenty [ˈtwentɪ]*) position of words. One does not meet it in the neutral and ending position of lexical units. Monophthong [e] is represented by four vowel letters (*a, e, u, é*), seven consonant letters (*f, l, m, n, s, x, z*) and seven groups of letters (*ai, ea, eg, ei, eo, ie, ue*). In six cases, this phoneme is made in graphic spelling by groups of vowel letters (*ai, ea, ei, eo, ie, ue*) and in one case by a group of vowel and consonant letters (*eg*).

Vowel sound [ə:] can be represented by groups of letters *ieu* (*milieu [ˈmɪljə:]*), *ear* (*pearl [pə:l]*), *eor* (*George [dʒə:dʒ]*), *er* (*tertiary [ˈtə:fərɪ]*), *ere* (*were [wə:]*), *err (inferred [ɪnˈfə:d]), eur* (*amateur [ˈæmətə:]* or *[ˈæmətə]*), *ir* (*dirge [də:dʒ]*), *olo* (*colonel [ˈkə:nəl]*), *or* (*attorney [əˈtə:nɪ]*), *our* (*courtesy [ˈkə:təsɪ]*), *ur* (*nocturnal [nɔkˈtə:nəl])*. Sound [ə:] can be put in the neutral (*Er [ə:]*), opening (*ear-*

*nest [ˈəːnɪst]*), central (*hurt [ˈhəːt]*) and ending (*infer [ɪnˈfəː]*) position of lexical units. Monophthong [əː] is represented by 12 groups of letters (*ear, eor, er, ere, erre, eur, ieu, ir, olo, or, our, ur*). In one case, this phoneme is made in graphic spelling by a group of vowel letters (*ieu*) and in 11 cases by groups of vowel and consonant letters (*ear, eor, er, ere, erre, eur, ir, olo, or, our, ur*).

Vowel sound [ə] can be represented by letters *a* (*abrupt [əˈbrʌpt]*), *e* (*fraudulent [ˈfroːdjələnt]*), *i* (*principal [ˈprɪnsəpl]*), *o* (*custody [ˈkʌstədɪ]*), *u* (*focus [ˈfəʊkəs]*) and by groups of letters *ai* (*villain [ˈvɪlən]*), *ar* (*leopard [ˈlepəd]*), *ay* (*always [ˈoːlwəz]* or *[ˈoːlweɪz]*), *ea* (*sergeant [ˈsaːdʒənt]*), *eo* (*sturgeon [ˈstəːdʒən]*), *eou* (*outrageous [autˈreɪdʒəs]*), *er* (*southern [ˈsʌðən]*), *er* or *re* (*fibre* or *fiber [ˈfaɪbə]*), *eu* (*pasteurize [ˈpæstʃəraɪz]*), *eur* (*chauffeur [ˈʃəʊfə]* or *[ˈʃəʊfəː]*), *gh (Edinburgh [ˈedɪnb(ə)rə]*), *hu* (*sorghum [ˈsoːgəm]*), *ia* (*initial [ɪˈnɪʃəl]*), *ie* (*sufficient [səˈfɪʃənt]*), *io* (*tension [ˈtenʃən]*), *iou* (*vicious [ˈvɪʃəs]*), *iour* (*saviour [ˈseɪvjə]*), *iu* (*premium [ˈpriːmjəm]* or *[ˈpriːmɪəm]*), *oar* (*cupboard [ˈkʌbəd]*), *oi (tortoise [ˈtoːtəs]), or* (*tailor [ˈteɪlə]*), *ou* (*ominous [ˈɔmɪnəs]*), *ough* (*thorough [ˈθʌrə]*), *o(u)r* (*vigour* or *vigor [ˈvɪgə]*), *re* (*macabre [məˈkaːbə]* or *[məˈkaːbr]*), *ue* (*guerilla [gəˈrɪlə]*), *uer* (*lacquer [ˈlækə]*), *uor* (*liquor [ˈlɪkə]*), *ur* (*surmountable [səˈmauntəbl]*), *ure* (*torture [ˈtoːtʃə]*), *wer* (*answer [ˈaːnsə]*), by a combination of the apostrophe (‘), a consonant and a vowel letters *‘re* (*we’re [ˈwɪə]*), a vowel letter and the apostrophe *o’ (o’clock [əˈklɔk])*. Sound [ə] can be put in the opening (*about [əˈbaut]*), central (*tenant [ˈtenənt]*), central and ending simultaneously (*opera [ˈopərə]*) and ending (*clever [ˈklevə]*) position of lexical units. One does not meet it in the neutral position. Monophthong [ə] is represented by five letters (*a, e, i, o, u*), by 30 groups of letters (*ai, ar, ay, ea, eo, eou, er, eu, eur, gh, hu, ia, ie, io, iou, iour, iu, oar, oi, or, ou, ough, o(u)r, re, ue, uer, uor, ur, ure, wer*), by one group of consonant letters (*gh*), by one combination of a punctuation sign (the apostrophe), a consonant and a vowel letters (*‘re*) and by one combination of a vowel letter and a punctuation sign (the apostrophe) (*o‘*). In 14 cases, this phoneme is made in graphic spelling by groups of vowel letters (*ai, ay, ea, eo, eou, eu, ia, ie, io, iou, iu, oi, ou, ue*), in 15 cases by a group of vowel and consonant letters (*ar, er, eur, hu, iour, oar, or, ough, o(u)r, re, uer, uor, ur, ure, wer*), in one case by a group of consonant letters (*gh)*.

**Diphthongs**

The vowel sound [aʊ] can be represented by combinations of English letters *au* (e.g. *Saudi Arabia – [saudɪəˈreɪbɪə]*), *ou* (*tousle – [ˈtauzl]* or *[ˈtauzəl]*), *ough* (*plough – [plau]*), *ow* (*scowl – [skaul]*). The sound [aʊ] can be placed in the zero (*Ow – [au]*), initial (*out – [aut]*), middle (*house – [haus]*) and final (*brow – [brau]*) position of words. The diphthong [aʊ] is represented by four combinations of letters (*au, ou, ough, ow*). In two cases, this phoneme is formed in graphic spelling by combinations of vowel letters (*au, ou*) and in two cases – by combinations of vowel and consonant letters (*ough, ow*).

The vowel sound [ɔɪ] can be represented by combinations of letters *oi* (*moist – [mɔɪst]*), *ois* (*Illinois – [ɪlɪˈnɔɪ]*), *oy* (*deploy – [dɪˈplɔɪ]*). The sound [ɔɪ] can be placed in the initial (*oyster – [ˈɔɪstə]*), middle (*avoid – [əˈvɔɪd]*) and final (*destroy – [dɪˈstrɔɪ]*) position of words. The diphthong [ɔɪ] is represented by three combinations of letters (*oi, ois, oy*). In two cases, this phoneme is formed in graphic spelling by combinations of vowel letters (*oi, oy*) and in one case – by a combination of vowel and consonant letters (*ois*).

The vowel sound [ɪə] can be represented by the letter *e* (*query – [ˈkwɪərɪ]*) and by combinations of letters *ea* (*ideal – [aɪˈdɪəl]*), *ear* (*sear – [sɪə]*), *eer* (*veneer – [vɪˈnɪə]* or *[vəˈnɪə]*), *eir* (*weird – [wɪəd]*), *eo* (*theory – [ˈθɪərɪ]*), *eou* (*hideous – [ˈhɪdɪəs]*), *ere* (*adhere – [ədˈhɪə]*), *eu* (*linoleum – [lɪˈnəʊlɪəm]*), *hea* (*gonorrhea – [gɔnəˈrɪə]*), *ia* (*guardian – [ˈgaːdɪən]*), *iar* (*peculiar – [pɪˈkjuːlɪə]*), *ie* (*nutrient – [ˈnjuːtrɪənt]*), *ier* (*pierce – [pɪəs]*), *io* (*oblivion – [əbˈlɪvɪən]*), *ior* (*warrior – [ˈwɔrɪə]*), *iou* (*tedious – [ˈtiːdɪəs]*), *ir* (*souvenir – [suːvəˈnɪə]*), *iu* (*premium – [ˈpriːmɪəm]*), *ya* (*Libya – [ˈlɪbɪə]*). The sound [ɪə] can be placed in the zero (*ear – [ɪə]*), initial (*earshot – [ˈɪəʃɔt]*), middle (*material – [məˈtɪərɪəl]*) and final (*fear – [fɪə]*) position of words. The diphthong [ɪə] is represented by one letter (*e)* and 19 combinations of letters (*ea, ear, eer, eir, eo, eou, ere, eu, hea, ia, iar, ie, ier, io, ior, iou, ir, iu, ya*). In 10 cases, this phoneme is formed in graphic spelling by combinations of vowel letters (*ea, eo, eou, eu, ia, ie, io, iou, iu, ya*) and in nine cases – by combinations of vowel and consonant letters (*ear, eer, eir, ere, hea, iar, ier, ior, ir*).

The vowel sound [əʊ] can be represented by the letter *o* (*rodent – [ˈrəʊdnt]* or *[ˈrəʊdənt]*) and by combinations of letters *aoh* (*pharaoh – [ˈfɛərəʊ]*), *au* (*sauté – [ˈsəʊteɪ]*), *eau* (*plateau – [ˈplætəʊ]*), *eou* (*Seoul – [səʊl]*), *ew* (*sew – [səʊ]*), *hau* (*haute couture – [əʊtkʊˈtuə]*, *[əʊtkʊˈtjuə]* or *[əʊtkuːˈtjuə]*), *ho* (*Rhode Island – [rəʊdˈaɪlənd]*), *‘ho (table d’hote – [taːblˈdəʊt]* or *[taːbəlˈdəʊt]), oa* (*float – [fləʊt]*), *oe* (*foe – [fəʊ]*), *ol* (*folk – [fəʊk]*), *oo* (*brooch – [brəʊtʃ]*), *ou* (*soul – [səʊl]*), *ough* (*dough – [dəʊ]*), *ow* (*mellow – [ˈmeləʊ]*), *owe* (*owe – [əʊ])*. The sound [əʊ] can be placed in the zero (*Oh – [əʊ]*), initial (*own – [əʊn]*), middle (*note – [nəʊt]*) and final (*polo – [ˈpəʊləʊ]*) position of words. The diphthong [əʊ] is represented by one letter (*o*), by 15 combinations of letters (*aoh, eau, au, eou, ew, hau, ho, oa, oe, ol, oo, ou, ough, ow, owe*) and by one combination of the apostrophe, a consonant and a vowel letters (*‘ho*). In seven cases, this phoneme is formed in graphic spelling by combinations of vowel letters (eau, au, eou, oa, oe, oo, ou), in eight cases – by combinations of vowel and consonant letters (*aoh, ew, hau, ho, ol, ough, ow, owe*) and in one case – by a combination of the apostrophe and letters (*‘ho*).

The vowel sound [aɪ] can be represented by the letters *i* (*grime – [graɪm]*), *y* (*ply – [plaɪ]*) and by combinations of letters *ei* (*skein – [skaɪn]*), *eigh* (*height – [haɪt]*),

*ey* (*geyser – [ˈgaɪzə]*), *eye* (*eye – [aɪ]*), *ie* (*tie – [taɪ]*), *ig* (*benign – [bɪˈnaɪn]*), *igh* (*knight – [naɪt]*), *ui* (*disguise – [disˈgaɪz]*), *uy* (*buy – [baɪ]*), *ye* (*bye – [baɪ]*). The sound [aɪ] can be placed in the zero (*I – [aɪ]*), initial (*either – [ˈaɪðə]*), middle (*neither – [ˈnaɪðə]*) and final (*verify – [ˈverɪfaɪ]*) position of words. The diphthong [aɪ] is represented by two letters (*i*, y) and by 10 combinations of letters (*ei, eigh, ey, eye, ie, ig, igh, ui, uy, ye*). In seven cases, this phoneme is formed in graphic spelling by combinations of vowel letters (*ei, ey, eye, ie, ui, uy, ye*) and in three cases – by combinations of vowel and consonant letters (*eigh, ig, igh*).

The vowel sound [ʊə] can be represented by the letter *u* (*rural – [ˈrʊərl]* or *[ˈrʊərəl]*) and by combinations of letters *ewer* (*skewer – [ˈskjʊə]*), *oor (moor – [mʊə]* or *[mo:]*), *our (dour – [dʊə]*), *ua* (*septuagenarian – [septjʊədʒɪˈnɛərɪən]*), *uar* (*Stuart – [ˈstjʊət]*), *ue* (*fuel – [fjʊəl]*), *ueur* (*liqueur– [lɪˈkjʊə]*), *uou* (*sumptuous – [ˈsʌmptʃʊəs]* or *[ˈsʌmptʃjʊəs]*), *ure* (*obscure – [ɔbsˈkjʊə]*). The sound [ʊə] can be placed in the middle (*gourmet – [ˈgʊəmeɪ]*) and final (*poor – [pʊə]*) position of words. The diphthong [ʊə] is represented by one letter (*u*) and by nine combinations of letters (*ewer, oor, our, ua, uar, ue, ueur, uou, ure*). In three cases, this phoneme is formed in graphic spelling by combinations of vowel letters (*ua, ue, uou*) and in six cases – by combinations of vowel and consonant letters (*ewer, oor, our, uar, ueur, ure*).

The vowel sound [ɛə] can be represented by the letters *a* (*pharaoh – [ˈfɛərəʊ]*), *e* (*wisteria – [wɪsˈtɛərɪə]*) and by combinations of letters *ae* (*aerodynanics – [ɛərədaɪˈnæmɪks]*), *ai* (*dairy – [ˈdɛərɪ]*), *air* (*fair – [fɛə]*), *aire* (*questionnaire – [kwestʃəˈnɛə]*), *are* (*welfare – [ˈwelfɛə]*), *ayor* (*mayor – [mɛə]*), *ear* (*forebear – [ˈfo:bɛə]*), *eir* (*their – [ðɛə]*), *er* (*concierge – [konsɪˈɛəʒ]*), *ere* (*therefore – [ˈðɛəfo:]*). The sound [ɛə] can be placed in the zero (*air – [ɛə]*), initial (*area – [ˈɛərɪə]*), middle (*whereas – [wɛəˈræz]*) and final (*where – [wɛə]*) position of words. The diphthong [ɛə] is represented by two letters (*a, e*) and by ten graphic combinations of letters (*ae, ai, air, air, are, ayor, ear, eir, er, ere*). In two cases, this phoneme is formed in graphic spelling by combinations of vowel letters (*ae, ai*) and in eight cases – by combinations of vowel and consonant letters (*air, aire, are, ayor, ear, eir, er, ere*).

The vowel sound [eɪ] can be represented by the vowel letters *a* (*slate – [sleɪt]*) and *e* (*elite – [eɪˈli:t]*), by the consonant letters *h* (*PhD – [pi:eɪtʃˈdi:]*), *j* (*J.F Kennedy – [dʒeɪefˈkenedɪ]*) and *k (KGB – [keɪdʒi:ˈbi:]),* by the French letter *é* (*protégé – [ˈprɔtɪʒeɪ]*) and by combinations of letters *ae* (*Gaelic – [ˈgeɪlɪk]*), *ag* (*champagne – [ʃæmˈpeɪn]*), *ai* (*maim – [meɪm]*), *aig* (*campaign – [kæmˈpeɪn]*), *aigh* (*straight – [streɪt]*), *ay* (*relay – [ri:ˈleɪ]*), *ea* (*steak – [steɪk]*), *ee* or *ée* (*matinee – [ˈmætɪneɪ], entrée – [ˈɔntreɪ]* or *[ˈa:ntreɪ]*), *ei* (*abseil – [ˈæbseɪl]*), *eig* (*reign – [reɪn]*), *eigh* (*freight – [freɪt]*), *er* (*foyer – [ˈfɔɪeɪ]*), *et* (*gourmet – [ˈgʊəmeɪ]*), *ey* (*fey – [feɪ]*), *oa* (*gaol – [dʒeɪl]*), *uet* (*bouquet – [bʊˈkeɪ]*). The sound [eɪ] can

be placed in the zero (*Eh – [eɪ]*), initial (*eight – [eɪt]*), middle (*tame – [teɪm]*) and final (*bay – [beɪ]*) position of words. The diphthong [eɪ] is represented by six letters (*a*, *e*, *h, j, k, é*), three of which are vowels and three are consonants, five are English and one is French, by 17 graphic combinations of letters (*ae, ag, ai, aig, aigh, ay, ea, ee, ée, ei, eig, eigh, er, et, ey, oa, uet*). In nine cases, this phoneme is formed in spelling by combinations of vowel letters (*ae, ai, ay, ea, ee, ée, ei, ey, oa*) and in eight cases – by combinations of vowel and consonant letters (*ag, aig, aigh, eig, eigh, er, et, uet*).

**Diphthongoids**

Vowel sound [i:] can be represented by vowel letters *e* (*genius [ˈdʒi:nɪəs]*), *i* (*fatigue [fəˈti:g]*), by consonant letters *b (BBC [bi:bi:ˈsi:]), c (CNN [si:enˈen]), d (PhD [pi:eɪtʃˈdi:]), g (NGO [endʒi:ˈəʊ]), p (PA [pi:ˈeɪ]), t (t-shirt [ˈti:ʃə:t]), v (VIP [vi:aɪˈpi:]), z* (Zz *[zi:]*), by French letter *ï* (*naïve [naɪˈi:v]* or *[na:ˈi:v]* or *naive [na:ˈi:v]*), and by groups of letters *ae* (*algae [ˈældʒi:]*), *ea* (*grease [gri:s]*), *ee* (*seethe [si:ð]*), *eh* (*vehicle [ˈvi:ɪkl]*), *ei* (*protein [ˈprəʊti:n]*), *eo* (*people [ˈpi:pl]*), *ey* (*key [ki:]*), *ie* (*retrieve [rɪˈtri:v]*), *oe* (*Phoenix [ˈfi:nɪks]*), *uay* (*quay [ˈki:]*). Sound [i:] can be put in the opening (*eat [i:t]*), central (*scheme [ski:m]*) and ending (*payee [peɪˈi:]*) position of lexical units. One does not meet it in the neutral position. Diphthongoid [i:] is represented by three vowel letters (*e, i, ï*), by eight consonant letters (*b, c, d, g, p, t, v, z*) and by 10 groups of letters (*ae, ea, ee, eh, ei, eo, ey, ie, oe, uay*). In nine cases, this phoneme is made in graphic spelling by groups of vowel letters (*ae, ea, ee, ei, eo, ey, ie, oe, uay*) and in one case by a group of a vowel and a consonant letters (*eh*).

Vowel sound [u:] can be represented by vowel letters *o* (*tomb [tu:m]*), *u* (*ruth [ru:θ]*), by consonant letters *q (IQ [aɪˈkju:]), w (WC dʌbljuːˈsi:])* and by groups of letters *eau* (*beauty [ˈbju:tɪ]*), *eu* (*pharmaceutical [fa:məˈsju:tɪkəl]*), *eu* or *oeu* (*maneuver* or *manoeuver [məˈnu:və]*), *ew* (*screw [skru:]*), *heu* (*rheum [ru:m]*), *hou* (*ghoul [gu:l]*), *iew* (*review [rɪˈvju:]*), *oe* (*canoe [kəˈnu:]*), *oo* (*maroon [məˈru:n]*), *ou* (*acoustics [əˈku:stɪks]*), *ough* (*through [θru:]*), *ue* (*rue [ru:]*), *ueue* (*queue [kju:]*), *ui* (*bruise [bru:z]*), *wo* (*two [tu:]*). Sound [u:] can be put in the opening (*Oops [u:ps]*), central (*shrewd [ʃru:d]*) and ending (*bamboo [bæmˈbu:]*) position of lexical units. One does not meet it in the neutral position. Diphthongoid [u:] is represented by two vowel letters (*o, u*), two consonant letters (*q, w*) and by 16 groups of letters (*eau, eu, eu, ew, heu, hou, iew, oe, oeu, oo, ou, ough, ue, ueue, ui, wo*). In ten cases, this phoneme is made in graphic spelling by groups of vowel letters (*eau, eu, eu, oe, oeu, oo, ou, ue, ueue, ui*) and in six cases by groups of vowel and consonsnt letters (*ew, heu, hou, iew, ough, wo*).

To sum up, we must note that the solution to the problem of graphic spelling of the vowels is still for the most part in its infancy. No single spelling rule can guarantee uniformed pronunciation of this or that vowel phoneme, that is why the

best way to specify correct pronunciation of a lexical unit remains in looking it up in off-line and on-line dictionaries. However, the ways of graphic spelling of the vowels described by us can simplify to some extent this process in the initial and further stages of teaching English at educational institutions in the Russian Federation.

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# 根据项目讲述方法的逻辑对教育组织进行项目有效性评估
# PROJECT EFFECTIVENESS ASSESSMENT IN EDUCATIONAL ORGANIZATIONS IN THE LOGIC OF THE PROJECT-TELLING METHODOLOGY

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注解。　　目前的工作致力于项目讲述方法中教育组织中项目有效性评估的标准，详细了解了五种技术的使用：项目统计、项目或自我观察的明确评估、项目工件的评估、　评估组织的变化，分析目标受众的反馈。

关键词：项目讲述、项目、教育组织营销、大学定位、学院定位、教育组织专业知识、教育组织认可、教育服务市场、项目效果评估体系。

***Annotation.*** *The present work is devoted the criteria for the project effectiveness assessment in educational organization in the Project-telling methodology, learned in detail about the use of five technologies: project statistics, express assessment of the project or self-observation, assessment of project artifacts, assessment of changes in the organization, analysis of feedback from target audience.*

***Keywords:*** *Project-telling, project, marketing of educational organizations, positioning of universities, positioning of colleges, expertise of educational organizations, recognition of educational organizations, market for educational services, project effectiveness assessment system.*

Actuality of Project effectiveness assessment in educational organizations is connected with the process of developing the project, the social and image obligations undertaken by the organization to the target audience when implementing the project and testing the project in the implementation format required significant financial and labor costs. To decide on the ineffectiveness and termination of a project with significant investments of intellectual and economic resources, such a balanced analysis is necessary.

The purpose of the article is considered, how to analyze the effectiveness of a project using Project-telling logic.

Project-telling are projects for positioning an educational organization, with the features of PR projects, which, on the one hand, are an investment of the

organization in development, on the other hand, we are talking about a special method of project implementation, when a product is created, a result that covers the costs of carrying out project and, ideally, profitable. Therefore, the economic component in assessing the effectiveness of a project will not be as deep as in classical approaches to assessing business and technology projects[1].

The result is the main guideline for project implementation in the Project-telling logic. However, the assessment of effectiveness among different team members can vary significantly depending on the experience gained as a result of the project, the circle of friends in the project, the nature of communications with the target audience of the project, and even mood. Therefore, objective assessments of the project's effectiveness are necessary. Taking into account the specifics of project activities - complexity, innovation, novelty, an assessment system is needed that allows you to comprehensively see the objective result of a long journey and activity.

A system for assessing the effectiveness of the project should be developed in the project methodology, because efficiency and result are a measurement of achieving the project goal.

The focus of a developed project effectiveness assessment system should be on measurability - how will we know that the project is successful?

The basic principle of project activity in an organization using the Project-telling methodology is changes, progress in a certain topic.

Therefore, before the start of the project implementation, it is necessary to describe in detail the indicators of the current situation of the topic, problems in the educational organization from the point of view of measurable indicators, or to collect a system of indicators from available statistics. And upon completion of the project, carefully analyze the dynamics of indicators. It should be noted that changes in education may not occur as quickly as in business. Therefore, you should also establish the frequency with which these indicators will need to be monitored. As a rule, the period of observation of changes in indicators based on the results of project implementation in educational organizations does not exceed 1 year or full cycle of the educational process.

Another important aspect of project effectiveness assessment is using the Project-telling methodology is the interpretation of the dynamics of the organization's performance indicators.

Several scenarios are possible:

1) when developing a project, in the section for developing project performance indicators, planned indicators of changes are immediately established.

2) the design of project performance indicators is carried out in the logic of testing the hypothesis of expected qualitative changes.

[1] Anisimova I.A. Project-telling: positioning by projects / Anisimova I.A. - Moscow: Litres, 2024. - 177 p. - ISBN - 978-5-532-90770-6.

3) a mixed form, in which some of the indicators may be obligatory numbers to achieve, and some are open to monitoring the dynamics of change.

It is possible to draw unambiguous conclusions about the ineffectiveness of a project in cases of negative dynamics of indicators identified as markers of project effectiveness. For example, when a career guidance project for applicants was developed and implemented, and the number of applications for admission and the number of students willing to study on a paid basis during the admissions campaign decreased compared to last year.

If there are no changes, a careful analysis of the project effectiveness assessment system is required: to what extent the selected system of indicators is capable of reflecting performance is consistent with the goals of the project. If, based on the results of the analysis, the project development team comes to the conclusion that the assessment tools fully corresponded to the project's objectives and the assessment system was unable to record changes and results following the implementation of the project, then we can talk about the ineffectiveness of the project. In cases where the assessment system raises doubts about its instrumental role in relation to the implemented project, if resources are available, it is possible to refine the project methodology, the system for assessing project results and re-implementation.

To evaluate projects using the Project-telling method, you can use 5 technologies:

a. Project statistics

b. Express project assessment or self-examination,

c. Evaluation of project artifacts,

d. Assessing changes in the organization,

e. Analysis of feedback from the target audience.

Let's consider the system of criteria in each of the technologies for assessing the effectiveness of a project.

*1. Project statistics – a quantitative snapshot of the project, showing the scale of coverage and involvement in the project.*

Most often, project statistics are needed for information materials about the project, but at the same time, this is the first layer for the project manager to analyze. As a rule, project statistics include the number of participants, the number of experts, authors, the number of employees who worked on the project, the number of project events (it is possible to detail the types of events - business, informational, daily, developmental, educational, entertainment), the number of days of implementation project, number of project partners (details by type are possible - information, educational partners, sponsors), number of stakeholders, etc.

*2. Express assessment of the project is based on the self-assessment of the project development and implementation team and is a self-observation sheet on the process of working on the project.*

The subject of the assessment is the process of development and implementation of the project:

a) duration of project development;

b) problems encountered during the project implementation stage;

c) conflict situations;

d) number of applications at the start of project;

e) number of refusals to participate for one reason or another;

f) constancy of the team in working on the project - staff turnover;

g) deviation of implementation from the original project;

i) comments voiced by the target audience;

j) gratitude voiced by the target audience;

k) project deficits;

l) project surplus (which was a wasted investment).

Analyzing the effectiveness of the project using an express method based on self-observation will help evaluate the process of development and implementation of the project, evaluate the quality of project management, observe factors and problems in project management that could have a significant impact on achieving objective project indicators, and evaluate the team's capabilities in implementing similar projects in the future.

*3. The evaluation of project artifacts is based on a checklist for achieving the project indicators laid down during its development.*

In any well-meaningful project, during development, the indicators that are planned to be achieved as a result of the project are prescribed. As a rule, such indicators in state projects are associated with the production of material or intellectual objects, services, digital services that can be counted and presented.

Artifact evaluation describes the actual outcome of the project and its quantitative implementation.

What could be the result of the project? There are books, trainings, events, websites, landing pages, mobile applications, registered IT products and technical developments, research, registered programs, courses, techniques, laboratories, new organizations, scientific and educational institutions, divisions, concluded contracts, etc.

Analysis of project artifacts shows an assessment of the achievement of the result as such, in full or in part, the result of the project's production cycle, starting from zero indicators at the start of the project and the quantity at the end of the project.

*4. The assessment of changes and significance for an educational organization is based on an analysis of the balance of investments and benefits from the development and implementation of the project.*

The focus of this assessment technology is the effect that the project had on changing the economy and communications of an educational organization. The

project-telling approach to the development and implementation of a project takes into account not only the achievement of favorable statistical indicators, the process and the result of the project, but also the added value - those consequences - financial, economic, marketing, which the organization acquires upon completion of the project. Only in this case does the project cease to be a project for the sake of a project and opens up broad opportunities that the organization can use as additional and accelerated growth points.

To assess a quantitative analysis of the following indicators is required:

1. Financial ratio in absolute values and shares of costly and profitable budget items of the entire organization):

- ✓ Expenses of implementing the project, including wages (and bonuses) to employees, and the organization's profit from the "sales" of project products,
- ✓ Expenses of implementing the project, including wages (and bonuses) to employees, and the dynamics of the organization's profit from the sale of the organization's basic services.
- ✓ Expenses of implementing the project, including salaries (and bonuses) to employees, and a financial estimate of the profit from contracted future projects based on the results of the original project.

2. Conversion of consumers of the organization's main services and products:

- ✓ The dynamics of the number of applicants for specialized project specialties, in general,
- ✓ The dynamics of the number of applicants for project-related specialties from among the direct participants of the project,
- ✓ The dynamics of the number of students in specialized continuing education programs, in general,
- ✓ The dynamics of the number of students of specialized further education programs from among the direct participants of the project,
- ✓ The dynamics of the number of requests for joint research projects according to the project profile, in general,
- ✓ The dynamics of the number of requests for joint research projects from among project stakeholders,
- ✓ The dynamics of the number of requests for joint research projects from among the project partners,
- ✓ The dynamics of the number of requests for joint research projects from among the organizations participating in the project
- ✓ The dynamics of the number of requests for joint educational programs from among project stakeholders
- ✓ The dynamics of the number of requests for joint educational programs from among the project partners,
- ✓ The dynamics of the number of applications for joint educational programs from among the organizations participating in the project

- ✓ The dynamics of the number of grants and subsidies that become available after the implementation of the project.
- ✓ The dynamics of increase in the state task, which becomes possible based on the results of the project implementation.
- ✓ The dynamics of development of the organization's human resources in the area of project implementation.

3. Potential investment portfolio of the project

With this framework, the organization's income from the potential implementation of all requests from target groups (as part of the conversion of consumers of the organization's main services and products) is assessed. In particular:

- ✓ Income from an increased number of applicants for specialized project specialties, in general,
- ✓ Income from an increased number of applicants for project-related specialties from among the direct participants of the project,
- ✓ Income from the increased number of students in specialized continuing education programs, in general,
- ✓ Income from an increased number of students in specialized continuing education programs from among the direct participants of the project,
- ✓ Income from an increased number of requests for joint research projects in the project profile, in general,
- ✓ Income from an increased number of requests for joint research projects from among project stakeholders,
- ✓ Income from an increased number of requests for joint research projects from among the project partners,
- ✓ Income from an increased number of requests for joint research projects from among the organizations participating in the project,
- ✓ Income from an increased number of requests for joint educational programs from among project stakeholders,
- ✓ Income from an increased number of requests for joint educational programs from among the project partners,
- ✓ Income from an increased number of requests for joint educational programs from among the organizations participating in the project,
- ✓ Income from an increased number of grants and subsidies that become available after the project is implemented,
- ✓ Income from an increased state assignment, which becomes possible following the implementation of the project,
- ✓ Income from an number of personnel requests to the organization in the direction of project implementation.

Other indicators are also possible that do not pretend to be profitable in the initial period after the implementation of the project but help to achieve sustainable

development trends based on the results of cooperation with partner organizations and participants. In this case we are talking about depressive directions and divisions. The project can solve the problems of overcoming the crisis and the deficit.

4. Information portfolio of the project

One of the results of the project is the information field created as a result of it. Information materials and publications are also an asset of the organization, which over time will generate income in the areas in which the project was implemented. Typically, information materials are published for a fee. A project that is interesting to the public, socially significant, built on the best principles of Project-telling, as a rule, is of interest to journalists without additional contractual relations.

The project information portfolio can be included numbers of news videos on television and Internet media channels, news publications in news agencies' feeds, in Internet media channels, in print media, radio activations, publications on social networks and in news feeds of authorities (regional and federal) and in the news feeds of project partners.

5. Project reputation portfolio

One of the criteria that determines the effectiveness of the project is also the reputational results of the project, which make it possible to further implement the project based on proven successful experience of cooperation. Indicators of the reputation portfolio are letters of gratitude following the results of the project from partners, stakeholders, project participants, expressing support for further implementation and planning cooperation in the future, including in other areas.

An educational organization - the organizer of the project - can manage the process of forming a reputation portfolio by initiating the exchange of similar letters, which will mutually strengthen the reputation portfolios of partners.

*5. Analysis of feedback from the target audience*

On the one hand, feedback is a subjective method of assessing the effectiveness of the project, and on the other hand, it is important from the point of view of the image of the project and, as a consequence, the target audience of the project. Feedback assessment shows what people say about the project and the educational organization, what information they disseminate to their social circle.

In addition, feedback is the only resource for improving the project. The opinions and assessments of the target audience highlight aspects of the project implementation that are weak. As part of the feedback, it is possible to collect suggestions for improvement, the consideration of which in the next project launch cycle will help achieve better results in terms of performance evaluation criteria.

Feedback can be collected in different ways:

1. A short interview in the form of an informal conversation with project participants. When collecting feedback in this way, the research purpose of the communication must be clearly understood.

2. Questionnaire. The most common and most objective way of receiving feedback. Allows you to see the opinions of the target audience about the project both in the format of qualitative, meaningful information, and in the form of quantitative indicators describing trends in assessment.

3. Reflection with participants on the results of the project. This method of obtaining feedback is similar in research format to the focus group research method. When a survey is conducted in a group orally with the participation of a moderator. The advantage of reflection is a deep understanding of the reasons for this or that assessment of aspects of the project, when participants not only express their attitude to the experience gained within the project, but also explain on the basis of what factors (personal, social, situational and others) their position was formed[2].

4. Emoji typing of project activities allows you to record the mood or emotional state of project participants at each stage.

All methods can be implemented both in the traditional way using a personal conversation face-to-face or using questionnaires printed on paper with their subsequent processing, and using digital forms - platforms for holding group and individual meetings Zoom, Skype, Google.Meet , Yandex.Teleconference, etc., as well as electronic surveys - in Google.Forms, etc. The advantage of digital formats for collecting feedback is a significant reduction in the time for processing and analyzing data based on the results of the study. An array of assessments or a transcript of a conversation can be obtained automatically based on the results of the study and the required analysis of information can be carried out within a few hours.

The main result and criterion for the effectiveness of implementing the Project-telling methodology is a controlled change in the consciousness of the target group on the subject of the project. The purpose of the feedback study is to analyze the impressions and assessments of target groups based on the results of the implemented project in the context of reflection and self-diagnosis by participants of changes in ideas, skills, knowledge, strategies, practices, etc.

Based on the results of a comprehensive analysis, the project manager and team will be able to objectively answer the question of whether the project is an investment in the further development of the organization, whether the project is profitable, what are the niches for the further implementation of the project, what new models of organization development and business models has this project opened, to what extent is it possible to scale the project and what is its life cycle as a tool for achieving the goal, on the one hand, and as a product of the organization, on the other hand.

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At this stage, the project no longer spoke to target groups, but to managers about the prospects for the organization's development in the chosen direction. Project-telling is a unique project management technique that allows you not only to tell about the organization, to let the target audience into your home and provide the opportunity to feel the motives that unite in moving towards a common goal, to see your relevance and future in the organization, but also reveals, perhaps, the most valuable – clear development prospects, mainly expressed in numbers and levels.

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# 心理学中的资源方法
# THE RESOURCE APPROACH IN PSYCHOLOGY

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注解。 回顾心理学文献表明，资源方法有相互矛盾的解释，这给这个概念留下了很大的解释空间。 另一方面，资源方法可以评估一个人的能力和潜力。 资源储备可以让一个人在工作、认知和沟通方面取得成功，成功克服压力情况，应对生活中的困难情况。 具有资源潜力的人能够更好地应对压力、生活困难和困难情况以及日常生活情况。 本文的目的是考虑和分析资源方法中的各种理论和方法概念。

关键词：资源法； 个人资源； 潜在的；主观幸福感； 应对策略。

***Annotation.*** *A review of the psychological literature has shown that the resource approach has contradictory interpretations, which leaves a lot of room for interpretation of this concept. On the other hand, the resource approach makes it possible to assess the capabilities and potential of a person. Resource reserves allow a person to succeed at work, in cognition and communication, successfully overcome stressful situations, and cope with difficult situations in life. People with resource potential are better prepared to cope with stress, life difficulties and difficult situations, and everyday circumstances. The purpose of the article is to consider and analyze various theoretical and methodological concepts within the resource approach.*

***Keywords*****:** *resource approach; personal resources; potential; subjective well-being; coping strategies.*

From a historical point of view, the first publications on the resource approach in psychology can be found in the 70s of the 20th century. The resource-based approach is based on the assumption that resources are central to meeting daily needs and life tasks; Personal resources ultimately influence a person's mental and physical health and well-being.

