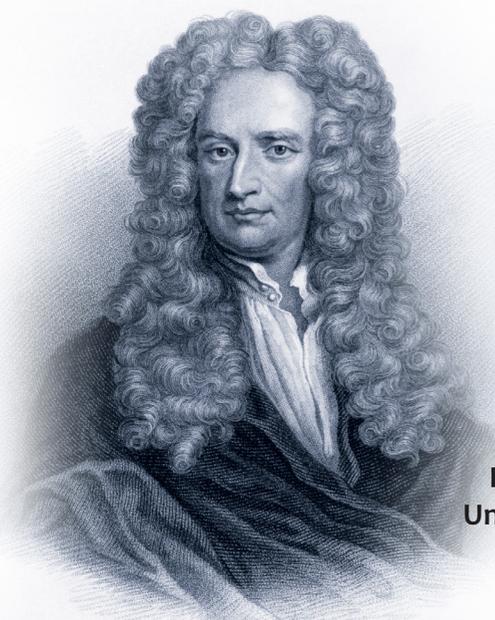




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## FACTORS OF HUMAN CAPITAL DEVELOPMENT IN THE KNOWLEDGE ECONOMY

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**Abstract.** The knowledge-based economy is increasingly acquiring real practical outlines not only in the leading developed countries, but also in countries that have embarked on the path of systemic modernization of their economic systems. In a knowledge-based economy, in first place are resources and human potential that are inexhaustible by their nature, which can be multiplied, improved, changed and developed in the process of application. The article shows that the process of human capital development includes its formation, accumulation and reproduction. It is noted that human capital is the only factor of production, which, in the process of use, is simultaneously consumed and improved (developed). It has been proven that a knowledge-based economy creates an external environment and factors for the development of a complex, expensive person, and human capital, improving, gives powerful impulses for the development of a knowledge-based economy. These processes are influenced by such factors as investment in human capital, the development of education, knowledge and intelligence, creative work, competitiveness, information. A person, being a resource of a special kind, acts as both a consumed resource of the knowledge economy and a resource capable of showing his own activity, using various resources for his own improvement, complication, and development.

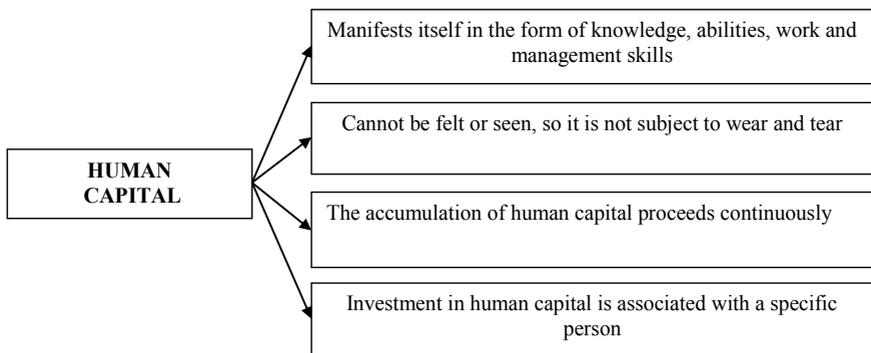
**Keywords:** human development, knowledge economy, human capital, factors of human capital development.

At the beginning of the XXI century, such significant changes took place in the economies of the leading countries of the world that we can speak of the formation of the foundations of a new economy - the economy of knowledge. In search of an answer to the question of increasing the efficiency of the social economy, the attention of scientists is increasingly concentrated around the person himself, who is becoming a key link in the formation of a new economy. The economy has always relied on the human factor, but

only now has it acquired the ability to operate on the phenomenon of its capitalization. Human capital is knowledge materialized in a person and his ability to work effectively, the effective use of which allows us to take advantage of the opportunity to significantly improve the living standards of the population and increase the rate of economic growth.

Human capital is a special economic category, the main research problem of which is the specific nature of human capital, due to the totality of a person's physical and mental abilities, which determine his ability to work. Human capital is a set of knowledge, skills, and abilities that are used to meet the diverse needs of a person and society as a whole. For the first time this term was used by the American economist Jacob Minser in 1958, then Theodore Schultz in 1961 and Gary Becker developed this idea since 1964, substantiating the effectiveness of investments in human capital and formulating an economic approach to human behavior. This approach reflects the main components of human capital, which are intelligence, health, knowledge, quality and productive work and quality of life. The concept of human capital can be interpreted as a special capital in the form of intellectual abilities and practical skills acquired in the process of education and practical activities of a person. This interpretation indicates the fact that the presence of human capital means the ability of people to participate in production [1, p. 36-37].

The specific features of the concept of human capital are presented in figure 1.



**Figure 1. The concept of human capital**

The main challenge to the development of human capital in a digital civilization is the speed of transformation of socio-technological infrastructure [2].

Human development is the process of providing people with wider choices in all aspects of human life: the opportunity to live a healthy and productive life, acquire knowledge, and have access to the resources necessary for a decent standard of living.

A systematic approach to the development of human capital in the knowledge economy is directly related to the concept of a society for all, a society for everyone. The specificity of this approach lies in a new understanding of development, in the process of which a person should become its key factor, its direct participant and the main consumer of development results.

In approaches to the problems of human development in a knowledge-based economy, an understanding has emerged that people are not only a source or means of economic development, i.e. "human capital", but also the goal of the development process.

The interpretation of human capital as a special type of "capital" also determines the corresponding attitude to the factors of its development. These factors are generated by the laws of the knowledge-based economy. The characteristic of human capital should take into account a variety of factors that open up opportunities for the development and implementation of human abilities.

Among the most significant factors of human capital development initiated by the knowledge economy are the following [3, p. 122-125]:

1. **Capital investment.** These are the costs of building and developing human capital. In the first case, the quality of the employee as a resource increases, knowledge and skills expand, health improves, i.e. the stock of this production factor increases. In the second, the market price rises, the implementation of human capital in the labor market improves.

2. **Family (household).** This is the sphere of "human production", where development, reproduction, the formation of a social genotype begins: the transfer of knowledge, cultural heritage, education and upbringing of a person, a potential employee.

3. **Education.** It is considered both as a means of expanded reproduction of human capital, and as a resource for its development, which allows using all the reserves of the human factor in the best possible way. Education forms future knowledge that allows you to effectively adapt your skills and competence-based abilities to rapidly changing conditions, to deal with global crisis phenomena, preventive means and actions. Human capital becomes a self-learning and self-organizing system, the priority for it is "advanced education", self-education.

4. **Knowledge and intelligence.** In the new economy, knowledge becomes an important economic resource of production. Knowledge modifies

work, giving it new features and enriching its content. Intellect represents that part of human properties and qualities (knowledge, experience, competencies, abilities, skills, aptitude, talent), which are a constant source and the very subject of actualization of the creative forces of a person, orienting him to the search for not all ways, namely intellectual-directed development.

5. **Unique abilities.** The availability of exclusive, unique, rare abilities and creative potential among employees is considered as a condition for the successful development of both personality and organization. The ability to make scientific discoveries, transform them into innovations, technologies, new products are exceptional, depending, among other things, on genetic selectivity. Possession of such abilities turns human capital into a highly developed and highly competitive one, giving its owner the opportunity to receive intellectual rent.

6. **Creative work.** In a knowledge-based economy, the nature and structure of labor changes, i.e. there is a transition from replication to creative and innovative work, which requires the greatest return from the intellect. Creative work is work that requires self-development and self-realization of the individual, conditioned by self-actualization and self-motivation.

7. **Intangible values.** The economy of non-material resources brings to the fore the non-economic motives of labor activity: focus on results, search for something new, passion at work, responsibility, demand, self-sufficiency, self-education and self-training, efficiency, high work ethic.

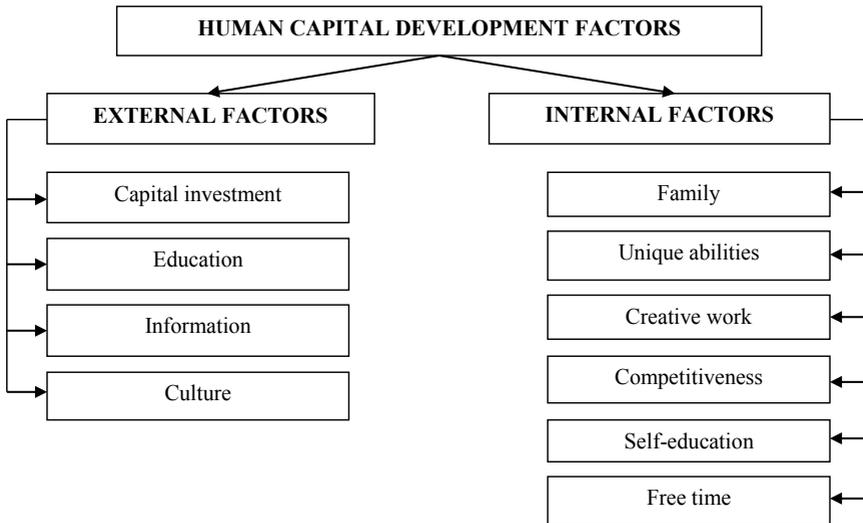
8. **Competitiveness.** In the XXI century, the most important competitive advantages are the generation and accumulation of specialized knowledge, the ability to think analytically, systematically, to see interconnections, and to constantly manage knowledge and information.

9. **Information.** Streams of relevant information not only open up unprecedented opportunities in the field of social communications, scientific research, economics, education, culture, but also significantly change the person himself, forming his new needs, behavioral stereotypes, ideas about the quality of life. Informatization of professional activity has become one of the leading trends that determine the development of modern civilization and a stable long-term trend.

10. **Free time.** In a knowledge-based economy, the measure of wealth is not the production of material goods, but the free time used by a person for continuous self-improvement, development of abilities, replenishment of knowledge, development of new professional niches, as well as participation in the implementation of scientific projects, health improvement, sports, recreation, acquaintance with the achievements of culture. Time is becoming the most precious and limited resource.

11. **Culture.** The development of human capital is unthinkable without the revival of high culture.

A person, being a resource of a special kind, acts as both a consumed resource of the knowledge economy and a resource capable of showing his own activity: he uses various resources for his own improvement, complication, development. Therefore, these factors can be divided into external and internal (Fig. 2).



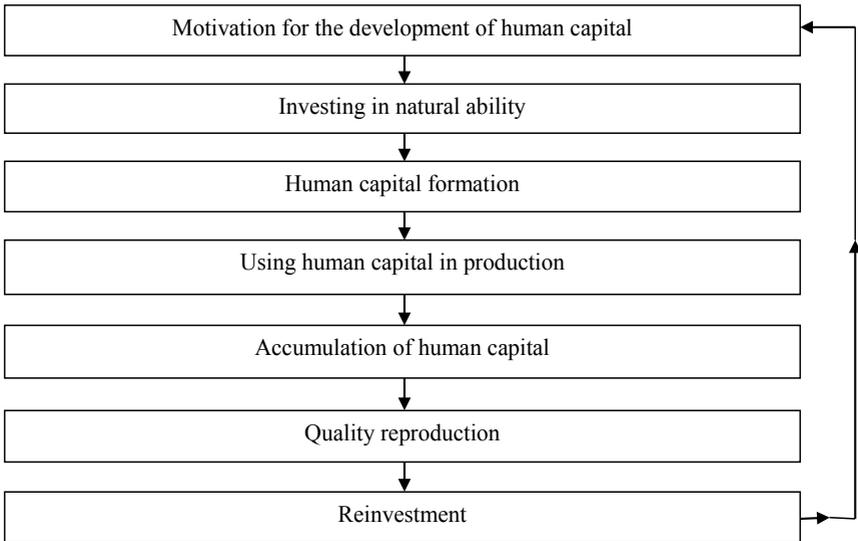
**Figure 2. Factors of human capital development in the knowledge-based economy**

Human capital development factors determine the algorithm on which the development of human capital is based, this algorithm is shown in Fig. 3.

The development and complication of human capital in a knowledge-based economy occurs at different levels:

- the development of individual (nano- or *mini-level*) human capital occurs in several stages with the participation of the person himself, other actors, including factors of the micro- and macro-level. Each factor has an independent meaning in the system of human capital development, and the quality of the implementation of the process under consideration as a whole may depend on each of them [4, p. 45];

- **at the micro level**, the development of human capital involves the creation of conditions for its improvement, retraining, advanced training.



**Figure 3. Algorithm for the development of human capital**

The main goal - is to get this accumulated human capital for more efficient operation of a company or industry and turn it into intellectual capital [5];

- **at the meso-level** (regional), the development of human capital is expressed in the implementation of the existing total human capital of the territory, taking into account the specifics of the development of the regional economic system, cultural characteristics, historical conditions [6]. In our opinion, the processes of formation and development of human capital in the region are characterized by the characteristics of processes at both the macro and micro levels;

- **at the macro level**, the development of human capital is aimed at the effective operation of human-oriented industries that provide quality characteristics of the life of citizens, contributing to security (in all areas), social stability and security of society [7];

- **at the mega-level**, the development of human capital is associated with the processes of globalization and the formation of the knowledge economy in the world. These processes are interrelated and affect the structure of the world labor market, the market of educational services, as well as intellectual migration [8].