The resource approach is based on the fact that each person has resources and, therefore, opportunities for further development, formation and accumulation of resources [11].

According to Hobfoll, humans tend to conserve, protect, and accumulate resources that they value. The idea of S. Hobfoll's concept is that both the loss and gain of resources are cumulative, that is, the initial loss can start a chain of resource depletion. On the other hand, resources can generate other resources. The theory implies that loss of resources is a major stressor [14].

Accordingly, people experience stress when valuable resources are threatened with loss, are lost, or when individuals are unable to obtain resources after making significant investments in resources. A person who has a resource reserve is more stable and less susceptible to the loss of resources, and is able to quickly find a way out of a stressful situation and cope with stress. [14]

Barbara L. Fredrickson's concept suggests that positive emotions "expand the repertoire of momentary thoughts and actions" [13], which enhance physical and cognitive activity, create openness to new ideas; cultivation and expansion of positive emotions (joy, interest, satisfaction, pride, love, etc.) contributes to the creation and strengthening of one's own resources. These resources are reserves that can be used in the future.

From the point of view of B. Fredrickson, positive emotions are the driving force of individual growth and social connections, and contribute to personal growth and development. Positive emotions "expand people's thought-activity repertoire" [13], neutralize negative emotions, and promote psychological stability and well-being.

The homeostasis model developed by R. Cummins et al. focuses on the stability of subjective well-being. According to the scientist, each person has a certain point of subjective well-being, which is controlled by the homeostatic system [15]. If an open system remains constant and maintains dynamic equilibrium, then the level of subjective well-being is stable over time. When the process of homeostasis is disrupted, environmental influences affect subjective well-being. Personal resources (self-esteem, optimism, and self-control) are important protective factors that help maintain levels of subjective well-being.

The resource concepts of R. Lazarus, L. Aspinwall, R. Schwarzer, E. Greenglass, S. Taubert are based on the fact that a person's coping behavior is a personality resource. The individual actively participates in the process of overcoming unfavorable circumstances, takes responsibility and is responsible for his actions, and productively solves complex problems [16].

In Russian psychology, the resource approach was studied by such scientists as L.S. Vygotsky, S.L. Rubinstein, A.G. Asmolov and others. So, L.S. Vygotsky believed that personal resources are psychological potential, formed psychological structures used by a person to meet the requirements of the environment. S.L. Rubinstein defined resources as "internal strengths and potentials of a person" [7, p.58], which are formed and developed throughout the entire life course of an individual.

Russian psychologist A.G. Asmolov believes that personal resources are systemic qualities that allow a person to achieve certain goals in the process of work. [12]. E.Y. Kozhevnikova considers personal resources as a means to achieve positive results.

L.G. Dikaya considers personal resources within the framework of professional adaptation and professional identity. [5] According to S. Nartova-Bochaver, personality resources are like character strengths. S. Nartova-Bochaver, summarized the ideas of representatives of positive psychology (C. Peterson, N. Park, M. Seligman, etc.), notes that character enhances personal functions, human characteristics, being a resource feature of the individual and, those best qualities of a person, which distinguish it from others. Character strengths, its positive qualities or virtues (according to Peterson), support the psychological well-being of an individual, professional success, and personal effectiveness. Positive character qualities allow a person to benefit society and demonstrate individual personal merits [9, p. 193].

The development of personal resources and their potential continue to remain relevant in psychology of the 21st century. So D. A. Leontyev believes that personal resources are a person's potential, a basic characteristic of a person, which plays an important role in activity [8].

V.N. Kosyrev notes that personal potential is a multicomponent psychological education. Personal potential helps a person to control and manage his behavior, regardless of changing conditions and factors, to maintain health and well-being.

Y.V. Smyk proposes to consider a resource as an integral characteristic of a person, defining a resource as a set of personal qualities, abilities, readiness to achieve personal goals and results, i.e. a resource is a person's abilities and personal qualities that help him overcome difficult life tasks and situations [10].

Summarizing the conducted theoretical research, we can conclude that the analysis of the main concepts of the resource approach showed that the interpretation of personal resources depends on the position of the author. Personal resources play an important role in overcoming difficulties and stress, in difficult life situations and in conditions of uncertainty, and are involved in a person's adaptation to the environment; the subject uses personal resources in activities [1]. Personal resources help a person cope with the demands of work, contribute to learning and development, and are also used by the individual to achieve goals, professional and academic success. Personal resources are important for maintaining a person's psychological well-being and health, etc.

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# 牡丹在俄罗斯城市植物群落中的应用
# THE USE OF *PAEONIA SUFFRUTICOSA* IN URBANOPHYTOCENOSES OF RUSSIA

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抽象的。 莫斯科国立大学生物学院植物园创建了独特的牡丹植物收藏，植物发育生物学实验室积累了巨大的理论潜力。 目前，已形成具体的工作方法：查明牡丹个体发育过程中引种群体形成的特点，培育耐寒牡丹新品种，开发加速繁殖技术。

关键词：牡丹，引种，选择，品种，繁殖。

***Abstract.*** *A unique collection of Paeonia suffruticosa Andrews plants has been created in the botanical garden of the Faculty of Biology of Moscow State University, and great theoretical potential has been accumulated in the laboratory of plant developmental biology. Currently, specific work methods have been developed: identifying the features of the formation of introduction populations of tree peony during ontogenesis, creating new winter-hardy varieties of peonies and developing technologies for their accelerated propagation.*

***Keywords:*** *tree peonies, introduction, selection, cultivars, reproduction.*

Tree peonies (homeland China) came to Russia at the beginning of the 19th century. In 1812, the Imperial Nikitsky Botanical Garden was created in Crimea. Its first director was Christian von Steven (1781-1863), who began work on the introduction of ornamental plants, which were imported mainly from Germany and France. The appearance of tree peonies in the botanical garden's collection was first mentioned in his diary in 1850 by the second director of the botanical garden, Nicolai Anhorn von Hartwiss. And in 1855, he already reported on selection work with tree peonies located in the collection of the Nikitsky Garden and in the park of his estate in Artek. He carried out selection by sowing seeds from free pollinated plants, and by selecting the most decorative forms. As a result,

Nikolai Andreevich (as he was called in Russian) obtained the first domestic varieties of tree peonies in Russia, which were actively propagated and even went on sale. “These bushes,” he writes in his diary, “decorate the local flower beds in the spring with an abundance of magnificent flowers. A beautiful terry variety, grown from seeds in the Nikitsky Botanical Garden, is bred under the name ‘Ornement de Nikita’” [4].

Academician Nikolai Ivanovich Vavilov, during the last expedition to Ukraine in 1940, noted that “the names of H. H. Steven and N. A. Gartvis are associated with a remarkable period of thoughtful introduction of valuable varieties of fruit crops, grapes, and ornamental plants, which had a great influence not only to the southern coast of Crimea, but also to other areas of the European part of our country.” These studies in the field of mobilization of plant resources and selection of fruit crops, ornamental, technical, as well as research in the field of protection, conservation of biodiversity, development of landscape architecture in Crimea, as a health resort of international importance, have been preserved and continue to expand [13].

After a long break, work with tree peonies in the Nikitsky Botanical Garden was resumed only in 1958 by senior researcher Konstantin Trofimovich Klimenko. During his activity, five varieties were obtained that have survived to this day, but which were never included in the state register of the Russian Federation[11].

There are some difficulties for the mass introduction of tree peonies into landscaping: slow seed germination and very slow growth in the first years of seedling life. In addition, tree peonies, unlike herbaceous peonies, are much more difficult to reproduce by vegetative means [10].

In 1858 Head of the Department of Applied Botany of the Ministry of Agriculture, Corresponding Member of the St. Petersburg Academy of Sciences Eduard August von Regel reports on the cultivation of tree peonies in open ground in the vicinity of St. Petersburg, provided that they are well covered for the winter with leaves and straw. 26-year-old bushes look very modest and only sometimes delight us with flowers, since they often freeze to the root collar under an ordinary winter leaf cover.”[9].

In Moscow, on the territory of the Apothecary Garden, in the post-war period, under the leadership of cytogeneticist Anastasia Antonovna Sosnovets, they began to engage in the selection of tree peonies. This work is successfully continued by Marianna Sergeevna Uspenskaya, now on the main territory of the Research Center of the Peter 1 Botanical Garden on Vorobyovy Gory, using two methods: the method of free pollination and subsequent selection and the method of artificial hybridization.

We found that peony pollen can remain viable for a long time - about 35 days; at low positive temperatures from +2 to +5C - up to 1 year. And the best fertilizing

ability was found in dried pollen stored at temperatures of minus 7-10 degrees. Therefore, for crossings, pollen brought from various botanical gardens, in particular from Nikitsky, from numerous collections of amateur flower growers in Russia and even from China, Japan, Latvia, and Ukraine can be used.

To develop new varieties, we also used the technique of ionizing radiation and chemical mutagens developed by a senior researcher at the Department of Higher Plants of Moscow State University, Doctor of Biological Sciences Irina Viktorovna Dryagina [2]. Freshly collected peony seeds were irradiated at the Institute of Physical Chemistry and Electrochemistry of the Russian Academy of Sciences at the GURKh-40000 installation with γ-rays at a power of 100 R/sec with doses of 500, 1000, 40000, 60000, 100000 R, and were also treated with different doses of chemical mutagens, in particular dimethyl sulfate. Peony seeds have proven to be resistant to both radiation and chemical mutagens.

The main scheme of breeding work with peonies was reduced to 1) sowing seeds from openly pollinated introduced species to obtain a heterogeneous cultural population; 2) selection of plants carrying a cold resistance gene; 3) culling of weak and diseased seedlings of the first generation (F1); 4) in seedlings of the second generation (F2), careful selection for several parameters: resistance to cold, drought, fungal diseases, as well as decorativeness and density of the bush, shape and color of the flower, length of the peduncle, flowering time, etc.; 5) further selection of parental pairs for hybridization; 6) crossing varieties of tree peonies with yellow peony and Delaway peony to obtain interspecific hybrids.

In 2006, the State Commission of the Russian Federation for Testing and Protection of Selection Achievements developed for all tree peonies “Methodology and timing for testing a selection achievement (new plant variety) for distinctiveness, uniformity and stability.” This technique was again approved by Order of the Ministry of Agriculture of Russia dated October 27, 2020 No. 631 (registered with the Ministry of Justice of Russia on December 23, 2020 No. 61734). The section of the tree peony (*Paeonia suffruticosa* Andrews) methodology was prepared in the botanical garden of the Faculty of Biology of Moscow State University using the document “Paeonia characteristics table for recording and registration”, valid in Japan. The methodologist of the State Commission Tatyana Vladimirovna Nikolaevskaya and the agronomist of the department of fruit, berry and ornamental crops Olga Vladimirovna Nikolaevskaya took part in this work [6].

Most of the European territory of Russia is located in the zone of risky agriculture. Temperature changes, thaws in the middle of winter, cold northern winds can affect frost resistance and sometimes lead to the death of plants. Tree peonies, unlike herbaceous peonies, have a superficial root system. It is much easier to dig up a bush that has reached the age of 20 years than a herbaceous bush of the same age. Therefore, at the end of October it is necessary to hill up the bush. Mulching

with peat and humus, improving temperature conditions and aeration, promotes the proliferation of beneficial microorganisms and makes it possible to preserve the buds at the base of the shoots: above-ground shoots may dry out, but due to the preserved buds, the bush will recover and bloom. The location of the shoots in space depends on the individual characteristics of the variety. Some shoots are erect, while others tend to droop. Before flowering, the main axis of the primary shoot does not stop growing in length, developing from the apical bud (monopodial branching), and after flowering, the apical part of the flowering shoot dies off to the upper axillary vegetative bud and the main axis is replaced by one of the lateral ones (sympodial type of growth). Therefore, in the spring it is necessary to remove dry, faded parts of the shoots.

The entire collection of tree peonies in the botanical garden of the Faculty of Biology of Moscow State University has been without shelter for many years. Our research has shown that in varieties with double flowers brought from countries with a milder climate, without shelter in the fall, the buds that appear in the spring dry out without blooming. It is recommended to cover such plants with lutrasil, but better with spruce branches. Having summarized the experience of introducing tree peonies, we came to the conclusion that they are quite winter-hardy and frost-resistant. Their above-ground perennial shoots are covered with a crust, which is an important adaptive feature for growing in regions with low temperatures. Peonies can withstand temperatures down to minus 36C. They, as a rule, die only when planted in low-lying areas where melt water stagnates.

To properly form the bush and increase its life expectancy, it can be recommended to carry out anti-aging pruning as the buds awaken. Every spring, all dried shoots are cut out, and all old ones are shortened to a height of 10 cm. In China, rejuvenating pruning of the bush is carried out to the soil level; it is believed that this does not harm the plant, but promotes its rejuvenation. In their homeland, some specimens of tree peonies are over 500 years old.

Recently, Japanese breeders have produced intersectional hybrids: they are called “Ito-hybrids” after the first creator. In the conditions of the Non-Black Earth Region of Russia, they have shown themselves to be winter-hardy, but in late autumn the entire above-ground part is removed from them, just like herbaceous peonies. The rest of the care for tree peonies is not much different from that for their herbaceous counterparts.

Considering the high life expectancy of tree peonies in one place, great attention should be paid to the choice of planting site. It is very important that the plant grows in a place protected from the wind. In Japan and China, young flowering bushes are protected from the sun, wind and rain by a reed canopy, which increases the duration of their flowering and preserves the shape and color of the flowers. In their natural habitats, peonies grow on or near loess soils, marly lime-

stones. Therefore, peonies should be planted in rich, well-drained alkaline soils. In low areas, peonies should be grown on high ridges. In China, they believe that the optimal time to transplant peonies is the day of the autumn equinox.

Renewal of this species in natural conditions and reproduction in introduction culture is difficult due to the slow germination of seeds (2-3 years). They have an underdeveloped embryo, which is distinguished by a very low content of physiologically active substances and weak enzyme activity [12; 8]. The fact is that the peony reproduction system is characterized by a change in the paths of morphogenesis: the replacement of embryogenesis with embryoidogenesis. As a result, a somatic rather than a sexual embryo is formed in a mature peony seed [14].

In addition, tree peonies have a long pregenerative period of development of individuals (5-6 years) associated with a morphophysiological deep epicotyl type of dormancy [7; 3]. We have found that the germination rate depends on the quality of the seeds: freshly harvested seeds sown in the ground in September - October give germination from 80 to 90%, and those sown in April - 15-20%. For accelerated seed germination, stratification is required, which consists of two stages. The first time, the seeds must germinate (until the root appears) at a temperature of 18-300C (2.5-3 months). In the second, sprouted seeds are sown in a box at a temperature of 5-70C until the first leaf appears. In May, the box with seedlings is placed in the shade and care is taken that the soil in it does not dry out, but the water does not stagnate. And at the end of August, seedlings that have strengthened over the summer are planted in loose open ground. The decorative qualities of a peony grown from seeds can be confidently judged only at 7-9 years of age. Therefore, this method of propagating tree peonies is usually used exclusively for breeding purposes.

Typically, tree peonies are divided into bushes that are 6-8 years old and older. It is pre-hilled, stimulating intensive shoot formation, and in the fall it is dug up, washed off with a hose and carefully divided. A standard division, like that of herbaceous peonies, consists of 2-3 shoots with buds. All wound sites are washed with permanganate and sprinkled with charcoal.

Tree peonies are propagated by layering in May (before the flowers bloom). To do this, lodging shoots are selected, a shallow incision is made from below and treated with a growth substance (heteroauxin, epin, zircon, etc.) Then the shoot is pinned to the ground and sprinkled with soil (12-15 cm) on top, which is regularly moistened. After a year or two in the fall, the rooted shoot is cut off from the mother bush and planted in a permanent place. In semi-shrub peonies (p. yellow and p. Delaveya), xylopodia are formed underground - highly thickened woody shoots capable of branching. Xylopodia provide shrubs with vegetative mobility and longevity, the ability to grow even on rocky soils and secure slope areas. These shoots, which form their own roots, are easy to use as layering.

Propagation of varieties of tree peonies by stem cuttings should be carried out during the flowering period. An unblooming branch with a pea bud is ideal. Over-blooming peony stems will have a lower survival rate. The cuttings are cut diagonally under the nodes (at a distance of 2.5 cm). Each cutting should have 2-3 leaves. At the two lower nodes, the leaf blades are removed (preserving 2 cm of the petiole "stump"), at the top node the leaf blade is shortened by two thirds. Before planting, cuttings are treated with growth preparations to stimulate root formation. The cuttings are planted in a shaded place at an angle of 45 degrees, completely burying the lower node with the bud, the second node with the bud remains at the surface of the soil. This method of reproduction is labor-intensive and time-consuming. Young plants obtained in this way, even with careful care and care, begin to bloom only in the 4th-5th year.

Grafting is a reliable and effective way to propagate varieties of tree peonies, allowing you to obtain a large amount of high-quality and healthy planting material for personal use or sale. Gardeners in the middle zone carry out this procedure in mid-August until the first half of September. In the southern regions, the timing of peony grafting can be postponed to the end of May or June.

Using the roots of herbaceous peonies as a rootstock helps to increase the winter hardiness of new plants. They are prepared in advance - approximately 20 days before the planned work. The roots must be stored in a dry, dark and cool place. The optimal length of the rootstock should be about 12-15 cm. Moreover, its thickness should correspond to the diameter of the scion cuttings.

As a scion, only semi-lignified shoots of the current year with 2-3 buds are used. If the scion and rootstock are of the same size, it is possible to graft in two ways - by rotating and by butt. In the case of a significantly thicker scion, propagation can only be carried out using the rotating method.

Lateral grafting, carried out in the butt, is considered a simpler and easier option. After 4-5 weeks, the grafted plants can be transferred to a greenhouse and planted in such a way that the level of deepening of the lower bud into the ground does not exceed 6 cm. After 1.5 years, the grafted peonies are ready for transplanting into a flower bed. At first, it is important to avoid direct sunlight on the scion and maintain high humidity. Young seedlings need high-quality winter shelter with coniferous spruce branches and non-woven materials.

Along with the use of traditional methods of vegetative and seed propagation, the use of the method of culture of organs, tissues and cells is relevant. The method is based on the unique ability of a plant cell to realize its inherent totipotency under the influence of experimental influences and give rise to an entire plant organism. Genetically stable apices and axillary buds of the stem are currently the most preferred objects for clonal micropropagation. According to R. G. Butenko [1], they are resistant to genetic changes, possibly due to the high activity of DNA

repair systems, as well as negative selection of changed cells. It can be assumed that the organization of the apical and axillary meristems of the stem in the form of discrete zones also contributes to their genetic stability. The method of clonal micropropagation by activation of axillary meristems is based on removing apical dominance or removing the main shoot and microcuttings in vitro, or introducing cytokinins into the nutrient medium that induce the development of numerous axillary shoots, or, finally, a combination of both. In all cases, the developed shoots are separated from each other and re-cultivated on a nutrient medium that stimulates the proliferation of axillary meristems and the emergence of shoots of higher orders. The resulting plants are usually phenotypically close to the original ones. In order to accelerate the reproduction of high-quality planting material, microclonal propagation schemes for tree peony of many varieties of European and Chinese origin have now been developed [15]. However, for each new variety of this crop it is necessary to clarify and select its optimal propagation regimes under sterile conditions. For the collection of tree peonies created by M. S. Uspenskaya, this work is successfully carried out by employees of the Laboratory of Plant Developmental Biology, Faculty of Biology, Moscow State University [5].

The approximate yield of rooted plants using our proposed method of microclonal propagation of tree peonies is about 20 plants per explant. At the same time, with skillful division of a bush of the same varieties, no more than 3-4 divisions are obtained, and with successful grafting onto the roots of a herbaceous peony - 9-10 units of planting material.

Knowledge of the morphological and decorative features of woody plants, their relationship to unfavorable conditions of the urban environment can significantly improve the artistic appearance of the city. It is quite obvious that in order to prevent active invasion into natural communities, the predominant types of strategies used by introduced species should be patient or violent-patient. The risk of their introduction into surrounding natural communities will be minimal. In this regard, taking into account the peculiarities of the culture of tree peonies, they can be widely recommended for landscaping cities and gardens.

Of the majority of flower crops, the tree peony occupies one of the leading places. After all, it has not only bright, beautiful, large and fragrant flowers, but also a magnificent, highly decorative bush. Moreover, its decorative effect begins to appear from the moment of spring regrowth, since even then the stems have their own specific bright color - from light green to red-brown. By selecting certain varieties, you can paint amazing spring pictures in different colors. With the correct selection of varieties, the flowering period of the array can be extended to 1.5 months.

After flowering, the tree peony bush is an excellent backdrop for other flower crops. In addition, the peony is a very durable plant, quite suitable not only as an ornamental plant, but also as a decorative and health-improving planting.

To keep up with the times, it is necessary to regularly expand the existing assortment of tree peonies. The unique and regularly growing collection of tree peonies bred by the Moscow State University Botanical Garden currently includes about 50 zoned varieties of tree peonies.

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# 感染俄罗斯远东地区大豆的新型马铃薯病毒
# NEW POTYVIRUSES INFECTING THE SOYBEAN IN THE RUSSIAN FAR EAST

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抽象的。 据证实，俄罗斯大豆研究所苗圃中发现的三种大豆新病害是由具有柔性丝状颗粒的病毒引起的。

用一种病毒的纯化制剂进行的 PAG 电泳显示存在 3 种分子量分别为 32.3 kD、31.2 kD 和 28.1 kD 的多肽。 在其他病毒制剂中，确定存在 1 个分子量为 34.1 kD 的主要多肽和 3 个分子量为 17.1、14.4 和 11.6 kD 的次要多肽。

正在研究的病毒与马铃薯病毒属有关。 一种病毒与豆黄花叶病毒（BYMV）表现出最接近的亲和力，尽管它们在许多特性上有所不同。 其他病毒与马铃薯病毒 Y（PVY）亲缘关系最密切，与大豆花叶病毒（SMV）和 BYMV 的亲和力较差。 第三种病毒在PVY和SMV系统中进行了测试，发现其与PVY的亲和力最大。 然而，所研究的后两种病毒的生物学和理化特征与SMV和PVY不同。 所有研究的病毒的外壳蛋白特性和生物学特性与俄罗斯远东地区大豆中描述的马铃薯病毒不同，包括豆黄花叶病毒、大豆花叶病毒和豆普通花叶病毒。

关键词：大豆，病毒病，马铃薯Y病毒属。

***Abstract.*** *It is established that three new diseases are revealed of soybean in the nursery collection of Russian Institute of Soya are caused by viruses with flexible filamentous particles.*

*Electrophoresis in PAG carried out with purified preparation of one virus revealed the presence of 3 polypeptides with MW 32.3 kD, 31.2 kD, and 28.1 kD. In other virus preparation the presence of 1 main polypeptide with MW 34.1 kD and 3 minor ones with MW 17.1, 14.4, and 11.6 kD was established.*

*The viruses under study are related with potyviruses. One virus demonstrated the closest affinity with bean yellow mosaic virus (BYMV) though they differed in*

*a number of properties. Other virus demonstrated the closest relationship with potato virus Y (PVY) and less affinity with soybean mosaic virus (SMV) and BYMV. Third virus was tested in PVY and SMV systems and the greatest its affinity was revealed with PVY. However, the biological and physicochemical characteristics of the latter two viruses under study differ from SMV and PVY. The properties of coat proteins and biological characteristics of all the viruses studied differ from potyviruses described in the soybean on Russian Far East including bean yellow mosaic virus, soybean mosaic virus and bean common mosaic virus.*

***Keywords:*** *soybean, virus disease, Potyvirus.*

**Introduction**

The most wide-spread leguminous crop in the Russian Far East is the soybean. Therefore, diseases of the soybean are of great interest. Five viruses (soybean mosaic virus, bean yellow mosaic virus, soybean stunt virus, tobacco ring spot virus and alfalfa mosaic virus) affecting soybean plants in the region have been revealed and identified previously (Polivanova, 1980).

Since, we have carried out a number of field observations of soybean crops. In these crops we often founded the infected plants with symptoms differing from those described earlier (Polivanova, 1980). Also, we have been analyzed the collection of soybean cultivars from the Russian Researching Institute of Soya (Blagoveshchensk). Recently, some data on virus pathogens revealed in this collection were published (Kakareka et al., 2002a). They were shown to differ in some characteristics from the viruses described previously for the soybean in the Russian Far East.

Here, we present the characteristics of the three new viruses founded in the collection of the soybean cultivars.

**Materials and Methods**

For the research, isolates not affected by the soybean mosaic virus (SMV) were selected. The collection numbers of soybean samples were used as the names of isolates.

On the initial plant of soybean, isolate A 15074 induced symptoms of weak mosaic but further the disease was not mechanically transmitted to soybean.

Isolate A 10213 was separated from soybean with chlorotic mottle.

Isolate A 15091 was isolated from soybean with chlorotic deformations of leaves and general chlorosis.

To propagate and obtain purified preparations of isolates A 10213 and A 15091, plants of soybean were mechanically inoculated with the infectious sap prepared in the presence of 0.05 M phosphate buffer**,** pH 7.6. Isolate A 15074 was purified from a broad bean mechanically inoculated with the infectious sap.

Leaves were detached on the 14th day after inoculation. The virus purification was carried out according to the method suggested by Novikov et al. (1982) and

modified by us (Kakareka et al., 2002b) Concentration of the virus preparation was determined spectrophotometrically using the absorbance constant $A_{260}^{0,1\,\%} = 3$.

The experimental host range was determined from 3 to 5 times. Physicochemical properties of the virions were defined by the standard methods (Gibbs and Harrison, 1978). During purification, a virus particle presence in the preparations was detected by electron microscopy. The droplet of suspensions obtained was placed on Formvar-coated grids, desiccated and the virions were contrasted with 2 % phosphotungstic acid, pH 7.0 or with 2 % uranyl acetate. The prepared samples were investigated with a Libra-200 electron microscope (Germany).

Electrophoresis was carried out according to Laemmli (1970) in vertical plates of 12 % PAG.

All immunochemical studies were carried out according to routine methods described in the methodological summary by O.V. Burakova, published by the Moscow State University Publishing House (2001). The value of nonspecific linkage of the conjugate with the sap from healthy broad bean plants was used as a check value**s** for ELISA. As substratum for definition of peroxydase activity was used 0**.**05 % solution of o-phenylenediamin. Optical density was measured at wave length of 492 nm. Heterologous antigen (tobacco mosaic virus) was used during the titration as a control.

**Results and Discussion**

Isolates differed in symptoms of the disease in both the initial plants and test-plants. Preliminary studies had shown that all 3 isolates could be related to the genus *Potyvirus* (Patatavirales: Potyviridae). For their further identification, the complex of researches of biological, physicochemical and antigenic properties of isolates was carried out.

Biological characteristics of isolates

The experimental host range has been investigated (Table 1).

The isolates were shown to differ in both symptoms and the quantity of species affected. Isolate A 15074 was more contagious than A 10213 and A 15091 but, unlike from those, was not transmitted back to soybean by mechanical inoculation.

To reveal a possibility of the viruses transfer by seeds and aphids, a series of experiments was carried out. Isolate A 15074 was not transferred by seeds from the infected broad bean but it was easily transmitted by *Myzus persicae Sulz*. Isolates A 10213 and A 15091, on the contrary, were transferred by seeds and were not transmitted by aphids (Table 2). The ability to be transmitted by aphids often depends on the plant variety and the strain of the virus (Lucas, B.S. and Hill, J.H. 1980). Therefore, in this case, it is premature to draw conclusions.

Physicochemical characteristics of isolates

A number of properties of the virus isolates necessary for their identification were investigated. Distinctions in heat resistance and stability in sap were shown

(Table 2). It was found that virus isolate A 10213 was difficulty transmitted to host-plants and appeared to infect not all inoculated plants. Virions in preparations of all isolates are flexible thread-like particles presented in great numbers. 10-14 days after inoculation, leaves were detached to purify the viruses. It should be noted that aggregation of virus particles during purification reduced their output.

Virus preparations of all isolates had a characteristic spectrum of absorption in ultraviolet areas (Table 2). The ratio of absorption in the maximum and the minimum was 1.1-1.2. These results are in good agreement with data for potyviruses available in literature (Shukla and Ward, 1989; Revers, F. and Garcia, J.M. 2015).

***Table 1***

*The experimental host-plant range of virus isolates revealed on a soybean*

| **Families, species and cultivars of plants** | **Symptoms of virus diseases** | | |
|---|---|---|---|
| | **A 15074** | **A 10213** | **A 15091** |
| ***Fabaceae Lindl.*** | | | |
| *Faba bona Medic.* | S: brM; Mot; Cl | 0 | 0 |
| *Galega officinalis L.* | S: Dis | L: N | - |
| *Glycine max L.* | 0 | S: ClMot; M | S: DisCl |
| *Phaseolus angularis L.* | S: VnDis | 0 | - |
| *P.vulgaris L.* | | | |
| cv. Topcrop | L: N | L: DotN | S: N; M |
| cv. Red Kidney | L: N | S: M; Dis | S: N; M |
| cv. Michelite | L: N | S: M | S: N; M |
| *Pisum arvense L.* | S: M | 0 | - |
| *P.sativum L* | | | |
| cv. Alaska | S: Mot | S: M | 0 |
| cv. Wisconsin | S: N | L: N | S-less |
| cv. Perfection | S: YelMot | S-less | S: M; N |
| cv. Champion | - | S: M, N | S: M; N |
| *Trigonella foenum-graecum L.* | S: YelSp | 0 | S-less |
| *V. sinensis Endl.* | S-less | S-less | 0 |
| ***Chenopodiaceae Vent.*** | | | |
| *Chenopodium amaranticolor Coste et Reyn.* | L: NSp | L: NSp | L: YelSp |
| *C. quinoa Willd* | S: ClSp | S: N | L: YelSp |
| ***Solanaceae Juss.*** | | | |
| *Nicotiana glutinosa L.* | 0 | S: VCl | 0 |
| *N. tabacum L. cv Xanthi* | 0 | S: VDis | 0 |
| *Petunia hybrida Vilm.* | S: Def | 0 | 0 |

Abbreviations:

0 – not infected, L: – local reaction, S: – system reaction, N – necroses, Sp – spots, Cl – chlorotic, chlorosis, - – no data, V – vein, Dis – distortion, Yel – yellow, M – mosaic, Def – deformation, S-less – symptomless, Mot – mottle, Dot – dotty, br – brown

The electron microscopic investigation of purified virus preparations of all isolates studied showed that those are morphologically similar to potyviruses (Table 2).

Electrophoresis in PAG carried out with purified preparations of isolate A 10213 revealed the presence of 3 polypeptides. In isolate A 15074, the presence of 1 main polypeptide and 3 minor was established.

A month after keeping of these preparations at 4°C in the presence of sodium azide, no additional polypeptides were found. The purified preparation of isolate A 15091 lost its infectivity for 2 months that testifies to the instability of its virions. Other isolates under investigation remained infective more than 6 months.

***Table 2***

*Biological and physicochemical characteristics of virus isolates from soybean*

| **Characteristics** | **Virus isolates** | | |
|---|---|---|---|
| | **A 15074** | **A 10213** | **A 15091** |
| Vectors | Myzus persicae | not shown | not shown |
| Seed transmission | not shown | 9% | 14% |
| Accumulation mg/100 g | 5-10 | 10-12 | 8-10 |
| Thermal inactivation point | 75±2 | 65±2 | 50±2 |
| Longevity *in vitro* | 7 days | about one day | less than a day |
| Dilution end point | $1 \cdot 10^4$ | $1 \cdot 10^3$ | $1 \cdot 10^4$ |
| Capsid protein MW (kD) | | | |
| main | 34.1 | 32.3 | 34-36 |
| minor | 17.7; 14.4; 11.6 | 31.2; 28.1 | |
| Morphology, modal length and wide | Flexible 850x12 nm | Flexible 700x12 nm | Flexible 750-800x12 nm |
| Characteristics of virus preparations | | | |
| $A_{260}/A_{280}$ | 1.2 | 1.2 | 1.18 |
| $A_{max}$ | 260 nm | 260 nm | 260 nm |
| $A_{min}$ | 245 nm | 250 nm | 240 nm |

Thus, morphology of virus isolates A 10213, A 15074 and A 15091, parameters of the nucleoprotein spectra typical for potyviruses and also MW of structural proteins confirm that the investigated pathogens belong to the *Potyvirus* genus.

Antigenic and immunogenic properties

To study antigenic and immunogenic properties of virus isolates A 10213 and A 15074, polyclonal antibodies were obtained. Isolate A 15091 was propagated in small amount and immunization of animals by this pathogen was not carried out.

For immunization of animals we used the previously developed scheme (Kakareka et al. 2008):

Re-immunization by isolates was carried out 6 weeks after the last immunization by a subcutaneous injection of 1 mg Ag + Freund's adjuvant.

Blood was taken on the 7th, 9th, and 11th days after the last immunization.

In the indirect method of ELISA, the antiserum against isolate A 15074 had titer 1:3200 - 1:6400. The antiserum prepared against isolate A 10213 had a higher titer (1:6400 - 1:12800) and was specific.

To develop immunodiagnostica for ELISA, IgG was purified from polyclonal antisera prepared against isolates A 10213 and A 15074. Concentration of IgG per 5 ml of antiserum was 5.1 mg for A 10213 and 11.1 mg for A 15074.

To diagnose and identify the virus isolates under study, conditions for ELISA "sandwich" method were created when the working dilution of the conjugate obtained was 1:600 and the optimum setting concentration of IgG was 5-10 mg per ml. The initial dilution of saps from infected and healthy plants was 1:100 - 1:400. For isolate A 10213, sensitivity of the method was determined starting from 3-5 ng/ml in a preparation and at $10^{-5}$-$10^{-6}$ dilution of the sap from the infected plants. For isolate A 15074, the method sensitivity was by an order of values lower.

Thus, specific polyclonal antisera with a high titer were obtained that suggests good immunogenic properties of isolate A 10213 and moderate properties of isolate A 15074. The IgG was purified and an immunodiagnostica for ELISA "sandwich" method were developed to both isolates.

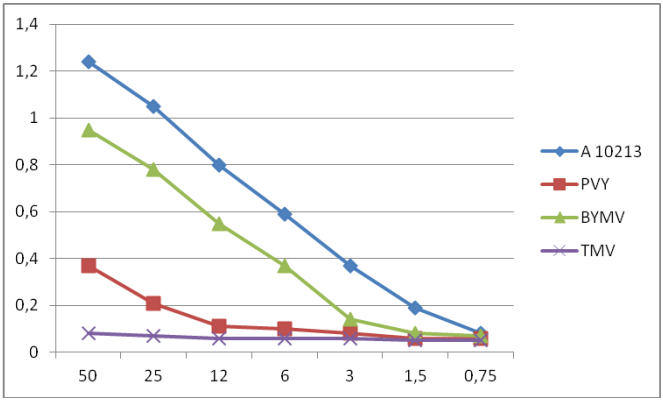
Antigenic interactions of isolates

Using indirect and "sandwich" variants of ELISA for definition of antigenic affinity of the isolates and their classification, it was established that both viruses under study had virus-specific and genus-specific epitops.

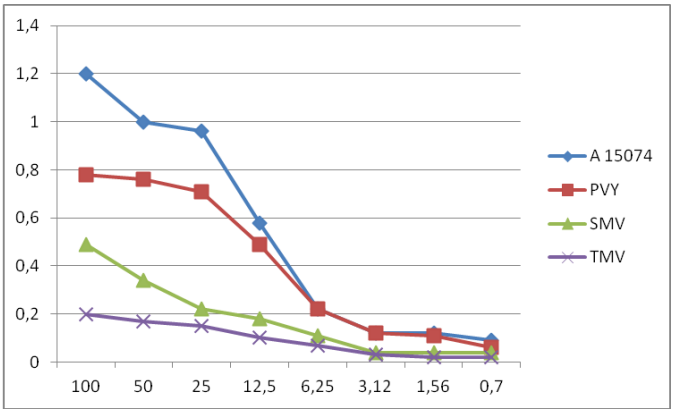
Isolate A 10213 demonstrated weak affinity with potato virus Y (PVY), the typical member of *Potyvirus* genus. This isolate showed the closest relationship with the bean yellow mosaic virus (BYMV) (Fig. 1, а). Isolate A 15074 demonstrated the most close affinity with the PVY and less affinity with the SMV and BYMV (Fig. 1, б). Isolate A 15091 was tested in PVY and SMV systems and the greatest its affinity was revealed with PVY.

The analysis of antigenic affinity showed the virus A 10213 to be close to the BYMV though they differ in a number of properties. Viruses A 15074 and A 15091 are closer to SMV and PVY, but differs from those by biological and physicochemical characteristics.

Thus, the results obtained on biological, physicochemical and antigenic properties of virus isolates A 10213, A15074 and A 15091, namely data on virion morphology, parameters of the nucleoprotein spectra typical for potyviruses, MW of capsid proteins and also the established affinity with typical members of the *Potyvirus* genus, give the grounds to attribute the new isolates investigated to this taxonomy group (Brunt, et al. 1996).




*a*




*b*

***Figure 1.*** *Definition of antigenic interactions of isolates A 10213 and A 15074 by the ELISA indirect variant*
*a. System of isolate A 10213.*
*Antigens: 1 – A 10213; 2 – PVY; 3 – BYMV; 4 – TMV*
*b. System of isolate A 15074.*
*Antigens: 1 – A 15074; 2 – PVY; 3 – SMV; 4 – TMV*

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# 苏尔古特市夏秋季节土壤微生物特征比较研究
# COMPARATIVE MICROBIOLOGICAL CHARACTERISTICS OF THE SOILS OF THE CITY OF SURGUT IN THE SUMMER AND AUTUMN SEASONS OF RESEARCH

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抽象的。 本研究介绍了对苏尔古特市夏季和秋季土壤和所选土壤的微生物分析结果。 研究结果发现，异养生物和同化矿物态氮微生物等生态营养微生物群的数量取决于温度因素，并且夏季各点的指标较高。 寡营养微生物区系的数量在两个研究季节都保持稳定。

关键词：城市土壤、人为土壤污染、微生物、微生物区系、土壤酸度、土壤湿度。

***Abstract.*** *This study presents the results of a microbiological analysis of soils and soils selected in the city of Surgut in the summer and autumn seasons. As a result of the research, it was found that the number of such ecological-trophic groups of microorganisms as heterotrophs and microorganisms that assimilate mineral forms of nitrogen depends on the temperature factor and the indicators at all points are higher in the summer. The number of oligotrophic microflora remains stable in both research seasons.*

***Keywords:*** *urban soils, anthropogenic soil pollution, microorganisms, microflora, soil acidity, soil moisture.*

The dynamics of the number of microorganisms depends on many factors, and the main factors include seasonal changes in temperature and amount of precipitation, and also in conditions of rapid and intense urbanization, we can talk about soil contamination with human waste products and various pollutants [1].

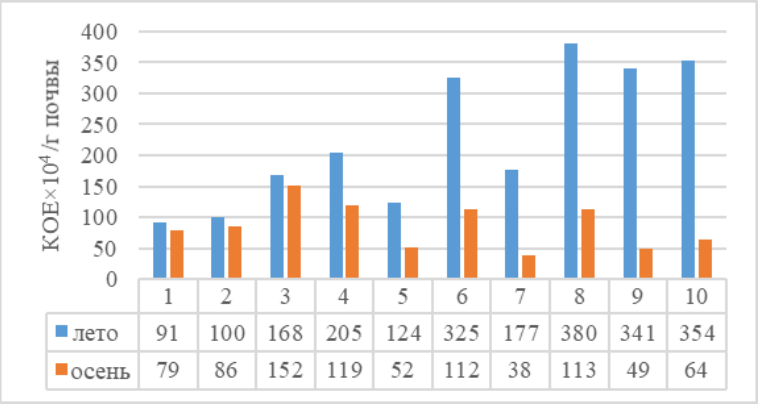
Urban soils experience strong anthropogenic pressure all year round, and the qualitative and quantitative composition of the soil can change very quickly from season to season. It is important to understand that the process of soil formation

completely depends on the soil microflora; various soil microorganisms are capable of decomposing high-molecular compounds to the simplest.

The study of the microbiological composition of urban soils in the city of Surgut (Khanty-Mansiysk Autonomous Okrug-Ugra) was carried out in summer and autumn. 10 different sampling points were selected as research objects.

The number of microorganisms that was determined in a particular sample in autumn or summer may differ not only due to climatic conditions, but also depend on the sampling location, and mainly on polluting factors in the area and vegetation cover. The projective coverage of all points is different, which may affect the results of the study.

Thus, the highest number of heterotrophic microorganisms in most samples is observed in the summer period of the study (Fig. 1), which is associated with the annual cycle. The total number of microorganisms increases when the maximum productivity of soil microorganisms is achieved [2].




| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| лето | 91 | 100 | 168 | 205 | 124 | 325 | 177 | 380 | 341 | 354 |
| осень | 79 | 86 | 152 | 119 | 52 | 112 | 38 | 113 | 49 | 64 |

***Figure 1.*** *Seasonal dynamics of the number of heterotrophic microorganisms*

Oligotrophic microorganisms are destructors of dispersed organic substances and plant residues. When comparing summer and autumn results, we can conclude that seasonality does not affect the activity of oligotrophic microorganisms. Based on the data in Figure 2, it can be argued that sampling points where vegetation is developed have a higher number of oligotrophs, which also proves that the presence of plant residues is important for the life activity of this group of microorganisms.

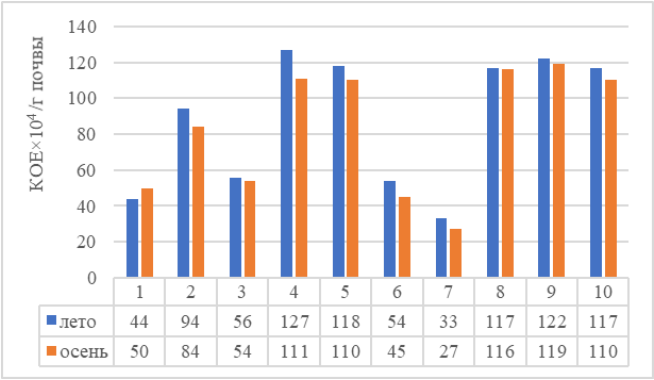



***Figure 2.*** *Seasonal dynamics of the number of oligotrophic microorganisms*

The amount of mineral nitrogen in the soil depends mainly on the amount of humus in the soil, as well as on the amount of organic matter entering it. It is precisely these conditions that are favorable for the life activity of the ecological and physiological group of microorganisms that assimilate mineral forms of nitrogen [3].

Based on the data obtained (Fig. 3), we can conclude that in the summer, climatic conditions are more favorable for the active reproduction of microorganisms of this group.

It is important to note that the samples were taken in different areas, which also affects the amount of microbial biomass. At sampling point No. 4, 8, herbaceous and shrub vegetation predominates, which could also affect the result of the study.

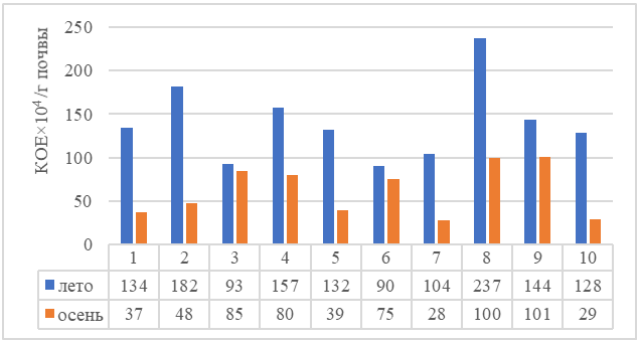



***Figure 3.*** *Seasonal dynamics of the number of microorganisms that assimilate mineral forms of nitrogen*

Molds, like other environmental groups, predominate in soil samples during the summer period of the study.

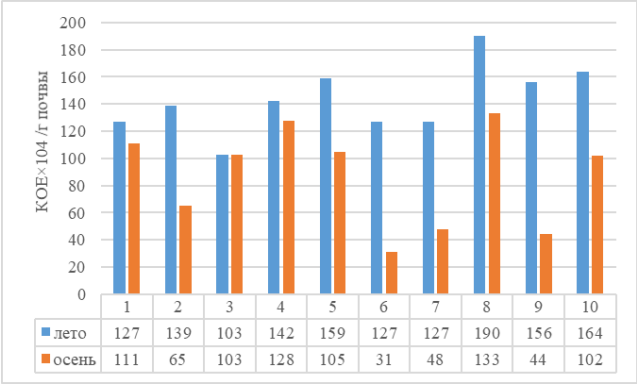
Samples with the highest abundance of molds and ascomycetes were also identified, these included samples with a large amount of vegetation and leaf litter. Thus, the projective coating at sampling point No. 5 is characterized by rage. Namely, grassy cover and shrubs on the lower tiers with a predominance of birch in the upper tier. This microlandscape is also typical for sample No. 8.

In addition, sample No. 9 shows active activity of fungi and actinomycetes, since the area at point No. 9 is characterized by coniferous plants and shrubs and shrubs on the lower tiers, as well as a large amount of plant litter.

It is important to note that of all 10 samples, only sample No. 9 was found to contain fungi of the genus Trichoderma. This is related to their habitat, since fungi of this genus are found on coniferous litter and are generally characteristic of forest areas, like sample No. 9, which was collected in the park area of the city [4].

In the remaining samples, the predominance of the genera Penicillium and Mucor was noted, which is typical for acidic soils in natural zones of the north. Fungi of the genus Fusarium were also present in small quantities.

In most samples when studying mold fungi and actinomycetes, almost equal numbers of microorganisms are observed. But in some there is a sharp decrease in numbers, which may indicate unfavorable living conditions for microorganisms or the dominance of other ecological-trophic groups of microorganisms. At points No. 2, 6, 7, 9, there is a sharp decrease in biomass by the autumn period, which is associated with a sharp change in climatic conditions. Thus, the greatest abundance is observed at the more illuminated sampling points, and the smallest at those shaded by the tree layer [5].

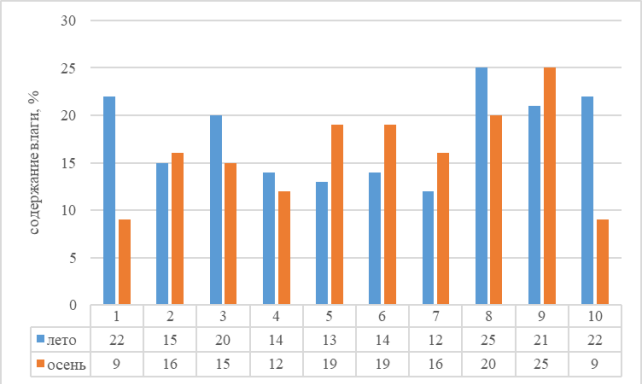



| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| лето | 127 | 139 | 103 | 142 | 159 | 127 | 127 | 190 | 156 | 164 |
| осень | 111 | 65 | 103 | 128 | 105 | 31 | 48 | 133 | 44 | 102 |

***Figure 4.*** *Seasonal dynamics of the number of mold fungi*

The number of microorganisms, as previously mentioned, depends on climatic conditions; the amount of precipitation in a given period of time can cause fluc-

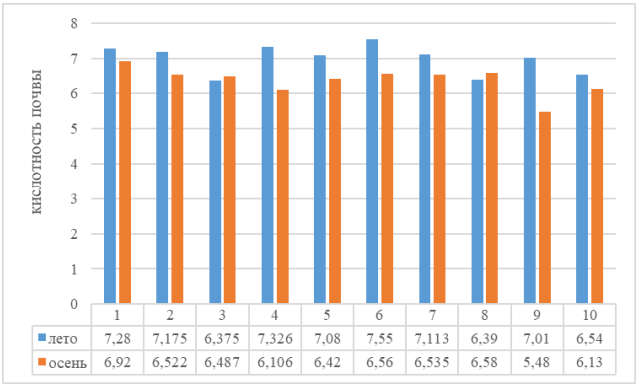
tuations due to changes in the proportion of moisture in the soil (Fig. 5). So for different ecological and physiological groups of microorganisms there is a different optimum in terms of moisture. Thus, waterlogging of soils can inhibit the growth of microorganisms or, conversely, cause active growth of biomass. The humidity indicators in summer and autumn differ slightly, but in some samples a sharp decrease in the indicator is observed. Such trends, among other things, are associated with the structure of the soil, granulometric composition, and water-holding capacity.




| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| лето | 22 | 15 | 20 | 14 | 13 | 14 | 12 | 25 | 21 | 22 |
| осень | 9 | 16 | 15 | 12 | 19 | 19 | 16 | 20 | 25 | 9 |

***Figure 5.*** *Moisture content during the summer and autumn research period*

According to acidity groups, the selected soil samples range from slightly acidic (6.3 units) to slightly alkaline (7.5 units) (Fig. 6). The results obtained are generally consistent with the description of soils in this region.




| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| лето | 7,28 | 7,175 | 6,375 | 7,326 | 7,08 | 7,55 | 7,113 | 6,39 | 7,01 | 6,54 |
| осень | 6,92 | 6,522 | 6,487 | 6,106 | 6,42 | 6,56 | 6,535 | 6,58 | 5,48 | 6,13 |

***Figure 6.*** *Soil acidity in the summer and autumn period of research*

Anthropogenic soil salinization occurs in almost all points of the city, which is due to their proximity to roads, as well as public places where there is a constant transfer of salt solutions, which affects the acidity of the soil after the winter period immediately after the snow melts.

According to Figure 6, soil acidity at almost all points changes slightly, but in the autumn period of the study, soil acidification is observed, which is the result of precipitation, the amount of rotting litter and the composition of vegetation growing in this area [6].

Based on the results of the study, it can be argued that microbiological abundance does not always depend on climatic conditions. In addition, the activity of a particular ecological and physiological group of microorganisms is strongly influenced by the presence of organic matter in the form of plant residues or chemicals used for various purposes in the city.

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# 自然条件下的熊蜂原生动物
# BUMBLEBEE PROTOZOOSES IN NATURAL CONDITIONS

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抽象的。 使用熊蜂作为栽培植物的高效传粉者，以及工业规模的熊蜂家族育种需要有关其病理学的准确数据。 目前有关熊蜂病虫害的信息非常粗略。 许多地理区域的害虫和病原体的物种组成尚未完全确定。 对于许多寄生虫，尚无明确的致病性。 控制害虫和大黄蜂寄生虫的措施仍未解决。 疾病能够对自然和实验室的熊蜂种群造成重大损害。

关键词：熊蜂、病理学、对抗熊蜂致病性原生动物的措施。

***Abstract****. The use of bumblebees as highly effective pollinators of cultivated plants, and the breeding of bumblebee families on an industrial scale require accurate data on their pathology. Information about pests and diseases of bumblebees is currently extremely sketchy. The species composition of pests and pathogens of many geographical regions has not been fully identified. With regard to a number of parasites, there is no clear idea of pathogenicity. Measures to control pests and bumblebee parasites remain unresolved. Diseases are capable of causing significant damage to natural and laboratory populations of bumblebees.*

***Keywords:*** *Bumblebees, pathologies, measures to combat pathogenic protozoa in bumblebees.*

Bumblebees are affected mainly by three species of protozoa - gregarin *Apicystus bombi*, microsporidia *Nosema bombi* and flagellate *Crithidia bombi* (Macfarlane et all., 1995).

*Apicystis (Mattesia) bombi* has been recorded in eastern Canada (Liu et all., 1974), France (Macfarlane et all., 1995), Finland, Italy (Triggiani, 1991), Switzerland (Schmid-Hempel, 1991). A. bombi has spores measuring 11.1-14.4x3.6-5.4

nm, sometimes as a boomerang (Liu et all., 1974). Unlike other protozoa, *A. bombi* spores are localized mainly in the fatty body of uterus, males and working bumblebees. The carriers of the parasite are overwintered uterus, the lesion of which reaches 5.5%, in some species 8.5% (Liu et all., 1974). The lesion probably causes uterus death during wintering (Macfarlane et all., 1995). Lifetime diagnosis and measures to combat this disease have not been developed.

Nosematosis is a bumblebee disease caused by parasitization of microsporidia *Nosema bombi* Fantham et Porter, 1913,1914. isolated the parasite from *B. terrestris* bumblebees and identified it as *Nosema apis*, the causative agent of honey bee nosematosis. In their next work (Fantham, Porter, 1914), the authors identified *N. bombi* as a separate species. Currently, bumblebee nosematosis is registered in Europe (Gorbunov, 1987; Grobov et all., 1982, Grobov, Sotnikov, 1998), North America (Liu et all., 1974), and New Zealand (Macfarlane et all., 1995).

Infection of bumblebees occurs when swallowing spores nosema during nest cleaning, nutrition. In the midgut, spores eject a polar tube that pierces the epithelial cell wall and injects a 2.2 μm diameter planont into the cell. Planont, due to the presence of pseudopodia, penetrates the host hemolymph and spreads throughout the body. It then penetrates the cytoplasm of Malpigian vessel cells. In 48 hours, all cells of Malpigian vessels are invaded (Grobov et all., 1982). In the cytoplasm of affected cells, the parasite divides to form two mononuclear formations. Subsequently, it goes through the schizogony stage, followed by the sporogonia stage. Inside the spores, the nucleus divides into two, and organelles (polar tube, polaroplast, vacuoles, etc.) are formed. Mature spores nosems refract light, have an oblong or slightly kidney-shaped shape measuring 4.4-4.8x2 microns, with two spherical nuclei. According to the data, spore sizes can reach 4.6-7.0x1.8-4.0 μm.

*Nosema bombi* infects uteruses, working individuals and bumblebee trunks. As Hasselrot T.B. (1960) points out, diseased bumblebee wombs lose the ability to lay nests, do not fly, crawl with difficulty on the ground, are very aggressive and are able to sting in the absence of provocation. Invasion extensiveness (EI) can vary greatly in different areas and by year. Fantham H.B. and Porter A. (1914) indicate a greater incidence of invasion in *B. terrestris* in England. In Sweden, these microsporidia affect 10 to 33% of bumblebees (Hasselrot, 1960). In spring in New Zealand, 7 to 43% of *B. terrestris* uteruses are invaded by nosema (Fisher, Pomeroy, 1989); in Switzerland - 13.5% (Shykoff, Schmid-Hempel, 1991); in Italy - 14% (Triggiani, 1991). According to P. Gorbunov (1990), in the Leningrad Region, this microsporidia affects *B. terrestris*, in 1.9-6.3% of cases.

Measures to combat nosematosis consist in a systematic inspection of the supplied artificial nests, when bumblebees die and in the fall after the nesting period, the used boxes are thoroughly machined and lowered into boiling water, or destroyed (Grobov et all., 1982).

In addition to the described protozoa from the body of bumblebees, the flagellate *Crithidia bombi* Gorbunov, 1987 (Gorbunov, 1987) was isolated. Skou J.P. et all. (1963) isolated from the intestines of flagellate bumblebees, which they assigned to *Leptomonas* sp.. P.S. Gorbunov (1986) noted bumblebee leptomonosis in the Leningrad Region. Probably in both cases we are talking about *Crithidia bombi*.

In the thin hindgut, the bumblebee *C. bombi* is represented by several types of individuals: flagellate or choanomastigote forms (choanomastigotes) and jelly-free or amastigote forms (amastigotes). Choanomastigotes, in turn, form three different groups of individuals: free single choanomastigotes, associates and immobile, attached to the surface of the cell epithelium, choanomastigotes. These groups regularly alternate in the life cycle of criticies.

Free choanomastigotes are pear-shaped with a deep funnel-shaped flagellate reservoir and one motor flagellum. Kinetoplast is located near the nucleus. Body dimensions: length 5.6 $\pm$ 0.18 μm, width 2.9 $\pm$ 0.10 μm. At all stages of the life cycle, the body is covered with plasmolemma with well-developed glycocalis. The surface of the body is uneven, folded. This surface structure is particularly pronounced in individuals attached to the gut surface. Attachment to the surface of the intestine of the host with the formation of semidesmosomes, as well as to each other using desmosome-like structures, prevents the excretion of flagellates into the external environment along with bumblebee feces (Gorbunov, 1987, 1990).

Unlike free and, especially, attached choanomastigotes, amastigotes that do not have a motor flagellum have a spherical body: length 1.72 $\pm$ 0.11 microns, width 1.48 $\pm$0.13 microns, core 0.5-0.7 microns. Deprived of active movement, the amastigotes located in the lumen of the small and large sections of the posterior intestine passively move due to peristaltic contractions of the wall of these sections and are brought out along with the fecal masses. The absence of flagellum and the smooth surface with a well-developed layer of glycocalis represent adaptive features that contribute to the unimpeded withdrawal of amastigotes from the host and their main function - ensuring the continuity of the life cycle by infecting other bumblebees (Gorbunov, 1990).

The development of the flagellum occurs only in the warm season, the maximum development of populations falls in mid-summer, when all forms of individuals of critidia can be observed. Seasonal continuity of the life cycle is provided by the founding wombs of the nests. During wintering, the intestines of the uterus contain attached choanomastigotes throughout the winter season. In Italy and Switzerland, EI *C. bombi* of bumblebee queens accounts for 54-81%, working individuals - 75-80%, males - 47-71% (Shykoff, Schmid-Hempel, 1991). In the Leningrad Region, *C. bombi* was found in the body of *B. terrestris* bumblebees. EI is 10.5-26.4% (Gorbunov, 1987).

Criticia are noted only in the intestines of bumblebee adults, larvae and pupae do not have infection. The pathways and ways of infecting *C. bombi* bumblebees are not yet sufficiently understood. However, P.S. Gorbunov (1990) experimentally proved the possibility of an alimental route of infection of bumblebees with cyst-like forms of critidia. Any symptoms of bumblebee disease in the presence of even very numerous populations of kritidia by P.S. Gorbunov were not found (Gorbunov, 1990). At the same time, according to Shykoff J.A. and Shmid-Hempel P. (1991), bumblebee workers affected by criticia have a decrease in the ability to collect pollen, an increase in the size of their ovaries. Measures to combat and prevent bumblebee criticism have not been developed.

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将数字技术引入制药组织的工作

# INTRODUCTION OF DIGITAL TECHNOLOGIES INTO THE WORK OF PHARMACY ORGANIZATIONS

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抽象的。 如果没有单个公司和整个行业的数字化，社会经济发展的现代趋势就不可能实现。 本文探讨了制药行业数字化转型的要素，确定了这一过程的法律监管特征，并以俄罗斯联邦最大的互联网销售服务之一为例，确定了互联网营销的主要数字工具。 在线药品。

关键词：数字技术、数字化、数字工具、在线药房。

***Abstract.*** *Modern trends in socio-economic development are impossible without digitalization of both an individual company and the industry as a whole. This article examines the elements of digital transformation of the pharmaceutical industry, identifies the features of the legal regulation of this process, and identifies the main digital tools of Internet marketing using the example of one of the largest Internet services in the Russian Federation for the sale of medicines online.*

***Keywords:*** *digital technologies, digitalization, digital tools, online pharmacy.*

**Introduction.** In modern society, digital technologies represent a key trend in the development of modern civilization, affecting all spheres of human activity. In the economies of different countries of the world, digitalization is primarily associated with the digital transformation of industrial production [1]. In the Russian Federation, the most promising area of innovative economic development is the pharmaceutical industry [2]. According to McKinsey analysts, the extensive introduction of digital technologies into the Russian economy, including the activ-

ities of the pharmaceutical complex, will increase the country's GDP by 4.1 – 8.9 trillion rubles by 2025 [3].

One of the main processes of pharmaceutical activity is the development and creation of innovative medicines and drugs, taking into account all the achievements of science and technology, where the introduction of digital technologies certainly plays an important role:

- firstly, when creating and testing a new molecule, digitalization allows testing processes to be carried out virtually, as a result of which it is possible not only to simulate physiological processes for research, but also to significantly reduce its time and financial framework;

- secondly, if necessary, rapid reconfiguration of the characteristics of production processes provides flexibility and, as a result, increases the efficiency of the entire production as a whole;

- thirdly, in accordance with the Decree of the Government of the Russian Federation of December 14, 2018 N 1556 "On approval of the Regulations on the system for monitoring the movement of medicinal products for medical use", the information content of the digital representation of all stages of production processes eliminates the spread of counterfeits and provides intermediate and final consumers medicines of appropriate quality [1,3,5].

Digital transformation affects not only the production branch of the pharmaceutical industry: under the influence of general trends, companies, when communicating with consumers, are "forced" to move into the virtual space, this can be seen especially clearly during the COVID-19 pandemic; finding themselves in conditions of forced quarantine, pharmacy visitors resorted to functions for online ordering of medicines. According to research by the Data Insight company, in 2019 online stores placed 98% more orders than in 2018; during this period, 51.6 million orders were placed worth 86.3 billion rubles; in 2022, the figure for online orders reached 140 million orders worth 236 billion rubles (Fig. 1) [7].

The coronavirus pandemic has accelerated the digital transformation of the pharmaceutical industry by more than five years [4,8].

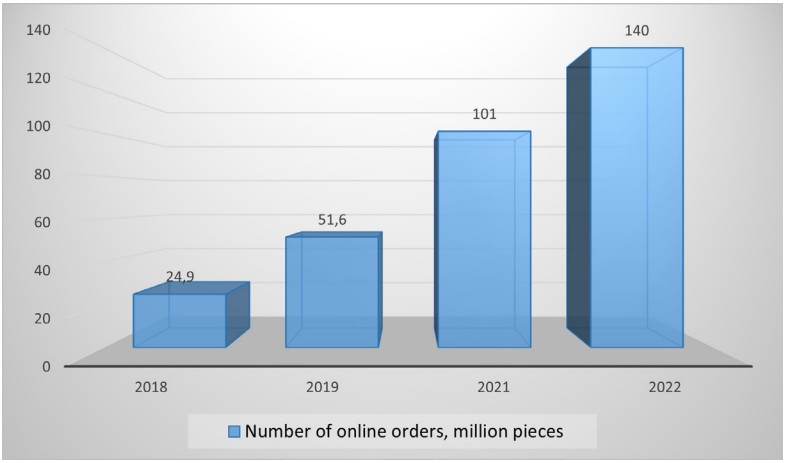


***Figure 1.*** *Number of online orders of medicines, 2018-2022. (Compiled according to the source Data Insight, marketing research of the online trading market)*

An important factor in the promotion by pharmacy organizations of the sale of products on online platforms were legislative amendments regarding the online sale of over-the-counter medicines: Decree of the Government of the Russian Federation of May 16, 2020 N 697 "On approval of the rules for issuing permits for remote retail trade of medicines for medical use" , carrying out such trade and delivery of these medicines to citizens and introducing amendments to certain acts of the government of the Russian Federation on the issue of retail trade in medicines for medical use by remote means" and Federal Law of April 3, 2020 N 105 "On amendments to Article 15.1 of the Federal the Law "On Information, Information Technologies and Information Protection" and the Federal Law "On the Circulation of Medicines" [5,6]. In the current circumstances, the transition of pharmacy organizations to the field of digital marketing is a prerequisite for their future competitiveness and efficiency.

The purpose of the study is to identify the results of digital marketing of one of the largest Russian Internet services for the sale of medicines.

Research materials: official branded website, telegram channel; During the work, the following methods were used: descriptive, comparative, logical, statistical.

Results and discussions. The Internet service for the online sale of medicines that we selected for the study is today one of the largest in Russia and, according to the results of research by the Data Insight company, is among the top three

in terms of sales volume among online pharmacies in recent years. The online pharmacy has a Telegram channel, its own branded website, which contains cards with information about medications in accordance with instructions for medical use, a blog with articles from medical specialists (nutrition, prevention of various diseases, examination of the body, etc.), geolocation data about points for issuing orders, information about various promotions, etc.

One of the current innovations of the Internet service under study is the ordering and home delivery of prescription drugs in Belgorod, Moscow and the Moscow region (in accordance with Article 55.1 of Federal Law No. 61 "On the Circulation of Medicines", from 03/01/2023 it is planned to conduct an experiment on retail sale of medicinal products for medical use, dispensed with a prescription for a medicinal product, remotely [9]), the website has an electronic prescription form, where, after entering and checking the data, you can familiarize yourself with the options for prescription drugs with home delivery.

The high growth in the level of digital trust of citizens and the transition of the audience to a model of digital content consumption takes the advertising of the product of individual organizations to a new level (Fig. 2).

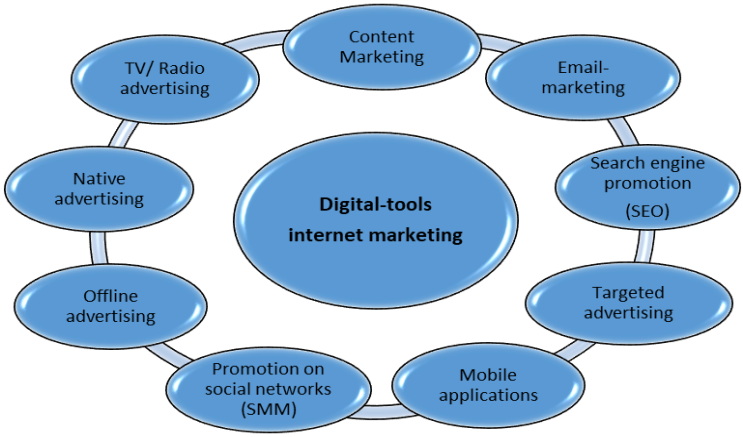


***Figure 2.*** *Basic digital marketing tools*

During the period under study, the Internet service we studied for the online sale of medicines used the following types of digital content: media advertising, e-mail mailing, targeting by search query, thematic selections of medicines/analogue drugs, trade marketing.

According to the results of statistics for January-February 2024 of the site under study, the following drugs were the most popular by search query: Migrenol

PM film-coated tablets; preparations containing vitamin D - Fortedetrim capsules and Aquadetrim drops for oral administration; Baziron AS gel for external use and MIG 400 film-coated tablets.

Among the leading drugs in the TOP-3 for native advertising are the following: Afobazol tablets, Frinozol nasal spray, Ecofuril capsules.

**Conclusions.** In the context of changing consumer behavior, under the influence of new trends, relying on customer focus, pharmacy organizations are forced to quickly change approaches to interaction with both consumers and specialists in the medical and pharmaceutical fields. Transferring communication to the online space and adapting to modern requirements allows pharmacy organizations to expand their target audience, helps increase sales and ensures further competitiveness and efficiency.

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# 躯体病理患者的眼病
# OPHTHALMOPATHY IN PATIENTS WITH SOMATIC PATHOLOGY

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抽象的。 本文从多学科医院的眼科医生的角度对伴有躯体多发病（风湿性疾病、脑血管病变和血脂异常）的眼病结构进行了回顾和研究。 眼科多发病中，存在屈光不正（58.3%），其中居首位的是近视（57.1%），其次是远视（42.9%）。 在针对躯体疾病学的保守血管治疗期间，所有青光眼患者都注意到眼内压（IOP）的补偿。

关键词：眼病、屈光不正、合并症患者。

***Abstract.*** *The article presents a review and study of the structure of ophthalmopathies with concomitant somatic polymorbidity (rheumatological diseases, vascular pathologies of the brain and dyslipidemia) from the position of an ophthalmologist at a multidisciplinary hospital. Among ophthalmological polymorbidity, refractive errors were identified (58.3%), among which the leading place is occupied by myopia (57.1%), the second is hypermetropia (42.9%). Compensation of intraocular pressure (IOP) was noted in all patients with glaucoma during conservative vascular therapy for somatic nosologies.*

***Keywords:*** *ophthalmopathies, refractive errors, comorbid patient.*

**Relevance**.

Increase in comorbid conditions in the population: In light of the increase in the average life expectancy of the population in the Russian Federation, modern society is faced with an increase in the number of people suffering from multiple chronic diseases. This applies to older people, who often have combinations of diseases such as hypertension, atherosclerosis, coronary heart disease, diabetes mellitus, and vascular diseases of the brain [1, 3]. In addition, in recent years, the incidence of ophthalmological complications in autoimmune diseases has been increasing, both due to the growing number of autoimmune pathologies throughout the world and due to the emergence of new diagnostic capabilities [2]. These comorbid conditions can significantly influence the development and progression of ophthalmopathies, which makes their timely detection and adequate treatment especially important.

Difficulty in diagnosing and treating ophthalmological disorders in conditions of comorbidity: Comorbid conditions can modify the clinical picture of ophthalmological diseases, complicating their diagnosis and choice of treatment strategy. In this context, an integrated approach to the examination and treatment of patients is required, taking into account the interaction of various pathological processes.

The need for a multidisciplinary approach: Modern medicine increasingly recognizes the importance of a multidisciplinary approach in the treatment of patients with comorbid diseases. Research aimed at studying the relationships between ophthalmological and comorbid pathologies contributes to the development of integrated examination and treatment protocols, which, in turn, can significantly improve the quality of life of patients.

Socio-economic significance: Ophthalmopathies can significantly reduce the quality of life of patients, limiting their ability to work and social activity. At the same time, there is a high frequency of comorbid pathology, which has a progressive course, leading to disability and early mortality [3]. In the context of such comorbidity, the problems associated with ophthalmopathies are aggravated, which places an additional burden on the healthcare system and the economy as a whole.

Thus, this study is extremely important because it aims to explore the clinical and socioeconomic challenges associated with improving the diagnosis and treatment of ophthalmic pathologies in patients with comorbid conditions.

Purpose of the work: Review and study of the structure of ophthalmopathies in the context of concomitant rheumatological diseases, vascular pathologies of the brain and dyslipidemia. The study is aimed at identifying the characteristics of ophthalmological disorders in patients with these comorbid conditions and determining the most effective approaches to their diagnosis.

Materials and methods: The study was conducted at the SBHI of TO Regional Clinical Hospital No. 1 in Tyumen from November 13, 2023 to December 4, 2023.

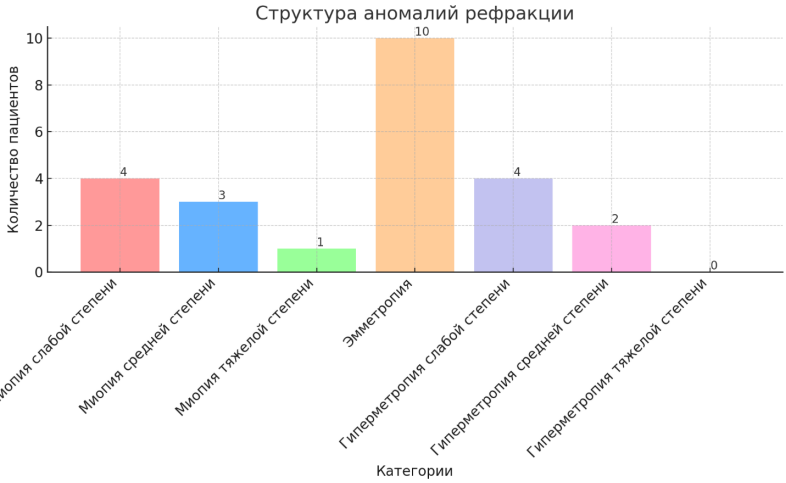
The study included patients who sought consultation at the ophthalmology department of SBHI of TO Regional Clinical Hospital No. 1. A total of 24 patients were selected from the cardiology, rheumatology, neurology and cardiac surgery departments, aged from 1 to 82 years.