The development of human capital is a reciprocal two-way process, on one side of which there is a knowledge-based economy that creates the external environment and factors for the development of complex, expensive human capital, and on the other - human capital, which, while improving, provides powerful impulses for the development of the economy, based on knowledge, and acts as a self-developing factor due to internal impulses and development resources. This process, in our opinion, is both deterministic (comes from the outside) and non-deterministic (comes from the inside).

Thus, current trends in the development of a knowledge-based economy indicate the importance of the problem of human capital development. In the context of the formation of the knowledge economy, the main factor of economic development is the human resource - more valuable than material and natural factors and resources; the development of human capital can be viewed as a process that goes both from the outside (due to external factors) and from within (due to the factors of self-development); internal contradictions are the source of human capital development; the formation, maintenance, development, accumulation of human capital require significant costs from the person himself and the whole society; investments in human capital give a rather significant in time, integral in nature, multiplicative in terms of the result, economic and social effect; human capital is inseparable from its carrier - the human person. The development and complication of human capital in a knowledge-based economy occurs at different levels: mini- (individual), micro-, meso- (regional), macro-, mega-level.

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## **SPECIFICS OF STIMULATING INNOVATION ACTIVITY IN THE CONTEXT OF DIGITALIZATION OF THE ECONOMY<sup>1</sup>**

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**Abstract.** The article considers the specifics of stimulating innovation in modern conditions. The directions of its improvement in the context of digitalization are indicated.

**Keywords:** innovation, innovation activity, stimulation, financing, digitalization

### **Introduction**

Stimulating innovations is aimed at expanding the possibilities for their implementation by creating favorable conditions for individual workers and organizations that implement innovative programs and projects, by developing financial incentives, attracting capital and joint investments, which to a certain extent are reflected in the existing structure of financing innovative activities. The prospects for innovation are changing due to the digital transformation of the economy, since incentive methods are not limited to financial instruments, but also include the development of intellectual, information and communication network capital.

### **Purpose of the study**

Analyze the development trends of forms and methods of stimulating innovation in the modern conditions of the digitalization of the Russian economy.

### **Research results**

In Russia and in most developed countries, such forms of state support for scientific and innovative activities are used as:

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<sup>1</sup>The study was carried out with the financial support of the Russian Foundation for Basic Research in the framework of a scientific project № 19-310-90043

- direct budget financing,
- tax incentives on profits, received when implementing scientific developments,
- exemption from tax on property and land owned by scientific organizations; [1].

One of the most famous tools for stimulating innovation is the taxation system. The tax system of the state should be focused on providing favorable conditions for enterprises engaged in innovative activities [2].

Improving state support for innovation and financial and credit forms of state incentives for innovative processes are formed by tax incentives, a decrease in the number of taxable profits, preferential lending and simplified registration of the results of innovative inventions.

At the same time, the structure of financing for innovation activity (Figure 1) indicates that the stimulation of innovation is far from limited to tax instruments, which are paid attention to by most researchers [5,6,7,8,9].



**Figure 1 – Structure of costs for technological innovation in industrial production by sources of funding.**

Source: compiled by the authors based on material of [3].

The methods of financing innovative entrepreneurship is not only in financing individual research and scientific works, but in the comprehensive financing of all projects carried out by innovative organizations and enterprises.

To close the likely gaps between innovation, technological development and their introduction into production, as well as the process of their commercialization, a thoughtful approach to the financing of innovation is required.

In this regard, the issue of attracting foreign capital to invest in Russian innovative developments will be urgent. Taking into account the current circumstances, in connection with the Ukrainian events that took place in late 2013 and early 2014, as well as the position of NATO member states towards Russia after the annexation of Crimea, it was not difficult to predict negative trends in this area. Indeed, in 2018, there was a decrease in foreign direct investment in Russian business by 6.5 billion US dollars [4]. To maintain the growth rate of the development of the innovative sector of the economy, it is necessary to compensate for the cash outflow through domestic public investment.

Despite this, there are several reasons for the successful development of Russian innovative enterprises in the medium term:

- formation of scientific and technical centers and business incubators;
- focus of educational and scientific institutions on the creation of a specific technology, its protection and further commercialization;
- focusing scientific research on obtaining a final product or technology.

Personnel motivation - moral and material - should be at the center of the stimulating function of innovation management. For this reason, it is necessary to link the internal systems of increasing the interest of employees in innovation with external means of enhancing the activity of innovatively active organizations.

Intraorganizational systems should rely on such incentives and instruments of influence that "flow" from the external organizational conditions created by the state and society, implying the ever-increasing value of innovations and innovators. Moreover, the clearer, stronger and more "attractive" this dependence, the faster the economy will develop in the innovative direction necessary for society, the faster people's thinking will be reorganized to accept constant transformations of production and consumption, the weaker the obstacles arising from the implementation of innovations will be. This will happen not because there will be no real obstacles themselves or they will remove themselves, these obstacles will remain, but overcoming them psychologically will not cause "paralysis" in the actions of economic actors of different levels.

Let us consider some of the possibilities of such a symbiosis of external and internal incentives for innovation.

So, for example, the main ways to improve the effectiveness of meas-

ures to stimulate innovation include:

- increasing capitalization by accounting for innovations as intangible assets;
- increase in efficiency through the introduction of technical and organizational and managerial developments;
- creation of a competitive innovation market as a single legal, information and trade space;
- concretization of the goals of research work, scientific and experimental-design developments [5].

These areas are considered key proposals for increasing the attractiveness of innovative enterprises for capital, based on the use of venture capital financing.

What internal incentives should match these external benchmarks?

Capitalization of innovations should give innovators the opportunity to receive part of the organization's intangible assets, and in such a way that it becomes an achievement recognized by society, the state, the collective and the owners of enterprises, the merit of a person who creates something new, ensures the functioning of the company on a digital platform.

The introduction of organizational and managerial innovations should not have a direct way to obtain a momentary effect from their implementation, but an indirect effect through improving the conditions for the activity of innovators, as well as reducing the cost of converting their ideas into a commercial product. If organizational and managerial innovations are oriented towards self-sufficiency, then a favorable environment for people who produce innovations will not be created.

In the direction of the competitive innovation market, it seems promising to supplement the public sector of fundamental research on digitalization with venture capital companies that are not afraid of competition, offering innovators assistance in the commercialization of their ideas for creating artificial intelligence, etc.

And in conclusion: the goals declared by the authorities, society, and business should be linked by the general concept of digital development and be concretized through specific tasks of research work on the digitalization of all technological processes.

This approach will help to cope with the possible problems of the formation of a digital economy in Russia and the use of the results of scientific and technical developments in the industrial and economic spheres.

**Conclusions.** The last decade has demonstrated the need for the domestic economy in a radical transition to an innovative basis. To achieve this, it is necessary to apply a well-formed systematic approach to stimulat-

ing and supporting innovative activities at the state and intra-industrial levels. Through the organization of effective national innovation systems that penetrate and integrate all enterprises of the national industrial economy into a single whole, it is possible to significantly increase the scientific and technical potential of the country, the efficiency of the economy as a whole and help each organization and its products to take a competitive position in the world market.

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## SCIENTIFIC ANALYSIS AND MANAGEMENT OF AGRICULTURAL PRODUCT PROMOTION PROCESSES

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Pryanishnikov

**Abstract.** Currently, the active use of marketing tools by agricultural producers, especially at the stage of product sales, has become of paramount importance, because the profitable sale of manufactured products is a key factor in the effective operation of the agro-industrial complex. In recent years, there has been an expanded penetration of marketing elements in the sphere of agriculture. Due to recurring problems in the implementation of marketing of agricultural products, there is a need for widespread and targeted use of such a marketing tool as promotion, which rural producers today pay great attention to.

**Keyword:** management, scientific analysis, processes, agricultural products, food, international trade, statistics.

The agricultural sector in Russia has a high potential. Our country has a huge territory that is quite suitable for the production of agricultural products.

By understanding the structure of trade flows in the global agricultural market, we can develop optimal trade strategies that will ensure the good functioning of the national economy and significantly reduce risks. In addition, it is important to determine which factors have the greatest impact on the formation of stable trade relations. Based on all the above facts, it is necessary to consider the global agricultural trade network, since this topic is relevant for the Russian economy.

Currently, the most modern trends in the distribution and promotion of agricultural products in the world, based on the analysis of foreign experience, are concentrated in the field of logistics. The study of these areas in developed countries confirms that one of the reasons for the development of logistics approaches was the resource capabilities of assortment and quality improvement of consumer service technologies [1].

The process of promoting agricultural products is more specific and complex than other types of marketing. It determines the variety of ways and methods of its implementation due to the large number of products produced, and their significance. For example, some of them are essential goods, while others are goods that meet a high standard of living.

Branch trade networks are the main object. All the methods and approaches used to study the world trade network are also applicable to the study of industry trade. There are studies on different sectors. Research related to the agricultural trade network includes the study of agricultural trade networks. Let's analyze the global agricultural trade network.

To build a multi-level graph, take data from the site Food and Agriculture Organization of the United Nations [15]. This organization collects, processes and distributes data on agricultural products and food in accordance with the standards of the methodology for international trade in goods statistics.

The main sources of information are UNSD, Eurostat and other national authorities, if necessary [4, 5]. The source data is checked for outliers. It is also worth noting that for countries that do not provide reporting, data obtained from a trading partner is used, and information on food aid is added to account for overall cross-border trade flows.

The trade database includes quantitative and monetary indicators of exports and imports, as well as all food and agricultural products imported or exported annually by all countries of the world.

Let's look at data on export flows of \$ 1000 for all countries and product categories for 11 years: from 2007 to 2017. To get the total trade flow for agriculture, trade flows for all product categories were summarized (table 1).

In the resulting multi-level network, 11 layers are constructed, each of which represents a specific year. For primary analysis, you need to read the basic statistics for each layer and for the network as a whole, presented in the table, where: N – the number of vertices, M – the number of edges, NC – the number of connectivity components, DENS– density, CC– the clustering coefficient, APL – the average path length, DIA-the diameter of the network.

**Table 1. Main statistical indicators of the network**

<i>layer</i>	<i>n</i>	<i>m</i>	<i>nc</i>	<i>dens</i>	<i>cc</i>	<i>apl</i>	<i>dia</i>
2007	213	13 495	1	0,30	0,64	1,54	3
2008	214	13 245	1	0,29	0,64	1,53	3
2009	215	13 629	1	0,30	0,65	1,52	3
2010	213	13 689	1	0,30	0,66	1,51	3
2011	213	13 545	1	0,30	0,65	1,49	3

2012	214	13 981	1	0,31	0,66	1,51	4
2013	214	14 430	1	0,32	0,66	1,50	3
2014	228	16 794	1	0,32	0,68	1,58	3
2015	228	16 998	1	0,33	0,68	1,57	3
2016	228	17 077	1	0,33	0,68	1,57	3
2017	228	17 213	1	0,33	0,69	1,57	4
flat	231	164 096	1	3,09	0,77	1,42	3

The table is based on data FAOSTAT [3]

The number of participants increased during the period under review. So, on average over 11 years, it increased by 7%, from 213 to 228. After a significant jump in 2014, the number of countries participating in agricultural trade has stabilized at 228, with the number of unique countries in the total network at 231. This means that some countries have dropped out of agricultural trade over time. A similar trend is observed in the number of connections between them. In 2014, there was a strong growth in the number of trade flows from 14 to 16 thousand connections, that is, an increase of 16% in one year, while continuing to increase and reaching 17.2 thousand connections by 2017 (figure 1).



Compiled based on data FAOSTAT [3]

Количество связей - Number of links

Количество стран-участниц - Number of participating countries

**Figure 1. Dynamics of the number of countries involved in agricultural trade and the links between them**

Now let's pay attention to the clustering coefficient and the average path length (figure 2)



Compiled based on data FAOSTAT [3]

**Кoeffициент кластеризации** - The coefficient of clustering

**Средняя длина пути** - The average path length

**Figure 2. Dynamics of the clustering coefficient and the average path length**

As you can see, before 2010, both indicators changed with the same average growth rate, but if the clustering coefficient grew, the average path length fell. Then in 2011, both indicators fell sharply. Perhaps this was due to the economic crisis in Europe. Later, there was a turnaround and rapid growth of both metrics began, which lasted until 2014. The clustering coefficient continued to grow during this period, and the average path length began to decline. These trends indicate that the global agricultural trade network has been acquiring the characteristics of a "small world" since 2014, which increases the efficiency of agricultural product flows in the global network and confirms the idea of trade globalization.

The reliability of these conclusions is confirmed by the minimum number of components in the network, and the low value of its diameter, equal to 1 and 3, respectively. In other words, there is only one component that represents the entire network. This means that each of the vertices in the graph is reachable by some path to each of the others. At the same time, the small diameter of the network indicates a fast message in it.

Thus, it can be noted that, despite the low density coefficient, there is a steady growth, which has grown from 0.3 to 0.33 over 11 years, which indicates a gradual increase in the interconnectedness of countries in the trade network.