A comprehensive ophthalmological examination included visometry (measurement of visual acuity), tonometry (determining the level of intraocular pressure), perimetry (examination of visual fields), Schirmer test, biomicroscopy of the anterior segment of the eye, as well as indirect ophthalmoscopy.

**Research results and discussion:**

The study included 24 patients of various profiles: 9 cardiology patients with an average age of 39.3 years [35;47], 1 cardiac surgery patient aged 1 year, 9 rheumatology patients with an average age of 44.1 years [38;52 ] and 5 neurological patients with an average age of 70 years [65;81].

Among the study subjects who sought consultation, refractive errors were detected in 58.3% of patients. Of these, myopia was diagnosed in 57.1%, and hypermetropia in 42.9%. At the same time, myopia is more often detected in young people, and hypermetropia in older and elderly people.




The presented diagram illustrates the structure of refractive errors among patients. The data shows that the majority of patients have emmetropia (10 patients), followed by mild myopia and mild hyperopia (4 patients in each category). Moderate myopia and moderate hyperopia occurred in 3 and 2 patients, respectively, while severe myopia was recorded in only one patient. Severe hypermetropia was not detected in any of the examined patients.

The study found no increase in IOP levels among participants, including four patients with previously diagnosed primary open-angle glaucoma. This fact indicates the systematic receipt of adequate therapy aimed at stabilizing IOP levels.

A narrowing of the visual fields was recorded in 25% of patients, mainly belonging to the older and elderly category, with the most pronounced manifestations in people with a history of glaucoma.

When performing a biomicroscopic examination of the anterior segment of the eye, cataracts were diagnosed in 41.6% of subjects, with the distribution by stage as follows: initial stage of cataract was 53.8%, immature cataract - 38.5%, mature cataract - 7.7%. Pseudophakia was detected in 16.6% of patients. One of the study participants had a history of radial keratotomy.

Dry eye syndrome was recorded in 29.2% of patients, and in patients with a rheumatological profile it was detected in 71.1% of cases, which significantly exceeds the figures among patients with other profiles. There is also a tendency for inflammatory diseases, in particular a history of uveitis and conjunctivitis in patients with ankylosing spondylitis, rheumatoid arthritis and systemic lupus erythematosus. Elderly patients with a complex of comorbid conditions associated with circulatory disorders and metabolic processes have a high incidence of retinopathy of varying severity. Among the most commonly diagnosed forms of retinopathy are hypertensive retinopathy of varying severity, non-proliferative diabetic retinopathy, vasospasm, vascular imbalance, microaneurysms and hard exudate deposits. At the time of examination, no acute ophthalmological pathology was detected in patients from the cardiology, rheumatology, neurology and cardiac surgery departments.

**Conclusions:**

The study of ophthalmological disorders in patients with these comorbid conditions revealed the following main conclusions:

1. Dry eye disease and inflammatory ocular diseases are found with high frequency among patients with rheumatologic diseases, highlighting the relationship between systemic and ophthalmic pathologies.

2. Vascular pathologies of the brain affect the state of the visual system, leading to narrowing of visual fields and other visual impairments, which emphasizes the need to integrate neurological and ophthalmological approaches into the comprehensive examination and treatment of patients.

3. Dyslipidemia, as a risk factor for the development of ophthalmopathies, including retinopathy, requires emphasis on the correction of lipid metabolism as part of the overall strategy for the prevention and treatment of visual disorders in patients with comorbid conditions.

The study confirmed the hypothesis that the presence of comorbid conditions significantly increases the risk of development and progression of ophthalmologi-

cal disorders, which requires the development and implementation of multidisciplinary approaches to the diagnosis, monitoring and treatment of these patients. An important aspect is not only the direct treatment of ophthalmopathies, but also the adequate management of underlying diseases, correction of lifestyle and lipid profile.

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SARS-COV-2病毒感染期间内脏器官损伤的形态学

# MORPHOLOGY OF DAMAGE TO INTERNAL ORGANS DURING INFECTION CAUSED BY THE SARS-COV-2 VIRUS

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注解。 迄今为止，COVID-19的病理解剖学、发病机制和形态发生以及并发症的研究仍不够充分。 [1] 本文讨论了最脆弱的内脏器官：胰腺、肾上腺和淋巴结。由于只有通过病理尸检才能获得有关COVID-19期间任何器官结构变化的可靠信息，本研究收集了20名经实验室确诊为新型冠状病毒感染COVID-19的死亡患者的尸检材料。

该论文介绍了2022年1月1日至2022年2月7日在皮亚季戈尔斯克死亡的20例死亡者的病理尸检结果。年龄从31岁到86岁（平均年龄58.5±21.4岁），死于严重的COVID-19，其中7人是男性和7人。 13 名是女性。 这种经验以前从未在其他来源中出现过。 病理尸检是在改建的病理科室进行的，严格遵守世界卫生组织、俄罗斯卫生部和Rospotrebnadzor的监管文件的生物安全规则。 最近，在快速发展的COVID-19感染背景下，出现了其他内脏器官与肺部同步受损的病例，这促使我们寻找SARS-CoV-2病毒与这些器官之间的关系。 值得注意的是，我们发现临床病例在上述传染病的背景下出现高血糖的最初迹象，这使各种形式的糖尿病患者面临并发症的风险。 服用糖皮质激素会增加肾上腺形态变化的风险。 淋巴组织的肺外并发症引起人们的兴趣，因为支气管肺淋巴结群非常接近呼吸系统的器官。 所有上述方面都决定了所选主题的相关性。

关键词：新型冠状病毒感染COVID-19、SARS-CoV-2病毒、COVID-19中的胰腺、COVID-19中的肾上腺、COVID-19中的淋巴结、细胞因子风暴。

***Annotation.*** *To date, the pathological anatomy, pathogenesis and morphogenesis of the manifestations and complications of COVID-19 remain*

*insufficiently studied. [1] This article discusses the most vulnerable internal organs: the pancreas, adrenal glands and lymph nodes. Due to the fact that obtaining reliable information about structural changes in any organ during COVID-19 is possible only through pathological autopsies, this study collected autopsy material from 20 deceased patients with a laboratory-confirmed diagnosis of the new coronavirus infection COVID-19.*

*The paper presents the results of 20 pathological autopsies of those who died in Pyatigorsk from January 1, 2022 to February 7, 2022. aged from 31 to 86 (average age 58.5±21.4) from severe COVID-19, of which 7 were men and 13 were women. This experience has not previously been presented in other sources. Pathological autopsies were performed in repurposed pathological departments in accordance with strict adherence to biosafety rules in accordance with the regulatory documents of the World Health Organization, the Russian Ministry of Health and Rospotrebnadzor. Since recently there have been cases of synchronous damage to other internal organs with the lungs against the background of a rapidly developing COVID-19 infection, this prompted us to search for a relationship between the SARS-CoV-2 virus and these organs. It is worth noting that we found clinical cases where, against the background of the previously mentioned infectious disease, the first signs of hyperglycemia occur, which puts patients with various forms of diabetes at risk of complications. Taking glucocorticosteroids increases the risk of morphological changes in the adrenal glands. Extrapulmonary complications in lymphoid tissue are of interest, because the bronchopulmonary group of lymph nodes is in close proximity to the organs of the respiratory system. All of the above aspects determine the relevance of the chosen topic.*

***Keywords:*** *New coronavirus infection COVID-19, SARS-CoV-2 virus, pancreas in COVID-19, adrenal glands in COVID-19, lymph nodes in COVID-19, cytokine storm.*

**The purpose of the study** is to conduct a study of autopsy material from patients who died from a new coronavirus infection. Determine the presence and nature of morphological changes in internal organs: pancreas, adrenal glands, lymph nodes

**Material and methods**:

The material for the study was 40 samples of adrenal glands, 20 samples of pancreas, 40 samples of peribronchial lymph nodes obtained from 20 patients with COVID-19. In all patients, the SARS-COV-2 RNA virus was identified by PCR. The material was fixed in a 10% formaldehyde solution for 24 hours, then subjected to standard histological processing, followed by sectioning, hemotoxylin and eosin staining, and microscopy. We performed an analysis of the patient's

medical record. Biochemical and clinical blood parameters, the dynamics of the patient's condition, the presence or absence of concomitant pathology, laboratory and instrumental research methods were taken into account.

**Results**. In all patients (100% of cases), the main cause of death was COVID-19, pronounced morphological changes in the lungs were detected, however, it is worth noting that simultaneous bilateral damage to the adrenal glands, pancreas and lymph nodes was also determined. It is known that the damage to the organs we are studying is multifactorial in nature and, according to Zairatyants et al., is called clinical and morphological "masks" of COVID-19 [1]. Among the factors contributing to the occurrence of morphological changes in the studied organs are: specific viral damage, hypoxia, hyperergic immune reaction, autoimmune genesis of the lesion cannot be excluded. COVID-19 is characterized by morphological changes associated with comorbid diseases and their complications in older age groups. In some cases, deceased patients were diagnosed with sepsis involving bacterial and mixed flora, occurring with multi-organ purulent foci.Our work examined lymph nodes as an important component of the immune system. We identified a wide range of changes, depending on factors such as the duration of the disease, the presence or absence of comorbid diseases, and the characteristics of therapeutic treatment. Similarly to the lungs, in the lymph nodes of the bronchopulmonary group the phenomenon of autocytophagy was detected in the marginal sinuses. Phagocytosis of whole lymphocytes was also present.

Macroscopically, the peribronchial group of lymph nodes showed a gray-pink color; on the section, pronounced plethora was noted. Unlike the lymph nodes of patients from the comparison group, they were larger in size.

On histological preparations, the pattern was erased and there was no visualization of lymphoid follicles and light germinal centers. Clusters of cells morphologically similar to monocytes were found in the sinuses. The presence of small lymphoid follicles, in which light germinal centers were not visualized, was rare; in the sinuses and cortex there were large accumulations of large cells with the morphology of monocytes.Microscopy in the peribronchial lymph nodes revealed the phenomenon of autocytophagy with pronounced congestion of the microvasculature and sludge of erythrocytes, and in 3 cases an accumulation of lymphocytes and macrophages in the sinuses was detected with the phenomenon autocytophagy.

The macroscopic picture of the adrenal glands is as follows: topographically, the adrenal glands were located superiorly and medially relative to the kidney. The right one was shaped like a pyramid, the left one was shaped like a crescent. On the section, three zones were clearly defined: the outer one was bright yellow, the middle one was a thin layer of brown color, and the inner one was gray, represented by the medulla.

As a result of the study, pronounced morphological changes were established in the adrenal tissue at the microscopic level, which manifested themselves in the form of lymphocytic infiltration and areas of necrosis. Also, upon microscopic examination, sections of the right and left adrenal glands show predominantly the cortical layer. The structure and relative position of the components of the cortical layer are not disturbed. Microscopically, in some cases, necrosis of the adrenal cortex was detected. The degree of blood filling of the cortex is moderate. Delipidation is weakly expressed.

At the macroscopic level, when examining the pancreas, in most cases, atrophy, focal or diffuse lipomatosis attracted attention. In a small number of cases, hemorrhages and hemorrhagic necrosis were found.

The microscopic picture of the pancreas is characterized by lipomatosis of the stroma and parenchyma, moderate atrophy of the exocrine parenchyma, congestion of the microvasculature with sludge of erythrocytes. Necrosis of cells of the endocrine part of the pancreas with perifocal fibrosis was quite rare.

**Conclusions:**

As a result of the study, pronounced morphological changes were revealed in the tissues of internal organs in patients who died from laboratory-confirmed COVID-19 infection. The most common morphological findings in the lymph nodes were the absence of visualization of lymphoid follicles and clear germinal centers, as well as the accumulation of cells with monocyte morphology. In the adrenal glands, the cortex was predominantly affected, with a histological picture of lymphocytic infiltration and areas of necrosis. Characteristic changes in the morphological picture of the pancreas were lipomatosis, which is both focal and diffuse in nature. Atrophy of the stroma, as well as the endocrine part of the gland. All of the above changes in morphology confirm the hypothesis of synchronous damage to internal organs associated with the cytokine storm with the lungs, and bacterial complications may be associated with transient immunodeficiency due to the effects of the SARS-COV-2 virus on the tissue of the lymph nodes.

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# 使用 Dorokhov-Petrukhin 方法研究青少年体型的性别差异
# GENDER DIFFERENCES IN SOMATOTYPE OF ADOLESCENT-AGED INDIVIDUALS USING THE DOROKHOV-PETRUKHIN METHOD

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注解。 借助体型分型方法，可以对疾病进行早期诊断并开发更有效的个体化治疗，从而加快患者的康复时间。 体质方法可以更准确地确定个体对环境劣势反应的类型特异性，并合理识别有害因素的风险群体，以便在疾病症状出现之前及时采取预防措施。 实用医学需要身体发育的标准（规范），并应不断修订，并考虑到发育的加速和减缓、社会的迁移过程和其他因素。 在分析体质特征时，需要考虑性别和年龄因素。 这项工作的目的是使用 Dorokhov-Petrukhin 方法确定青少年体型的性别特征。

关键词：体型、体质、人体质。

***Annotation.*** *Thanks to somatotyping methods, it is possible to carry out early diagnosis of diseases and to develop more effective individualized treatment, allowing to accelerate the recovery time of a person. The constitutional approach makes it possible to more accurately determine the typological specificity of an individual's reactions to environmental disadvantage and to reasonably identify risk groups with respect to damaging factors in order to timely implement preventive measures even before the onset of disease symptoms. Practical medicine requires standards (norms) of physical development, which should be constantly revised, taking into account acceleration and retardation of development, migration processes in society and other factors. When analyzing constitutional features, it is necessary to take into account gender and age factors. The aim of the work is to determine gender features of somatotypes of adolescents using the Dorokhov-Petrukhin method.*

***Keywords:*** *somatotype, physique, human constitution.*

**Relevance**: Thanks to somatotyping methods, it is possible to carry out early diagnosis of diseases and make more effective individualized treatment, allowing to accelerate the time of human recovery. The constitutional approach allows to determine more accurately the typological specificity of individual's reactions to environmental disadvantage and reasonably distinguish risk groups in relation to damaging factors in order to timely implement preventive measures even before the onset of disease symptoms. Practical medicine requires standards (norms) of physical development, which should be constantly revised, taking into account acceleration and retardation of development, migration processes in society and other factors.When analyzing constitutional features, it is necessary to take into account gender and age factors.

**Purpose of the work**: to determine gender features of somatotypes of adolescent individuals according to the Dorokhov-Petrukhin method.

**Material and Methods:**

A prospective study was conducted, 50 adolescent males aged 17 to 22 years (mean age 19 years) were examined. Somatotyping began with the assessment of the individual's dimensions, or the assessment of the overall level of variation, then the component and proportional levels of variation were assessed using standard anthropometric tools. Body length and body mass were measured to determine the gauge level of variation. The girth parameters: "upper arm circumference" - shoulder circumference at the level of the deltoid tuberosity of the humerus, "lower arm circumference" - shoulder circumference at the level of the transition of the abdomenof the biceps brachii muscle to the tendon; "thigh circumference upper" - thigh circumference in the area of the gluteal crease; "thigh circumference lower" - thigh circumference at the level of the maximum of the lateral head of the broad muscle of the thigh - were used to assess the muscular component of the soma. Distal limb diameters: "shoulder diameter" - distance between the epicondyles of the humerus, "forearm diameter" - size of the forearm bones above the styloidprocesses; "femur diameter" - distance between the femoral condyles measured in the sitting position with the knee joint bent at 90º; "tibia diameter" - size of the tibia bones above the ankles used to assess the bone component of the soma. The values of skin-fat folds on the limbs: "posterior shoulder" - vertical fold on the middle of the posterior surface of the shoulder; "anterior shoulder" - vertical fold on the middle of the anterior surface of the shoulder; "upper thigh" - in the upper third of the thigh, laterally; "lower thigh" - in the lower third of the thigh, laterally - were used to estimate the fat component of the soma. The length of the lower limb from the groin point to the floor was measured to assess the proportional level of variation. Assessment of somatotype was carried out according to the method of R.N. Dorokhov and V.G. Petrukhin using standard formulas. According to the results of somatotyping, the distribution of indicators by gender was analyzed.

**Results and Discussion:**

1. The total number of people examined was 50 (n=50=100%).
2. The gender distribution was: among the 50 youth, 32% were male and 68% were female.
3. The distribution of adolescent-aged individuals by dimensional level of variation with respect to gender was as follows:

a) Among women (n=34=100%): number of mesosomal type 10 (31%), mesomacrosomal type 3(9%), microsomal type 5(15%), micromesosomal type 9 (25%), macrosomal type 7(20%), megalosomal type 0(0%).

b) Among males (n=16=100%): number of mesosomal type- 3(19%), mesomacrosomal type- 3 (19%), microsomal type- 1 (6%), micromesosomal type- 2 (12%), macrosomal type- 6 (38%),megalosomal type-1(6%).

4. The distribution of adolescent-aged individuals by component level of variation with respect to gender was (n=50=100%):

a) Among women (n=34=100%), the number of muscle type-17 (49%),fat type- 16 (47%), bone type- 1 (4%).

b) Among males (n=16=100%):number of muscle type-8(50%),fat type-8 (50%), bone type-0 (0%).

5. The distribution of adolescent-aged individuals by proportional level of variation bygender was (n=50=100%):

a) Among women (n=34=100%): number of mesomembranous type- 7 (20%), micromembrane type-24(70%), macromembrane type-3(10%).

b) Among males (n=16=100%): number of mesomembranous type- 4(20%),micromembrane type-12(80%), macromembrane type-0(0%).

**Conclusions:**

In the subjects, depending on the gender sign, differences in constitutional indicators are observed. Thus, when assessing the dimensional level of variation, the mesosomal type was predominantly registered among women, while the macrosomal type was registered among men. Megalosomal and microsomal somatotypes were the least frequent among women and microsomal somatotype among men. Component analysis showed the same distribution of constitutional features regardless of gender, and was represented by an equal proportion of muscle and fat types. According to the analysis by proportional level of variation, the micromembranous type was the most frequent in both sexes. Macromembral type was absent among men, whereas it was represented by 10% among women.

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低强度激光辐射综合治疗丹毒患者的疗效

# THERAPEUTIC EFFECTIVENESS OF LOW-INTENSITY LASER RADIATION IN THE COMPLEX THERAPY OF PATIENTS WITH ERYSIPELAS

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注解。 现代丹毒病程的问题表明，需要优化治疗这种传染性疾病患者的治疗方法。

这项研究的目的。 评估低强度激光辐射（LILR）在丹毒患者综合治疗中的治疗效果

材料和方法。 红斑出血性丹毒（48%）和红斑性（52%）患者40例，年龄63.2±1.4岁，分为两组进行比较。 第一组包括接受抗菌药物标准药物治疗的患者，第二组增加了一个疗程的 LILR。

结果。 研究表明，在丹毒患者的综合治疗中使用LILR有助于最早消除丹毒区域的皮下脂肪肿胀，消退疼痛症状、红斑和出血成分，并更快地消退。 四肢运动的恢复和实验室血液参数的正常化表明炎症过程的消退。 此外，在接受复杂治疗的患者中没有记录到血小板聚集活性的病理性降低。

结论。 对丹毒患者进行抗菌治疗与低强度激光多波复合治疗相结合，不仅有助于疾病临床症状的早期消退，而且有助于恢复止血平衡。

关键词：红斑出血性和红斑丹毒，低强度激光辐射，血小板。

***Annotation.*** *The problems of the modern course of erysipelas suggest the optimization of therapeutic approaches to the treatment of patients with this infectious pathology.*

***Purpose of the study.*** *To evaluate the therapeutic effectiveness of low-intensity laser radiation (LILR) in the complex therapy of patients with erysipelas*

***Materials and methods.*** *There were 40 patients with erythematous hemorrhagic erysipelas (48%) and erythematous (52%) aged 63.2±1.4 years, who were divided into two comparable groups. Group I included patients who received standard pharmacotherapy with antibacterial drugs, and a course of LILR was added to group II.*

***Results****. The study showed that the use of LILR in complex therapy of patients with erysipelas contributed to the earliest resolution of swelling of the subcutaneous fat, regression of pain symptoms, erythema and hemorrhagic elements in the area of erysipelas, as well as a more rapid restoration of movement in the limbs and normalization of laboratory blood parameters indicating regression inflammatory processes. In addition, no pathological decrease in platelet aggregation activity was recorded in patients receiving complex therapy.*

***Conclusion.*** *The combination of antibacterial therapy with a multi-wave complex of low-intensity laser radiation in patients with erysipelas contributes not only to an earlier regression of the clinical symptoms of the disease, but also to the restoration of balance in hemostasis.*

***Keywords:*** *erythematous-hemorrhagic and erythematous erysipelas, low-intensity laser radiation, platelets.*

In the Middle Ages, erysipelas was called “St. Anthony’s fire” due to high fever and changes in the skin in the form of tongue-shaped or irregular erythema. Despite the long history of close attention of scientists to this anthroponotic infection, its incidence rates still remain high [1, 2]. As is known, the causative agent of erysipelas is the β-hemolytic streptococcus of group A - S. pyogenes, whose genomes have currently been sequenced, encoding about 2000 virulence and pathogenicity proteins, which create great problems for prescribing antibacterial therapy for this infection [3]. The ability of S.pyogenes to penetrate endothelial, epithelial, and dendritic cells, as well as macrophages and polymorphonuclear granulocytes, with the formation of a membranous flap in the form of a film of microvilli on the host cell membrane, allows it to be unreachable for penicillin and cephalosporin antibiotics. However, in vitro these drugs exhibit a bacteriolytic effect against streptococcus [4]. It is possible that these factors contribute to the fact that more than 100 million skin infections caused by Streptococcus A, C, G are registered annually in the world, with complications and relapses in 18 million people and more than 500,000 cases ending in death [5] The course of erysipelas on The modern stage is characterized by an increase in the proportion of severe, hemorrhagic forms, a tendency to develop a relapsing course and slow repair at the site of inflammation [6]. The leading cause of the development of a recurrent

course of this infection is the localization of S.pyogenes inlymphocapillaries of the dermis,as indicated by the tongue-shaped or irregular shape of the erythema, while morphological changes in the capillaries are presented in the form of pronounced proliferation of endothelial cells with a decrease in the cross-section of blood vessels, resulting in the formation of lymphostasis. And with each episode of relapse, lymphovascular fibrosis forms,which is the focus of persistent streptococcal bacteremia. Therefore, the search for the most effective methods of therapy and prevention of the formation of lymphostasis is still ongoing. And one of these methods is the inclusion of LILR in complex therapy for erysipelas.

**Purpose of the study**: To evaluate the therapeutic effectiveness of LILR in the complex therapy of patients with erysipelas.

**Materials and methods**. On the base Federal Budgetary Healthcare Institution Central Medical Unit No. 141 FMBA in the city of Udomlya, Tver region, conducted clinical and laboratory observation of 40 patients with erythematous-hemorrhagic erysipelas (48%) and erythematous (52%) at the age of 63.2±1.4 years, among which 65% patients were registered with type 2 diabetes mellitus (T2DM). Depending on the treatment regimens, patients were divided into two comparable groups according to gender (64% and 61% were female), age (62.4±0.9 and 58.9±1.1, respectively) and timing of admission to the hospital on the 3.4±0.8 day of illness. Group I included patients who received standard pharmacotherapy with antibacterial drugs, and group II, against the background of standard therapy, added a course of LILR , which was carried out with the RIKTA 04/4 apparatus for up to 10 sessions by zone (vascular bundles, spinal scanning and acupuncture points of thrombopoiesis) and locally - in the area of erysipelas. The laser radiation apparatus used is a multi-wave complex combining a pulsed infrared laser with a wavelength of 905 nm, incoherent infrared radiation with a wavelength of 880 nm, red spectrum radiations with a wavelength of 640 nm and a magnetic field. This combination makes it possible to obtain a synergistic positive therapeutic effect with minimal radiation exposure.

In addition to general clinical laboratory research methods, the observed patients were examined for the functional activity of platelets on NFP BIOLA aggregation analyzer (model 230LA) under the influence of the aggregation inducer adenosine diphosphate (ADP) - manufacturer NPO RENAM in concentrations of 2.5 μmol.

Statistical processing of the research results was carried out using software packages: Microsoft OfficeExcel 2007 (Microsoft, USA), STATIS-TICA 5.5 (StatSoft, Inc., USA) with the calculation of the arithmetic mean (M), standard deviation (SD). To assess differences between indicators, Student's t-test and $\chi 2$ test were used, where differences were considered significant at $p<0.05$.

**Research results**. In all observed patients, the disease began acutely with a rise in body temperature to febrile values, which was accompanied by severe pain,

swelling of the subcutaneous fat and the appearance of erythema in the form of "tongues of flame" in the erysipelas area, mainly on the legs (58%), thighs (18%) and upper extremities (24%). In group I, the erythematous-hemorrhagic form was recorded in 9 patients and the erythematous form in 11, and in group II, the distribution of observed patients according to the clinical form of erysipelas was the same. The duration of the febrile period was not statistically significantly different in the groups and was 6.2±0.6 and 5.6±0.7 days, respectively, while the onset of regression of symptoms such as pain, tissue swelling and erythema in patients of group II occurred on the second day from the beginning of LILR. In addition, these symptoms were less durable (5.7±0.4, 6.6±0.4, 7.8±0.4, respectively) in comparison with patients of group I, in whom the pain persisted until 12.4±0 .4, swelling up to 11.7±0.4, and erythema up to 15.6±0.6 days of illness. The onset of depigmentation of hemorrhagic elements in the area of erythema in patients with the erythematous-hemorrhagic form of group II coincided with the fourth session of LILR on 7.2 ± 0.5 days of illness, while in group I their regression began on 10.4 ± 0.7 days of illness. Upon admission to the hospital, all patients experienced significant limitation of limb movement due to the severity of swelling and severe pain. In the group of patients receiving complex therapy including LILR, complete restoration of movement was observed on the 7.8±0.4 day of illness, and in patients receiving standard therapy – on 11.9±0.4 ($p<0.05$). General clinical laboratory parameters were assessed by the number of leukocytes, the percentage of band neutrophils, CRP activity, procalcitonin as indicators of acute inflammation. And, despite the prescription of cefotaxime/sulbactam to all patients upon admission at a daily dose of 3.0 + 1.5 gram as initial antibiotic therapy, the dynamics of these indicators in the groups were different. In group I, in 2/3 of patients with erythematous erysipelas, the number of leukocytes from 14.8±0.7x10 9 /l gradually decreased to 7.8±0.7x10 9 /l by discharge from the hospital, and the band shift remained until 6.1±0.5 days of illness. In patients with the erythematous-hemorrhagic form, 72 hours after the start of antibacterial therapy, an increase in leukocytosis was noted from 15.9±0.6x10 9 /l to 19.8±0.8x10 9 /l and the percentage of band neutrophils from 8 to 10, and also an increase in the activity of CRP to 209.3±1.7 mg/l and procalcitonin over 5 ng/ml. As a result, all these patients had their antibiotics changed to vancomycin at a daily dose of 2.0 g. In group II, a change in etiotropic therapy to this glycopeptide, as a repeated course of antibacterial therapy, was carried out only in four patients with the erythematous-hemorrhagic form. In the remaining patients receiving LILR, a decrease in the number of leukocytes to normal values was noted on the fifth day,

At admission, no statistically significant changes in the number and average volume of platelets were detected in all patients. However, a study of their functional activity showed that at the time of hospitalization with the erythema-

tous-hemorrhagic form, a statistically significant decrease in the degree of platelet aggregation was recorded by 2 times from the values of the control group (74.5±1.8%), and in patients with the erythematous form - an increase in this indicator up to 94.5 ±1.4%, but without statistical significance. Further observations showed that in patients of group I there was a tendency towards a decrease in the average platelet volume and thrombocrit against the background of a statistically significant increase in their number. However, the degree of aggregation activity of blood platelets decreased by more than 3 times in the erythematous-hemorrhagic form (23.5±1.4%) and 2 times in the erythematous form (42.4±1.5%). And only towards the end of hospitalization there was a tendency towards an increase in the functional activity of platelets, which in patients with the erythematous-hemorrhagic form had not fully recovered by the time of their discharge from the hospital. At the same time, in patients of group II, during LILR, regardless of the clinical form of erysipelas, there was no tendency towards a decrease in the average volume of platelets and thrombocrit, and their aggregation activity after the third session of physiotherapy was restored to control values and remained at the time of discharge of the patients.

In the coagulation link of hemostasis during hospitalization in patients with erythematous-hemorrhagic erysipelas, an increase in the concentration of D-dimers was recorded by more than 1.5 times and the level of fibrinogen by 2.2 times from control values (424.3±1.8 ng/ml and 3.5 g/l, respectively), and in patients with the erythematous form, these indicators did not change statistically significantly. In patients of group I, the recovery of these indicators occurred gradually, while the level of D-dimers reached normal values by the time the patients were discharged from the hospital, and the concentration of fibrinogen remained the same. Whereas in group II, a progressive decrease in D-dimers was observed after the third session of LILR, and the fibrinogen concentration at the time of discharge decreased to control values. It is important to note that the length of hospitalization in the group of patients who received complex therapy including LILR was reduced by 4 bed days.

**Discussion.** The continued high incidence of erysipelas in the world, the increase in the registration of hemorrhagic forms and the tendency to develop a recurrent course determine the relevance of this infection in practical healthcare. Features of the pathogenetic mechanisms of the infectious process, the etiological factor of which is group A β-hemolytic streptococcus – S.pyogenes suggeststhe leading role of platelets in lymphogenesis and angiogenesis. The results of our study showed that with this infection, it is not so much the quantitative indicators of blood platelets that change, but the qualitative ones, namely aggregation activity. And as is known, the leading formed elements of blood involved in the angiogenesis of the microvasculature are platelets. The discovery of the lectin-like

receptor 2 C-type (CLEC-2) on the membrane of blood platelets has led to the hypothesis that they specifically control the development and formation of lymphatic vessels. In an experimental model of lymphostasis, it was proven that in the presence of podoplanin, thanks to CLEC-2, platelets adhere to endothelial cells after administration of thrombomass, they are subsequently grouped and after 12 hours a lymphatic vessel is formed [7]. Thus, the functional activity of these plates plays a leading role in the prevention of lymphostasis. It is also known that lipoteichoic acid, as a pathogenicity factor for streptococci, inhibits platelet aggregation [8]. Therefore, we noted this phenomenon in the observed patients in the absence of statistically significant changes in their number.

Mechanism of intracellular absorption S.pyogenes mainly in the lymphatic capillaries of the skin, as a factor protecting the pathogen from exposureβ-lactamantibiotics, limits the range of antibacterial therapy in the treatment of patients with erysipelas. This gives rise to constant searcheffective methods of therapy and prevention of the formation of lymphostasis. The results of our study showed that the use of LILR in the complex treatment of patients with erysipelas promotes an earlier resolution of swelling of the subcutaneous fat, regression of pain symptoms, erythema and hemorrhagic elements in the area of erysipelas, as well as restoration of movement in the limbs. Our data are consistent with the analysis of a number of researchers who associate the positive dynamics of LILR in patients with lymphedema with improved lymphatic drainage [9]. At the same time, we do not exclude the corrective effect of LILR on the hemostatic system. The absence of a decrease in platelet aggregation activity in patients who received a course of laser therapy does not exclude the direct effect of the multiwave complex on blood platelets, since acupuncture points of thrombopoiesis were included in the LILR scheme.

**Conclusions** Thus, the combination of antibacterial therapy with a multi-wave complex of low-intensity laser radiation carried out by the device “RIKTA 04/4” in patients with erysipelas, it contributes not only to an earlier regression of the clinical symptoms of the disease, but also to the restoration of balance in hemostasis. The inclusion of low-intensity laser radiation in the standard treatment of patients with erysipelas promotes a favorable outcome of the disease and earlier recovery.

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农工石化发达地区环境设施中有害物质含量的公共卫生风险

# PUBLIC HEALTH RISKS ON CONTENT OF HARMFUL SUBSTANCES IN ENVIRONMENTAL FACILITIES IN THE REGION WITH DEVELOPED AGRO-INDUSTRIAL AND PETROCHEMICAL COMPLEX

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抽象的。 近年来，对环境和卫生风险的评估和分析已成为科学研究和医学研究的合法工具，形成对生活在人为污染地区的人口健康状况的预测。 在这种情况下，形成致癌和其他风险的主要污染物是：大气中的甲醛、四氯甲烷、铬（VI）、碳和苯； 饮用水中 - 砷、铬、二氯乙酸、五氯苯酚、氯仿和溴二氯甲烷。 综合体周围的土壤受到石油产品、有机化合物、金属和盐的污染，这些污染物能够从土壤转移到半径 10-20 公里或更远的蔬菜和其他农产品中。 用于生产矿物肥料的原料含有锶、铀、锌、铅、镉等。这些元素作为杂质包含在过磷酸钙和钾肥中。 通过合理和有针对性地使用矿物肥料和其他肥料，不会对该地区的环境目标造成不良后果。 作者分析了巴什科尔托斯坦共和国最相关的管理决策、卫生和环境措施的数据。

关键词： 卫生因素； 健康风险；空气；水；土壤；石化和农工联合体。

***Abstract.*** *Assessment and analysis of environmental and hygienic risks in recent years has become a legitimate tool for scientific and medical research, forming a forecast of the state of health of the population living in zones of man-made pollution. In this case, the leading pollutants that form carcinogenic and other risks are: in atmospheric air-formaldehyde, tetrachloromethane, chromium (VI), carbon and benzene; in drinking water - arsenic, chromium, dichloroacetic*

*acid, pentachlorophenol, chloroform and bromodichloromethane. The soil around the complexes is contaminated with oil products, organic compounds, metals and salts, which are capable of translocation from soil to vegetables and other agricultural products within a radius of 10-20 or more km. Raw materials used for the production of mineral fertilizers contain strontium, uranium, zinc, lead, cadmium, etc. As impurities, these elements are included in superphosphates and potash fertilizers. With the justified and targeted use of mineral and other fertilizers, they do not cause undesirable consequences for the environmental objects of the region. The authors analyze data on the most relevant management decisions, hygienic and environmental measures in the Republic of Bashkortostan.*

***Keywords:*** *hygienic factors; health risks; air; water; soil; petrochemical and agro-industrial complexes.*

The risk methodology we use makes it possible to form more reliable and correct estimates of pollution of environmental objects and to develop a series of scientifically based sanitary, hygienic, environmental and management decisions [1].

In the territories of Ufa (Ufa, Blagoveshchensk) and the Southern Industrial Nodes (Salavat, Sterlitamak, Meleuz and Ishimbay) of the Republic of Bashkortostan (RB), a number of the largest facilities of the Russian Federation (RF) have been successfully operating for many decades, characterized by the concentration of a group of agricultural enterprises (hereinafter - agro-industrial complex), oil production, oil refining and petrochemicals (petrochemical complex).

The operation of the above-mentioned complexes of the Republic of Belarus creates a certain threat to public health as a result of pollution of water, soil and air in populated areas with a diverse set of chemical compounds. Thus, emissions of petrochemical enterprises contain up to two hundred or more names of substances with a variety of physicochemical, biological and toxic properties. Some of the pollution can accumulate in objects of the natural environment, enter into various chemical reactions with the formation of new harmful substances, as well as migrate from one medium to another. These features create the possibility and do not exclude the appearance of even more toxic and dangerous substances.

Our long-term studies on the state of environmental facilities and the formation of public health in regions with a developed petrochemical industry and agro-industrial complex indicate significant pollution of the human habitat. At the same time, atmospheric air pollution and a pronounced response of the population's body are observed at distances of up to ten or more km from enterprises, which also depends on the capacity and nature of concentration of such enterprises. A close correlation relationship between the morbidity and the range of residence of the population from petrochemical and other complexes was revealed. A particularly high correlation is noted for diseases of the respiratory system, digestion and

the central nervous system [2, 3, 4]. Among the numerous environmental factors that form the level of public health, atmospheric air and water of water bodies, one of the leading places belongs.

The analysis of compliance of atmospheric air with sanitary legislation in recent years shows a tendency to stabilize and reduce the number of samples with exceeding hygienic standards from stationary sources of harmful emissions of industrial enterprises and a gradual increase in the number and share of harmful emissions from mobile sources of harmful emissions. The main causes of environmental pollution are depreciation of fixed assets in almost all industries and transport, outdated technologies, accidents at enterprises, unfavorable meteorological and climatic conditions, as well as a significant increase in the number of vehicles over the past two decades.

In the conditions of the Republic of Bashkortostan (RB) and certain regions of the country, the main pollutants are toxic elements (mainly heavy metal compounds), chemical toxicants (benz (a) pyrene, dioxins, pesticides, etc.) and radionuclides,. All these substances form and pollute certain objects not only during man-made accidents and other emergencies, but also during normal operation of production systems [5, 6].

In the agro-industrial complex and rural settlements of the RB, large and medium-sized poultry, pig and livestock complexes, machine-tractor and repair and transport stations are significant and harmful sources of air pollution in the working zone and atmospheric air in residential areas. The conducted studies of the state of atmospheric air around these complexes, the survey and complaints of the population confirm the data on high concentrations of hydrogen sulfide, formaldehyde, ammonia and other strongly smelling substances in the atmospheric air not only in the minimum veterinary and sanitary protection zones of these complexes, but also in a radius of 500-1000 or more meters, but also exceeding the MPC of these substances around the complexes within a radius of up to 2-3 km.

Specifically for the cities of the region in recent years in Salavat, Sterlitamak and Ufa, the level of air pollution is characterized as increased, and in Blagoveshchensk and Tuymazy as low. Urban atmospheric pollution levels are mainly determined by high concentrations of benz (a) pyrene, nitrogen dioxide, formaldehyde and suspended matter. At the same time, the potential for atmospheric pollution on average per year is 3-4, and the atmospheric pollution index reaches 5-6 units. Per resident of the republic, the intake of pollutants into the atmosphere is on average up to 220 kg and per hectare of the territory of about 65 kg. The highest indicators for the density of pollutant emissions in the following territories: more than 6000 kg in Sterlitamak, in Tuymazy and Ufa, respectively, 4000 and 3000 kg per hectare of territory.

Analyses of water samples taken in 2023 in the territories of the agricultural complex showed that the water of underground and surface sources used by the

population for domestic, drinking and cultural purposes does not meet the requirements for microbiological indicators. The presence of generalized coliform bacteria (up to 9 col.), spores of sulfite-reducing clostridia (2-5 col.) was found in the water of underground sources (mine wells and wells). In the water of individual studied surface reservoirs, a high content of the total microbial number (up to 10 thousand) was found. CFU/cm3), the presence of generalized coliform bacteria and spores of sulfite-reducing clostridia (up to 9 col.), bacteria of the species Escherichia coli, causative agents of intestinal infections.

Earlier calculations of the risk of non-carcinogenic effects in chronic inhalation exposure showed that the levels of the total hazard indices of the combined action of pollutants on critical organs and systems are in the range from 1.5 to 9.1. The obtained results indicate a significant level of air pollution in the studied areas and cause a high probability of the development of adverse effects on public health. Individual carcinogenic risk levels for chronic aerogenic admission of carcinogenic hazardous substances in the study areas are within the range acceptable to occupational groups and unacceptable to the general population.

For example, in Ufa, the level of individual carcinogenic risk was 1.8; in Sterlitamak - 2.5; and in Salavat - 5.1 cases per 10 thousand population. At the same time, benzene (in Ufa - from 28 to 48%, Sterlitamak - 25%, Salavat - 22%), formaldehyde (in Ufa - from 27.5 to 47%, Sterlitamak - 20.2%, Salavat - 17.7%), tetrachloromethane (in Ufa - 34.7%, Sterlitamak - 44.4%, Salavat - 46.0%). The values of population carcinogenic risks in Ufa amounted to 179.1; Sterlitamak - 69.12; Salavat - 39.03 additional cases of neoplasms that can occur during life due to exposure to the listed substances.

Thus, the results of our research make it possible to assert that in order to assess the ecological and hygienic situation of the regions of the country, it is necessary to focus not only on exceeding the MAC of harmful substances in the air and other objects, but also on the levels of their carcinogenic and non-carcinogenic risks. Priority criteria have been developed to assess pollution of environmental objects in the region. They make it possible to increase the focus of social and hygienic monitoring in assessing the current situation and the correctness of ranking hazards in the method of analyzing environmental and hygienic risks. In the course of research, probabilistic models of risk to public health from existing petrochemical and agro-industrial complexes were obtained.

The conducted risk assessment significantly complements the information on the impact of harmful substances on the body of the population and expands the possibilities for developing measures for risk management and making effective sanitary and hygienic and management decisions to protect environmental facilities.

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确定经尿道等离子前列腺切除术治疗良性前列腺增生症患者的手术适应症

# DETERMINATION OF INDICATIONS FOR SURGICAL TREATMENT OF PATIENTS WITH BENIGN PROSTATIC HYPERPLASIA USING PLASMAKINETIC TRANSURETHRAL RESECTION OF THE PROSTATE

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抽象的。 本文致力于讨论使用新等离子体技术选择手术治疗良性前列腺增生（BPH）的方法的问题。 作者描述了双极手术的有效性和安全性，并将有前途的治疗方法（例如经尿道等离子前列腺切除术（PlTURP）和经尿道等离子内镜前列腺剜除术（PlEP））与传统方法进行了比较。 该研究是在两组患者的临床观察基础上进行的，证实了血浆方法相对于双极前列腺切除术的优势。 对使用过各种手术治疗方法的患者的尿流率、PSA水平、经直肠前列腺超声、前列腺结构和IPSS指数等参数进行详细分析。 研究结果表明，血浆方法具有高效能和优异的耐受性，这使其成为治疗 BPH 的潜在“金标准”。 作者计划进一步研究和开发一项计划专利，以优化此类患者的手术干预选择。 因此，文章强调了在 BPH 手术治疗中使用创新技术的重要性，这有助于提高患者的生活质量并节省资源。

关键词：良性前列腺增生，经尿道等离子动力前列腺切除术，经尿道等离子内窥镜前列腺剜除术，肿瘤学。

***Abstract.*** *The article is devoted to the problem of choosing a method of surgical treatment of benign prostatic hyperplasia (BPH) using new plasma technologies. The authors describe the effectiveness and safety of bipolar surgery, compare promising treatment methods such as plasmokinetic transurethral resection of the prostate (PlTURP) and transurethral plasmakinetic endoscopic enucleation of the prostate (PlEP) with traditional methods. The study was conducted on the basis of*

*clinical observations of two groups of patients, confirming the advantages of plasma methods over bipolar prostate resection. Parameters such as uroflowmetry, PSA level, transrectal ultrasound of the prostate, prostate structure and IPSS index in patients who have used various surgical treatment methods are analyzed in detail. The results of the study indicate the high efficacy and excellent tolerability of plasma methods, which makes them a potential "gold standard" for the treatment of BPH. The authors plan further research and development of a patent for a program to optimize the choice of surgical intervention in this category of patients. Thus, the article emphasizes the importance of using innovative techniques in the surgical treatment of BPH, which contributes to improving the quality of life of patients and saving resources.*

***Keywords:*** *Benign prostatic hyperplasia, plasmokinetic transurethral resection of the prostate, transurethral plasmakinetic endoscopic enucleation of the prostate, oncourology.*

Despite significant achievements in the field of pharmacotherapy of benign prostatic hyperplasia (BPH) To date, the proportion of patients with this disease who require surgical treatment remains very significant. Surgical intervention in BPH is aimed at eliminating mechanical obstruction at the level of the prostatic urethra[1]. Currently, bipolar (plasma) surgery, which has replaced open and traumatic surgical interventions, refers to fairly safe and effective methods of treating BPH. To date, it has been proven that plasmokinetic methods of transurethral resection of the prostate (PlTURP) and transurethral enucleation of the prostate (PlEP) in combination with general and local drug therapy differ from open prostatectomy (OPE) and monopolar transurethral resection of the prostate (M-TURP) with a significantly lower frequency of severe intraoperative complications (TURP syndrome, massive bleeding with hemotransfusion, electric burns), as well as shorter recovery times for patients after surgery and the duration of their stay in the hospital. Effective elimination of prostatic obstruction, reduction of the risk of recurrence and re-hospitalization are also among the advantages of new plasma technologies for endourethral surgery, which, of course, has a beneficial effect on the quality of life of operated patients. Saving money through faster recovery and discharge to the outpatient stage of follow-up treatment is of great importance not only for the hospital and the state budget, but also for the patients themselves.[2]

As a new treatment method that uses the most advanced plasma bipolar technology, transurethral plasmakinetic resection of the prostate gland (PlTURP) allows to achieve an incision of the prostate gland by evaporation of thermal energy, as well as sequential irrigation with saline solution. On the other hand, transurethral plasmakinetic endoscopic prostate enucleation (PlEP) is considered as another new method of treating BPH, which combines the advantages of TURP and open prostatectomy [3].

An older technology, bipolar resectoscopy, is based on the fact that current passes through the tissue only in the area between two electrode loops, which are under the visual control of the surgeon. In this case, saline solution can be used as a stretching agent, since it does not pose a risk of current dissipation. The generator generates a high initial voltage surge, which creates a voltage gradient in the gap between the bipolar electrodes. When the activated bipolar electrode is not in contact with the tissue, the electrolyte solution in the urethra disperses it. When the loop is close enough to the tissue, an arc with a high bipolar voltage between the electrodes converts a conductive sodium chloride solution into a nonequilibrium vapor layer containing energized sodium particles. Upon contact with the tissue, the tissue disintegrates by molecular dissociation. Energetically charged ions formed when exposed to plasma lead to the destruction of carbon–carbon and carbon-nitrogen bonds. Dissociation of water molecules is also observed when electronically exposed to the released fragments of H+ and OH−ions. As a result, cell membranes rupture, which leads to visible cuts. Clinically, an accurate tissue effect is achieved with minimal concomitant damage, since charged ions have an estimated penetration depth of only 50 to 100 microns (0.5–1 mm) into tissues. The depth of coagulation is determined mainly by the configuration of the electrodes and the design of the system, as well as the technique used by the operator (contact time and pressure) [4].

The purpose of this study was to determine the indications for surgical treatment of patients with BPH by plasmakinetic transurethral resection of the prostate.

In the period 2022-2023, a retro- and prospective clinical study was conducted at the Center for Innovative Urology on the basis of the MK “My Science” of 217 patients diagnosed with BPH. 2 groups of patients were formed depending on the type of endoscopic intervention: experienced group 1 of men (age 50-83 years) who underwent PlTURP – plasmakinetic transurethral resection of the prostate (n=121), control group 2 (age 53-71 years) – BiTURP – bipolar transurethral resection of the prostate (n=96). The distribution of patients by age is shown in table 1 and table 2. Based on clinical recommendations, for comparison of laboratory and instrumental indications for surgical interventions, the following were taken: urofloumetry (UFM), PSA level, transrectal ultrasound of the prostate (TRUS), prostate structure. [5] Statistical processing was carried out using Microsoft Corporation software (Microsoft Excel 2007) and using specially developed predictive programs in the Visual Basic environment, which allows calculating correlation coefficients.

***Table 1.***

*Age of patients after PlTURP.*

| Age | n | % |
|---|---|---|
| 50-60 | 25 | 20,6 |

| | | |
|---|---|---|
| 61-70 | 33 | 27,3 |
| 71-83 | 63 | 52,1 |

***Table 2.***

*Age of patients after BiTURP.*

| Age | n | % |
|---|---|---|
| 50-58 | 22 | 23 |
| 59-65 | 26 | 27 |
| 66-71 | 48 | 50 |

Calculating the correlation coefficient between surgical intervention methods and the age of patients, we obtained Rxy=0.25, which means a weak positive relationship between the two indicators. This means that age has no influence on the choice of surgical intervention and is not an indication for PlTURP

Based on the analysis of numerous publications devoted to the problem of benign prostatic hyperplasia (BPH), the most significant indicator of the study of urine flow in uroflowmetry (UFM) in the diagnosis of infravesical obstruction (IVO) is considered to be the maximum volumetric flow rate of urine. In men, a decrease in this indicator to ≤ 10 ml/s indicates IVO with a confidence of 70-90%, the lower limit of normal values is considered to be ≥15 ml/s [1, 2, 3]. Another indicator that may indicate IVO in men is a uroflowmetric index, rarely used due to the frequent absence of uroflowmeters in the software. In a pathological condition, its value is <0.8, normally > 1.1, intermediate values are considered doubtful. The rate of acceleration of urine flow is also recorded by far not all devices designed for FMS, in this regard, information about the values of this indicator is very limited. Given that the FMS is predominantly screening in nature, increasing the significance of its results for the diagnosis of IVO in BPH is important for developing treatment tactics or further examination of patients.

Let's look at the uroflowmetry data. The distribution of patients depending on the level of uroflowmetry is shown in Table 3. Analyzing the data, it can be seen that BiTURP and PlTURP were performed in patients with UFM less than 5 ml/sec. The correlation coefficient Rxy= 0.46, which indicates an average positive relationship between the UMF data and the choice of the operation method. It turns out that UFM > 5 ml/sec is an indication for the implementation of PlTURP

***Table 3.***

*Distribution of patients depending on the UFM*

| Methods | <5 | 5-10 | 10-15 | >15 |
|---|---|---|---|---|
| PlTUPR (n=121) | 63 | 32 | 16 | 10 |
| BiTUPR (n=96) | 54 | 23 | 15 | 4 |

The determination of the concentration level of prostate specific antigen (PSA) as a biochemical marker of the disease, introduced into clinical practice in the mid–80s of the XX century, is currently one of the standard examination methods for the diagnosis of prostate cancer. In countries where PSA monitoring has been widely used, there has been an increase in the frequency of detection of prostate cancer. Currently, due to early diagnosis performed during screening measures, from 70 to 80% of cases of prostate cancer are detected at an early stage of the disease, which allows for more effective surgical or radiation treatment. Recently obtained results of large-scale clinical studies demonstrate that PSA is not only a valuable marker of prostate cancer, but also a good predictor of the progression of benign prostatic hyperplasia (BPH) [6]. The literature data reflect the controversy regarding the diagnostic value of PSA values in the detection of prostate cancer. The essence of these contradictions lies in the fact that an increase in PSA values more reliably characterizes the degree of BPH, i.e. an increase in the volume of the pancreas, rather than the presence of a tumor transformation in the pancreas. This, in turn, leads to false positive results and an increase in the number of performed pancreatic biopsies, which are an invasive and expensive examination method, while false negative data may not allow timely diagnosis of prostate cancer at an early stage of its development [7].

Now let's turn to our sample of patients. The distribution of patients depending on the level of PSA and the method of surgery is shown in Table 4. The lower level is fixed at 1.4, the highest values reached 10.7. The correlation coefficient between the level of PSA and the method of surgical treatment Rxy =0.57, which means an high positive relationship between these signs and may be an indication for PlTURP.

***Table 4.***

*Distribution of patients depending on the PSA.*

| **Methods** | **<2.5** | **2.5-4** | **4-10** | **>10** |
|---|---|---|---|---|
| PlTURP(n=121) | 10 | 27 | 54 | 30 |
| BiTURP(n=96) | 9 | 28 | 31 | 28 |

Transrectal echography (TRUS) in BPH makes it possible to assess in detail the condition and direction of prostate growth, separately calculate the volume of hyperplasia nodes, study the nature of the echostructure, identify ultrasound signs of chronic prostatitis, prostate cancer, prostate sclerosis. Glandular structures on ultrasound look less echogenic than stromal elements. In most patients, the so-called mature benign prostatic hyperplasia has a hyperechoic structure. Ultrasound can be used to examine the mass of the organ and hyperplastic tissue, for which their volume must be multiplied by the coefficient of relative density of the pros-

tate gland, equal to 1.1. With ultrasound of the prostate gland, an isolated increase in only the middle lobe can be determined in the absence of pronounced hyperplastic changes in the lateral lobes, which is of fundamental importance, since the rapid progression of infravesical obstruction in these patients makes the prostate TOUR indicated. Since 1988, the technique of transrectal prostate biopsy under the control of a rectal ultrasound sensor has been widely introduced, which made it possible to obtain tissue samples from suspicious areas of the prostate gland. Nevertheless, the use of TRUS as a method of early diagnosis of prostate cancer causes a lot of discussion due to its low specificity and sensitivity. The sensitivity of TRUS as an independent method is higher compared to with (finger rectal examination). Due to the low specificity and sensitivity of TRUS, the role of an auxiliary diagnostic method used in the presence of changes in screening tests is assigned. Although TRUS has become a standard imaging technique for prostate diseases, the specificity and sensitivity of this study in the diagnosis of prostate cancer is still low, especially in cases where there are no pronounced hypoechoic areas. Creating a three-dimensional image of the prostate based on the results of ultrasound or even in real time is a promising area of ultrasound. The scope of application of three-dimensional ultrasound is extensive. It is used to accurately measure prostate volume, selectively take gland samples during biopsy, stage prostate cancer, and as a method of controlling prostate cancer therapy. The value of three-dimensional scanning can be increased with joint contrast enhancement or prostate Dopplerography. As is known, the areas affected by the tumor are characterized by hypervascularization. One of the additional factors in the prognosis of prostate cancer is the density of microvessels in prostate biopsies affected by cancer. As a result of impaired blood supply and blood flow, the structure of the gland tissue is disrupted. These changes can be recorded using Doppler ultrasonography, which increases the diagnostic capabilities of the TRUS. Doppler ultrasonography, depending on the type of scan, can be color-coded and enhanced. [1]

Reviewing the above, it can be understood that prostate ultrasound is the most relevant method of diagnosing BPH. And now let's move on to our sample(Table 5). The prostate volume is fixed in the range of 30-100 cm. The correlation coefficient between the TRUS and the method of surgical treatment Rxy =0.61, which means an high positive relationship between these signs and may be an indication for PlTURP.

***Table 5.***

*Distribution of patients depending on the TRUS.*

| **Methods** | **<30** | **31-80** | **81-100** |
|---|---|---|---|
| PlTURP(n=121) | 15 | 68 | 38 |
| BiTURP(n=96) | 18 | 51 | 27 |

If we talk about the formation of the 3rd lobe of the prostate in BPH, it is often observed in such patients and leads to infravesical obstruction. We examined the relationship between the structure of the prostate and the choice of its treatment method (Table 6). The correlation coefficient between the TRUS and the method of surgical treatment Rxy =0.72, which means an high positive relationship between these signs and may be an indication for PlTURP.

***Table 6.***

*Distribution of patients depending on the structure of prostate.*

| Methods | 2 lobe | 3 lobe | > 3 lobe |
|---|---|---|---|
| PlTURP(n=121) | 16 | 70 | 35 |
| BiTURP(n=96) | 21 | 48 | 27 |

Thus, the Pl TOUR is carried out according to the following indications: UFM 0<5 ml/sec, PSA 2.8-10.7, TRUS 30-100 cm3, formation of 3 or more prostate lobes. The most significant indications of these are the structure of the prostate, the data of the TRUS and the level of PSA. This technique has a number of advantages over BiTURP and can enter as the "gold standard" for the treatment of BPH. At the moment, a patent is being developed and obtained for a computer program for determining indications for surgical treatment of patients with BPH and choosing the most effective method of surgical intervention.

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# 达吉斯坦共和国妇女预防宫颈糜烂的当前问题
# CURRENT ISSUES IN THE PREVENTION OF CERVICAL EROSION IN WOMEN OF THE REPUBLIC OF DAGESTAN

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介绍。 在本研究中，作者首先对宫颈糜烂进行了定义。 该研究的相关性是由于宫颈癌的发病率和死亡率呈上升趋势。 宫颈糜烂是一种癌前病变，需要及时发现、治疗和预防。 目的：提供旨在提高达吉斯坦共和国妇女预防宫颈糜烂有效性的建议。

材料和方法。使用的材料是在国际书目和摘要数据库（Scopus、PubMed）、国内文献和科学资料、发病率和死亡率的官方统计数据中发表的文章。 为实现这一目标，采用了系统文献综述、内容分析、比较分析、国际经验分析等研究方法。 结果。 研究发现，最有效的预防宫颈糜烂和宫颈癌的策略是确定并随后尽量减少这些疾病发生的风险。 为了实施这一战略，该研究的作者提出了以下建议： 对民众进行关于宫颈糜烂的危险因素、其负面后果以及与宫颈癌的关系的教育； 改善女性人口筛查系统，加强定期体检和巴氏涂片检查并扩大其覆盖范围，接种人乳头瘤病毒疫苗，并进行初步研究以确定达吉斯坦共和国妇女感染的人口特征。本文对每项建议进行了更详细的讨论。

结论。 由于过去 12 年来，俄罗斯联邦宫颈癌的发病率和死亡率呈上升趋势，因此需要采取措施预防癌症本身以及作为其危险因素的癌前病症和病症。 作者在本研究框架内提出的建议有助于改善宫颈癌及其癌前病变（包括宫颈糜烂）的预防。 关键词：宫颈癌、宫颈糜烂、达吉斯坦共和国、预防、筛查

关键词：宫颈癌、宫颈糜烂、达吉斯坦共和国、预防、筛查。

***Introduction.*** *In this study, the author first defines cervical erosion. The relevance of the study is due to the trend of increasing incidence and mortality of cervical cancer. Cervical erosion is a precancerous condition, which dictates the need for its timely detection, treatment and prevention. Purpose: is to offer recommendations aimed at improving the effectiveness of the prevention of cervical erosion among women in the Republic of Dagestan.*

***Materials and methods.*** *The materials used were articles published in international bibliographic and abstract databases (Scopus, PubMed), domestic*

*literary and scientific sources, official statistics on morbidity and mortality. To achieve this goal, such research methods as a systematic literature review, content analysis, comparative analysis, and analysis of international experience were used. Results. It was found that the most effective prevention of cervical erosion, as well as cervical cancer, is a strategy for determining and subsequently minimizing the risks of their occurrence of these diseases. To implement this strategy, the author of the study proposes the following recommendations: education of the population about the risk factors for cervical erosion, its negative consequences and the relationship with cervical cancer; improvement of the screening system for the female population with the intensification and increase in the coverage of regular medical examinations and the Pap test, vaccination against the human papillomavirus with a preliminary study to determine the population characteristics of infection of women in the Republic of Dagestan. Each recommendation is discussed in more detail in the article.*

***Conclusions**. Since over the past 12 years in the Russian Federation there has been a tendency to increase the incidence and mortality of cervical cancer, measures are needed to prevent both cancer itself and precancerous conditions and conditions that are its risk factors. The recommendations proposed by the author in the framework of this study contribute to the improvement of the prevention of cervical cancer and its precancerous conditions, including cervical erosion. Keywords: cervical cancer, cervical erosion, Republic of Dagestan, prevention, screening*

***Keywords:** cervical cancer, cervical erosion, Republic of Dagestan, prevention, screening.*

**Introduction.** Before considering the current issues of preventing cervical erosion in women of the Republic of Dagestan, it is necessary to determine what is meant by this term. In fact, there is no erosion of the cervix, since erosion is understood as a defect in the surface layer of the epithelium, which does not affect the basement membrane and deeper layers, and when the erosion heals, no scar is formed [1].

However, in the context of the female reproductive system, cervical erosion is understood as a benign disease, which is considered as a normal variant found in women of the reproductive age group. In this condition, the glandular cells (columnar epithelium) that line the endocervix are present on the ectocervix, resulting in the exposure of columnar cells to the vaginal environment. This condition is better known as cervical ectopia or cervical inversion [2].

In the majority of cases, cervical erosion is detected during a routine gynecological examination of women of reproductive age. The condition is asymptomatic in 90%, but a number of researchers correlate it with chronic cervicitis, a common physiological condition of adolescents and pregnant women.

Cervical erosion is one of the most common gynecological diseases. The worldwide prevalence of cervical ectropion ranges from 17% to 50%. Prevalence increases with parity but decreases with age 35 years and older [3]. Cervical erosion occurs in 80% of sexually active adolescents. Available research also suggests that the prevalence of the condition depends on the type of contraception used. Erosion is more often observed in women taking oral contraceptive pills, and less often in women using barrier methods of contraception [4].

If we talk about the level of prevalence and incidence in the Russian Federation, in the structure of morbidity associated with gynecological problems, benign changes in the cervix, including cervical erosion, occupy first place [5]. The most common pathology among the background processes of the cervix is ectopia, which accounts for 10 to 25% of all cases of cervical diseases, depending on the authors. In the presence of other gynecological diseases, this percentage can reach up to 49.2%, and the highest incidence (more than 50%) is observed in nulliparous women under the age of 25 years [6].

In addition, cervical ectopia is the main risk for developing cervical cancer, which is one of the top 7 malignant tumors and ranks third among cancers in women. It accounts for approximately 9.8% of all cancers. It should be noted that the number of women with confirmed cervical cancer in the Russian Federation from 1990 to 2022 has a positive trend, the incidence has increased 5 times, and the mortality rate of this type of oncology has increased by 2 years [7]. Since the Republic of Dagestan is part of the Russian Federation, these statistical trends can be extrapolated to it.

In the absence of timely treatment, cervical erosion can lead to complications, including degeneration into cervical cancer. The increased incidence among young women and the growing neglect of cervical cancer dictates the need to improve the prevention and treatment of background changes in the cervix in general and cervical erosion in particular. The above determines the relevance of this study.

**Purpose** This study is to propose recommendations aimed at increasing the effectiveness of the prevention of cervical erosion among women of the Republic of Dagestan.

**Materials and methods.** The materials used were articles published in international bibliographic and abstract databases (Scopus, PubMed), domestic literary and scientific sources, official statistics on morbidity and mortality. To achieve this goal, research methods such as a systematic literature review, content analysis, comparative analysis, and analysis of international experience were used.

**Results.** Based on a systematic literature review and content analysis, comparative analysis and analysis of international experience, it was found that the most effective prevention of cervical erosion, as well as cervical cancer, is a strategy for identifying and subsequently minimizing the risks of their occurrence by assessing

the availability of opportunities and prospects for correction of these factors, gradual implementation at the level of the state health care system of measures aimed at neutralizing or eliminating these factors [8].

To implement this strategy, the following preventive technologies have shown their effectiveness:

**1. Education of the population about risk factors for the development of cervical erosion, its negative consequences and the relationship with cervical cancer.**

Women's training should be carried out by primary care doctors and, above all, gynecologists and obstetricians. Depending on the conditions and opportunities, different forms of health education should be used: information and recommendations from a doctor, distribution of thematic leaflets on prevention, holding thematic conversations and lectures in groups, and so on.

**2. Regular medical examinations and Pap tests.**

Women should undergo a Pap test from the beginning of sexual activity and for as long as their physical condition allows. This implies the need to improve the existing national screening program and develop a unified structured algorithm for examining women, which would include a Pap test. Today on the territory of the Russian Federation30 regional screening programs have been developed and implemented.

However, it cannot yet be said that they provide 100% coverage of the population, including the female population of various regions, with high-quality medical examinations. According to various researchers, the level of population coverage with preventive examinations is no more than 60-70% of the population [9].

Today, regions independently formulate a system and program for screening the population. In particular, in the Republic of Dagestan, screening of the population is carried out in accordance with Decree of the Government of the Republic of Dagestan dated December 22, 2014 N 662 "On approval of the state program of the Republic of Dagestan "Health Development in the Republic of Dagestan""

However, in the majority of cases, these programs do not contain schemes for routing, examination and treatment of patients, centralization and automated accounting, or monitoring of further examination.

**3. Vaccination against human papillomavirus.**

However, to determine the extent of vaccination coverage among the female population, vaccination regimens, and in which groups it is most indicated, the peculiarities of the spread of human papillomavirus infection in the region and population should be taken into account. The distribution of human papillomavirus infection and the frequency of different genotypes can vary significantly in different geographic and ethnic populations, as well as in different age groups of the female population.

In order to assess the extent of vaccination of the female population, the ideal vaccination schedule and appropriate groups, it is necessary to consider the level of human papillomavirus infection in a given region and in a given population. The genotypic frequency and distribution of infection can vary significantly among different geographic areas and ethnic groups, and depending on the age of women. For example, in a Chinese province, human papillomavirus infection was detected in only 7.4% of women aged 18 to 75 years [10]. In Bahrain, the virus was detected in 9.9% of women.

The study, which included 12,000 women aged 15 to 45 years, found persistent HPV infection in 28% of women aged 15 to 26 years, 13% of women aged 24 to 34 years, and 7% women aged 35 to 45 years [11]. A high prevalence of human papillomavirus is observed in some African countries and among the native population of Australia: in women under 21 years of age, the presence of this infection was found in 67.4%, and in women over 40 years of age - in 16.5%. One of the reasons for such a high prevalence of this virus among young people is the increase in sexual activity [12].

It should be noted that population-based studies aimed at studying the characteristics of the spread of human papillomavirus infection have not been conducted on the territory of the Republic of Dagestan. Therefore, before introducing mass vaccination against human papillomavirus, in order to increase its effectiveness, the author of this work proposes to carry out this study.

It is also important to note that internationally, vaccination against human papillomavirus is already widespread. Available research results indicate that in countries where the level of coverage of the population with this type of vaccination is high, the USA, Great Britain and other countries, there is a decrease in the incidence and, as a consequence, mortality of cervical cancer and diseases associated with the human papillomavirus, including cervical erosion, which is a precancerous condition.

**Conclusions.** Thus, today, cervical erosion in women of the Republic of Dagestan is a dangerous precancerous condition, which, in the absence of timely diagnosis and treatment, can degenerate into a malignant cancer. Since over the past 12 years in the Russian Federation there has been a trend towards an increase in the incidence and mortality of cervical cancer, measures are needed aimed at preventing both the cancer itself and precancerous conditions and conditions that are its risk factors.

A systematic literature review and content analysis showed, comparative analysis and analysis of international experience showed that the most effective prevention of cervical erosion, as well as cervical cancer, is a strategy for identifying and subsequently minimizing the risks of these diseases. To implement this strategy, the author of the study offers the following recommendations: educating the

population on risk factors for the development of cervical erosion, its negative consequences and the relationship with cervical cancer; improving the screening system for the female population by intensifying and increasing the coverage of regular medical examinations and Pap tests, vaccination against the human papillomavirus with a preliminary study to determine the population characteristics of infection of women in the Republic of Dagestan.

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# 中风后痉挛的医疗康复
# MEDICAL REHABILITATION OF POST-STROKE SPASTICITY

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抽象的。 中风是最重要的医学和社会问题之一。 急性脑血管意外（ACVA）致残率超过60%。 根据世界卫生组织的数据，全球中风后痉挛的患病率为0.2%，即每10万居民中有200人； 超过1200万患有急性脑血管意外的患者患有痉挛。 研究目的：评估针灸治疗中风后痉挛恢复期的有效性。 材料和方法。 该研究涉及40名处于早期和晚期恢复期的急性脑血管意外患者。 使用 Ashworth 肌肉痉挛量表、改良 Rankin 量表、Rivermead 活动指数和康复路线量表评估反射疗法治疗中风后痉挛的有效性。 结果。 总体而言，34 名患者 (85%) 的活动能力有所增加，26 名患者 (66%) 的日常活动有所增加，21 名患者 (54%) 的身体能力有所提高，7 名患者 (16.2%) 的肌肉痉挛有所减少 ） 患者。 结论。 针灸的使用是中风和四肢严重痉挛患者复杂医疗康复的重要组成部分。

关键词：急性脑血管意外； 医疗康复； 针刺; 痉挛; 中风。

***Abstract.*** *Stroke is one of the most important medical and social problems. The level of disability in acute cerebrovascular accident (ACVA) exceeds 60%. According to the World Health Organization, the prevalence of post-stroke spasticity in the world is 0.2%, or 200 people per 100 thousand inhabitants; more than 12 million patients who have suffered an acute cerebrovascular accident suffer from spasticity. Purpose of the study: to evaluate the effectiveness of treatment of post-stroke spasticity in the recovery period using acupuncture. Materials and methods. The study involved 40 patients with acute cerebrovascular accident in the early and late recovery period. The effectiveness of treatment of post-stroke spasticity using reflexology was assessed using the Ashworth Muscular Spasticity Scale, Modified Rankin Scale, Rivermead Mobility Index, and Rehabilitation Routing Scale. Results. Overall, mobility increased in 34 (85%) patients, an increase in daily activity was noted in 26 (66%) patients, an increase in physical capabilities in 21 (54%), and a decrease in muscle spasticity in 7*

*(16.2%) patients. Conclusions. The use of acupuncture is an important element in the complex medical rehabilitation of patients who have suffered a stroke and have severe spasticity of the limbs.*

***Keywords:*** *acute cerebrovascular accident; medical rehabilitation; acupuncture; spasticity; stroke.*

**Introduction**

Stroke is one of the most important medical and social problems. The level of disability in acute cerebrovascular accident (ACVA) exceeds 60% [1].

According to various authors, rehabilitation measures can be effective for 80% of stroke survivors; In 10%, complete recovery can occur on its own, and for 10%, rehabilitation measures are futile [2,3,4].

It should be noted that it is the motor neurological deficit that reduces the quality of life of patients and changes their social and family role. Motor disorders after a stroke in the greatest number of cases manifest themselves in the form of: hemi- or monoparesis of the limb with increased muscle tone according to the type of spasticity [5,6,7,8].

According to the World Health Organization, the prevalence of post-stroke spasticity in the world is 0.2%, or 200 people per 100 thousand inhabitants; more than 12 million patients who have suffered acute cerebrovascular accident [9] suffer from spasticity.

The time interval from 3 to 12 months is of greatest importance for the development of the spasticity symptom complex. Frequency of occurrence of post-stroke spasticity in the time interval from 3 months. up to 1 year: 3 months. - 19%; 12 months – 39%; only in hand – 15%; only in the leg – 18%; in the arm and leg – 67%. According to J. Wissel et al.: 1–2 weeks. – 25%, 1–3 months. – 27%, 6 months. – 22%; according to E. Lundström et al.: 1–3 months. – 27%, 6 months. – 23% [9.10].

The time interval is a key factor in the formation of post-stroke spasticity. Understanding the period of stroke affects the development of an individual program of rehabilitation measures.

There are several different methods for treating post-stroke spasticity, which in most cases take a comprehensive approach. Medical rehabilitation of post-stroke spasticity includes medicinal and non-medicinal methods, in particular reflexology.

Reflexology (from the Latin “reflexus” - reflected, and the Greek “therapeia” - treatment) is a method that affects the homeostasis system and changes pathological processes as a result of the impact (stimulating or inhibitory) on certain reflexogenic areas by various factors. At the same time, there is a correspondence of acupuncture to the basic principles of systems theory and systems analysis [11].

**The purpose of the study** is to evaluate the effectiveness of treatment using reflexology, which is part of complex medical rehabilitation, in patients with post-stroke spasticity of the upper and lower limbs.

**Materials and methods**

The study was conducted as an observational study within the framework of everyday neurological rehabilitation clinical practice in the medical rehabilitation department No. 2 on the basis of the State Budgetary Healthcare Institution of the Republic of Belarus of the Clinical Hospital of Emergency Medical Care in Ufa for 2018-2019. The subjects of the study were 40 patients with stroke in the early and late recovery period, with spasticity of the upper or lower limb.

The criteria for inclusion in the study were a history of ischemic or hemorrhagic stroke (stroke duration from 2 weeks to 2 years), post-stroke spasticity, informed consent of the patient to treatment and participation in the study. Exclusion criteria from the study were acute infectious diseases, impaired consciousness, skin diseases in the acute stage, and the patient's refusal to undergo examination.

All patients underwent comprehensive rehabilitation according to an individual program.

Rehabilitation activities included daily individual and group classes with physical therapy instructors, physiotherapy (magnetic therapy), massage of paretic limbs, reflexology, consultations with a therapist, clinical psychologist, and, if necessary, a speech therapist and psychotherapist. Basic drug therapy prescribed at the previous stage of medical rehabilitation continued.

All patients, as well as relatives, received a thorough explanation and training in the methods of independent exercise therapy, and were given information about the need for their regular and long-term implementation.

All patients underwent a comprehensive examination, including the study of complaints, anamnestic data, assessment of neurological status and clinical symptoms using scales and questionnaires.