Improving the promotion mechanisms described above can solve the problem of selling agricultural products, systematize the trade process, improve the quality of agricultural products, and determine the same conditions for all agricultural producers. [2]

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## THE FINANCIALIZATION OF HOUSING

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**Abstract.** Nowadays the problem of finding and keeping an adequate place to live in has become a pressing issue for the majority of households across the globe. People are struggling to keep up with the rising living standards and the prices on such essential housing and communal services, as water, electricity, etc. Many families have to sell their properties and move to cheaper regions, having lack of finances to keep their current homes. In addition, more and more housing facilities are being demolished, and their inhabitants are getting evicted, being provided no alternative as to where to go or how to find a new place to settle.

**Keywords:** financialization, social inequality, exclusion

Financing of housing construction is carried out from various types of sources, it can be funds of construction organizations - their own or attracted, mainly due to a significant share of bank loans, budget financing, and public funds. It should be noted that different countries in different periods have their own peculiarities of financing and the predominance of certain sources.

In Western countries, they boil down to three main areas:

1. construction is financed from the own funds of construction companies;
2. financing goes through the channels of commercial lending to construction companies;
3. Mortgage lending is widely used for private developers and buyers of finished housing.

The total volume of financial resources is increasing due to the wide circulation of mortgage-backed securities. Currently, the sources of financing for housing construction in the Russian Federation have their own

characteristics. The financing mechanism itself has undergone significant changes.

In the Soviet period, the housing finance system was consistent with the housing policy and consisted in the centralized distribution of budgetary resources for the construction of public housing and its free distribution to citizens waiting in line to improve their housing conditions. In 1987, the share of state capital investments in housing construction exceeded 80%, and the funds of the population accounted for only 14.6% (including funds of individual developers and members of housing construction cooperatives). A legal rights activist, Leilani Farha, addressed the issue under consideration in her statement on the right to adequate housing during the Interactive Dialogue at the Human Rights Council in 2017. In the following essay, I am going to give a brief coverage to the major points she made with regard to the financialization of housing from a political, social and economic perspectives [1].

The main source of financing for housing construction in Russia is the funds of citizens who are either independently engaged in the construction of individual residential buildings, or participate in financing the construction of apartment buildings, as a rule, through direct investment through various forms of contracts with developers. Unfortunately, there is no available information on the sources of funding for housing construction in Russia, but, according to our estimates, using their own and borrowed funds, the population built 65% of the total housing area, or 54% of residential units (see Fig. 1).

Developers of apartment buildings attract funds from citizens in various forms, shifting the main risks onto them. The federal law<sup>12</sup>, adopted in 2004, provided relative protection for citizens, but, unfortunately, is not yet fully operational. According to calculations, in 2011 38% of residential premises built by professional developers were financed in accordance with the specified law under contracts for participation in shared construction (Fig. 1). Unfortunately, it is impossible to accurately assess the amount of funds raised by developers from citizens according to other schemes, but, according to expert estimates, it makes up a significant share in financing the construction of apartment buildings [4].

**Table 1 - Structure of housing commissioning by funding sources**

<b>Index</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>
Financing from own funds	26	26	30	26
Share building	22	25	37	28
Other ways of financing	52	49	33	46

In the foreign literature, the housing construction market is characterized as rather competitive, open for the entry of new participants. For example, in Australia, 40,000 residential development firms are employed (Housing Industry Association, 2002). About 60% of US home development firms that build individual family homes add fewer than 250 housing units annually.

In foreign studies, as a rule, the low elasticity of housing supply in the housing construction market is justified by strict requirements of urban planning regulation, including zoning, which restrain construction by limiting the types of land use in various territorial zones. According to some estimates, the requirements of urban planning regulation determine up to 75% of price increases in the US housing market<sup>4</sup>. To begin with, every person has a right to adequate housing which shall not be, but, sadly, is often violated [3].

Having paid a social visit to India and Portugal, she encountered depressing living conditions in slums and otherwise improper living environments. With this in mind, Farha formulated a memorandum containing three major ways in which human rights are assaulted by the authorities' policies aimed at further financialization of housing. First [2], it is stated that real estate financialization undermines democracy, as such, leaving citizens with no alternative as to how to support even moderate standards of living. Real estate has turned from a means of organizing one's household into a commodity, and the government's aim is to obtain as many revenues as possible by selling it at a higher price.

Consequently, fewer people are able to purchase a new flat or a house in such metropolitan cities, as Mumbai, Porto or Lisbon, having to settle down in the outskirts, while the most prosperous districts are being occupied either by the rich who invest in property, or by foreign citizens who, in this way, seek for legal ways of obtaining a citizenship or starting a local business [7]. Market economy and free trade are the cornerstones of democracy. Introducing strict government regulations and imposing higher taxes on private property, we are violating the basics of a democratic society turning the country into a socialistic state. What is more, allocating housing facilities may result in corruption, as someone in the higher circles will decide who is going to get a free flat or buy a house at a cheaper price, and might be easier to get inclined in favour of this or that social group. Thus, I strongly believe in the rules of market economy and social Darwinism, according to which only the fittest and the strongest will survive.

Further on, Farha argues that financialization of housing kindles social inequality and exclusion. In this way, some particular social groups, as the

poor, migrants, homeless, or people with disabilities stand no chances of survival and, thus, must be provided government support. In my view, this might result in only more negative consequences, as these social groups have to face now. Inequality has always been a part of any society, with the top of it formed by the elite, followed by a strong middle class and miscellaneous lower social strata. A healthy competition is a driver of any market society, and a means of motivating people to grow, to develop, to achieve higher results. Having lack of motivation to do anything and being rendered various social help, starting from housing and finishing with pensions and other social benefits, people become lazy and are no longer ready to work for the common good, if work at all. In its turn, the abundance of free time and conscious unemployment might cause various conflicts and raise crime rate in separate districts. Being a strong believer of the theory of social Darwinism, I suppose that excessive government support brings only further social parasitism and makes people weaker than they are. Rich will be rich if only they know what to do with their wealth, and poor might get rich if they work hard and find ways to think out of the box and make capital changes in their lives. Everyone has equal chances of achieving one's global goals, and if the benchmark data are a bit different, it means that one has to work a bit harder on the way to one's dream house and dream life.

Finally, the idea of financialization performing as a tool that undermines such human values, as dignity and security. Having to cope with critical living conditions, people are no longer ready to fight poverty and decay. However, if we put a sign of equality between high moral standards and affluence, what does it say about our morality? The most prominent scientists, musicians, artists, computer geniuses and other creative people have lived in poverty in this or that period of their lives. Still, this has never stopped them from creating, trying new ways of achieving their goals and getting an end product. If a person feels insecure, disrespected or otherwise morally offended, this problem is in their head, not in their wallet. The truth is always very simple and quite obvious: if you don't have money, go and get them (but do it legally). Create a new product. Sell a new idea. Or just get any job, for starters.

So, making a conclusion, I would like to say that financialization of housing is a global market trend which cannot be stopped by creating artificial limits or imposing government regulations. It's the law of nature, and it always knows what is right in terms of survival.

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**INTERNATIONAL AND RUSSIAN NATIONAL LEGISLATION ON  
THE CONSTITUTIONAL RIGHTS OF CHILDREN LIVING IN REMOTE  
AREAS AND THE ROLE OF THE PROSECUTOR**

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**Abstract.** The article provides an analysis of the international and Russian legislation governing the rights of children living in territories remote from the center of Russia, including in the northern territories and in rural areas. The article identifies the problems of legal regulation in the field of protecting the rights of children living in these territories. Emphasis is placed on the important role of the prosecutor, who protects the rights of children in this category.

**Keywords:** children's rights, international legislation, national legislation, distant from the center of the territory, rural areas, northern territories, problems in legislation, protection of children's rights by the prosecutor.

According to the Universal Declaration of Human Rights,<sup>1</sup> children have the right to special care and assistance. The Constitution of the Russian Federation guarantees state support for families, mothers and children. By signing the Convention on the Rights of the Child<sup>2</sup> (hereinafter referred to as the Convention on the Rights of the Child) and other international acts in the field of ensuring the rights of children, the Russian Federation expressed its commitment to participate in the efforts of the world community to create an environment that is comfortable and friendly for children.

The Convention on the Rights of the Child has enshrined the basic principles of protecting the rights of the child, including: prohibition of discrimination; priority of the child's interests; the right to life, survival and development; family priority; the right to freely express one's own views in accordance with the age and maturity of the child, etc.

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<sup>1</sup>The Universal Declaration of Human Rights was adopted by the UN General Assembly on 10.12.1948.

<sup>2</sup>The Convention was signed on behalf of the USSR on 26.01.1990, ratified by the Supreme Soviet of the USSR on 13.06.1990, entered into force for the USSR on 15.09.1990.

The 1990 UN World Declaration on the Survival, Protection and Development of Children considers the well-being of children as a priority for all states.

The Plan of Action for the Implementation of the World Declaration on the Survival, Protection and Development of Children of 30.09.1990 gives the family the primary responsibility for ensuring the nutrition and protection of children from infancy to adolescence. For the comprehensive and harmonious development of the personality, children should grow up in a family environment, in an atmosphere of happiness, love and understanding. Accordingly, all institutions in society should respect and support the efforts of parents and guardians to provide food and care for children in a family setting. Every effort should be made to prevent children from separating from their families. Any separation of children from the family, whether it is due to extraordinary circumstances or made in their own interests, requires the adoption of measures to ensure family care, so that the child continues to develop in his cultural environment. It is necessary to support large families, to help meet the needs of orphans and abandoned children.

The UN Declaration and Plan of Action "A World Fit for Children" dated 10.05.2002 states that meeting the needs and ensuring the rights of children should be a priority. The policy should be aimed at eliminating the causes of the disadvantaged situation or alienation of children, at protecting the rights of children, it is necessary to apply a targeted approach that gives quick effect. Multisectoral programs aimed at protecting the rights of young children and helping families deserve special support.

The UN Declaration and Plan of Action (2002) states that parents, families, guardians and other people who take care of children have primary responsibility for the well-being of children, and the state is obliged to support them in fulfilling their parenting responsibilities. These individuals, as well as society as a whole, should be responsible for the upbringing of children.

The legislature must enact appropriate laws, allocate the necessary financial resources and monitor the efficiency of their use. Civil society organizations should express the civil position of society on issues related to children. The media can play a key role in raising public awareness of the situation of children, and more actively informing children, parents, families and the general public about initiatives to protect children's rights.

The principles of the general well-being of the family and the child are also reflected in the UN Declaration on Social and Legal Principles Relating to the Protection and Welfare of Children, Especially in Foster Care and Adoption at the National and International Level of 03.12.1986, UN Guidelines for the Prevention of Crime among minors (ER-Riyadh Guide-

lines) dated 12.14.1990, in which education is considered as a system of work with parents, public organizations and institutions dealing with youth issues. Schools should play the role of database and reference centers for the provision of medical, counseling and other assistance to young people, especially those at risk.

The above principles of international law are implemented in the legislation of the Russian Federation and the constituent entities of the Russian Federation.

Observance of children's rights is guaranteed by the Constitution of the Russian Federation, constitutions and charters of the constituent entities of the Russian Federation, federal legislation and regional legislation.

The legal basis in the sphere of realizing the rights of children living in areas remote from the center and in rural areas is formed by the basic laws applicable to the implementation of the rights of all children living in the Russian Federation, including federal laws: from 24.07.1998 № 124-FZ "On the basic guarantees of the rights of the child in the Russian Federation", dated 29.12.2012 № 273-FZ "On education in the Russian Federation", dated 21.11.2011 № 323-FZ "On the basics of protecting the health of citizens in the Russian Federation", 29.12.2010 № 436-FZ "On the protection of children from information harmful to their health and development", 29.12.2006, 2006 № 256-FZ "On additional measures of state support for families with children", 21.12.1996, 1996 № 159-FZ "On additional guarantees for social support of orphans and children left without parental care ", dated 24.06.1999 № 120-FZ" On the basics of the system for the prevention of neglect and delinquency minors ", etc.

The constituent entities of the Russian Federation are implementing a state policy in the interests of children, solving issues of social support and social services for orphans and children left without parental care, neglected children, disabled children, organizing and providing recreation and health improvement for children, which, of course, affects the interests of children living in the indicated territories.

In order to comply with the guarantees of the rights of minors in the Russian Federation, the following are in force: The concept of the demographic policy of the Russian Federation for the period up to 2025, approved by the Decree of the President of the Russian Federation dated 09.10.2007 № 1351; The concept of sustainable development of the indigenous small-numbered peoples of the North, Siberia and the Far East of the Russian Federation, approved by the Decree of the Government of the Russian Federation dated 04.02.2009 № 132-r; The strategy of the state anti-drug policy of the Russian Federation until 2020, approved by the Decree of the

President of the Russian Federation dated 09.06.2010 № 690; The concept of the federal target program "Sustainable development of rural areas for 2014-2017 and for the period up to 2020", approved by the order of the Government of the Russian Federation dated 08.11.2012 № 2071-r; The concept of state family policy in the Russian Federation for the period up to 2025, approved by the order of the Government of the Russian Federation dated 25.08.2014 № 1618-r; The concept for the development of additional education for children, approved by the order of the Government of the Russian Federation dated 04.09.2014 № 1726-r; The concept of information security for children, approved by the order of the Government of the Russian Federation dated 02.12.2015 № 2471-r.