All patients underwent massage of spastic limbs, at a slow pace, 20 minutes, 10 sessions. In almost half (48.7%) of the cases, patients were prescribed paravertebral magnetic therapy lasting 15 minutes, 10 sessions.

Statistical processing of the obtained results was carried out using the computer licensed program Microsoft Exel and Statistica (version 10.0) and analytical methods. Differences were considered statistically significant at $p<0.001$.

To correct spasticity, the method of acupuncture was used. Disposable steel acupuncture needles 0.3×38 mm "Sumbal" were used. The number of points of influence per procedure ranged from 5 to 20. The method of influence was inhibitory. The depth of insertion is canonical. We acted on acupuncture points located on the antagonists of spastic muscles.

The course of reflexology in the early and late recovery periods of stroke was 10 sessions. The procedures were prescribed daily, in the first half of the day, with a break on weekends (Saturday, Sunday).

To determine the strategy and tactics of acupuncture, the patient was examined, palpated, diagnosed by pulse and tongue, which made it possible to determine the nature of the disorder in the Yin-Yang system, etiopathogenetic factors, the damaged organ and changes in one of the main meridians. The points were selected taking into account the specific syndrome and the functional properties of acupuncture points. The choice of reflexology technique and compilation of an acupuncture prescription for biologically active points was carried out strictly individually, taking into account the stage of stroke and its clinical and pathogenetic variant.

For the treatment of movement disorders, the following main points were used: for the hands – Jian-yu LI15, Qu-chi LI11, Wai-guan TB5, Hegu LI4; for legs – Huan-tiao GB30, Zusan-li ST36, Yang-lin-quan GB34, Xuan-chung GB39, Jie-si ST41 [10]. The options for influencing acupuncture points were different due to the diagnosis according to traditional Chinese medicine.

The effectiveness of reflexology to reduce spasticity as part of complex rehabilitation was assessed clinically at the time of admission and at the end of the course of treatment: using the Ashworth muscle spasticity scale (Table 1), the modified Rankin scale, the Rivermead mobility index, and the rehabilitation routing scale (RRS).

***Table 1***

*Ashworth Muscle Spasticity Scale*

| Score in points | Clinical signs |
|---|---|
| 0 | Muscle tone is unchanged |
| 1 | A slight increase in tone, felt when flexing or extending a limb segment in the form of slight resistance at the end of the movement |
| 2 | A slight increase in tone in the form of resistance that occurs after performing at least half the range of movements |
| 3 | Moderate increase in tone, evident throughout the entire movement, but not complicating the performance of passive movements |
| 4 | Significant increase in tone, making it difficult to perform passive movements |
| 5 | The affected limb segment is fixed in flexion or extension |

**Results and discussion**

The study included 40 patients, including 30 (75%) patients with ischemic stroke (IS) and 10 (25%) patients with hemorrhagic stroke (HS). Post-stroke spasticity of the limbs in the early and late recovery period of stroke was detected in 24 (60%) and 16 (40%) patients, respectively. Cases of recurrent ischemic and hem-

orrhagic stroke were observed in 10 (25%) and 2 (5%) patients, respectively. The ratio of ischemic to hemorrhagic stroke is 3:1. By gender, patients are presented as follows: 22 men (55%) and 18 women (45%). The average age of patients with IS of both sexes was 63.2±10.1 years. The average age of patients with HI of both sexes was 57.6±15.6 years.

The diagnosis was verified using magnetic resonance or computed tomography in 40 (100%) patients. According to the results of instrumental examination, focal ischemic lesions were equally observed in the left and right carotid territories in 32 (40%) patients, in the vertebrobasilar region - in 8 (20%) patients.

In this group, patients with post-stroke spasticity of the upper and lower limbs were observed, of which 34 (85%) patients had predominant spasticity of the upper limb.

Neurological motor disorders in patients with post-stroke spasticity were caused by hemiparesis of varying severity: moderate - in 13 (32.5%) cases, deep - in 7 (17.5%), a combination of moderate to deep paresis in the distal parts was detected in - 9 (22.5%), a combination of moderate paresis to plegia in the distal parts - in 8 (20%) cases, a combination of deep paresis to plegia - in 3 (7.5%).

Overall, mobility increased in 34 (85%) patients, an increase in daily activity was noted in 26 (66%) patients, an increase in physical capabilities in 21 (54%), and a decrease in muscle spasticity in 7 (16.2%) patients.

As a result of complex rehabilitation, including reflexology, there is a decrease in spasticity in the limbs according to the Ashworth scale; an increase in motor activity and mobility of patients was confirmed based on the Rivermead mobility index, modified Rankin scale and rehabilitation routing scale (Table 2, Table 3).

***Table 2***

*Dynamics of treatment based on scales (in points)*

| | **Ashworth Muscle Spasticity Scale** | **Modified Rankin Scale** | **p** |
|---|---|---|---|
| At the beginning of treatment | 2,91 ± 1,14 | 4,28 ± 0,56 | 0,001 |
| At the end of treatment | 2,09 ± 1,05 | 3,67 ± 0,56 | 0,001 |

***Table 3***

*Dynamics of treatment based on scales (in points)*

| | **Rivermead Mobility Index** | **Rehabilitation Routing Scale** | **p** |
|---|---|---|---|
| At the beginning of treatment | 3,81 ± 2,33 | 4,28 ± 0,56 | 0,001 |
| At the end of treatment | 5,86 ± 2,67 | 3,61 ± 0,67 | 0,001 |

**Conclusions**

The main component of the effectiveness of medical rehabilitation of post-stroke spasticity is a diverse set of measures carried out by a multidisciplinary team, which allows to reduce the manifestation of motor neurological disorders. When treating post-stroke spasticity, it is necessary to keep in mind that the lower the degree of pyramidal motor deficit and the time period from the onset of stroke, the more likely it is to improve motor function [1,6,12].

The use of reflexology is an important component of complex medical rehabilitation of patients who have suffered a stroke and have severe spasticity of the limbs.

An integrated approach to the treatment of patients with post-stroke spasticity leads to increased effectiveness of medical and social rehabilitation, improving the quality of life not only for the patients themselves, but also for their relatives.

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添加蔬菜原料的禽肉碎制品的开发

# DEVELOPMENT OF CHOPPED POULTRY MEAT PRODUCTS WITH ADDED VEGETABLE RAW MATERIALS

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注解。 本研究致力于开发一种浓缩禽肉碎产品的新配方，用植物原料部分替代经典配方的成分。 该主题的相关性是毋庸置疑的，因为在现代世界，有必要创造出一方面可以维持身体正常功能并避免疾病发生，另一方面也可以取悦人们的产品。 本文的目的是证实使用植物原料作为结构形成剂和营养价值调节剂的禽肉半成品的配方。 这项工作研究了各种植物成分对所得产品的质地、味道和营养价值的影响。 考虑到实验室获得的结果，考虑到营养价值和消费者的需求，这些结果是合理的。 由此产生的食谱可以成为开发具有更高营养价值和改善口味特征的新食品的基础。

关键词：蔬菜原料、碎禽肉、小麦面包、强化产品。

***Annotation.*** *The presented research is devoted to the development of a new recipe for enriched minced poultry meat products with partial replacement of the ingredients of the classic recipe with plant raw materials. The relevance of the topic is beyond doubt, since in the modern world it is necessary to create products that will allow, on the one hand, to maintain the normal functioning of the body and avoid the occurrence of diseases, and will also please people. The purpose of this article is to substantiate the formulation of semi-finished poultry meat products using plant raw materials as a structure former and nutritional value regulator. The work examines the influence of various types of plant ingredients on the texture, taste and nutritional value of the resulting products. The results obtained in the laboratory are considered, which are justified taking into account*

*the nutritional value and demand by consumers. The resulting recipes can become the basis for the development of new food products with increased nutritional value and improved taste characteristics.*

***Keywords:*** *vegetable raw materials, minced poultry meat, wheat bread, enriched product.*

Considering the catering industry, one cannot help but notice that the modern market is saturated with a variety of products that only help to satiate a person. The creation of a product with the addition of plant materials is necessary due to the fact that more and more people are becoming susceptible to “big city” diseases, such as obesity, diabetes, metabolic syndrome, etc. All these diseases share risk factors (that provoke them), such as a sedentary lifestyle, consumption of fast carbohydrates, poor nutrition and lack of dietary fiber in foods.

Scientists who have examined nutritional problems most often recommend reducing the amount of fat in foods, and cooking foods with little or no fat by steaming or boiling. A promising type of heat treatment of a product is cooking it in a combi oven or roasting it in an oven.

Problems associated with healthy eating and diet therapy have great potential for preserving the health of the nation, and therefore are considered by many scientists. This topic was considered by such researchers as: Das A.K., Romano G., Xu J., Zhang K., Hairi A. N.A., Nabukwangwa W. Vasyukova A.T., Varlamov I.A., Myachikova N.I., Pocheykin Yu.E. . and other much or little-known researchers. It is worth paying attention to the research of Das A.K., in his work on the formation of polycyclic aromatic carbohydrates (PAHs) during the preparation of meat and meat products. According to Das A.K, this is a global problem, since PAHs are well-known carcinogens, mutagens, teratogens and genotoxic for living beings. PAHs are formed in cooked meats as a result of various cooking methods, such as smoking, grilling, smoke oven cooking, baking and broiling at very high processing temperatures. These carbonaceous compounds with two or more cyclic benzene rings are very stable and toxic, and their formation is enhanced by improper heat treatment methods, contaminated raw materials and environmental pollution. According to the toxicity level of the European Commission (EC-No.1881/2006), Benzo[a]pyrene (B[a]P) is recognized as the most likely human carcinogen among various PAH fractions. The article presented in the study provides a comprehensive understanding of the occurrence and formation of PAHs in meat and meat products, as well as their toxicological effects on humans [Das A. K. et al.].

Principles of consideration of the article by the author Anisimova E.Y. allow us to identify promising directions for the development of new food products. They are products with reduced calorie content, the composition of which is par-

tially replaced by ingredients of plant origin. The goal of this work was to develop an optimized recipe for a meat product - pate, based on a traditional recipe, but including herbal ingredients of local origin. The proposed recipe for pate in traditional cuisine makes it possible to reduce the calorie and fat content of the daily diet of a modern person while increasing the protein content, expands the range of finished meat products on the consumer market, and also covers the body's needs for essential nutrients. The paper presents the results of a comparative analysis of the qualitative characteristics of pate prepared according to a traditional recipe and test samples with different contents of herbal ingredients, followed by the selection of a sample with an experimentally established optimal composition. The plant components included in the new recipe - pumpkin-flax complex and carrot dietary fiber - provide the maximum balance of nutrients [Anisimova E.Y. et al.].

Thus, having examined various articles for the period 2023-2024, we can say that the trend of healthy eating is gaining popularity and therefore the creation of a product in which an ingredient of animal origin is replaced with a plant one is a promising area for research.

Based on all of the above, it can be noted that the purpose of this article is to substantiate the formulation of semi-finished poultry meat products using plant raw materials as a structure former and nutritional value regulator.

**Materials and methods**. The experiment was carefully prepared; the raw materials used were thawed before preparation. Defrosting occurred at a temperature of 20-21 oC. The control sample was prepared according to recipe No. 500. "Chopped broiler chicken cutlets with garnish" from the "Collection of recipes for dishes and culinary products for public catering establishments", publishing house "Profix", St. Petersburg, 2003 Compiled by L. E. Golunova.

The study was carried out in 2 stages:

At the first stage, semi-finished products and culinary products were produced

The object of the study was a culinary product made from minced poultry meat enriched with herbal additives. Zucchini and carrots were chosen as herbal additives. The breading was a mixture of crushed bran and paprika.

Research sample - poultry fillets, frozen "Meat Master". Manufacturer: Myasnoy Master LLC, 410010 Russia, Saratov, st. Tankistov, 82

The preparation technology was carried out using the following equipment:

Four-burner electric stove with oven EP-4ZhSh "Abat", combi steamer KEG 0074 "Kuppersbusch Gelsenkirchen" (Germany), electronic thermometer TR101 "Raylights" (China), culinary thermometer "BEKA" (Germany).

The following technology for preparing culinary products has been developed:

Stage of manufacturing semi-finished products: prepared ingredients (poultry meat, fat (butter), salt, vegetable additive) are passed through a meat grinder. It is recommended to mince the meat twice to achieve a softer texture. Pre-prepared

milk is added to the prepared minced meat, thoroughly kneaded and beaten. Next, before cooking, the product is shaped and coated with breading. Then put it on a baking sheet greased with 5% vegetable (sunflower) oil.

Sample preparation stage: Baking cutlets in the oven. Heating up the combi steamer in the "convection" mode at 200°C. The semi-finished product is placed on a baking sheet and the probe of the measuring device (thermometer) is connected. During the experiment, information was obtained that at 200°C the product is cooked for 14-15 minutes until it reaches 80°C inside and another 3-5 minutes at this temperature.

To prepare the resulting samples, the recipe presented in Table 1 was used. Where 1 is a control sample, 2 is a sample with the addition of zucchini, 3 is a sample with the addition of carrots.

***Table 1***

*Recipes for minced poultry products*

| Ingredient | Sample 1, g (control) | Sample 2, g | Sample 3, g |
|---|---|---|---|
| Chicken fillet | 690 | 690 | 690 |
| Wheat bread | 170 | - | - |
| Milk | 140 | 140 | 140 |
| Salt | 30 | 30 | 30 |
| Zucchini (fresh) | - | 170 | - |
| Carrots (fresh) | - | - | 170 |
| Bran breading | 100 | 100 | 100 |
| Paprika (color) | 30 | 30 | 30 |
| Exit: | | | 1000 |

Thus, the total addition of plant raw materials amounted to 17% of the mass of the produced product.

At the second stage, a laboratory study of quality indicators of semi-finished and finished culinary products from poultry meat with herbal additives was carried out.

These studies were carried out on the basis of the ROSBOITECH laboratory at the Institute of Food Systems and Health-Saving Technologies. By the efforts of master's students. The studies were carried out in accordance with GOST 31470-2012 "Poultry meat, offal and semi-finished poultry meat products. Methods of organoleptic and physicochemical research." The nutritional value, percentage of proteins, fats, carbohydrates, mass fraction of moisture and ash content of the products were calculated. Also, the mass fraction of breading (by mechanical processing of the product) was calculated. Data from laboratory studies are presented in the next section.

**Results and discussion**. After manufacturing and shaping the products, they were subjected to heat treatment in a combi oven; during their preparation they lost weight. Average weight loss was 13-17% in samples with herbal supplements and 19-22% in the control sample. During the experiment, the samples were weighed 2 times, at a temperature of 80°C, as soon as the product was manufactured and after it cooled to 65°C. The data obtained can be presented in the form of curves on a graph. Picture 1.

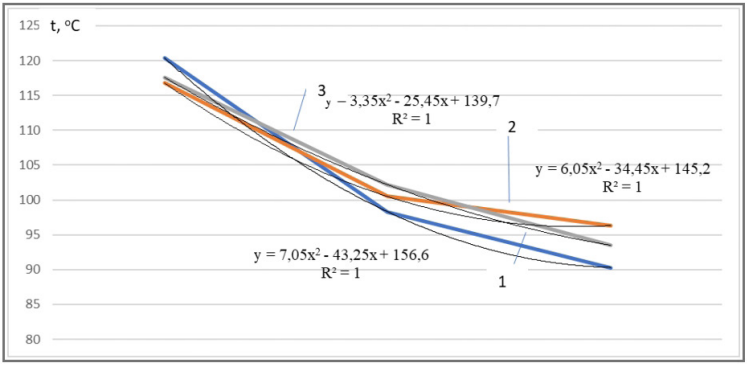


***Figure 1.*** *Change in the mass of samples under different heat treatment modes: 1 – control; 2 – sample with zucchini, 3 – sample with carrots*

Thus, the graph shows that the greatest weight loss occurred in the control sample. The research results are presented in Table 2.

Thus, after the experiment, it was established that the control sample loses a significant portion of moisture during cooling.

***Table 2***

*Change in weight loss of semi-finished poultry products when processed in a combi oven depending on the duration of heat treatment*

| Indicators studied | Sample 1, g | Sample 2, g | Sample 3, g |
|---|---|---|---|
| Weight before cooking, g | 120,4 | 116,8 | 117,6 |
| Product weight at t=80°C, g for 8 minutes | 98,3 | 100,5 | 102,2 |
| A loss, % | 18,35 | 13,95 | 13,09 |
| Product weight at t=80°C, g for 10 min | 92,1 | 98,6 | 100,0 |
| A loss, % | 23,5 | 15,6 | 14,96 |
| Product weight at t=65°C, g | 90,3 | 96,3 | 97,5 |
| A loss, % | 25 | 17,55 | 17,09 |

The next stage of the experiment is laboratory tests conducted in accordance with GOST 31470-2012 “Poultry meat, offal and semi-finished poultry meat products. Methods of organoleptic and physicochemical research.” The mass fractions of proteins, fats and carbohydrates were determined.

Changes in the mass fraction of moisture in all studied samples are presented in Table 3.

***Table 3***

*Change in the mass fraction of moisture in test and control samples*

| **Indicators studied** | **Sample 1, g** | **Sample 2, g** | **Sample 3, g** |
|---|---|---|---|
| 1 проба, W (%) | 60,2738±10% | 52,4545±10% | 56,8018±10% |
| 2 проба, W (%) | 60,2718±10% | 52,4520±10% | 56,8006±10% |
| 3 проба, W (%) | 60,2737±10% | 52,4545±10% | 56,8010±10% |
| 4 проба, W (%) | 60,2915±10% | 52,4531±10% | 56,8025±10% |
| 5 проба, W (%) | 60,2801±10% | 52,4541±10% | 56,8071±10% |

A directly proportional dependence of mass loss in all on the duration of heat treatment has been established. Deviations between parallel studies are 0.01%. It is also clear from the presented data that the most moisture is retained in sample 1 - the control.

A study of the nutritional value of minced poultry products is given in table. 4-5.

***Table 4***

*Change in protein content in minced poultry products depending on the duration of heat treatment in a combi oven*

| **Indicators studied** | **Sample 1, g** | **Sample 2, g** | **Sample 3, g** | |
|---|---|---|---|---|
| Duration of heat treatment 10 minutes | | | | |
| V, г | 24,432 | 17,400 | 31,512 | |
| N,% | 1,430 | 0,971 | 1,903 | |
| Protein, % | 7,631 | 6,069 | 11,894 | |
| Duration of heat treatment 8 minutes | | | | Duration of heat treatment 10 minutes |
| V, г | 38,635 | 17,924 | 26,588 | |
| N,% | 2,363 | 1,084 | 1,430 | |
| Protein, % | 14,769 | 6,775 | 8,938 | |

It has been established that protein loss in chopped semi-finished poultry products depends on the duration of processing of samples in a combi oven. The nu-

tritional value of individual samples may vary. The influence of breading on the nutritional value of all samples, including the control one, was revealed.

***Table 5***

*Change in fat content in minced poultry products depending on the duration of heat treatment in a combi oven*

| Indicators studied | Processing time, min | Sample 1, g | Sample 2, g | Sample 3, g |
|---|---|---|---|---|
| 1 sample, fats, g | 0 | 6,4582±10% | 6,4235±10% | 6,8795±10% |
| 2 sample, fats, g | 8 | 6,1405±10% | 6,1938±10% | 6,5245±10% |
| 3rd sample, fats, g | 10 | 6,1709±10% | 6,3201±10% | 10,1650±10% |
| 1 sample, carbohydrates, g | 0 | 23,45±10% | 29,35±10% | 30,32±10% |
| 2nd sample, carbohydrates, g | 8 | 22,65±10% | 27,84±10% | 31,05±10% |
| 3rd sample, carbohydrates, g | 10 | 23,02±10% | 29,01±10% | 29,33±10% |
| 1 sample, ash, g | 0 | 1,54±10% | 1,41±10% | 1,33±10% |
| 2 sample, ash, g | 8 | 1,23±10% | 1,23±10% | 1,20±10% |
| 3rd sample, ash, g | 10 | 1,02±10% | 1,08±10% | 1,01±10% |
| Calorie content | kcal | 185,03±10% | 217,37±10% | 201,87±10% |

It has been established that fat loss in chopped semi-finished poultry products depends on the recipe and duration of processing in a combi oven. The maximum amount of fat is contained in samples with carrots.

Changes in carbohydrate and ash content in all samples had the same dependencies as protein. The longer the heat treatment, the greater the loss of nutrients. The greatest preservation of nutritional value is observed in samples with zucchini and carrots compared to the control. Samples of chopped semi-finished poultry with zucchini have a high calorie content, which is 17.48% higher than the control and 7.68% higher than the sample with carrots.

Thus, research has demonstrated that the use of plant raw materials has great potential, since the resulting product is not inferior to a classic product, and even surpasses it in a number of characteristics.

**Conclusions**

The objectives set in this article have been achieved. One of the most important tasks was the creation of recipes for experimental product samples that were tested and analyzed during the study. This made it possible to determine the optimal compositions and proportions of ingredients to achieve the desired quality and taste characteristics of the products.

Another important feature is the preparation of semi-finished products in a combi oven based on developed recipes. This made it possible to conduct experimental studies and evaluate the influence of various factors on the quality and

properties of products. This approach made it possible to verify the reliability of the results and ensure their repeatability.

Finally, it was important to determine the parameters of the finished product and their analysis. This made it possible to evaluate the quality of the experiments performed, identify patterns and trends in changes in product characteristics, depending on the composition of additives, and also draw conclusions about possible ways to optimize production processes and further improve product quality.

Thus, the implementation of these tasks plays an important role in ensuring the successful completion of scientific research, as well as in achieving the set goal and obtaining meaningful results.

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# 电动汽车电池快速充电的问题与可能性
# PROBLEMS AND POSSIBILITIES OF FAST CHARGING OF ELECTRIC CAR BATTERIES

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抽象的。 本文基于快速充电的特点，旨在建立工艺、材料性能、电池设计和充电策略优化之间的关系。 文中进行的电池测试包括直流放电容量，检查电动汽车的功率特性。 本文描述了用于获取基线指标的方法，从中计算退化并获得运行期间电池容量的指标。 检查测试电池之间的差异，包括功率分布和热特性。 显示所得的容量和功率降低值，并与电池所处的条件进行比较。

关键词：快速充电、热流、热控制、温度、电池、容量、放电、充电、冷却系统、电流、电动汽车。

***Abstract.*** *Based on the characteristics of fast charging, this paper aims to establish the relationship between processes, material properties, battery design, and charging strategy optimization. In the article, the battery tests carried out include DC discharge capacity, checking the power characteristics of the electric vehicle. The article describes the methodology used to obtain baseline indicators from which degradation is calculated and indicators of battery capacity during operation are obtained. Differences between the tested batteries are examined, including power profiles and thermal characteristics. The resulting capacity and power reduction values are presented and compared to the conditions the batteries were exposed to.*

***Keywords:*** *Fast charging, heat flow, thermal control, temperature, battery, capacity, discharge, charge, cooling system, current, electric vehicle.*

**Introduction.** Electric vehicles are becoming increasingly popular every year, but many drivers remain hesitant to use them due to unreliable range or concerns about battery longevity.

Despite progress in improving the charging power of electric vehicles, fast charging technologies are not suitable for all situations.

Charging a battery with too much power can cause lithium coating and dendrites to form around the anode, resulting in a permanent decrease in capacity,

which can cause the cells to age at different rates and overheat the battery. If the Kia Soul EV's battery capacity were doubled, it could hypothetically consume 200 kW but would still be limited to a 14-minute charging time [14]. This relationship between power consumption and capacitance is shown at the element level in Figure 1.

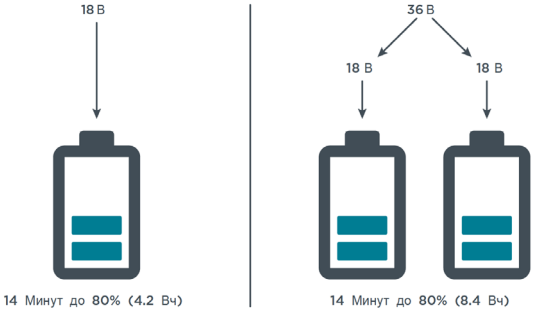


***Figure 1.*** *Doubling the battery capacity by adding more cells increases the total power the battery pack can accept, but the charging time remains constant.*

Car batteries are made up of many cells connected together, but each cell has a maximum charging rate.

Fully charging of an electric vehicle can take anywhere from 20 minutes to more than 30 hours. Charging times are affected by several factors, mainly: battery size, vehicle charger limits, and charger output power (Table 1). For example, a typical EV with a 60 kWh battery may require just under 8 hours to charge from full to full using a 7 kW charging point [13].

***Table 1***

*Factors affecting the charging time of an electric vehicle*

| Factor | Impact on charging time |
|---|---|
| Battery size | Larger batteries typically take longer to charge than smaller batteries because they require more energy to fill |
| Charging speed | Electric vehicles can charge at different rates depending on the type of charging station used. For example, a Level 1 charging station can take several hours to charge an EV, while a Level 3 DC fast charger can charge an EV to 80% in just 30 minutes |
| State of charge | The time required to charge an electric vehicle will depend on the current state of charge (SoC) of the battery. A battery with a low SoC usually takes less time to charge than a battery with a high SoC |
| Temperature | Battery temperature can affect charging time, as lower temperatures can reduce the efficiency of the charging process |

| | |
|---|---|
| Charging infrastructure | The availability and accessibility of charging infrastructure may affect charging times, as searching for a charging station and waiting for an available charging space may take longer |
| Car make and model | Different brands and models of electric vehicles may have different charging capacities, which can affect charging times. Additionally, some electric vehicles may be compatible with certain types of charging stations, which may also affect charging times. |
| Power supply | The wattage of the power supply and the amount of electricity available can affect charging time, as using a lower wattage power source may take longer to charge the electric vehicle. |

Today, different charging speeds are available, from slow AC charging to ultra-fast DC charging [3]:

Slow AC charging (1.8 to 7 kW). Known as Level 1 or 2 charging, it is ideal for home use for overnight charging.

DC fast charging (50 to 350 kW): known as Level 3 charging, which can recharge an EV battery from 10% to 80% in 20 to 60 minutes, making them ideal for long and long trips [11].

In fast charging mode, due to safety and other factors, the battery can only be charged to 80% capacity. At higher power, the charging speed will gradually decrease to avoid overcharging. In addition, charging power is limited by the battery management system (BMS). As the industry becomes increasingly interested in the field of fast battery charging, it is important to understand the speed determination steps of different charging methods and their impact on battery life.

One common concern is the impact of fast charging on battery degradation. This is understandable, given that electric vehicle manufacturers such as Kia and even Tesla recommend sparing use of fast charging in the detailed specifications of some of their models [9].

The purpose of the study is to assess the impact on the battery of an electric vehicle of fast charging exclusively with direct current, and compare it with identical AC powered electric vehicles, as well as to study the effect of fast charging on battery life and vehicle performance characteristics

Materials and methods. All batteries, including those in electric vehicles, use direct current (DC) to charge and discharge. But the electrical network provides alternating current (AC). Therefore, the alternating current from the mains must be converted to direct current so that it can be used to charge the battery. This is done by an AC/DC converter. This AC/DC converter is part of what we call the charger. Chargers can either be integrated into the vehicle as an on-board charger, or they can be external to the vehicle (such as a fast charger).

Today, almost all electric cars have a small built-in charger. It is possible to use a cable to connect the on-board charger to a regular AC outlet in the garage or

to a charging point. The charging point supplies the alternating current needed by the on-board charger to charge the battery. Thus, the charging point is not actually a charger, but a smart socket for connecting a charging cable [10].

During fast charging, there is continuous communication between the BMS and the fast charger (Figure 1). The BMS sends a signal to the fast charger to set the charging rate. This speed is usually expressed in kilowatts (kW). Charging a car at a power of 50 kW for 1 hour transfers 50 kWh of energy to the battery. On average, an electric car spends 1 kWh to travel 5 km. Some cars, such as Tesla, also express charging rates in kilometers of range gained per hour of charging [1]. Thus, 50 kW equals approximately 250 km/h ("250 km range, charged in 1 hour").

To evaluate the performance of a fast charging station, voltages and currents are measured on both the AC and DC sides of the charger. The function for calculating the efficiency of the charger is:

$$\mu = \frac{P_{dc}}{P_{ac}} \quad (1)$$

where $P_{dc}$ - power supplied to the vehicle, and $P_{ac}$ - power from the network.

On the vehicle side, voltage, current, temperature and charge level are recorded via the CAN bus. The sampling time depends on how often data is transferred to the CAN bus.

Fast battery charging is one way to increase the driving range of an electric vehicle by reducing battery charging time through more powerful charging (Table 2).

***Table 2***

*Charging time for electric vehicles depending on charge level*

| Charge level | Charging time (hour) | Power, (kWt) | Current (A) | Voltage (V) |
|---|---|---|---|---|
| 1st level | 8-20 | ~ 1,4-2 | 12-16 | 120 |
| 2nd level | 3-8 | 3,3-19,2 | 16-8 | 240 |
| 3rd level | 0,5-1 | 50-350 | < 30 minutes | 400-800 |

Table 3 provides approximate full charge times for some brands of electric vehicles, but actual charging times may vary depending on the specific vehicle, battery capacity, state of charge, and other factors [4].

***Table 3***

*Charging time for some electric vehicle models*

| Vehicle | | Full charge time | | | | |
|---|---|---|---|---|---|---|
| Model | Battery | 3,7 kW slow | 7 kW fast | 22 kW fast | 43-50 kW fast | 150 kW fast |
| Volkswagen ID.5 | 82 kW for 1 hour | 22 hours | 12 hours | 8 hours | 1 hour | 30 minutes |
| Tesla Model S (2022 onwards) | 75 kW for 1 hour | 21 hours | 11 hours | 5 hours | 1 hour | 30 minutes |

| | | | | | | |
|---|---|---|---|---|---|---|
| Mitsubishi Outlander PHEV (2018 onwards) | 13,8 kW for 1 hour | 4 hours | 4 hours | 4 hours | 40 minutes | Cannot charge with this charger |

The battery runs on DC power, while the mains power runs on AC power. Therefore, when energy is transferred between the battery and the grid, a conversion must occur between the two.

In the case of DC charging stations, the conversion of AC to DC occurs at the station itself, outside the vehicle, while AC charging stations transmit AC mains voltage directly to the vehicle's on-board converter [9]. In other words, an AC charging station does not require power conversion, while DC charging stations require power electronics to convert AC to DC, which increases the cost, weight, and complexity of the charging station [5].

Continuous charging time is calculated as follows:

$$t_{заряд} = \frac{s_i}{100 \cdot (p_c \cdot \eta)} k \quad (2)$$

where $t_{заряд}$ – charging time of the i-th source, $s_i$ – distance to the i-th source. These two parameters have the same probability density distribution. pc – rated power of the charger. η=0.9 – charging efficiency, k – power consumption per hundred kilometers.

If we take into account that the charging demand of electric vehicles is determined by the state of charge (SOC), and assume that the initial SOC follows a normal distribution, then the charging time t can be expressed as follows:

$$t_{заряд} = \frac{(SOC_f - SOC_t) E_r}{p_c \cdot \eta} \quad (3)$$

where $SOC_f$ – state of charge in which the electric vehicle completes charging following a normal distribution; $SOC_t$ is the charge level of the electric vehicle arriving at the charging station at time t; $E_r$ is the nominal capacity of the electric vehicle battery; η – charging efficiency of the charging station; Pc is the rated charging power of the electric vehicle.

If the remaining power does not allow for the next leg of the trip, the electric vehicle must be recharged at that time, and such cases apply to on-demand users [2].

When operating a charging network, the main focus is on the spatio-temporal characteristics and economics of stations, on the basis of which evaluation indicators such as station utilization rate, service volume, and annual construction and operation costs are constructed.

The charging station utilization factor η refers to the ratio of the actual total charging time provided by each station to the total operating time:

$$\eta = \sum \frac{t_j}{T_j} \quad (4)$$

where $t_j$ — the total time that charging station j provides charging services to users; $T_j$ — hours of operation of the charging station.

Thus, the state of charge, SOC, of a battery with a constant discharge rate is:

$$K = I^n \cdot T_i \quad (5)$$

where I – discharge current in amperes, n – battery charge constant, determined by battery technology.

The ampere-hour capacity of a battery at a given discharge rate $I_i$ can be related to the known discharge rate $I_n$, as given by:

$$C_i = C_n\left(\frac{I_n}{I_i}\right)^{n-1} \quad (6)$$

where $C_i$ - battery capacity in ampere hours, $C_n$ is the known battery capacity in ampere hours, In is the known discharge rate in amperes, $I_i$ is the specified discharge rate in amperes, n is the battery charge constant determined by battery technology.

At a constant discharge rate, the SOC depending on the current discharge rate and capacity can be calculated:

$$SOC = 1 - C_{Di}/C_i \quad (7)$$

$$C_{Di} = I_i t \quad (8)$$

where Ci - battery capacity in ampere-hours, $CD_i$ – capacity in ampere-hours at discharge rate $I_i$ and time t, $I_i$ – specified discharge rate in amperes, SOC – current state of charge of the battery.

For a non-constant discharge rate, as is the case when implementing a real battery energy storage system, the SOC equation will change such that the relationship will be evaluated at short intervals:

$$\Delta SOC_k = -\frac{I_i \Delta t}{3600\, C_n}\left(\frac{I_i}{I_n}\right)^{n-1} \quad (9)$$

where $I_i$ – specified discharge rate in amperes, $I_n$ – known discharge rate in amperes, $C_n$ – known battery capacity in ampere-hours, n – battery charge constant determined by battery technology, $SOC_K$ – state of charge at the kth time period.

As the battery capacity increases, the ability to accept more energy proportionally increases, but the charging time from empty to 80% remains constant. This simplistic doubling of capacity also assumes that the space for the battery is doubled, but in reality doubling the capacity often involves packing the battery cells closer together, which affects the ability to cool the battery, which slows down charging time [7]. For example, the Chevrolet Bolt's battery capacity is approximately twice that of the Soul, but does not provide the 200 kW maximum output that would be double that of the Soul, reflecting complexities associated with cell placement and temperature control [3]. This relationship between charging speed and battery capacity or manufacturing technology is shown in Figure 2.

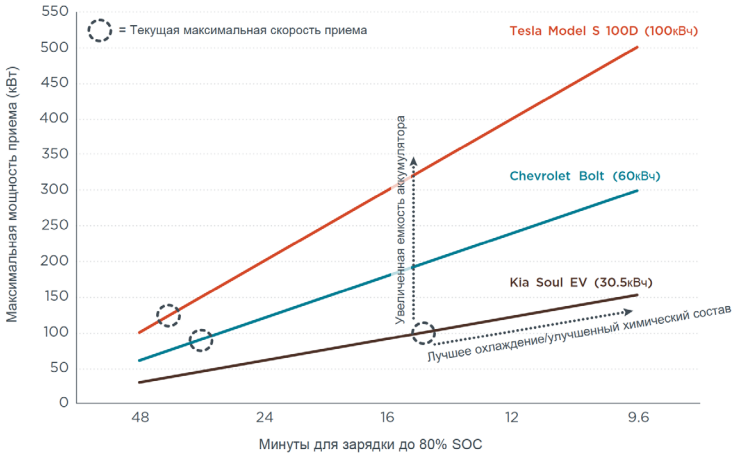


***Figure 2.*** *Relationship between the maximum power consumption of a vehicle depending on the battery capacity and configuration technology using examples of modern vehicles.*

It can be seen from Figure 2 that the relationship is not linear and the horizontal axis has been adjusted to illustrate the relationship for the three battery packs.

Tesla's charging speed is quite modest given its large battery capacity. If the Kia Soul EV's battery were scaled up to the size of a Tesla Model S 100D, a 14-minute charge would require 328 kW, indicating that current battery designs can handle 350 kW charging if the battery capacity is large enough [8].

Frequent fast charging (DC) results in worse battery condition than AC charging. This is due to temperature control, as lithium-ion EV batteries are sensitive to high temperatures.

Power output varies depending on the charging station, but DC fast chargers can provide 7 to 50 times more power than a typical AC charging station. While this high power is great for quickly refueling an electric vehicle, it also generates a significant amount of heat and can strain the battery [12].

Car batteries gradually lose capacity as they are cycled through driving and charging, although the rate depends on the chemistry, usage and environmental conditions.

Battery chemistry affects both the ability to withstand high charge currents and the resulting service life when fast charging. The generally accepted theory is that higher charging rates increase the rate of degradation.

The constant current-constant voltage (CC-CV) method is considered the traditional charging method for Li-ion batteries [2].

The CC-CV methodology is based on charging the battery with a constant rated charging current until the voltage reaches a limit value, and then the voltage is kept constant until the current drops to a minimum value, as shown in Figure 3.

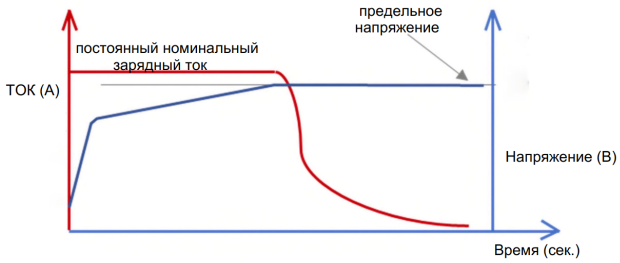


***Figure 3.*** *Schematic diagram of the constant current-constant voltage (CC-CV) method*

This method is efficient, easy to implement, has simple requirements and avoids overcharging due to constant voltage mode.

In addition, CC-CV is considered a major contributor to minimizing EV charging queuing delays at centralized EV charging stations, especially during peak hours. However, it is conservative due to the long charge time while gradually reducing current density to 0.1 C, where C-rate is a measure of the rate at which the battery charges/discharges relative to its maximum capacity, low efficiency, and short battery life. The authors showed that the CV charging stage can lead to server performance degradation whenever the voltage exceeds the cut-off voltage [6].

An electric battery heats up during operation, both during charging and discharging. The internal resistance of the battery is used to estimate the power loss in the battery. The impedance is always determined in the technical description of the specific battery.

Energy losses in the power supply battery $(E_{\text{потерь}})$in a charged battery are determined by the formula:

$$E_{\text{потерь}} = I^2 \cdot r_{int} \cdot t_{\text{заряд}} \quad (10)$$

where I - the effective value (rms value) of the respectively supplied current from/to the battery, and $t_{\text{заряд}}$ - is the time during which energy is supplied or withdrawn.

Energy loss increases with the square of the current, as can be seen from the equation. (1) and fig. 4, which is a very disadvantageous situation for fast charging.

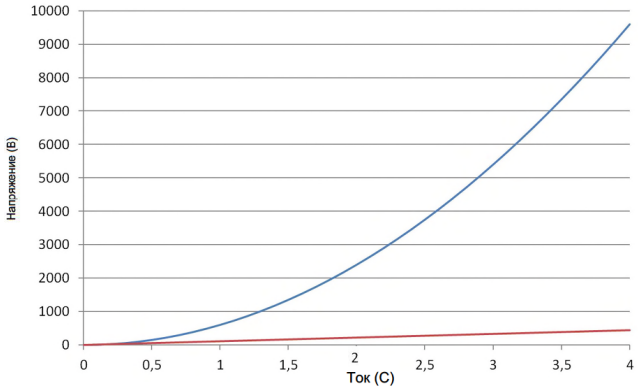


***Figure 4.*** *Dependence of power losses on charging current*

The red line describes a linear increase in current, while the blue line represents a quadratic dependence on the charging current.

The losses caused by current conduction $(E_{\text{провод}})$, are determined according to the following equation:

$$E_{\text{провод}} = (I_{av} \cdot V_{CE_0} \cdot I_{RMS}^2 \cdot r_d) \cdot t_{\text{заряд}} \quad (11)$$

where $I_{av}$ – the average value of the current, $I_{RMS}$ – is the effective value of the current, and $V_{CE0}$ – is the threshold voltage, $r_d$ – is the differential resistance of the switch.

Determining the dependence of power losses on current in this case is more complex. The average current component varies linearly, while the effective current component increases with the square of the current. The significance of the second part is significantly lower depending on the mutual relationship between both components.

- Power loss when switching

Switching power loss $(E_{\text{перекл}})$are determined according to the following equation:

$$E_{\text{перекл}} = \left[(E_{on} + E_{off}) \cdot f_{sw})\right] \cdot t_{\text{заряд}} \quad (12)$$

where $E_{on}$ - energy loss when turning on a semiconductor switch (IGBT), $E_{off}$ - the energy loss when turning off the IGBT, and $f_{SW}$ is the applied switching frequency.

All these partial switching losses depend linearly on the current. The power semiconductor converter also contains free-wheeling diodes.

Results and discussion. To study the impact of fast charging on battery life and vehicle performance under real-world conditions, 2022 model year Nissan Leafs were used in this study. This vehicle's battery is rated at 24 kilowatt-hours and 66.2 amp-hours. The active materials of the cell consist of LMO with an LNO

cathode and a graphite anode. The packaging is located under the bottom of the car and is sealed.

To relate differences in battery condition to charging effects, batteries were tested with AC and DC charging.

Upon returning from the trip, the vehicle was connected to the network and charging began. A stand-alone DC fast charger was used to charge the battery with DC current. This charger has been configured for a maximum output current of 120 Amps and an output voltage of up to 500 VDC. Vehicle data was collected during all on-road operation and charging using a data logger recording signals at a frequency of 1 Hz. Testing used controller area network (CAN) data when available, and additional temperature data was collected using thermocouples placed on the bottom of the package, top of the package, and near the front bumper to determine ambient air temperature. During periods when vehicles were parked, the CAN controllers stopped sending messages.

Figure 5 shows the DC fast charging graph of a 2022 Nissan Leaf charged using a 50 kW charger. Charging automatically completed after 1725 seconds, and shortly after the first charge was completed, another charging session was initiated to fully charge the battery.

Figure 6 shows AC Level 2 charging for a 2022 Nissan Leaf with a 3.3 kW on-board charger.

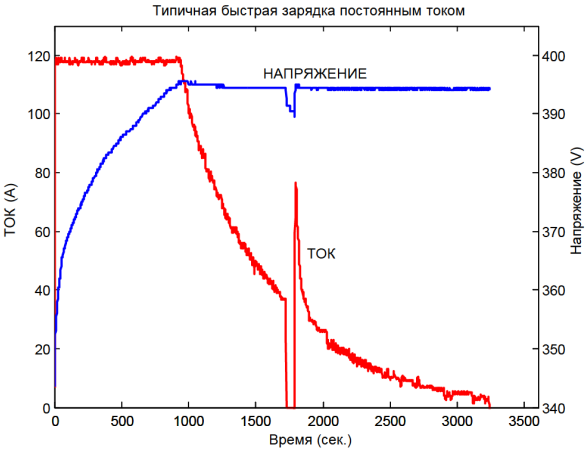


***Figure 5.*** *Vehicle DC charging*

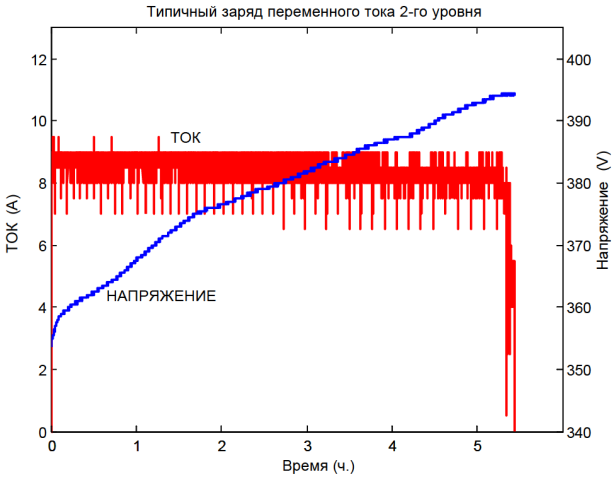


***Figure 6.*** *Charging a car with alternating current*

Figure 7 shows the average remaining power as a percentage of baseline for each test battery, and the slope of the line shows how quickly power loss occurred over a given interval.

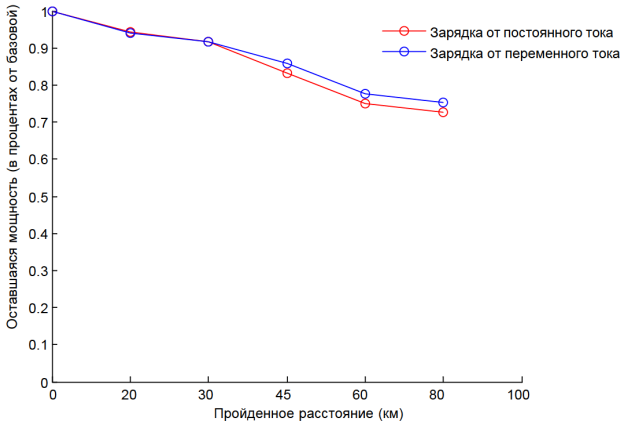


***Figure 7.*** *Remaining battery capacity as a percentage of base, averaged for vehicles in each test group*

The figure shows differences in this slope depending on distance (mileage), although for any given interval the difference between batteries is not very noticeable, and the remaining power for each battery gradually decreases compared to the total power loss. This indicates that while charging the battery with DC fast charging did lose more power than AC charging, the difference is small compared to the overall power loss.

Conclusions. Because the battery is a sensitive system and improving one parameter can negatively impact other battery performance, incremental changes in lithium-ion battery technology require a holistic approach.

In addition, a special focus on research into battery technologies, such as new battery chemistries and 3D battery printing, is required to ultimately enable fast charging and widespread adoption of electric vehicles.

In general, as vehicle range increases, vehicles have an increased ability to accept higher charging rates. Based on various industry announcements, using variations in current battery chemistries and battery pack designs, recharge times are expected to decrease to approximately 14-16 minutes to charge up to 80%.

In line with these overall goals, the number of vehicle models capable of operating at higher power levels is expected to increase over the next few years. However, charging times to 80% are unlikely to drop below 10 minutes in the near term, meaning that vehicles with lower capacity and shorter range will not be able to use this power. In the long term, technological improvements may also enable faster charging speeds; possible improvements include alternative anode chemistry, more sophisticated cell management to ensure uniform charging, higher battery voltage, and improved battery liquid cooling.

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# 散斑定向全息图模型
# SPECKLE-ORIENTED HOLOGRAM MODEL

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*"Knowledge of a few principles liberates*
*from knowing many facts"*
*Rene Descartes.*

注解。 提出了一种基于散斑的全息图结构模型以及在其参与下记录和恢复物体图像的机制。 与将全息图表示为正弦衍射光栅或菲涅尔区结构的叠加的经典模型不同，在所提出的模型中，全息图结构是一组基本衍射元素，它们是具有干涉条纹的物场散斑？ 该模型使得清晰、定性地描述全息图像的形成过程成为可能。 它的实用性通过创建人工全息图的示例得到了证明，该人工全息图使得可以使用不使用参考光束获得的光谱图来重建图像。

关键词：散斑结构、全息图、模型、衍射元件、叠加。

***Annotation.*** *A speckle-based model of the hologram structure and the mechanism for recording and restoring the image of an object with its participation is proposed. Unlike the classical model, which represents a hologram as a superposition of sinusoidal diffraction gratings or Fresnel zone structures, in the proposed model the hologram structure is a set of elementary diffraction elements, which are speckles of the object field with interference fringes? This model makes it possible to clearly and qualitatively describe the process of forming a holographic image. Its usefulness is demonstrated by the example of creating artificial holograms that make it possible to reconstruct an image using a spectrogram obtained without using a reference beam.*

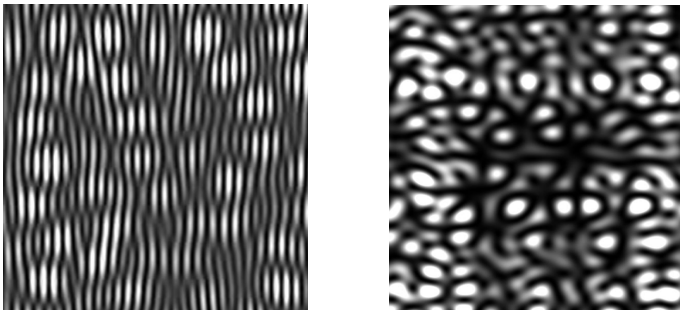
***Keywords:*** *speckle structure, hologram, model, diffraction element, and superposition.*

A hologram is an intensity distribution recorded on some medium (photographic plate, CCD matrix, etc.) resulting from the interference of object and reference waves. A widespread model of such a distribution (so widespread that it should be considered classical) [1, 2] usually represents it in the form of a superposition of sinusoidal diffraction gratings or Fresnel band structures.

This model of the formation of hologram structures of various optical registration schemes (Gabor, Leith-Upatnieksa, Fourier, etc.) allows us to quite adequately formalize the mathematical description of the processes of formation of a holographic image and its basic optical properties. However, for all its mentioned usefulness, it does not allow us to make any constructive assumptions about the structure of the hologram itself as a kind of amplitude-phase transparency. Indeed, the remark that "the light scattered by each of the points (of the object) interferes with the reference wave, resulting in a superposition of many holographic zone plates" [1] gives little in the sense of understanding what exactly is recorded on the hologram in the form a specific intensity distribution of the field scattered by the registration object, supplemented by the superposition of a reference wave. It is only noted that this is a "complex interference pattern" [2]. The observation is certainly correct, but it is of little use for answering the question posed above.

The proposed hologram model arose in the development of methods for reconstructing images of objects when recording a speckle field scattered by an object (specklegram) without using a reference beam [3]. This creates a pseudo-hologram with artificially applied interference fringes.

A microscopic examination of the specklegram and hologram (Fig. 1) shows that the application of a reference beam leads to modulation of each speckle by interference fringes without deformation of the original speckle structure as a whole. In addition, it is obvious that the phase of the field in the speckle remains constant and changes randomly when passing the conventional speckle boundary, which is accompanied by a shift in the observed interference fringes.



*a* *b*

***Figure 1.*** *A fragment of an enlarged image of the real holographic structure of a scattering object (a), a fragment of a specklegram (b)*

Limiting this randomness under certain circumstances made it possible to develop an image restoration algorithm using only a specklegram without superimposing a reference beam [3].

Within the framework of the proposed model, the hologram structure is a set of elementary diffraction elements, which are speckles of the object field with interference fringes. The ratio of the amplitudes of the object and reference waves in each speckle determines the contrast of the interference fringes. Consequently, the amplitude of the object field is encoded by the contrast value of the interference fringes, and the phase of the field in the speckles is encoded by the spatial position of both the fringes and the position of the speckles themselves. The transverse dimensions of speckles carry information about the width of the angular spectrum of the object field.

The object wave field reconstructed from the hologram is a superposition of elementary waves diffracted by each of the diffraction elements (modulated speckles) of the hologram (fig. 2). In this case, each speckle contributes to the formation of each image point. The spatial position of the interference fringes inside the speckle and the position of the speckle itself in the hologram plane determine the phase of the diffracted elementary wave, the period of the fringes determines the direction of propagation of the elementary wave diffracted on a given speckle, and the contrast of the fringes determines the amplitude of the elementary wave.

Thus, using a real hologram, the amplitude-phase structure of the object field in the plane of the hologram, and therefore in the diffraction field, is restored.

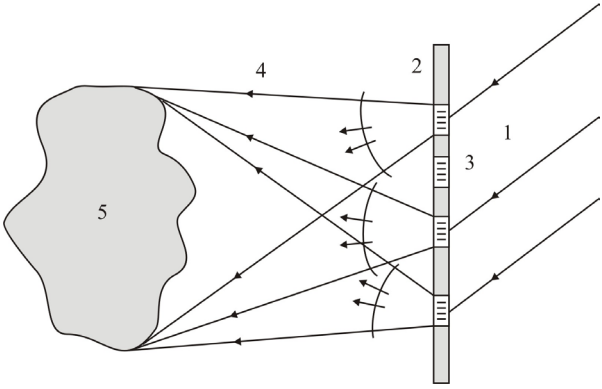



***Figure 2.*** *Schematic representation of the process of reconstructing a real image of an object from a hologram.*
*1 – restoration wave; 2 – hologram; 3 – diffraction elements (speckles); 4 – elementary waves diffracting on speckles; 5 – actual image of the object*

In Figure 2 schematically shows the process of forming a real holographic image in a diffraction field as a result of the superposition of elementary waves diffracted by the elementary diffraction elements (speckles) of the hologram.

Conclusion

The proposed speckle-oriented hologram model makes it possible to clearly and qualitatively describe the process of forming a holographic image. Its usefulness is demonstrated by the example of creating artificial holograms that make it possible to reconstruct an image using a spectrogram obtained without a reference beam.

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手术切除猫腹部血管肉瘤——作为治疗单独实体瘤的一种可能策略，作为改善资金不足患者的预后和提高生活质量的措施（临床病例）

# SURGICAL REMOVAL OF ABDOMINAL HEMANGIOSARCOMA IN A CAT - AS A POSSIBLE TACTIC FOR THE TREATMENT OF A SEPARATE SOLID TUMOR AS A MEASURE TO IMPROVE THE PROGNOSIS AND IMPROVE THE QUALITY OF LIFE OF A PATIENT WITH INSUFFICIENT FUNDING (CLINICAL CASE)

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注解。 一组作者描述了猫血管肉瘤的临床病例，这是一种与内脏器官组织无关的独立固体结构。 未找到类似案件的公开信息。 作者对血管肉瘤进行了术前诊断和手术治疗，并随后对猫进行了组织学证实。 当资金不足时，可以针对个体实体血管肉瘤选择手术治疗策略，作为改善个体动物预后、提高患者生活质量的措施。 手术团队的专业性高，业主与主治医生的协调配合，及时发现患者体内的肿瘤，并与慢性病的及时发现和控制、术后早期和远期的筛查控制相结合。 随访，以便及时应对复发。 在本例中，动物在发生自发性出血之前就来到诊所，肿瘤切除没有技术困难，并且在没有任何治疗的情况下长期对动物进行进一步观察显示出无复发的良好结果。

关键词：血管肉瘤、腹部肿瘤、腹部实性肿瘤、猫肿瘤、癌症患者（临床病例）。

***Annotation.*** *A team of authors described a clinical case of hemangiosarcoma in a cat, which is a separate solid formation not related to the tissues of internal organs. No published information on similar cases was found. The authors carried out work on preoperative diagnosis and surgical treatment of hemangisarcoma with subsequent histological confirmation of the diagnosis in a cat. When funding*

*is insufficient, a surgical treatment strategy may be chosen for individual solid hemangiosarcoma as a measure to improve the prognosis of the individual animal and improve the patient's quality of life. High professionalism of the operating team, coordination between the owner and the attending physician, as well as timely detection of a tumor in the patient should be combined with timely detection and control of chronic diseases, screening control in the early postoperative period and long-term follow-up for a timely response to relapses. In this case, the animal came to the clinic before spontaneous bleeding occurred, tumor removal had no technical difficulties, and further observation of the animal without any therapy in the long term showed a relapse-free favorable outcome.*

***Keywords:*** *hemangiosarcoma, abdominal neoplasms, solid abdominal tumor, neoplasms in cats, cancer patient (clinical case).*

***Financing:*** the research was carried out as part of the fulfillment of contractual obligations between individual entrepreneur V.A. Gerstendorf and the animal owner.

***Acknowledgments:*** The work was carried out at the veterinary clinic of individual entrepreneur Gerstendorf V.A. The authors express their gratitude to the director of the individual enterprise and owner of the Veterinary Clinic, V.A. Gerstendorf, for the assistance and support provided during the resear

***For quotation:*** Soboleva N.I., Safronova A.O., Sheiko Yu.S.. Surgical removal of abdominal hemangiosarcoma in a cat - as a possible treatment tactic for a separate solid tumor as a measure to improve the prognosis and improve the quality of life of the patient with insufficient funding (clinical case)



**Introduction**

Hemangiosarcoma (HSA, also hemangioendothelioma or angiosarcoma) is a highly aggressive and fast-growing malignant neoplasm of endothelial cells of blood vessels.1,2,4,5,6,8 Occurs in most cases in dogs and only occasionally in cats, horses, and mice. A common cause of death is tumor rupture with uncontrolled acute bleeding.1,2,6

In cats, hemangiosarcomas make up about 2% of all tumors; they are equally found on poorly pigmented skin of the ears and head, in the spleen, liver and intestines, and less often in the heart, chest and nasal cavities.5 An age factor is noted, most often these are animals older than 11.5 years .6

In cats, local recurrence is recorded in 50-80% of cases on average 420 days after surgery with a small margin during tumor resection.5 Metastases have been reported, but they are less common than in dogs.5 With wide resection, metastases in cats appear statistically after more than 1460 days.5 In the absence of surgical treatment, the average time for the appearance of metastases was 60 days.3,5

No widely described literature data on hemangiosarcoma, which is a separate solid formation not related to the tissues of internal organs in cats and dogs, was found.

**Purpose of the study**

The purpose of this research work was to study literature data and find methods for treating feline hemangiosarcomas in conditions of insufficient funding. A strategy for monitoring the animal during surgical treatment in a monotherapy format was developed.

**Materials and methods**

The study was conducted at the clinic of IP Gerstendorf V.A. As a result of a ten year old Scottish Fold cat being admitted for treatment. The animal was admitted in March 2022, neutered, without diagnosed chronic diseases with complaints of weight loss over the past 6 months and sporadic episodes of pain in the abdominal area. Appetite is preserved, diuresis and thirst are normal, defecation and urination are normal.

During the examination, the following laboratory and diagnostic tests were carried out: a general clinical blood test with a leukogram to assess the amount of hemoglobin, red blood cells, platelets, ESR, leukocyte count and leukocyte formula; biochemical blood test with electrolytes to identify information about the functional state of the body as a whole; ultrasound diagnostics of the abdominal cavity.

Additional research methods, such as ECHO-kg and ECG, X-ray of the chest and abdominal cavity, coagulogram, were relevant for the age and condition of the animal (a breed tendency to cardiomyopathies was allowed), but the owner refused.

The work is based on observation of the animal for 212 days (total number)

**Results and discussion**

Despite the cautious prognosis, a decision was made to conduct preoperative diagnostics and surgical intervention to study the anatomical and topographic location of the tumor and assess the possibility of surgical removal.

Blood tests revealed a diagnostically significant increase in alanine aminotransferase (ALT) (155 when the norm was up to 79), alkaline phosphatase (ALP) (99 when the norm was up to 55). An ultrasound examination revealed a volumetric formation in the abdominal cavity measuring more than 10*10 cm (it was impossible to accurately determine, the tumor was not located in the area of the sensor's action), heterogeneous echogenicity, with cysts and abundant blood supply. The neoplasm pushed the intestine and omentum dorsally and it was impossible to perform ultrasound diagnostics of the intestine and mesentery, since they did not fall within the range of the device's sensor. Using ultrasound diagnostics, it was difficult to determine the nature of the origin of the tumor, although when the animal breathed, it could be seen that it was moving separately from the liver tissue and from the spleen tissue.

It was decided to perform a diagnostic surgical procedure through a midline superior laparotomy incision.7 Anesthetic management was provided according to the protocols recommended AVO VICAR (anesthetic veterinary society "Institute for the Development of Veterinary Intensive Care, Anesthesiology and Reanimatology"). During laparotomy, it was discovered that the tumor was a completely independent formation, which had only two vessels, on which it was held in the abdominal cavity, extending under the liver tissue towards the portal vein of the liver or the inferior vena cava. The neoplasm was so solid and heavy that the caudate lobe of the liver was twisted and most likely in some positions of the animal's body in space the blood supply to the lobe was disrupted. Cyanosis of the lobe was observed, but the operating team decided not to remove this lobe of the liver, but to eliminate the torsion and promote the return of the anatomical position of the lobe in the abdominal cavity, and then monitor the dynamics by assessing the condition of the animal, ultrasound diagnostics and monitoring blood counts. The size of the tumor reached 14*10 cm, it consisted of many cysts and vessels, the weight of the tumor was about 500 g, with the weight of the animal before surgery being 4,700 g.

The tumor was sent for histological examination with a confirmed diagnosis of hemangiosarcoma.

RESEARCH RESULTS

| RESULT |
| --- |
| MATERIAL: tissue fragment in formalin solution (1 pc.)<br>LOCALIZATION: abdominal cavity<br>BLOCK NUMBER: 26250<br><br>HISTOLOGICAL PICTURE: The preparation contains fragments of a high-cellular vascular mesenchymal formation, constructed from loose cellular layers and stroma with the formation of numerous vascular-like structures. The shape of the cells varies from spindle-shaped to round or oval, with a moderate amount of amphophilic cytoplasm, sometimes vacuolated with clear boundaries, centrally located round or oval nucleus and 1-2 central nucleoli. Moderate anisocytosis and anisokaryosis are noted. Mitoses are encountered at a frequency of 0-1 per field of view.<br>CONCLUSION: Hemangiosarcoma. |

**The study was conducted by:** E. V. Muretova.

***Figure 1.*** *Results of histological examination*

The owner was informed about the results of surgery and histological examination, as well as about the high malignancy of the tumor, its high metastatic potential and the likelihood of recurrence. Due to insufficient funding, a refusal to consult a veterinary oncologist and chemotherapy was recorded, and a strategy for monitoring the animal's condition was chosen.

On the 44th day after the operation, a repeat ultrasound examination of the abdominal cavity was performed; a hyperechoic area of the liver was discovered near the site of tumor removal; the animal felt well and there were no complaints about the condition. On the 212th day after the operation, a repeat ultrasound examination was carried out, the hyperechoic area on ultrasound became significantly smaller, the borders were smoothed out, and the remaining internal organs were within the age norm.

**Conclusions:**

Hemangiosarcoma in oncological practice is considered an aggressive malignant tumor with a poor long-term prognosis, an increased risk of metastasis and a high risk of mortality, in particular due to spontaneous bleeding. Due to the fact that these tumors are more often found in the chest cavity and parenchymal organs, they are very difficult to resect. Frequent postoperative complications are spontaneous bleeding after operations on parenchymal organs, rapid relapses of the underlying disease, and adhesions at the surgical site. However, the team of authors managed to encounter a case of atypical tumor localization, which had a favorable location for uncomplicated resection, followed by a relapse-free course of the underlying disease on day 212 after surgery

Selected solid hemangiosarcomas can be excised surgically without further chemotherapy. In this case, the animal can experience long-term disease-free remission with a high quality of life.

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# CHARACTERISTICS OF SKFNTSVV SELECTION APPLES AT HARVEST MATURITY

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注解。 本文提供了有关商业品质（重量、硬度）、淀粉、糖、酸含量和乙烯释放强度研究的实验数据，这些数据使得建立描述苹果果实最佳采收时机的标准成为可能。 遵守苹果果实的最佳采收时间，可以提高适销产量、改善口感，并有助于减少贮藏期间的损失。

关键词：苹果果实，采收期，产品指标，品质成分。

***Annotation.*** *The article presents experimental data on the study of commercial qualities (weight, hardness), the content of starch, sugars, acids and the intensity of ethylene release, which made it possible to establish criteria that characterize the optimal timing of harvesting apple fruits. Compliance with the optimal timing of harvesting apple fruits makes it possible to increase the marketable yield with better taste and helps reduce losses during storage.*

***Keywords:*** *Apple fruits, harvesting times, product indicators, quality composition.*

One of the main tasks of gardening in Russia remains the development of measures that guarantee the receipt of not only high and regular yields, but also high-quality fruits. This is due to the need to provide the population with the recommended volumes of products rich in vitamins, bioflavonoids, micro-, macroe-

lements and other vital substances. Apples, along with other fruits, are necessary for rational human nutrition as sources of biologically active substances, so they should be on our table all year round [1, 2]. However, solving the problem of year-round supply of fruit products to the population is impossible without organizing long-term storage. High storage efficiency depends on proper organization and timely harvesting. It is relevant to establish the removable maturity of fruits selected by the institute for storage, since harvesting fruits at the optimal time can provide a yield increase of 11-22%, depending on the variety. The fruits of the apple tree at harvest maturity are fully developed and formed, and have reached the characteristic size, shape, size, color of the skin and pulp, and biochemical quality indicators. At this stage, the accumulation of nutrients and their consumption are balanced in the fruits, which will ensure maximum resistance to physiological disorders and microbiological diseases. When picked, they do not have the best taste, but after harvesting during storage they fully reach consumer maturity [3-6].

In terms of fruit size, winter varieties of apples bred by the Institute belong mainly to the group of very large ones (over 175 g), which include the varieties Renet Platon (194.6 g), Zolotaya Korona (206.5 g), Bagryanets Kubani (217.5 d), Prikubanskoe (220.0 g), Orpheus (224.5 g), Margot (225.3 g) (Fig. 1)..

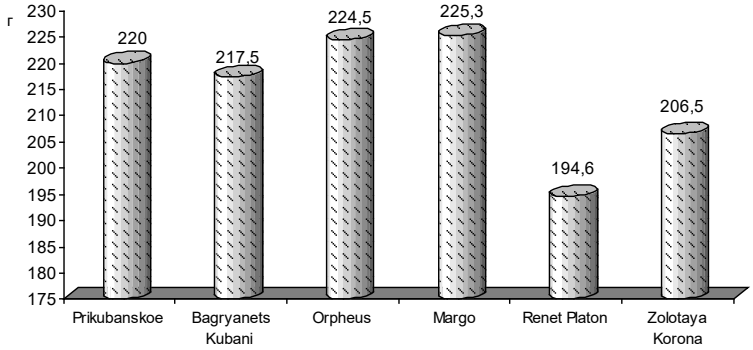


***Figure 1.*** *Weight of apple tree fruits of the institute's selection varieties at harvest maturity*

The obtained experimental data on physical and chemical quality indicators made it possible to establish the range of variation in the content of starch, sugars, acids in fruits, as well as the hardness of the pulp, which characterize the harvest maturity for the SKFNTSVV selection varieties growing in the Krasnodar region (Table 1).

***Table 1***

*Optimal quality parameters for harvestable apple fruit maturity*

| Variant | Starch, score | | Flesh hardness, kg/cm² | | Sugar, % | | Acidity, % | |
|---|---|---|---|---|---|---|---|---|
| | min | max | min | max | min | max | min | max |
| Bagryanets Kubani | 2,0 | 3,0 | 10,0 | 11,0 | 9,1 | 9,7 | 0,56 | 0,62 |
| Zolotaya Korona | 4,0 | 5,0 | 8,0 | 8,5 | 8,5 | 9,0 | 0,40 | 0,48 |
| Margo | 3,0 | 4,0 | 8,0 | 9,0 | 9,0 | 9,8 | 0,45 | 0,50 |
| Orpheus | 3,0 | 4,0 | 7,5 | 8,0 | 9,5 | 10,0 | 0,50 | 0,55 |
| Prikubanskoe | 1,0 | 2,0 | 10,0 | 11,0 | 8,8 | 9,1 | 0,58 | 0,60 |
| Renet Platon | 1,0 | 2,0 | 8,0 | 9,0 | 8,5 | 9,0 | 0,60 | 0,70 |

These indicators can be used as normative ones to determine the optimal harvesting time when storing fruits for storage, as well as to predict the shelf life of fruits.

The method of determining removable maturity by changes in starch content is based on the fact that when fruits ripen, a decrease in starch content occurs, which is first consumed at the seed nest, and then in the cells of the outer epidermis. The starch content in apples is determined by both varietal characteristics and the degree of fruit ripeness. The more starch in the fruit, the less ripe the fruit is. When determining the starch content depending on the varietal characteristics, it was found that a higher starch content is characteristic of the varieties Prikubanskoe, Renet Platona, Bagryanets Kubani. Apples of these varieties must be harvested when the cell load with starch grains is 2.0-3.0 points. Varieties Orpheus and Margot must be harvested when the starch load is 3.0-4.0 points. Apples of the Zolotaya Korona variety at ripeness have a cut color of 4.0-5.0 points.

An informative indicator in determining the degree of ripeness of apple fruits is also the hardness of the pulp, which is determined using a penetrometer with a plunger diameter of 11.0 mm. The higher the hardness, the better the keeping properties. The range of variation of this indicator is determined by the varietal characteristics of the fruit and ranges from 7.5 kg/cm2 (Orpheus variety) to 11.0 kg/cm2 (Bagryanets Kubani, Prikubanskoye varieties).

Objective information about the degree of fruit ripeness is provided by indicators of the release of endogenous ethylene, which are determined by the varietal characteristics of the fruit. Ethylene, as a plant hormone, causes a series of biochemical reactions that result in apple fruit softening and ripening and possibly loss of quality and commercial value.

The high rate of ripening of apple fruits during storage is due to the increased intensity of ethylene release. The Bagryanets Kuban and Prikubanskoe varieties are distinguished by low respiration intensity and ethylene release, which provides

the ability to effectively control metabolic processes during storage and determines the fairly high keeping quality of fruits (Fig. 2).

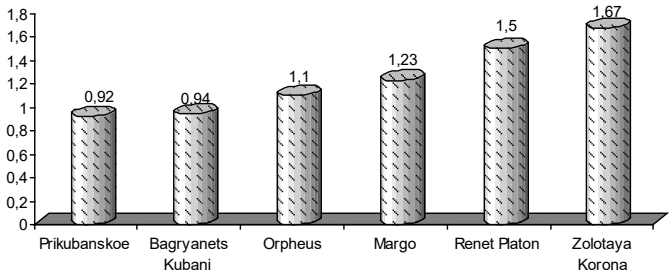


***Figure 2.*** *The intensity of ethylene emission from apple fruits, due to varietal characteristics, ppm l/kg-h*

During ripening, biochemical processes occur in apple fruits associated with the accumulation of dry substances, sugars, and acids. All these processes are accompanied by the formation of taste, aroma, color, and hardness of the fruit pulp. At optimal ripeness, these indicators change slightly or do not change at all, that is, the amount of reserve nutrients characteristic of a given variety accumulates in the fruits. They must be used as normative ones to determine the optimal harvesting time and predict the shelf life of fruits. Each pomological variety of apples at ripeness corresponds to a certain chemical composition corresponding to their degree of ripeness. The experimental data obtained made it possible to establish the range of variation in the content of soluble dry substances, sugars, acids, and vitamins for a number of apple varieties that characterize the harvest ripeness of the fruit (Table 2).

***Table 2***

*Chemical composition of apple fruits at the stage of removable ripeness*

| Variant | Dry substances, % | Vitamin C, mg/100g | Vitamin P, mg/100g |
|---|---|---|---|
| Bagryanets Kubani | 12,4 | 11,2 | 95,8 |
| Zolotaya Korona | 14,3 | 7,4 | 70,6 |
| Margo | 14,0 | 6,1 | 102,6 |
| Orpheus | 14,7 | 6,5 | 85,7 |
| Prikubanskoe | 12,5 | 12,7 | 104,8 |
| Renet Platon | 12,4 | 7,2 | 82,0 |

Thus, the experimental data obtained made it possible to establish criterion indicators characterizing the optimal timing for harvesting apple fruits, including characteristics of commercial qualities and chemical composition.

Compliance with the optimal timing of harvesting apple fruits makes it possible to increase the commercial yield of varieties with better taste and helps reduce losses during storage from microbiological rot and physiological diseases.