By the Decree of the President of the Russian Federation dated 29.05.2017 № 240, the Decade of Childhood was announced in Russia, and by the Order of the Government of the Russian Federation № 1375-r dated 06.07.2018, the Plan of the main activities until 2020 held within the framework of the Decade of Childhood was approved.

Particular attention should be paid to the National Action Strategy for Children for 2012-2017, approved by Decree of the President of the Russian Federation № 761 dated 01.06.2012, which provides for a set of measures to improve the situation of children in the Russian Federation.

In the constituent entities of the Russian Federation, there are similar strategies in the field of protecting children's rights. For example, in Amur Oblast, there is a Regional Strategy for Action in the Interests of Children in Amur Oblast for 2012-2017, which was approved by the decree of the Government of Amur Oblast dated 08.10.2012 № 564<sup>3</sup>.

At the regional level, programs are being implemented aimed at protecting the rights of children - residents of areas remote from the center and rural areas.

For example, in Sakhalin Oblast there is a state program "Improvement of the public administration system (2014-2020)", approved by the Oblast government decree of 04.14.2014 № 161, in pursuance of which the Oblast government decree № 128 of 03.15.2012 approved the regulation on the procedure and conditions payments of funds for the purchase

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<sup>3</sup>Krai strategy of action in the interests of children for 2012-2017, approved by the order of the Governor of Khabarovsk Krai dated 10.10.2012 № 515-r; The strategy of action in the interests of children for 2013-2017, approved by the decree of the Government of the Jewish Autonomous Oblast dated 05.02.2013 № 31-pp; The strategy of actions in the interests of children in the Krasnoyarsk Krai until 2017, approved by the order of the Governor of the Krasnoyarsk Krai dated 20.02.2013 № 44-rg; Strategy of Action in the Interests of Children of the Republic of Sakha (Yakutia) for 2012-2017, approved by the Decree of the President of the Republic of Sakha (Yakutia) dated 14.12.2012 № 1769 and etc.

of school clothes, footwear and school supplies for schoolchildren from among the indigenous peoples of the North who are in a socially dangerous situation, and schoolchildren from among the indigenous peoples of the North from poor families."

In Khabarovsk Krai there is a state program "Development of social protection for the population of Khabarovsk Krai" approved by the decree of the Government of Khabarovsk Krai dated 16.05.2012 № 152-pr, which provides for the provision of measures of social support and state social assistance to families and children, large families with school-age children living in rural areas, student and low-income family with children.

In the Republic of Sakha (Yakutia) there is a state program "Prevention of offenses, ensuring public order and combating crime for 2012-2019", approved by the Decree of the President of the Republic of Sakha (Yakutia) dated 12.10.2011 № 972, which provides for the organization and conduct of refresher courses on prevention of offenses, alcohol and tobacco use for employees of educational institutions, construction teams and volunteer movement.

In Vologda Oblast there is a state program "Support and development of small and medium-sized businesses in Vologda Oblast for 2013-2020", approved by the Government of Vologda Oblast dated 03.10.2012 № 1156, which provides for the receipt of preferential support by small and medium-sized businesses in the implementation of such priority activities, as the provision of services in the field of education, including conducting classes with children and additional education for children, organizing leisure activities for children and youth, health services, social services for the population.

The programs adopted in the constituent entities of the Russian Federation are aimed at social protection of the most vulnerable categories of minors: orphans and children left without parental care; disabled children and children with disabilities; children from large and low-income families.

For example, in the Republic of Bashkortostan there is a state program "Development of the building complex and architecture of the Republic of Bashkortostan", approved by the Government of the Republic of Bashkortostan dated 31.12.2014 № 686, which provides for measures to improve the living conditions of disabled children and orphans.

A similar program operates in Penza Oblast - the program "Social support of citizens in Penza Oblast for 2014-2020" and in other constituent entities of the Russian Federation.

Local governments also adopt social programs to protect children's rights; these programs are further extended.

Thus, the Administration of the city of Sarapul of the Udmurt Republic, by decree № 2809 of 03.10.2014, approved the municipal program of the city of Sarapul "Development of education and upbringing" for 2015-2020, which provides for the provision of social support measures to exempt from parental fees for looking after and caring for disabled children, orphans, children left without parental care, children with tuberculosis intoxication.

The head of the administration of the municipal district "Borovsky District" of Kaluga Oblast, by decree dated 28.11.2016 № 1081, approved the municipal program "Development of the system of social services for the population of the Borovsky District" for 2017-2020, which provides for measures to provide social support for large families, families with disabled children, children - orphans, prevention of family and child trouble.

Similar programs operate in other regions of the Russian Federation.

At the same time, the results of a survey of current prosecutors indicate the following. In the opinion of 32.5% of the interviewed prosecutors (out of 1134 people) in the constituent entities of the Russian Federation, there are no normative legal acts aimed at protecting the social rights of children living in the northern and peripheral territories. Accordingly, 28.1% of the prosecutors spoke about the absence of relevant programs in the constituent entities of the Russian Federation.

60.2% of the 1,134 interviewed prosecutors supported the need to improve legislation to protect the social rights of children living in the peripheral and northern territories.

Consequently, improving the work of prosecutors in the field of lawmaking on the adoption by the legislative authorities of the constituent entities of the Russian Federation of legal initiatives of the prosecutor's office in order to protect the rights of children is extremely important and relevant.

Researchers of the health problems of children living in the North distinguish two categories of minors: children of the indigenous and children of the newcomer population, which differ in physiological characteristics, biological and mental development, which must be taken into account in the process of their education, nutrition, health care<sup>4</sup>.

The remoteness of rural areas from the central regions, poor transport accessibility, the impossibility of obtaining those social benefits that are used in cities and regional centers, makes children more vulnerable in relation to other groups of the population, and therefore children living in areas remote from the center and in rural areas, need special care, legal protection.

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<sup>4</sup>Prakhin E.I. Biomedical aspects of children's health in the North // Siberian medical review. 2002. № 1 (21). P. 3-7.

However, there is not a single federal law that would be compensatory in nature, would provide benefits both for children living in rural areas and for children living in areas remote from the center.

In this regard, children living in rural areas, especially in “dying out villages”, in areas remote from the center, cannot receive full-fledged education, which is often replaced by distance education; timely qualified medical care; varied nutrition according to age characteristics; they are deprived of the opportunity to receive additional musical, sports, art and other education.

According to prosecutors, most often children living in remote areas and rural areas are not provided with qualified medical care (59.4% of 1134 interviewed prosecutors), education is not provided (36.2%, respectively), and employment is not provided (33,1%).

In our opinion, it is necessary to revive the federal target program "Children of the North" (operated until 2002)<sup>5</sup>. The goal of this program was to create conditions for the normal physical, mental and cultural development of children in the regions of the North who are in especially difficult living conditions, to improve the prevention of diseases, sanitary and hygienic living and nutritional conditions, to provide educational and upbringing conditions that take into account the national traditions of local residents, and etc.

As indicated by a number of researchers,<sup>6</sup> when the Children of the North program was in operation, the implementation of its activities made it possible to ensure the health of children in the northern regions by expanding the possibilities of receiving prompt medical care, regardless of the distance and transport accessibility of the place of residence by creating the Children of the North telemedicine consulting network, and also thanks to the prevention of their diseases by providing children's institutions with sports and health-improving complexes, dental units, improving the quality of the drinking water used, etc.

At the same time, it is necessary to consider the feasibility of adopting a federal target program focused on observing the social rights of rural children.

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<sup>5</sup>Federal target program "Children of the North" (2001-2002), approved by the decree of the Government of the Russian Federation of 08.25.2000 № 625.

<sup>6</sup>Smirnov I.E., Kuznetsova M.N., Marchenko T.K., Temnaya V.I., Ways of recovery of children in the conditions of the North / Scientific Center for Children's Health of the RAMS / <http://www.ncrd.ru> (appeal date: 20.06.2016).

## LEGAL CONSEQUENCES OF THE PANDEMIC IN THE RUSSIAN FEDERATION

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**Resume.** In the study, what is happening at the moment, in reality, is considered under the prism of how the coronavirus infection and the consequences that it entailed affect law enforcement and, in general, legislation, in relation to various spheres of human life. During the analysis of the current legislation, both its strengths and weaknesses were identified, hindering the exit from the adverse consequences of the pandemic.

**Key words:** pandemic, tax support, force majeure, lease agreement, civil law.

The spread of the coronavirus infection COVID-19 has really affected virtually every area of human activity, both in Russia and around the world. Of course, such an influence could not but have its significance in the field of taxation. In recent months, government bodies have put forward and adopted fairly large-scale amendments to the tax legislation of the Russian Federation.

For example, it was proposed that for organizations and individual entrepreneurs, which at the time of March 1, 2020, were in the Unified Register, created specifically for small and medium-sized businesses (hereinafter referred to as SMEs), and operating in the industries affected by the coronavirus, it will be applied [6]:

- a six-month extension of the deadlines for the payment of corporate income tax, tax paid in connection with the application of the simplified tax system, unified agricultural tax, for 2019;

- a six-month extension of the deadlines for paying taxes (advance tax payments), excluding VAT, for reporting periods falling in the first quarter of 2020 (by 4 months - for reporting periods falling in half a year (second quarter) of 2020);

- setting the deadlines for the payment of advance payments for transport tax, corporate property tax and land tax for the I quarter of 2020 - no later than 30.10.20, for the II quarter of 2020 - no later than 30.12.20

Obviously, the list of support measures will be expanded. The next logical measure is the extension of the deadlines for paying insurance premiums. This is likely to affect both payments to individuals and legal entities that pay insurance premiums and work in sectors of the economy affected by the epidemic.

The epidemic of the coronavirus COVID-19 has not passed by the sphere of contracts, in the first place, real estate lease contracts. The law specifies an unconditional obligation for an entity leasing real estate, within 30 days from the date of the request of the person who leases this property, to conclude an additional agreement with him on deferring the payment of rent for the use of property for the year 2020. The same rule, by the decision of the Government of the Russian Federation [4], also applies to federal property leased. In other words, the rent, which was due to be paid in 2020, will have to be paid in 2021 in equal installments. The terms of payment will be stipulated by the specific clauses of the lease agreement. Items are offered by tenants and agreed by both parties.

It would seem that the next step to support the economy was to reduce the amount of rent. Nevertheless, the legislator chose a different path and did not specifically formulate a peremptory norm. Instead, the government offered to give tenants the opportunity to ask for rent cuts for a specific year, that is, for 2020. The wording “due to the impossibility of using the property” is used. The reason why it is impossible to use it is the decision of the state authorities of a particular constituent entity of the Russian Federation (the leadership of each region of Russia introduced its own measures to combat the spread of coronavirus infection). This decision is intended to support, first of all, tenants as the most vulnerable party from a legal and economic point of view.

At the moment, all market participants are concerned about the question - can the COVID-19 pandemic be considered force majeure? And if so, to what extent does this force majeure circumstance release the violator from liability if he is unable to fulfill the contractual obligations?

Although the World Health Organization (hereinafter WHO) has officially declared the coronavirus pandemic, this recognition itself is not enough to legally qualify what is happening as force majeure. Force majeure is a legal doctrine, according to which a party to a contract can avoid liability for non-performance of the contract when certain circumstances occur. As we know, for force majeure, the obligatory presence of three main parameters

is required (Article 401 of the Civil Code of the Russian Federation):

1. The extraordinary nature of the event, that is, what is happening clearly goes beyond the normal course of events, it cannot be foreseen, and, therefore, taken into account.

2. Inevitability of the event, that is, the party to the contract cannot avoid contact either with the emerging circumstance, or with the consequences of this circumstance. For example, the introduction of a trade embargo.

3. The irresistibility of the event. In this case, the concept is expanded, that is, theoretically, the obstacle can be overcome, but this requires so much effort that it is unreasonable for the debtor, and the increase in costs is incommensurable. For example, the delivery of goods to the desired point can be organized not directly, but around, through the territory of several countries, but since this is impossible from the point of view of costs, this obstacle is recognized as insurmountable.

So, in both cases we are talking about the fact that the impossibility must be permanent and final, and not temporary. It is the permanent ultimate impossibility that is the main criterion by which force majeure can be distinguished from the impossibility of execution. The only exception is if the impossibility, although it is temporary, is reliably known that the circumstances that caused the impossibility will not disappear before the expiration of the obligation.

Investigating the circumstances of the pandemic, its development and based on the above signs, we can conclude that the COVID-19 pandemic is force majeure. However, there is no final, binding decision on this topic. Therefore, in the event of disputable situations, it is obvious that the injured party will seek the exercise of its rights through the court, and the decision in each specific case will be made by him.

Despite the fact that the recognition of the coronavirus by force majeure looks natural, the Supreme Court of the Russian Federation has its own point of view on this issue. He published it in the corresponding review (No. 1 dated 04.21.2020). The published document says that the spread of the disease as such is not force majeure, and, therefore, cannot be considered a circumstance that exempts from liability [5].

The RF Armed Forces explains that force majeure in this case is the measures taken in order to prevent the spread of infection. That is, the decisions that are made by the state authorities. They, in turn, vary from region to region.

The coronavirus became the challenge that made it possible to check how effectively the main legal mechanisms are working in Russia. Despite the obvious need for measures to protect the population from COVID-19, it can be concluded that, from the point of view of the current legislation, not

enough measures were taken, and the legislation itself requires modernization in this area.

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## FEATURES OF CONDUCTING CLASSES ON THE SUBJECT OF "TECHNOLOGY" IN CORRECTIONAL GENERAL EDUCATION SCHOOLS

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**Abstract.** The article deals with the problems associated with the specifics of teaching the subject of "Technology" in modern correctional schools. The analysis of the role of labor training in the education and upbringing of children with disabilities is carried out. The organization of technology classes in correctional general education schools in Russia in modern conditions is presented with specific examples.

**Keywords:** technology, labor training, pedagogy, correctional school, special school, SHN

One of the signs of modern society is the rapid change in the pace of life, the development of the latest technologies, the expansion of the information base, and, above all, the complication of labor and social interaction of people. In such conditions, the main, and perhaps the most important task of teachers of modern special (correctional) schools is the maximum help and assistance in the socialization of children with intellectual disabilities. This is necessary for their subsequent independent life, as well as the disclosure and development of personal qualities and potential abilities. Correctional pedagogy, therefore, is aimed at developing a mechanism for compensating for their defect in each student with special health needs (SHN), which can serve as the basis for the successful integration of a student into modern society [1].

Correctional pedagogy is currently receiving a lot of attention, thanks to which there is an opportunity for a constant search for new means, forms, and methods of teaching and upbringing children with SHN. Therefore, each teacher tries to find more effective ways to improve the educational process, and also seeks to increase the motivation for learning among their students. However, the main method in correctional work is still the use of traditional teaching technologies, which are based on close emotional interaction between students and teachers. Thanks to traditional technologies, it is possible to enrich the imagination of students, stimulate the development of their speech.

A special place in the correctional-pedagogical system is occupied by labor training and education, otherwise - technology lessons. This is due to the fact that, like a general education, a special school has the goal, first of all, to ensure the psychological readiness of students for work [2]. However, despite the similarity of the tasks facing the mass and correctional educational institutions, the special school has some specific tasks. First of all, this is the need to correct the shortcomings of the general mental development of the student, as well as to ensure the high-quality assimilation of the knowledge, skills and abilities by students that they acquire in the process of work.

The purpose of this work is to identify the features of labor education in special (correctional) schools.

In most cases, a special education student is not easy to learn. He is more likely to encounter setbacks, convinced that he is not always able to correctly complete the task given to him. Thus, a negative attitude towards learning is formed - the student perceives it as an activity that is inaccessible for him. However, much better results can be achieved by combining learning with labor [3]. Labor is an activity, the results of which can be directly felt, since there is a final product such as simple crafts, products, toys. They stimulate interest in the student, encouraging purposeful activity, and show that learning can be quite accessible to him.

Also, labor training ensures the formation of the correct attitude among schoolchildren to the material taught by the teacher and the skills that are developed as a result of classes. So, performing the processes of measuring or weighing in technology lessons, determining the shape, size and other characteristics of the material with which the student works, he makes sure that the knowledge that the teacher tells him is of great practical significance.

Labor is rightfully considered one of the most important means of correction, allowing to preserve the clarity of teaching - schoolchildren make, copy, model and design. Thus, learning to work with tools and materials,

studying their properties and creating material values in the form of crafts, students develop strong work attitudes [4].

There are different types of work activities that can apply when working with children with SHN. Special attention in technology classes in correctional schools is paid to manual and socially useful labor.

Manual labor is responsible for the development of design skills and abilities, helps to develop the creative and technical abilities of the child, and also has a positive impact on the mental development of schoolchildren [5]. In a correctional school, manual labor is perhaps the most important work activity. Basically, it means teaching children how to work with various materials - fabric, wood, etc.

One of the tasks of manual labor is to educate students in the habit of thinking about the task before he starts to complete it [6]. To develop this habit, application work is widely used, because when performing them, the child first of all needs to correctly determine the places of gluing of individual parts, as well as observe a clear sequence of their application.

Appliqué work develops spatial representation, which is important because correctional school students often find it difficult to correctly combine details with each other, or may have problems using direction words on their own, such as top, around, right, left, etc.

So, classes using applications help to develop organization, the ability to act according to a plan, and also, when using geometric shapes in applications, the technology lesson is connected with a mathematics lesson.

Pupils of correctional schools, to a greater extent than students of mass schools, need training in the ability to apply in practice the knowledge that they receive in the course of their studies. This, as well as an increase in interest and activity in the learning process, is facilitated by classes in technology lessons in socially useful labor [7]. It is very important for students of a special school to understand the benefits of what they are doing, otherwise the knowledge they acquired in school will be useless for them in later life.

It is obvious that the formation of motor skills is not enough to prepare students of special schools for labor activity - it is also necessary to develop their general labor skills, such as orientation in a task, planning, and self-control.

In Russia, correctional schools are provided with programs of work in urban conditions - carpentry, locksmith, cardboard bindery, sewing, shoe, service, as well as special programs for schools in rural areas - primarily, agricultural labor, carpentry and plastering and painting. Floriculture and ornamental gardening programs have also been developed, which can be

applied in both urban and rural schools. Usually, in special schools, they teach those types of work that are popular in the region, and for which students can subsequently be employed - this is sewing and knitting, carpentry, culinary, etc.

In particular, the experience of correctional school № 34 in Yakutsk shows that plasticinography is widely used in technology lessons, that is, modeling, for the development of fine motor skills and hand strength in students, patchwork, cross-stitching, and origami. Students take part in the improvement of the school grounds, and also create crafts from natural and waste materials in the classroom. It should be noted that the school also pays great attention to the formation of the hard work of children with SHN in technology lessons and their moral and aesthetic education. Teachers note that such a system of aesthetic education widely stimulates the personal development of a “special” child, helps in choosing a future profession and contributes to subsequent socialization in society.

In Seversk, Tomsk Oblast, there is a successfully functioning boarding school №195 for students with disabilities of type VIII. The school administration notes that technology lessons are favorite activities for schoolchildren, which they expect and attend with pleasure. Here, on technology lessons, children get the opportunity to develop in various directions - floriculture, carpentry or sewing. Such a labor education allows graduates to find a job immediately after leaving school, because these are quite relevant areas: in the cities of the Tomsk region, there is active gardening, there is a greenhouse, there are many workshops for the manufacture of wood products and household items, and private ateliers. Due to the fact that the school pays special attention to teaching the discipline "Technology", students subsequently get the opportunity to have a good and stable income, and successfully socialize. Despite the fact that often for “special” children, access to education after school is closed, thanks to high-quality labor education, graduates of school №195 successfully enter the Tomsk technical school of social technologies. There they can master such professions as a greenhouse worker, a seamstress, a tailor, an embroiderer, a shoe repairman. Also, many students continue their education at the Seversk Industrial College, where they receive the specialty of a carpenter-woodworker. For children who cannot master floriculture, carpentry or sewing, technology lessons provide an alternative in the form of artistic creativity.

So, the main task of vocational training of students of a special (correctional) school is to study the individual labor opportunities of schoolchildren, as well as to form their readiness for vocational training [8], [9]. Technology lessons should be held in the conditions of cooperation be-

tween teacher and student, taking into account the interests and needs of students. It is necessary to demonstrate to the child the benefits of the products made by him, to cause a sense of pride and satisfaction in connection with the work done.

In the course of manual labor lessons, students get the opportunity to make simple products, mastering general labor skills in the process, learning about the properties of materials and methods of processing them [10]. In these classes, you can observe how they successfully cope with their intellectual or physical disabilities.

The motives followed by the students are also of great importance in the success of labor education. Therefore, pedagogical activity in technology lessons should also be aimed at developing the personality of students, the formation of a correct attitude to work [11]. Thus, it is important not only to learn labor operations, but also intellectual actions, such as self-control and patience, for example.

So, when choosing methods, techniques and means of teaching, it is necessary to be guided by the age and individual characteristics of students of a special school in such a way as to contribute to the correction of existing psychophysical defects and to form positive motives for educational and labor activities. Of course, it is important to instill in schoolchildren the desire to engage in various types of work. By competently using various types of work in special schools, it is possible to develop and follow an effective approach to their education and training.

The systematic organization of the student's work activity is capable of fostering a correct attitude to work [12], [13]. In the course of working in technology lessons, students get the opportunity to learn in practice what a sense of responsibility for the work they do, to cultivate frugality and the ability to work in a team. The result is the formation of those qualities that express the proper attitude of the student to work. Thanks to the wide practical base of special schools, it is possible to solve most of the issues of preparing "special" students for life in modern society and work, that is, to help them adapt in social and labor terms.

Thus, when working with children in correctional schools in technology lessons, various types of work activities can be used, which will provide a full and high-quality education within the framework of the "Technology" discipline for each student.

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## ON THE GEOMETRIC FOUNDATIONS OF MEASURE THEORY IN MATHEMATICS EDUCATION

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**Abstract.** The content of school and university courses in mathematics in most cases is associated with finding areas and volumes of geometric shapes that are in demand from the point of view of applications in practice. Therefore, applying a methodological technique consistent with a flat scan of cylindrical and conical surfaces, the idea of fundamentalizing mathematical education is actualized on the basis of the methodological principles of integrated teaching of mathematics and the selection of course content by identifying structural units and logical schemes.

**Keywords:** integrated thinking, logical diagram, structural unit, homogeneous, heterogeneous, unfolding, cylinder, cone, sphere.

The post-nonclassical paradigm inherent in the modern development of science and society imposes integrated requirements on mathematics education. These requirements are formalized, first of all, as methodologies of subject methods, within the framework of which new concepts and approaches to teaching mathematics at various levels of education are developed [1-5]. The methodological training of teachers and specialists in universities becomes the basis for the fundamentalization of theoretical knowledge, focused on the application of the acquired knowledge in practice. Analysis of the structure of thinking, adequate to the corresponding pedagogical activity, plays an important role in the perception of a methodological object and the formation of universal competencies defined in the FSES of HE. In such an education strategy, methodological thinking should become the key competence of a university graduate in the direction of "Pedagogical education" (G.I. Sarantsev).

The purpose of this article is to actualize methodological thinking in the direction of its generalization in the form of complex (or integrated) thinking, considered as a synthesis of mathematical, dialectical and life-activity (methodological) thinking, and the corresponding integrated ap-

proach to teaching mathematics, which allows to identify logical schemes connecting the fundamental concepts of structures different subject areas.

We consider the main methodological principles of integrated teaching of mathematics in higher education to be the principles of the unity of opposites, analogy, correspondence, symmetry, duality, invariance and mathematical modeling, and the main methodological technique for selecting the content of mathematical education is the way to identify structural units through logical, algorithmic and combinatorial schemes [4, 5].

In the context of comprehensive teaching of mathematics at various levels of education, let us analyze the process of forming practice-oriented geometric concepts in measure theory according to the scheme: perception of an object - its idealization (identification of essential features) - formalization - application.

In the general case, the length  $l$  of the segment  $a$ , the area  $S$  of the plane figure  $F$ , and the volume  $V$  of the spatial figure  $G$  will be called the measure of the set (figure). In geometry, in particular, they are called measurements of lengths, areas and volumes. The measure is required to fulfill two basic conditions: 1) non-negativity; 2) additivity. Measurements of lengths, areas and volumes of figures have similar properties: the existence of a single element, the equality of the values of quantities of equal (congruent) figures and additivity. So, the measurement of lengths, areas and volumes is a non-negative measure that satisfies the above properties and is defined on the set of all geometric shapes. We select as basic linear geometric figures: a segment on a straight line, a rectangle on a plane and a straight rectangular parallelepiped in space. We will consider the circle and its boundary (circumference), as well as the ball and its boundary (sphere) as basic nonlinear geometric figures.

A plane set (figure) is called elementary if it can be represented in at least one way as the union of a finite number of pairwise disjoint rectangles. Elementary sets on a line and in space are defined similarly.

Two polygons (polytopes) are called homogeneous (uniform) if the number of vertices (edges) of one polygon (polyhedron) is equal to the number of vertices (edges) of another polygon (polyhedron). For example, a rectangle, parallelogram, rhombus, and any quadrilateral are homogeneous to each other. Otherwise, we will call them heterogeneous (dissimilar). (Principles of the unity of opposites and invariance). Two polygons (polyhedrons) will be called equal if their areas (volumes) are equal. It should be noted that homogeneity (or heterogeneity) is a topological feature of a geometric figure, and equal-size is its algebraic feature.

We will consider as unit elements: a unit segment, a square with a side equal to the unit of length and a cube with an edge equal to a unit segment. We will consider the structural units of basic geometric figures: the formula for the area of a rectangle  $S = ab$  with sides  $a$  and  $b$ , the formula  $l = 2\pi R$  of the circumference of a circle of radius  $R$  and the volume of a straight rectangular parallelepiped  $V = abc$  with sides  $a$ ,  $b$ ,  $c$ . The above requirements for geometric figures are postulated.