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# 雄性紫貂改变发情技术的效力分析
# ANALYSIS OF THE POTENCY OF MALE SABLES WHEN CHANGING THE TECHNOLOGY OF RUTTING

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抽象的。 众所周知，大多数黑貂雌性都有几个性热期的特征，这些热期应该发生在成对交配的时间内。 由于荷尔蒙水平不足，一岁的雌性在发情季节没有时间遮盖自己。 本文讨论了通过改变配对时间来提高年轻雌性紫貂的繁殖能力的方法，并分析了雄性紫貂随着发情时间的增加而产生的强度和生产力。 研究结果表明，如果将强健的雄性在八月份留在紫貂养殖场进行配对，就会观察到年轻雌性的繁殖性能有提高的趋势。

关键词：紫貂，繁殖，一岁雌性，雄性效力，幼犬。

***Abstract****. As is known, most sable females are characterized by several periods of sexual heat, which should fall within the time of mating of pairs. Due to insufficient hormonal levels, one-year-old females do not have time to cover themselves during the rutting season. The article discusses ways to increase the reproductive capacity of young female sables by changing the timing of pair unions, and analyzes the intensity and productivity of males with an increase in the timing of the rut. The research results showed that a tendency towards increased reproductive performance in young females will be observed if potent males are left on sable breeding farms for pairing in August.*

***Keywords:*** *sable, reproduction, one-year-old females, potency of males, puppies.*

**Introduction.** The sable breeding season consists of the false rut, which occurs in February and March, as well as the real rut, which occurs from June to August, depending on age. Females that for any reason remain uncovered during the true rut may not be bred until the following year. It has also been established that ovulation in sables is provoked and occurs 70-85 hours after mating. After ovulation, heat does not recur and only the last matings are complete.

For many years it was believed that with cage breeding, the majority of female sables on average reach sexual maturity at the age of 2–3 years or do not produce offspring at all. Young and old females do not differ in fertility. At one year of age (14...15 months), according to various authors, from 33 to 43% of females are covered. At the same time, from 15 to 30% of females covered at one year of age bear offspring [2].

According to some authors, estrus in one-year-old females occurs in the second half of the pairing period - from July 12 to August 17 [1,4].

And according to other authors, in 57% of one-year-old females, estrus begins by June 20 (the last mating occurs on August 6), and two-year-old sables become mated 4...7 days later than individuals of three years of age and older [3].

While the increase in the reproductive capacity of young females by increasing the timing of the rut is confirmed by many researchers, the effect of prolonging the union of pairs on the sexual activity of males has not been studied enough. As a result, the goal of our research was to study the reproductive ability of males under conditions of modified rutting technology.

**Materials and research methods**. The research was carried out on the basis of "Fox" LLC in the Kugarchinsky district of the Republic of Bashkortostan in 2021-2022 on 88 randomly selected males and 264 females assigned to them. Data on the course of the rut, whelping, and fertility were used.

The changed rutting technology implied an increase in the economic timing of the rutting season (July 1-31). The pairing continued in August, after preliminary assessment of external changes in the loop in females.

**Results and discussion**. The formed group of males by age categories was distributed as follows (Fig. 1): one-year-olds - 32%, two-year-olds - 31%, three-year-olds - 15%, four-year-olds and older - 23%.

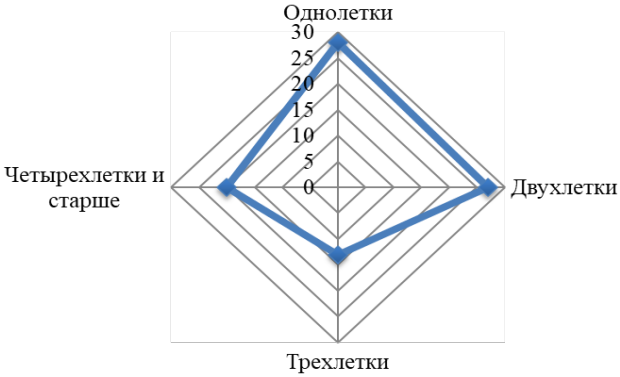


***Figure 1.*** *Age distribution of the male herd*

When analyzing the results of the rut (Fig. 2), it was found that the largest number of matings occurs in the first ten days of July by adult males. Until July 21, males average up to 43 matings per day. During the second and third hunts, young males also began to show high activity. All males taken together performed 990 coitus during the rutting period, of which 241 (24%) performed 28 yearlings. 17 males of two years of age performed 243 coitus, from which it follows that young males, despite the fact that they occupied a large share (60%) in the formed herd, are not full-fledged producers and cannot fully perform the polygamous function.

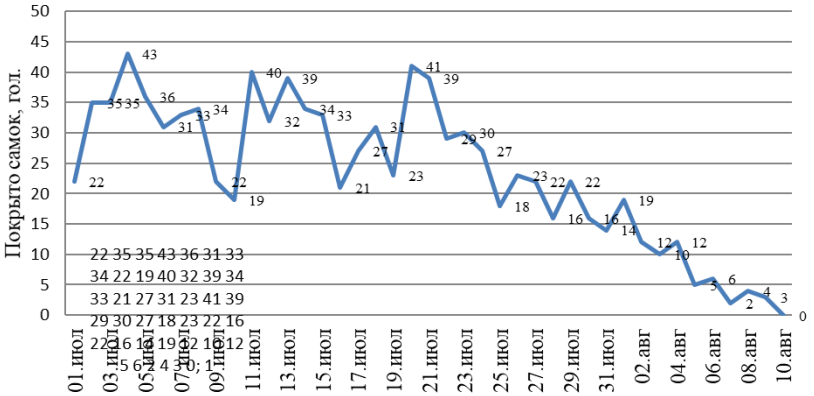


***Figure 2.*** *Mating intensity of sables*

Based on the results of rutting (in August) and whelping (in April-May next year) of experimental animals and animals, an analysis of their reproductive indicators was carried out, which are shown in Table 1.

***Table 1***

*Dynamics of productivity of sable rutting in August*

| Males | n (heads.) | Number of coitus, pcs. | | Number of coitus, pcs. | | Number of puppies born, heads. | |
|---|---|---|---|---|---|---|---|
| | | Totally | on average per head | Totally | on average per head | Totally | on average per head |
| Yearlings | 22 | 43 | 2,0±0,19 | 10 | 0,5±0,11 | 29 | 1,3±0,37 |
| Two year olds | 10 | 23 | 2,3±0,37* | 6 | 0,6±0,16 | 16 | 1,6±0,49 |
| Three year olds | 4 | 11 | 2,2±0,58 | 2 | 0,4±0,24 | 4 | 0,8±0,58 |
| Four year olds and older | 6 | 10 | 1,7±0,21 | 3 | 0,5±0,22 | 5 | 0,83±0,40 |

* P<0,05

From the data presented in Table 1, it follows that one-year-old and two-year-old males were more active in August than adult males. Thus, the number of completed coitus in two-year-olds is significantly higher ($P<0.05$) than in adult males by 26%. This can be explained by the intensive use of older males during the economic period of the rut. Of those covered with one-year-old sables, 23% whelped; those covered with two-year-olds – 60%. It should be noted that the minimum number of fertile inseminations of females by three-year-olds is explained by the fact that out of five covered females, 60% whelped unsuccessfully.

In terms of the output of puppies, there is a greater preponderance of 45-86% in the direction of one-year-old males, due to the increase in the number of fruitful inseminations compared to other age groups. In the second group there is a difference in the average number of puppies by 0.3-0.8 goals. This is apparently due to the greater potency of two-year-old males.

Summarizing the results of the experiment, they confirmed the assumption of a longer continuation of the rut in young animals. Periods of estrus were observed in female yearlings in August. However, an objective indicator of the quality of preparation for breeding is not only the change in the timing of the rutting season in sables, but also the performance of males. The intensive use of the latter in July, during the economic period of the rutting season, limits work with them in August. The herd was faced with the problem of non-working males, for which the females had to be covered by other producers. In order to have active males with full sperm to continue the rutting season in August, it is necessary to think through the rutting system to reduce the workload of males during the economic time of pairing.

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# 根据产驹前三个月的促性腺激素活性水平选择巴什基尔母马
# SELECTION OF BASHKIR MARES ACCORDING TO THE LEVEL OF GONADOTROPIN ACTIVITY IN THE FIRST THREE MONTHS OF FOALING

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抽象的。 本文介绍了巴什基尔马品种的选育工作结果，旨在提高怀孕母马血液中促性腺激素的活性。

关键词：育种、马匹、甘那曲平。

***Abstract.*** *The article presents the results of selection work with horses of the Bashkir breed of horses aimed at increasing the activity of gonadotropin in the blood of pregnant mares.*

***Keywords:*** *Breeding, horses, ganadotrapine.*

Bashkortostan is a region of developed horse breeding; in terms of the number of horses, it ranks one of the first places in the Russian Federation. As of January 1, 2024, the number of horses in the horse breeding farms of the republic amounted to more than 120 thousand heads.

Basically, horses of the Bashkir breed are used for the production of mare's milk, horse meat, tourism and equestrian sports. In addition, horses of the Bashkir breed are used for the production of biological drugs, vaccines and serums [1].

In animal husbandry, an important role is played by the blood serum of pregnant mares, which helps to increase the fertility of animals. The introduction of this serum into the body of a cow, sow, or sheep stimulates the maturation of eggs and increases reproductive capacity, thus possibly regulating the reproductive functions of animals [3].

The Bashkir horse, at the initial stage of its formation, was created under the influence of harsh natural selection and unique selection with minimal human influence. It retained high fertility, milk and meat productivity, universal performance, great endurance, unpretentiousness and good adaptability to year-round grazing. Thanks to these qualities and economy, it has become the leading horse breed in Bashkortostan.

Due to the fact that the selection of the Bashkir breed of horses for many years was carried out on the basis of characteristics that take into account milk productivity, adaptive qualities and an increase in live maize of animals, there is no data for the selection of mares based on the content of gonadotropic hormone in the blood serum, while it is the horses of the Bashkir breed that are used to obtain biological products.

Thus, the purpose of our research was to determine the selection criterion for horses of the Bashkir breed based on the level of gonadotropin activity in the first three months of pregnancy. To achieve this goal, we identified tasks;

1. To conduct a comprehensive assessment of horses of the Bashkir breed in the conditions of an enterprise engaged in the production of blood serum of mares.

2. To study the age composition of mares producing blood serum (donors).

3. To study the dynamics of gonadotropin content during targeted selection for this trait.

4.To develop a scale for assessing the productivity of mares depending on the level of gonadotropin.

Studies of Bashkir breed horses on the activity of gonadotropic hormone in blood serum, as well as an assessment of the effectiveness of selection of mares for this selection trait were carried out at “Bashagrogen” LLC. The object of the research was purebred mares of the Bashkir breed. The results obtained were processed using biometric analysis methods [2].

For the rational use of producer mares (donors) and the need to regulate the timing of insemination and receipt of foals, the breeding company at Bashagrogen LLC is held from February 1 to August 1. Starting from April 1, every 15 days, all single mares that have been in mating for more than 45 days are examined rectally (with an ultrasound scanner) for pregnancy periods. According to the results, single mares are treated with the drug surfagon (releasing hormone luliberin), and from pregnant mares with a period of 45 days or more, 5 ml of blood is taken for enzyme-linked immunosorbent assay (ELISA) for serum gonadotropin levels. The analysis is carried out in a laboratory on the farm. An enzyme-linked immunosorbent assay is used, based on the “sandwich” principle: two-center binding of monoclonal antibodies to horse gonadotropin. When GSFA activity is above 50 IU/ml. the mare becomes a donor and is transferred to a separate kennel with an enhanced feeding ration. Donor horses receive plenty of hay, premix, haylage

in early spring, and are grazed during the pasture period. Blood is collected from mares once every 7 days, on average 4-5 times.

Due to the fact that selection in this enterprise is carried out not for milk and meat productivity, but for the concentration of the hormone gonadotropin in the blood serum, the most valuable are large-sized mares with high live weight and high content of the hormone in the blood serum. Exterior indicators of mares are presented in table 1

***Table 1***

*Exterior characteristics of mares of the main herd*

| Indicator | Measurements | | | | Body indices | | | Live weight, kg |
|---|---|---|---|---|---|---|---|---|
| | height at withers | oblique length of the body. | chest girth | pastern girth | format | broad body | bonyness | |
| 1 class | | | | | | | | |
| Average | 142,0 | 147,5 | 175,1 | 18,5 | 103,9 | 123,3 | 13,0 | 430,7 |
| Standard error | 0,3 | 0,2 | 0,5 | 0,0 | 0,1 | 0,2 | 0,0 | 3,2 |
| Standard deviation | 1,7 | 1,4 | 3,1 | 0,1 | 0,7 | 1,4 | 0,1 | 18,7 |
| Minimum | 139,0 | 146,0 | 170,0 | 18,0 | 102,1 | 120,7 | 12,8 | 400,0 |
| Maximum | 145,0 | 151,0 | 182,0 | 18,5 | 105,8 | 126,4 | 13,3 | 472,0 |
| Calculation | 35 | 35 | 35 | 35 | 35 | 3 | 35 | 35 |
| Elite | | | | | | | | |
| Average | 142,6 | 147,8 | 176,2 | 18,5 | 103,7 | 123,6 | 13,0 | 437,5 |
| Standard error | 0,1 | 0,1 | 0,2 | 0,0 | 0,1 | 0,1 | 0,0 | 1,1 |
| Standard deviation | 1,3 | 1,5 | 2,8 | 0,1 | 0,8 | 1,7 | 0,1 | 16,8 |
| Minimum | 141,0 | 146,0 | 171,0 | 18,0 | 100,7 | 120,3 | 12,7 | 406,0 |
| Maximum | 145,0 | 153,0 | 184,0 | 18,5 | 105,7 | 127,8 | 13,1 | 484,0 |
| Calculation | 230 | 230 | 230 | 230 | 230 | 230 | 230 | 230 |

As can be seen from the table, 89.8% of the mares of the main herd of 230 heads belong to the elite class, while the mares of the elite class have slightly larger linear body dimensions and live weight in comparison with their peers of the 1st class.

Productive longevity of animals plays an important role in the economics of agricultural enterprises; therefore, it is important to study the age of productive use of horses of the Bashkir breed. The age composition of the mares is presented in Table 2.

***Table 2***

*Age structure of donor mares, herd of horses of the Bashkir breed.*

| Age groups, years old | Quantity | |
|---|---|---|
| | heads | % |
| 18 | 2 | 0,78 |
| 16 | 4 | 1,56 |
| 15 | 5 | 1,95 |
| 14 | 5 | 1,95 |
| 13 | 6 | 2,34 |
| 12 | 5 | 1,95 |
| 11 | 3 | 1,17 |
| 10 | 3 | 1,17 |
| 9 | 11 | 4,29 |
| 8 | 12 | 4,68 |
| 7 | 14 | 5,46 |
| 6 | 14 | 5,46 |
| 5 | 53 | 20,7 |
| 4 | 56 | 21,87 |
| 3 | 72 | 28,12 |
| Totally | 256 | 100 |

The average age of blood donor mares was 5.7 years, with 70% of mares aged 3 to 5 years, 20% aged 6 to 10 years, and 10% of mares aged 11 to 18 years. Thus, it can be argued that receiving blood serum in the first three months of pregnancy does not harm the health of mares.

One of the methods of breeding work is the selection of animals for economically useful traits. In our studies, the selection of mares was carried out based on the results of blood sampling in the first three months of pregnancy. In this case, not only the amount of blood received is taken into account, but also the activity of the hormone. Twice-single mares and mares with low gonadotropin hormone activity are culled or sold to other farms

The dynamics of the activity of the hormone gonadotropin in the blood serum of mares of the main herd are presented in Table 3.

***Table 3***

*Dynamics of changes in serum gonadotropin levels.*

| Indicator | Activity indicators by year. | | | | |
|---|---|---|---|---|---|
| | 2018 г. | 2019 г. | 2020 г. | 2021 г. | 2022 г. |
| Mean serum gonadotropin level | 83,24 | 87,02 | 80,13 | 103,61 | 105,02 |
| Standard error | 2,02 | 0,95 | 1,80 | 1,25 | 1,35 |

| | | | | | |
|---|---|---|---|---|---|
| Standard deviation | 34,07 | 32,65 | 28,71 | 46,04 | 41,33 |
| Minimum | 40,00 | 40,00 | 40,00 | 40,00 | 41,00 |
| Maximum | 200,00 | 200,00 | 200,00 | 323,00 | 278,00 |
| Calculation | 283 | 1191 | 254 | 1367 | 935 |

As can be seen from the table, thanks to the targeted selection of animals with low productivity, the correct selection of stallions from sires, as well as the targeted rearing of replacement young animals at the enterprise, it was possible to significantly increase the average level of gonadotropin in the serum of mares of the main herd.

To assess the productive qualities of mares at "Bashagrogen" LLC based on the level of serum gonadotropin, the company's specialists, together with scientists from the ANO Research Institute Bashkort-Ata, based on the analysis of 2296 blood samples, developed a scale for assessing mares based on the maximum level of the hormone during the period of blood collection, which is presented in the table 4.

***Table 4***

*Scale for assessing the productivity of donor mares based on gonadotropin levels*

| Hormone level | Points | Samples number | Share |
|---|---|---|---|
| 279-323 | 10 | 458 | 20% |
| 234-278 | 9 | | |
| 189-233 | 8 | | |
| 144-188 | 7 | 590 | 25% |
| 99-143 | 6 | | |
| 54-98 | 5 | 1012 | 44% |
| 40-53 | 4 | 236 | 11% |

This scale, although it has a scientific basis based on the results of laboratory research and mathematical calculations using the methods of variation statistics, requires a more detailed study of its application in practical conditions. Since the level of gonadotropin hormone in the blood serum of pregnant mares is influenced by many factors. And in some cases, the level of the average hormone concentration is, from a practical point of view, more appropriate.

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# 电脉冲技术和养蜂系统
# ELECTRIC PULSE TECHNOLOGIES AND BEEKEEPING SYSTEMS

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抽象的。 本文讨论了使用功能生成的脉冲电场开发新型电工养蜂系统。 养蜂电气技术的功能解释被提出为利用电场有目的地控制蜜蜂的生命过程（社会功能）。 在蜂群的一年周期中，确定了 40 种社会功能，这些功能可以通过电场的影响进行纠正，从而控制蜜蜂的行为。 根据影响模式（刺激或抑制），可以实施 80 种养蜂技术。

关键词：养蜂、技术、功能发生器、电极系统、脉冲信号。

***Abstract.*** *The article discusses the development of new electrotechnological beekeeping systems using functionally generated pulsed electric fields. A functional interpretation of beekeeping electrical technologies is proposed as a purposeful control of the life processes (social functions) of bees using electric fields. In the annual cycle of a bee colony, 40 social functions are identified that can be corrected by the influence of an electric field and thus control the behavior of bees. Depending on the mode of influence (stimulation or inhibition), it is possible to implement 80 beekeeping technologies.*

***Keywords:*** *beekeeping, technology, functional generator, electrode system, pulse signal.*

Electric pulse beekeeping technologies were developed at the scientific school of Professor A.M. Basov. CHIMEA-SUSAU under the leadership of Candidate of Technical Sciences Salikhov S.S. The scientific basis of new technologies is the research and discoveries of Academician of the Russian Academy of Natural Sciences, Professor E. N. Eskov. and systems methodology [1,2,3].

The life processes of honey bees are considered as social functions or as natural technologies. Consistent application of the principles of the systems approach presupposes the need to consider the structural and material-field organizations of the bee colony [4]. An important stage of system analysis is to introduce the relationship between the structure and functions of the "bee colony" system. The material-field organization of a bee colony was considered by us in [2]. The bee family (BF) as a material formation consists of a material formation, which is called a frame, and living matter. The material frame consists of an inert substance, honeycomb and wax, which have unique dielectric and electret properties. Living matter includes PS individuals (queen, drones, worker bees), as well as brood. The PS block diagram is shown in Fig. 1.

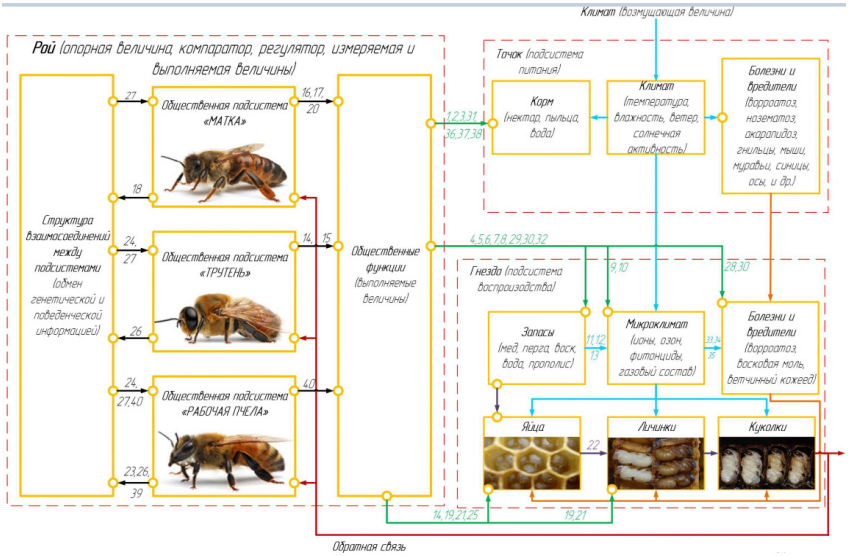
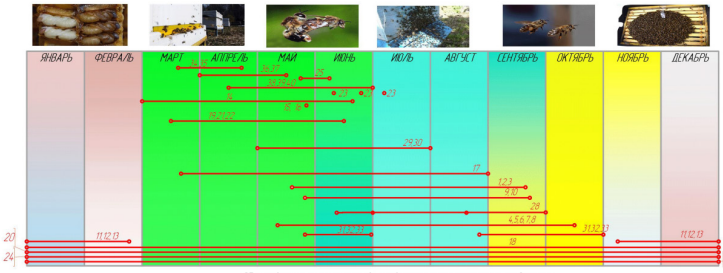



***Figure 1.*** *PS block diagram*

The main target function of the PS as a system is reproduction and reproduction (brood and swarm), the main target function of the beekeeper is the maximum productivity of the apiary, and the agronomist is the maximum number of pollinated plants.

Figure 2 shows the functional and temporal life cycle of bees throughout the year (annual cycle). The social functions of the PS and individual individuals are also highlighted here with the names of subsystems, processes and performers.




| № | Название подсистемы | Название процесса подсистемы | Функции подсистемы и исполнитель | № | Название подсистемы | Название процесса подсистемы | Функции подсистемы и исполнитель |
|---|---|---|---|---|---|---|---|
| 14 | Производство спермы | Производство спермы для оплодотворения маток | Размножение / Трутень | 20 | Кормление Матки | Кормление Матки маточным молочком | Размножение / Рабочая пчела |
| 15 | Спаривание | Спаривание с маткой | Размножение / Трутень | 21 | Кормление яиц | Кормление отложенных яиц маточным молочком | Размножение / Рабочая пчела |
| 16 | Спаривание | Спаривание с трутнями | Размножение / Матка | 22 | Кормление личинок | Кормление личинок личиночным кормом (мед, вода, пергa) | Размножение / Рабочая пчела |
| 17 | Откладывание яиц | Откладывание оплодотворенных или неоплодотворенных яиц | Размножение / Матка | 23 | Роение | Роение в случае необходимости | Размножение / Рабочая пчела |
| 18 | Выделение феромона | Выделение феромона матки для ее индентификации | Размножение / Матка | 24 | Прием феромона матки | Прием феромона Матки для ее индентификации | Размножение / Рабочая пчела |
| 19 | Выделение маточного молочка | Выделение маточного молочка рабочими пчелами | Размножение / Рабочая пчела | 25 | Яйцекладка рабочих пчел | Откладывание яиц рабочими пчелам в отсутствии Матки | Размножение / Рабочая пчела |

***Figure 2.*** *Functional-temporal life cycle of bees*

In the structural diagram (Fig. 1), the numbers correspond to the functions shown in Fig. 2. The electric field generated by the bee colony at all hierarchical levels of the biosystem is the main system-forming factor. The technological approach we propose is that the influence of the functional pulse generator serves for the purpose of directed correction of the state of the bee colony, thus the social function corrected by the electric field is the technological operation of beekeeping. So, for example, by stimulating the protective function 28 with an electric field, we excite the bees and implement intensive collection of bee venom (three points on the time diagram from mid-June to the 1st decade of July). When stimulating social functions 1,11,12,13, technologies of motor activity are implemented to regulate the temperature regime of the bee's home and combat the Varroa mite. Inhibiting function 28 prevents bees from swarming.

The main target function of electrotechnological beekeeping systems is targeted control of the condition of bees, i.e. the object of influence is the behavior of bees. The working body (tool) is an element of the system that interacts with the object of influence (the state of the bee colony). An impulse generator is an element of an electrical technological system in which energy from a source is converted into the energy needed by the working body. The electrode system - transmission - is an element of the system through which energy is supplied to a biological object (bee, group of bees, family, swarm) and is finally converted into the necessary characteristics of the working organ (electric field). Operating parameters are determined by both the parameters of the generator (voltage, frequency, pulse shape, etc.), the electrode system (shape of the electrodes, characteristics of the electrode

coating, degree of field heterogeneity, etc.), and the electrophysical parameters of the bees. The exposure and exposure time is determined in accordance with the functional time cycle (technological map) and environmental parameters.

Figure 3 shows some functional beekeeping generators developed at CHIMEA [2,6], and in Fig. 4 – electrode systems and patents in the field of technological systems developed at CHIMEA.


***Figure 3.*** *Functional generators for beekeeping*

The most effective electrode systems are those that generate non-uniform electric fields [5].

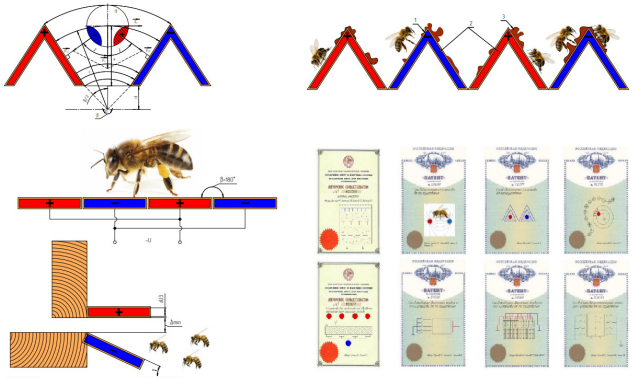


***Figure 4.*** *Electrode systems and beekeeping technologies and patents in the field of technological systems*

The developed electrotechnological beekeeping systems make it possible to improve traditional technologies for breeding and keeping bees, increasing the productivity of commercial beekeeping, as well as pollination technologies.

In accordance with the methodological foundations of the development of technical systems, the evolution of the working body occurs at both the micro and macro levels. Therefore, the considered approaches at the PS level can be further extended to an individual individual (queen, drone) and to groups of bees in winter conditions. Naturally, the number of electrotechnological beekeeping systems will be significantly more than 80.

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# 利佩茨克州境内沃罗涅日河水上游乐部分的底部沉积物
# BOTTOM SEDIMENTS ON SECTIONS OF WATER RECREATION OF THE VORONEZH RIVER IN THE TERRITORY OF THE LIPETSK REGION

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注解。 该研究的目的是对利佩茨克地区沃罗涅日河流域底部沉积物质量进行地球化学评估。 介绍了对沃罗涅日河（顿河左支流）人为负荷最大地区底部沉积物状况的化学分析结果。 在沃罗涅日国立大学地理、地球生态和旅游学院环境分析实验室的基础上，采用电位分析、滴定分析、伏安分析、重量分析和粒度分析方法对海底沉积物中的污染物进行了定量化学分析。

沃罗涅日河现状的特点是，由于工业发达、河床附近人口稠密，人为负荷较高。 根据水库污染物时空累积动态，区分不同富营养化程度区域。

关键词：底部沉积物、定量分析、定性分析、克拉克浓度、总污染指标、优先污染物。

***Annotation.*** *The purpose of the study is a geochemical assessment of the quality of bottom sediments of the Voronezh River basin within the Lipetsk region. The results of a chemical analysis of the state of bottom sediments of the Voronezh River (the left tributary of the Don River) in places of the greatest anthropogenic load are presented. Quantitative chemical analysis of pollutants in bottom sediments was carried out on the basis of the environmental analytical laboratory of the Faculty of Geography, Geoecology and Tourism of Voronezh State University using potentiometric, titrimetric, voltammetric, gravimetric and granulometric analysis methods.*

*The current state of the Voronezh River is characterized by a high degree of anthropogenic load due to developed industry and densely populated areas*

*adjacent to the river bed. Based on the dynamics of the spatiotemporal accumulation of pollutants in a reservoir, zones with different levels of eutrophication are distinguished.*

***Keywords:*** *bottom sediments, quantitative analysis, qualitative analysis, clarke concentration, total pollution indicator, priority pollutants.*

Environmental problems of water landscapes arose and worsened with the development of civilization and were a consequence of anthropogenic impact on nature. Currently, we have to solve pressing issues to prevent river degradation.

Pollution of water bodies is a pressing problem in many industrialized and densely populated areas of Russia. The main cause of pollution of watercourses and reservoirs is the discharge of domestic wastewater and mixed wastewater. The quality of surface and groundwater determines the health of the population and the quality of life in general [1].

OBJECTS AND METHODS OF RESEARCH

The key areas of water recreation of the Voronezh River in the Lipetsk region were identified as the object of study. Two large regional centers of the Central Black Earth region are located on the watercourse: Lipetsk and Voronezh.

The Voronezh River valley has a clearly defined asymmetrical structure with steep right-bank slopes and a terraced left bank. The watercourse is flat, characterized by the presence of meanders and long meanders due to channel processes.

Within the urban agglomeration of Lipetsk, a spillway dam of the Novolipetsk Metallurgical Plant was built on the Voronezh River, forming the so-called “Lipetsk Lake”. In 2009, the Novolipetsk Iron and Steel Works completely stopped discharging industrial wastewater into the Voronezh River and reduced river water intake by 3 times. The reduction in environmental load was achieved due to the completed large-scale modernization of the technical water supply complex and the introduction of new technological processes.

Downstream, a few kilometers from the river mouth, a dam was built that formed the Voronezh Reservoir [2]. Thus, the river flow of the watercourse is almost completely regulated along its entire length.

The degree of negative impact of anthropogenic activities on the river can be assessed using bottom sediments. The accumulating depositing role of bottom sediments in the environment makes it possible to assess changes occurring in a reservoir [3].

On the territory of the Lipetsk region, 5 control areas were identified and bottom soil samples were taken.

1. Mayakovskogo Street - a beach equipped by residents of the area;

2. Sokolsky beach, Bardina street, 14, building 1 (upstream of the Svobodny Sokol plant);

3. Novolipetsk beach, Levoberezhnaya street, 36 (upstream of the Novolipetsk metallurgical plant);

4. Beach of the Tractor Plant, Krasnozavodskaya Street, property 2a (downstream of the Novolipetsk Metallurgical Plant);

5. Beach of the Zarechye microdistrict (downstream of the Lipetsk aeration station).

Sampling was carried out in the summer of 2023 using a GR-69 bottom probe. The sampling program is determined in accordance with 17.1.5.01-80 "Nature Conservation. Hydrosphere. General requirements for sampling of bottom sediments of water bodies for analysis of pollution."

The samples were determined for the gross content of heavy metals (lead, cadmium, copper, zinc), petroleum products, hydrogen sulfide, sulfates, and the pH value of the water extract [4].

RESULTS AND DISCUSSION

The thicknesses of the bottom soils of the Voronezh River differ in the color of the horizons. Dark gray, bluish and black colors of bottom sediments are distinguished, which is a sign of gleyization and the presence of reducing conditions

Within the selected study points, the predominance of sand fractions with a grain size of less than 0.25 mm in the bottom soil was established. The silt fraction (less than 0.001 mm in size) is contained in the samples in the range from 12.2 to 18.9%.

Environmental assessment of the levels of heavy metals in natural environments is carried out in accordance with quality standards. There are no approved maximum permissible concentrations (MPCs) for bottom sediments. To characterize the content of heavy metals, a concentration clarke (Ck) was used, calculated as the ratio of the content of a chemical element to the soil clarke compiled by A.P. Vinogradov in 1962. The total indicator of contamination of bottom sediments by elements (Zc) was calculated using the formula: $Zc = \sum Ck - (n-1)$, where n is the number of elements with $Ck > 1$.

Despite the predominance of silt in the bottom soil, no excess of the clarke content of metals was detected and the total indicator of contamination of bottom sediments is less than 8 and is low (Table 1).

The content of petroleum products in the river bottom sediments varies in the range from 30 to 90 mg/kg. The presence of this pollutant indirectly indicates increasing changes in the bottom ecosystem of the reservoir.

The concentration of petroleum products is a significant factor influencing the rate of reactions occurring in a reservoir. We calculated a moderate negative correlation between the concentrations of petroleum products and hydrogen sulfide ($r=-0.49$) and a strong positive correlation between the content of petroleum products and the value of the hydrogen index of the water extract ($r=0.7$).

***Table 1***

*Level of pollution of bottom sediments of the river. Voronezh on the territory of the Lipetsk region in 2023*

| Numbers points | Excess factor Zc permissible level | Level pollution |
|---|---|---|
| 1 | No excess | Short |
| 2 | No excess | Short |
| 3 | No excess | Short |
| 4 | No excess | Short |
| 5 | No excess | Short |

Under natural conditions at oil and gas fields, high concentrations of hydrogen sulfide are possible in soil samples, which are determined by the specific processes of the formation of positive geochemical anomalies. In the water landscapes of the Central Black Earth region, oil products are exclusively of technogenic origin and are considered exclusively as a risk factor. The negative correlation between hydrogen sulfide and petroleum products is due to their properties. Hydrogen sulfide is the main reducing gas of aquatic landscapes, formed during the decomposition of organic matter. Petroleum products in a liquid aggregate state have the ability to accumulate in surface horizons, sticking and limiting the penetration of other substances. Such “preserved” organic matter takes longer to decompose, and, therefore, in places with a high content of petroleum products, the concentration of hydrogen sulfide is lower.

The hydrogen index of the water extract (actual acidity) has a weak negative correlation of values with the concentrations of hydrogen sulfide (r = -0.35) and sulfate ions (r = -0.42).

The oxidation of hydrogen sulfide and sulfides of active metals in bottom sediments produces sulfate ions. The more active the oxidation process occurs, the more sulfates are formed. The calculation established a moderate negative correlation (r= -0.65) between sulfates and hydrogen sulfide (Fig. 1).

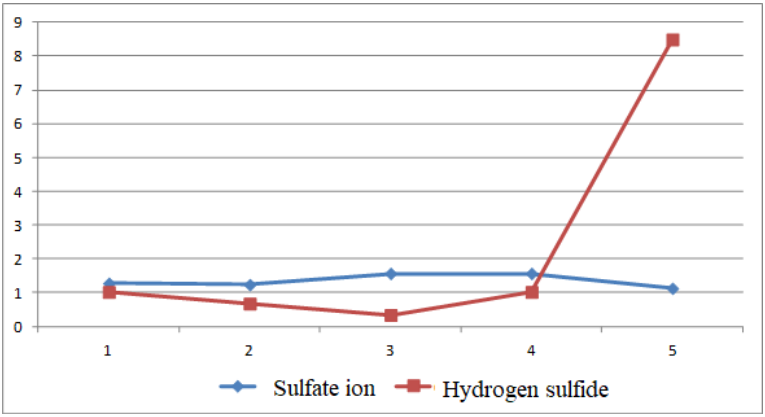


***Figure 1.*** *Content of hydrogen sulfide and sulfate ion in bottom sediments R. Voronezh (mg/kg)*

Bottom sediments of the beach in the Zarechye micro district (downstream of the Lipetsk aeration station) contain a significant amount of hydrogen sulfide. The concentration exceeds the established MPC value (0.4 m/kg) by 8.5 times. The bottom sediments of the remaining sections of the river examined contain hydrogen sulfide at the MPC level and below.

CONCLUSIONS

The condition of water bodies everywhere requires close attention. All rivers of the Central Black Earth region are included in federal or regional monitoring and quality control programs.

The Voronezh River is under pressure from economic activities along its entire length. The most problematic areas remain the areas where insufficiently treated wastewater is discharged. For these sections of the river, it is necessary to increase the frequency of quality control of bottom sediments and limit recreation areas.

Thus, the research carried out allows us to conclude that it is necessary to thoroughly develop a program of monitoring observations of the quality of water and bottom sediments of the Voronezh River, as well as to make complex, comprehensive and economically sound decisions to reduce the discharge of wastewater into the reservoir.

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