Let a rectangle be given with sides  $a$ ,  $b$  and area  $S = ab$ . The closest figure homogeneous to the rectangle is the parallelogram  $ABCD$ . Let us drop perpendiculars  $DE$  and  $CF$  from vertices  $D$  and  $C$  of parallelogram  $ABCD$  to side  $AB$ . From the equality of triangles  $AED$  and  $BFC$  it follows that the area of the parallelogram  $ABCD$  is equal to the area of the rectangle  $EFCD$ , i.e.  $S_{ABCD} = S_{EFCD} = AB \cdot ED = DC \cdot ED = a \cdot h$ .

Next, we use this structural unit to find the area of a triangle. Divide the rectangle  $ABCD$  with the diagonal  $AC$  into two right triangles. From the equality of these triangles, it follows that the area of one of them is equal to half the area of the rectangle, i.e.  $S = \frac{1}{2} a \cdot b$  (area additivity property). Now, knowing the area of a right-angled triangle, we will find the area of any triangle. Let  $ABC$  be an arbitrary triangle. Let us drop the perpendicular (height) from the vertex  $C$  to the side  $AB$ . We get two right-angled triangles  $ADC$  and  $BDC$ . Then  $S_{ABC} = S_{ADC} + S_{BDC} = \frac{1}{2} AD \cdot DC + \frac{1}{2} DB \cdot DC = \frac{1}{2} (AD + DB) \cdot DC = \frac{1}{2} AB \cdot DC$ . Since  $DC = AC \cdot \sin A$ , we get another formula for the area of an arbitrary triangle  $ABC$ , namely, we have  $S = \frac{1}{2} AB \cdot AC \cdot \sin A$ . This formula will not change if angle  $A$  is obtuse, since  $\sin(\pi - A) = \sin A$ . (The principle of invariance). Similarly, we obtain formulas for the areas of the trapezoid and rhombus. (Principles of correspondence and analogy).

The main idea of the method for obtaining new formulas is to substantiate the possibility of reducing the measure of arbitrary linear geometric objects to the sum of measures of basic structural units. In this case, the basic structural unit of the measure of a flat linear geometric figure is the formula for the area of a triangle, obtained on the basis of the postulated formula for the area of a rectangle. Because a triangle is the smallest planar line figure that encloses a bounded area on the plane.

So, the area of any flat polygon  $F$  is found as follows.

A partition of a polygon  $F$  into triangles  $T_i$ ,  $i = \overline{1, n}$ , is called a triangulation (a partition into triangles), if:

1) no two triangles  $T_i$  and  $T_j$  for  $i \neq j$  have common points;

2) the union of all triangles in the partition coincides with the polygon  $F$ .

Then the sum of the areas of all triangles  $T_i$  equal to the area of the poly-

gon F (the area additivity property). The value of the area of the polygon does not depend on the method of dividing the polygon into triangles, i.e. the area is an invariant quantity for a given figure (the principle of invariance).

Thus, the additivity property of a measure and the principles of correspondence, analogy and invariance of complex teaching of mathematics allow, according to a certain logical scheme, to find the area of any flat linear geometric object, i.e. polygon.

A polygon is called convex if it lies in one half-plane with respect to any line containing its side. The angle of a convex polygon at a given vertex is the angle formed by its sides converging at this vertex. A convex polygon is called regular if all sides of it are equal and all angles are equal.

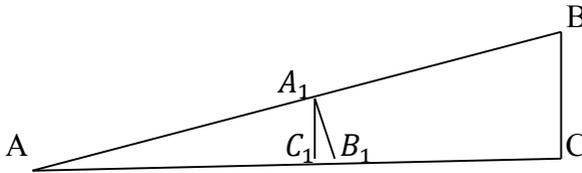
Using the above idea of triangulation and the property of convergence of a bounded sequence, we find the area of a circle of radius R, knowing that the length of the circle is given by the structural formula  $l = 2\pi R$ .

In the circle with center O we inscribe a regular n-gon  $F_n$ . We connect the center of the circle O to each of the vertices of the regular n - gon and thus obtain a partition of this polygon into equal triangles. Then the area of each of these triangles is  $S_n = \frac{1}{2} a_n \cdot h$ , where  $a_n$  - is the side of the polygon (the base of the triangle). Then the area of a regular n-gon is equal to the sum of the areas of all triangles of the partition, i.e.  $S(F_n) = \sum_n S_n = \frac{1}{2} \sum_n a_n \cdot h$ . In this equality,  $\sum_n a_n$  is equal to the length of the perimeter  $p_n$  of the polygon  $F_n$ . With an unlimited increase in the number of sides n of the polygon  $F_n$  its perimeter tends to the circumference, and the height h to its radius R. Then the area of the polygon  $F_n$  tend to the area of a circle S of radius R, i.e.  $S = \frac{1}{2} 2\pi R \cdot R = \pi R^2$ . We represent this formula as  $S = \frac{1}{2} 2\pi \cdot R^2$ . This means that the area of a circle is equal to the product of the square of its radius and half of the radian measure of the total angle with the apex at the center of the circle. Then, if the value of the central angle is  $\alpha$  radians, then the area of the sector with this angle will be equal to  $S_\alpha = \frac{1}{2} \alpha R^2$ . Similarly, the arc length of a sector in  $\alpha$  radians is  $l_\alpha = \alpha R$ . Then  $S_\alpha = \frac{1}{2} \alpha R^2 = \frac{1}{2} \alpha R \cdot R = \frac{1}{2} l_\alpha \cdot R$ . This formula resembles the formula for the area of a "circular" triangle, the base of which is the arc  $l_\alpha$  of the circle, and the height is its radius R.

Let us generalize these ideas for the measure of second-order elementary surfaces (or their parts), to which, first of all, we refer to a cylinder, a cone and a sphere. Let a straight circular cylinder C with a base radius R be given. Cutting the lateral surface of the C cylinder along the generatrix perpendicular to the base, we obtain its flat sweep, which is a rectangle with sides  $2\pi R$  and H - the height of the cylinder. Then the area of the

lateral surface of the cylinder obviously coincides with the area of such a rectangle, i.e.  $S_b = 2\pi RH$ . Since the total surface of the cylinder consists of a lateral surface and two equal circles, the area of the total surface  $S_n$  is equal to  $S_b + 2\pi R^2 = 2\pi RH + 2\pi R^2 = 2\pi R(H + R)$ . In other words, the total surface area of a cylinder is equal to the area of a rectangle with sides  $2\pi R$  and  $H + R$ . Thus, the surface area of the second order is reduced to the basic structural unit determined by the area of the rectangle. For an inclined cylinder, the lateral surface area coincides with the parallelogram area - the lateral sweep of the cylinder.

Using the ideas of a flat sweep, we find the surface area of the cone and its parts. Let a straight circular cone be given, and its surface represented as the surface of rotation of a right-angled triangle around one of its legs. Let the cone be obtained by rotating the hypotenuse AB around the leg AC.



Cutting the resulting surface of the cone along the generatrix AB, in a flat sweep we obtain a circular sector of radius  $l = AB$ , with angle  $\alpha$  at apex A. Then the area of such a sector S is equal to the area of the lateral surface of the cone, i.e.  $S = \frac{1}{2} \alpha l^2$ . If R - is the radius of the base of the cone, then  $\alpha l = 2\pi R$ . Then for the area of the lateral surface of the cone we have  $S = \frac{1}{2} \alpha l \cdot l = \frac{1}{2} 2\pi R \cdot l = \pi Rl$ . In this case, the second-order surface area is also represented as the area of a rectangle with sides  $\pi R$  and  $l$ .

We represent the formula obtained above for the area of the lateral surface of a cone in an equivalent form convenient for use in solving problems of a more general nature.

To the segment AB at point  $A_1$  we build a mid-perpendicular, which intersects with the axis of rotation (AC) at point  $B_1$ . From the similarity of triangles  $A_1C_1B_1$  and ACB we have  $\frac{A_1B_1}{AB} = \frac{A_1C_1}{AC}$ , or  $A_1B_1 \cdot AC = A_1C_1 \cdot AB = \frac{R}{2} \cdot l$ . Multiplying both sides of the last equality by  $2\pi$ , we get:

$$2\pi A_1B_1 \cdot AC = 2\pi A_1C_1 \cdot AB = \pi Rl. \tag{1}$$

It follows from equalities (1) that the lateral surface of the cone can also be calculated by the formula

$$S_b = 2\pi A_1B_1 \cdot AC, \tag{2}$$

where  $A_1B_1$  - the length of the segment of the middle perpendicular at point  $A_1$  to the segment AB cut off by the axis (AC), and AC is the projection of the generatrix AB onto the axis (AC).

Then the total surface area of the cone is

$$S_n = \pi Rl + \pi R^2 = \pi R(l + R). \quad (3)$$

Formula (3) can be interpreted as the formula for the area of a rectangle with sides equal to half the circumference of the base of the cone and  $l + R$ .

Taking into account equalities (1), we obtain a formula for the lateral surface area of a truncated cone with base radii  $R_1, R_2$  and generatrix  $l$ , namely

$$S_{bu} = 2\pi \frac{R_1 + R_2}{2} \cdot l = \pi(R_1 + R_2)l, \text{ where } \frac{R_1 + R_2}{2} - \text{the length of the perpendicular}$$

dropped from the middle of the generatrix  $l$  to the axis of rotation.

If the sphere is represented as a surface of rotation of a semicircle around the diameter of the AC, then, using formula (2), we obtain the formula for the surface area of a sphere  $S = 2\pi R \cdot 2R = 4\pi R^2$ .

If a spherical segment is represented as a surface of rotation of a semicircular arc around the diameter of the AC, then from (2) we obtain the formula for its surface area in the form

$$S_{cc} = 2\pi RH, \quad (4)$$

where  $H$  – projection of a semicircular arc on the diameter of the AC. In addition, formula (4) can be represented as  $S_{cc} = \alpha R^2$ , where  $\alpha$  – spatial angle in steradians equal to the angle at the apex of the cone coinciding with the center of the sphere. The last formula is a spherical analogue of the formula for the length of an arc  $l$  of a circle with a central angle equal to  $\alpha$ , i.e. formulas  $l = \alpha R$ .

The methodological technique proposed by us above and based on the idea of a flat sweep of a cylindrical or conical surface is generalized for the volumes of bodies of revolution. In this case, the volume formula of a right rectangular parallelepiped is used as a structural unit of volume. This is a topic for a separate article and we will not consider it here.

Meanwhile, the problems associated with measure theory in analytic geometry are solved using scalar and vector products of vectors. If the first of these products is associated with finding lengths and distances, and the second determines the element of the area, then together they, in the form of a mixed product of vectors, solve the problems associated with finding volumes of geometric bodies. Thus, at another level of mathematical education, the scalar and vector products of vectors act as structural units of length, area and volume. They are defined by logic diagrams as follows. The scalar product is denoted by simple brackets ( , ), and the cross

product - by square brackets  $[ \ , \ ]$ . Then, for any three vectors  $\mathbf{a}$ ,  $\mathbf{b}$ ,  $\mathbf{c}$  and a real number  $\alpha$ , the scalar product of vectors is determined by the logical scheme: 1)  $(\mathbf{a}, \mathbf{b}) = (\mathbf{b}, \mathbf{a})$ ; 2)  $(\alpha\mathbf{a}, \mathbf{b}) = \alpha(\mathbf{a}, \mathbf{b}) = (\mathbf{a}, \alpha\mathbf{b})$ ; 3)  $(\mathbf{a} + \mathbf{b}, \mathbf{c}) = (\mathbf{a}, \mathbf{c}) + (\mathbf{b}, \mathbf{c})$ ; 4)  $(\mathbf{a}, \mathbf{a}) = a^2$ . For the same vectors and the number  $\alpha$ , the vector product of vectors is determined by the following logical scheme: 1)  $[\mathbf{a}, \mathbf{b}] = -[\mathbf{b}, \mathbf{a}]$ ; 2)  $[\alpha\mathbf{a}, \mathbf{b}] = \alpha[\mathbf{a}, \mathbf{b}] = [\mathbf{a}, \alpha\mathbf{b}]$ ; 3)  $[\mathbf{a} + \mathbf{b}, \mathbf{c}] = [\mathbf{a}, \mathbf{c}] + [\mathbf{b}, \mathbf{c}]$ ; 4)  $[\mathbf{a}, \mathbf{a}] = \mathbf{0}$ . In these schemes, conditions 2) and 3) are similar and they express the linearity of operations. The first and fourth conditions show that these operations are inherently opposite, such as the trigonometric functions  $\cos x$  and  $\sin x$ . Therefore, the definition of the dot product contains the cosine of the angle, and the definition of the vector product contains the sine of the angle (the principle of unity of opposites).

Thus, the fundamentalization of mathematics education based on the methodological principles of integrated teaching of mathematics at different levels of education follows the same logical scheme. A methodological technique for finding areas and volumes, based on the idea of unfolding a conical and cylindrical surface, is the most effective from the point of view of continuity in teaching mathematics and a holistic perception of a geometric object.

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**INTEGRATION OF EDUCATIONAL AND PROFESSIONAL ACTIVITIES  
INTO THE EDUCATIONAL PROCESS OF A UNIVERSITY AS A  
CONDITION FOR THE FORMATION OF PERSONALITY TRAITS  
DEMANDED BY THE LABOR MARKET**

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**Abstract.** The proposed publication actualizes the problem of forming a complex of “key” competencies among university graduates, including those directly in demand by the labor market. At the same time, paramount importance is given to the psychological, pedagogical and organizational side of the educational process. The formation of a competitive personality of a specialist occurs directly in the process of practical activity. The translation of theoretical knowledge into the field of professional activity and the purposeful development of the student's personal potential were carried out in the process of solving quasi-professional tasks, unrefined production tasks and situations, labor activity at the enterprises of the industry, various kinds of practices, diploma design. The experimental results of the study on the levels of formation of a complex of competencies in the experimental and control groups of students and the competitiveness of young specialists in the labor market are presented.

**Keywords:** competence, formation, activity, problem "zones", practical training, educational process

### **Introduction**

In the conditions of a “tough” market economy, one of the main tasks of vocational education is to ensure the competitiveness of graduates of educational institutions in the modern labor market. The competitiveness of a young specialist is determined, in many respects, by the presence of a complex of competencies in a university graduate, which are in demand by society, industry and the person himself. Currently, there is a contradic-

tory situation on the labor market. Every year, universities prepare certified specialists with competencies in accordance with the requirements of the federal state educational standard of Russia, however, graduates often face the problem of employment due to the discrepancy between their competencies - both the set of competencies themselves and the levels of their formation - in accordance with the requirements of employers. Moreover, this situation is due, in our opinion, to the increased variability of the complex of competencies and the dynamics of the needs of the modern innovative labor market [1].

This contradiction allows us to actualize and formulate the research problem, namely, what are the psychological and pedagogical conditions for the formation of a complex of specialist competencies that are in demand by an individual, society and the labor market.

The purpose of the study - is the development and experimental verification of a complex of organizational and pedagogical conditions for the implementation of effective practical training of technologists-designers of light industry.

The subject of the research - is the organizational and pedagogical conditions for the practical training of future technologists-designers of light industry.

The object of the research - is the process of forming a system of competitive specialists demanded by the labor market - technologists-designers of light industry.

The authors see the demand for specialists capable of efficiently and creatively solving complex, non-standard professional problems in the need to move from the concept of broad education to the idea of applied knowledge. The principles of education are not only knowledge, but also the ability to manage them in the process of making production and technological decisions in order to release innovative products of light industry [2]. Determination of "key" requirements for a specialist in light industry will allow you to quickly respond to dynamically changing requirements for a graduate both by the labor market and by the student's personality [3].

Within the framework of this study, the set of competencies that are significant for the individual, society and professional sphere of activity includes two groups:

- professional, ensuring the effective performance of a certain type of professional activity;
- general, realizing the adaptation of young specialists to professional activities and readiness to solve problems in non-standard production situations.

The identification of "problem areas" in the training of technologists-designers of light industry was carried out by assessing the satisfaction of employers with the preparation of graduates for working conditions in modern production. The results of the assessment of the complex of competencies by experts-representatives of the light industry are as follows:

- good preparedness of graduates for the main types of professional activity ("modeling and design of light industry products") and satisfactory - for the preparation, organization and management of innovative technological processes;
- insufficient formation of general competences, the difficulty of adapting to production conditions, teamwork, to the performance of new professional functions when changing types of activities, etc.

The presented assessment shows that practical training is the most important component of the complex of competencies of young specialists with a demanded level of formation of the latter, which provides graduates with competitive advantages.

The proposed integration of educational and professional activities determines the foundations of designing the content, forms, methods and means of training a specialist technologist-designer of light industry of a new type.

By practical training, the authors mean the formation of a complex of "key" competencies, in the context of organizing and conducting independent student work in laboratory and practical classes, in the course of various types of practices in an educational institution and at basic enterprises, while performing final qualifying work [4, 5].

To determine the complex of organizational and pedagogical conditions for the formation of "key" competencies of practical training, the modeling of the professional activity of competitive specialists - technologists-designers of the industry was carried out. The professional activity model is characterized by:

- the unity of theoretical and practical training, consistency, modularity;
- taking into account the environmental, competence and personality-activity approaches;
- focus on training specialists capable of carrying out multifunctional professional activities.

In the conditions of fierce competition in the market, the systemic approach ensures the interconnection of all structural components of the model, the competence-based approach orients the educational process towards the formation of a complex of professional and general competencies of the individual. The environmental approach involves the creation

of an environment conducive to the effective formation of competencies based on the development and self-development of the individual. The personality-activity approach emphasizes the educational process on the disclosure of the potential of a person through activity, as the main means and a decisive condition for the development of a complex of competencies [6].

The training model contains four interrelated components: target, content-procedural, diagnostic, evaluative and effective. The backbone element of the model is the target, which determines the content of the general set of requirements for a specialist. The content-procedural component of the model determines the content and organization of the educational process at all stages of training specialists in accordance with the goal, cognitive abilities of students and the level of their motivation. The diagnostic component includes monitoring the dynamics of a complex of specialist competencies, employers' satisfaction with the level of training, and student satisfaction with the organization of the educational process. The function of the evaluative-effective component is to assess the results of the training of specialists, which, if the results obtained do not correspond to the set goal, allows you to make adjustments to the corresponding components of the model [7, 8, 9].

The model provides for a dispersed version of the organization of student practices, while practical activities are carried out together with theoretical training within the framework of professional modules both in an educational institution and at enterprises of the industry. Such an organization of practices contributes not only to the formation of professional skills in students, the development of new technologies, but also to the awareness of the degree of responsibility of a specialist for the effective performance of production functions.

Experimental verification of the effectiveness of the organizational and pedagogical conditions for the practical training of students - technologists-designers was carried out on the example of students in the educational groups of the university. The experiment involved 48 students (24 students in the experimental group, 24 students in the control group). During the experiment, the homogeneity of the experimental and control groups was established using the Student's t-test and the  $\chi^2$  test. The effectiveness of organizational and pedagogical conditions was assessed on the basis of comparing the levels of competence formation among students of the indicated groups.

At the final stage of the experimental work, the data of the expert assessment of the formation of competencies were assessed using the Stu-

dent's *t*-test for independent samples.

The results obtained indicate that the threshold, advanced and superior training level for the experimental group is 8.3; 33.4; 58.3% and for the control group - 10.0; 85.0; 5.0% respectively. The given data indicate that there are 53.3% more students with an excellent level of competence formation in the experimental group than in the control group.

An analysis of the data on the employment of graduates in the studied groups allows us to state that most of the graduates of technologists-designers of the experimental group continued their studies at the next stage of higher education (45.83%), got a job at industry enterprises of light industry - 20.83%. Similar indicators for the control group are 30.0 and 25.0%, respectively.

The results of the experimental work allow us to conclude that the model and the complex of organizational and pedagogical conditions developed by the authors ensure the formation of "key" competencies in specialists of technologists-designers that are in demand by production and the labor market.

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## THE ATTITUDE OF YOUNG PEOPLE TO THE SOCIAL PROBLEMS OF ORPHANS (BASED ON THE MATERIALS OF A SOCIOLOGICAL STUDY)

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**Abstract.** The article is devoted to the analysis of empirical data obtained by the authors in the course of sociological research. The purpose of the study was to examine the awareness of Oryol youth about the social problems of orphans, as well as their readiness for social activity in this area. The main conclusion of the study is that young people, understanding the importance of social problems of orphans and declaring their intentions to take part in solving them, nevertheless, in real practice, shifts the entire completeness of social responsibility for the fate of orphans to state and public organizations.

**Keywords:** orphans, public opinion, social problems, youth.

### 1. Introduction

The problem of orphans - is not only a problem of Russian society; there are almost 120 million orphans in the world [1]. According to the website of the UN Children's Fund, more than 2.7 million children live in orphanages, boarding schools and other state institutions. In the countries of Eastern and Central Europe, 666 out of 100 thousand children live in shelters. In modern Russia, there is a record low number of children in orphanages.

Domestic legislation recognizes minors whose parents have died as orphans; children left without the care of their father and/or mother (for example, if the court limited their parental rights or deprived them altogether), as well as children whose parents are declared dead, declared incapacitated, missing, serving a prison sentence or removed from raising their offspring.

According to the Prosecutor General's Office of Russia, the number of orphans has almost halved from 2014 to 2019 (from 87,604 to 44,429

people). There are less than 48 thousand questionnaires left in the data-bank maintained by the Russian Ministry of Education. Five years ago, there were 1.5 times more children in the bank - 68.8 thousand, and 10 years ago - 115.6 thousand. Now there are 180 thousand adoptive parents and adoptive parents in the country [2].

However, the problems of orphans are still relevant regardless of the decline in their number. Moreover, according to A. Gezalov, director of the social center of St. Tikhon, there is a so-called hidden orphanhood, i.e. when children remain "overexposed" in an orphanage for six months due to temporary difficulties of their parents [2].

### **1.2 Research methods**

In order to study public opinion about the problems of orphans, a sociological study (Internet survey) was conducted among Oryol youth (April-May 2020). The sample consisted of 250 people, including 36.3% of men and 63.7% of women. 57% of respondents are students of higher educational institutions, 17.7% of respondents have secondary and specialized secondary education, 25.3% of respondents have completed higher education.

### **1.3 Purpose of the study**

The purpose of the study is to examine the awareness of Oryol youth about the social problems of orphans, their readiness for socially active agency, namely, for practical participation in solving these problems.

## **2. Results of the study**

According to the results of a sociological survey, 71.3% of respondents unequivocally believe that orphans are an important social problem in modern society, another 21.3% of respondents believe that this problem is rather important than not important. Therefore, it is not surprising that a large number of respondents (78.8%) are aware of the problems associated with the social status of orphans.

According to the respondents, the main problems of orphans in modern Russian society are:

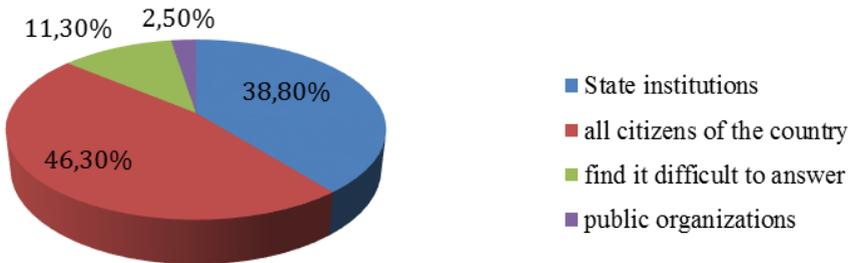
- difficulties in the process of socialization (adaptation problems, psychological complexes and problems of self-realization);
- problems associated with common stereotypes that an orphan is an aggressive child with poor heredity, prone to deviant behavior;
- poor living conditions in orphanages and shelters;
- the prevalence of bad habits among orphans;
- communication problems, manifested in the fact that orphans do not know how to build positive partnerships, to present their skills;
- violence from adults (guardians, educators, teachers);
- social insecurity in obtaining quality education and own housing (Tab. 1).

**Table 1 - Opinion of respondents about the known problems of orphans**

Problems of orphans	% of interviewed
difficulties in the process of socialization	73,8
problems associated with common stereotypes that an orphan is an aggressive child with poor heredity, prone to deviant behavior	61,5
poor living conditions in orphanages and shelters	58,5
prevalence of bad habits among orphans	50,8
communication problems	43,1
violence from adults	38,5
social insecurity in obtaining quality education and own housing	35,4

However, knowing the problems of orphans and assessing their social significance, as the research has shown, does not mean that each respondent is ready to personally participate in solving them. In particular, only 15.5% of the respondents expressed their willingness to take part personally, almost the same number found it difficult to answer, doubts were expressed by 49.3% (“rather yes than no”).

As can be seen in Figure 1, an approximately equal number of respondents believe that assistance should be provided first of all by all citizens of the country (46.3%) and state institutions (38.8%).



**Figure 1 - Opinion of respondents about whose prerogative it is to provide assistance to orphans**

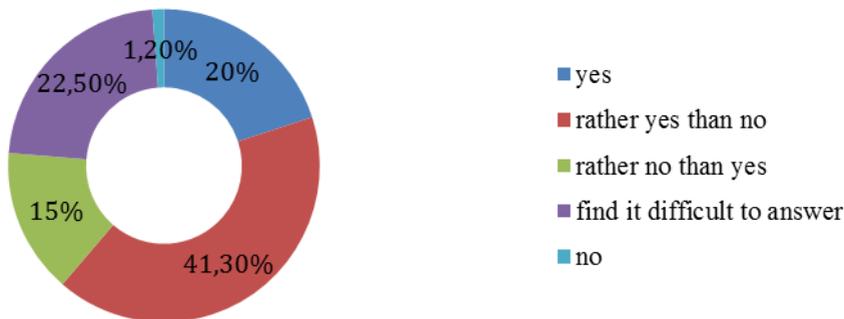
Public organizations were indicated only by 2.5% of respondents, which indicates either the lack of information among young people about the scope and directions of the activities of public organizations (foundations, parties, etc.), or a very low assessment of their activities (hence the lack of confidence in them).

As the study showed, the most famous forms of placement of social orphans are guardianship and foster care (88.8% and 86.3%, respectively), and they are the most effective in terms of solving educational problems (23.8% and 56.3% respectively).

An orphanage and a boarding school were among the ineffective forms of placement of social orphans. However, according to a quarter of the respondents (25%), placing children in state educational institutions is a positive and necessary measure, and 46.3% admit such a measure only as a last resort.

The contradictory opinions of the respondents are due, in our opinion, to a very superficial acquaintance with the problems of the social status of orphans in state and non-state institutions.

According to the data obtained, the attitude towards foster families in the majority (68.8%) is positive, but only 20% of respondents are ready without hesitation to take an orphan into their family, 41.3% are more likely than not ready, and only 1.2% of respondents gave a categorical negative answer. 22.5% of survey participants found it difficult to answer this question of the questionnaire (Figure 2).



**Figure 2 - Distribution of respondents' answers to the question about their readiness to take an orphan child into their family for upbringing**

Such a high percentage of those who found it difficult to answer is explained by the fact that among the respondents the overwhelming majority are university students, i.e. those who have little life experience and, as a rule, do not have their own family (91.3%). In our opinion, positive answers to the corresponding question in the questionnaire indicate rather that modern young people have the values of family and children than a real readiness to take other people's children into the family.

Answering the question of what should be done to encourage people to accept orphans into their families, young people actually expressed their opinion about the conditions under which they themselves would be ready to accept an orphan child into their families. The answers of the respondents are presented in Table 2.

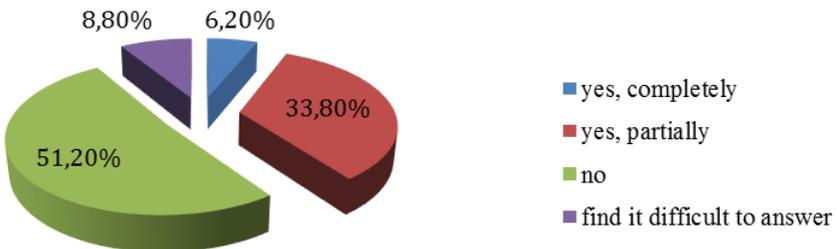
**Table 2 - Opinion of respondents about measures to encourage people to accept orphans into a family**

Measures to encouragement	% of interviewed
Promote positive experiences of foster families	37,5
Increase the amount of material support	13,7
Develop a system of additional benefits	42,5
Find it difficult to answer	6,3

As can be seen from Table 2, 42.5% of respondents believe that a system of additional benefits for foster families should be developed, 37.5% of Oryol youth named the promotion of the positive experience of foster families as an incentive measure. Contrary to the prevailing stereotype about the dominance of the material factor in solving practically any social problem, an increase in the amount of material support was indicated by only 13.7% of the respondents.

Analyzing the answers to the question about the formation of negative qualities in orphans through constant assistance, such as dependency, parasitism, inadequate perception of reality, the respondents can be divided into two groups.

Representatives of the first group fully or partially agree that by providing assistance, society forms negative qualities in orphans (40.1%). 51.2% of the representatives of the second group completely disagree with this statement (Figure 3).



**Figure 3 - Distribution of respondents' answers to the question "Do you share the opinion that rendering assistance to orphans forms their dependence, parasitism, inadequate perception of reality?"**

In the process of rehabilitation of orphans, according to the respondents, the following should participate: centers of social assistance to children (80.5%); school social educators/psychologists (55.8%); guardianship and trusteeship bodies (53.2%); public youth organizations (50.6%), crisis centers based on orphanages (37.7%).

### **Conclusions**

Analysis of the results of sociological research allows us to make the following conclusions:

- the modern youth is aware of the position of orphans as a socially important problem and has some idea of the problems faced by orphans in Russia;

- the willingness/unwillingness to take part in solving the problems of orphans is largely determined by the young age of the majority of respondents, as well as limited experience of contacts with representatives of the categories of orphans;

- the stereotypes prevailing in society regarding the social behavior and social qualities of orphans leave an imprint on the attitude of young people towards children of this category;

- the mismatch in young people's values and readiness to act in accordance with them indicates the presence of cognitive dissonance in the youth environment.

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**TRANSLATION OF SLANG WORDS IN BOOKS BY MARTINA COLE  
FROM ENGLISH INTO RUSSIAN**

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**Abstract.** The article is devoted to the problem of conveying slang words in literary translation from English into Russian. Slang is an integral part of modern fiction; slang words used in the speech of a character can demonstrate linguistic and cultural differences within one particular language. Authors of literary works quite often resort to the use of slang constructions to create vivid images of their personages. The purpose of this article is to study the problems which arise when translating slang words and terms in a literary text, to provide an analysis of specific examples based on the translation of slang words into Russian in literary works of Martina Cole and to try to define patterns and methods for translation of slang words from English into Russian based on existing translation strategies.

**Keywords:** slang word, slang construction, literary work, literary translation, translation method, translation strategy.

A lot of linguistic research and scientific works are devoted to slang, each of which is of great interest, but despite the fact, linguists are still arguing whether slang should be considered as an independent phenomenon and a separate category in modern linguistics. Moreover, the concept of slang in a literary text is a field of particular linguistic and translation interest.

English-language culture has given the rise to the study of slang. French terms such as *jargon* and *slang* are often identified and considered synonyms in some scientific works and sociolinguistic dictionaries. There is a big number of slang definitions which seem to contradict each other. As a result, it is difficult to single out the most accurate one from the variety

of definitions. In English philology, slang is still considered to be one of the most obscure terms.

The main definition of slang words in Russian linguistics was given by Vladimir Homiakov, who identified slang as a relatively stable, widely used and stylistically marked lexical stratum; a component of expressive vernacular, included in the literary language, very heterogeneous in its origins [7]. Another rather detailed definition of the term “slang” was given by Richard Spears, the author of a dictionary dedicated to slang “Slang and Euphemism”. His concept, in general, allows breaking the established strong link of slang with criminal jargon, as well as asserting that the very concept of “slang” includes a lot of different types of non-literary vocabulary [8]. The point of view of Richard Spears was very similar, in many respects with the position of Charles Fries, an American linguist who paid particular attention to such a phenomenon as “slang”.

According to many linguists, slang should be considered purely as a violation of the basic language norms of a generally accepted language. However, slang words are expressive ironic words that serve to designate objects that people talk about in their daily lives. The statement that this kind of vocabulary cannot be used in a literary text can be considered quite controversial. Slang words are quite often for the stylistic purposes in literary works.

Even though slang is mostly considered in the context of colloquial speech, it also has its functions in the literary text. As a rule, authors resort to the use of slang units on purpose having their own motivation in mind. For example, some authors use slang intentionally for stylistic purpose, to give the text a certain novelty. It is evident that any language is gradually developing and acquiring new linguistic units, modern authors try to enrich their works with specific kind of vocabulary, despite the fact that it can be related to slang. Thus, some authors are trying to attract the attention of youth to their works.

The translation of literary works can be fully compared with art, which task is not only to transfer a text to another language, but to do something more. The complexity of the translation of literary texts can be explained by the difference in linguistic norms between languages, the differences in the use of specific vocabulary and the difference in cultures of languages, which makes translation a professional field. To create a competent literary translation, the translator must be able to interpret words given the variety of their meanings. Consequently, a translator of a literary work is not just a person who is fluent in two languages, but a writer. During the translation of a literary text, the translator encounters a number of difficulties, one of

which is slang. Translation of slang depends on the function of slang units in a book, which is determined by the author's style.

The role of literary translation is huge for all the humanity. In the modern world, with the advent of the Internet and translation tools that facilitate the translation process, literary translation has not lost its relevance. Despite this, the role of a "live" translator still occupies a leading position in terms of literature because computer-aided translation is not capable of the creative process.

The creative process of literary translation cannot be subordinated to any set of rules. There are many difficulties, ranging from differences in living conditions of different people to the fundamental differences in the structure of languages. Slang units represent one of the problems in literary translation due to the fact that slang expressions in one language do not always have adequate correspondences in other languages.

When creating a work of art, the author creates an artistic image using various means of expression and linguistic means. In the works of literature slang is not a rare phenomenon. The main reason for the use of slang in most modern fiction texts is the expression of a subjective evaluative and emotional attitude to reality. It is the expressiveness of the slang, its dark and deep implicit meanings that translators striving to make the text of the translation as natural, stylistically correct, and focused on reproducing the personal identity of the characters should pay attention to. Slang words must be distinguished from commonly used words and expressions. In modern style of the English literary language, in which slangisms can be used, i.e. in the style of artistic speech and in the newspaper language, they are usually used without quotation marks. In the literature, colloquial words and expressions are used to create an authentic true-to-life dialogue of the characters, to bring the written text as close as possible to the colloquial speech.

When translating slang, translators can use two main methods of translation: **direct** or literal translation and **indirect** or transformational translation. Literal translation of slang can be used when the slang word is evident in the context does not violate the norms of the language, the principles of adequacy and equivalence. An indirect technique for translating slang is the use of translation transformations, the main function of which is to create a lexically accurate, adequate translation in the absence of regular language correspondences.

The issue of interpreting slang when translating fiction is relevant in translation studies. Translation in this case is a correct interpretation or adaptation of the original slang units within the context and author's style.

A single and complete definition of adaptation does not exist today, but since it is one of the many translation strategies, adaptation is explained both from a technical and objective points of view. The definition of Jean-Paul Vinay and Jean Darbelnet is best known: adaptation is a procedure that is used if the context of the original text does not exist in the target culture, and therefore a certain form of its reconstruction is needed [9, 45]. It should be noted that the difficulties in adapting slang in literary translation are caused by the heterogeneity and versatility of the very concept of slang, and the lack of tradition of translating this layer of vocabulary in Russian translation practice. When translating slangisms, the peculiarities of the context in which they are used should be taken into account. Translation techniques should be aimed at achieving the maximum level of equivalence and adequacy and the most accurate transfer of meaning, style and function in the translated text.

The adaptation of slang units in the translation of literary works is considered to be an adequate transfer of slang from the original language to the translating language using translation transformations. The following **adaptation methods** are possible: 1) the transcription of the original, 2) intentional omission of slang words, 3) expansion of its meaning, 4) substitution by euphemisms, 5) substitution by other slang units, 6) using a cultural analogue, 7) using dysphemism. Expansion of slang happens in cases when it is necessary to clarify the broad slang concept, a euphemism is used in cases when slang is extremely negative, substitution takes place to replace obsolete slang of the original work in translation, cultural analogues are used in cases of cultural differences between the languages of the original and the translation, dysphemism is used in cases when the translator enhances the expressiveness of ordinary words which are not slang words.

Slang does not always remain constant. With the change of one fashionable phenomenon in a language to another, old words are forgotten, others come to replace them. The slang that we see in fiction can represent absolutely any kind of slang. While analyzing the literary works of the British writer Martina Cole we found out different types of slang, such as negative slang, positive slang, mixed slang and neutral slang. **Negative slang** refers to slang units that are offensive to someone or something, for example: “a numbskull” – «болван» [5, 28]; “a bugger” – «молокосос» [1, 18]; “a nutter” – «псих» [5, 55]; “a do” – «игрушка» [5, 10]; “a bird” – «телочка/бабенка» [2, 22]; “thick” – «тупица/идиот» [1, 3]. **Positive slang** is used to give a positive rating to someone or something, for instance: “a bloke” – «малой» [1, 9]; “a git” – «бедняжка» [2, 20]; “a mate” – «дружище»

[1, 22]; “a bird” – «пташка» [5, 22]; “a cherub” – «ангелочек» [2, 28]; “a breaker” – «кувалда» [2, 20]; “righty ho then” – «окей» [2, 8]; “cracker” – «девочка» [2, 11]; “boysie” – «пацаны» [1, 46]; “darlin” – «крошка» [2, 87]. **Mixed slang** consists of slang units and structures that can be either positive or negative, depending on the context: “boy” – «дорогуша/ходок/мальчишка» [2, 48]; “to walk around” – «гулять/шлендрать» [2, 34]. **Neutral slang** includes slang abbreviations and inanimate objects that do not give any character to expression or sentence: “smacker” – «доллары» [2, 22]; “dosh” – «капустка» [2, 17]; “quid” – «штука» [2, 17]; “guy” – «сэр» [5, 22]; “ya” – «ты» [5, 17]; “yer” – «ты» [5, 22].

Slang units that are found in a literary text in a particular language are translated into other languages in different ways. The process of their adaptation should be determined by the role of slang vocabulary in the original work, since authors can assign different functions to slang. Some authors try to diversify the literary vocabulary with substandard words, some authors use slang words to characterize the features of speech of a particular group of people. The main and first task of a translator when adapting slang to a translating language is to find slang equivalents. To do this it is necessary to turn to special slang dictionaries, which offer a large number of translation options for slang words, set expressions, and even whole sentences. Then if there are no equivalents or if they are not relevant for this particular author’s style, a translator should resort to those methods described earlier in this article.

We came to the following results after analyzing the problem of translation of slang vocabulary in the works of Martina Cole from English into Russian. Such methods as using a functional (cultural) analogue, using dysphemism, using euphemistic translation, omission and loan translation were used to adapt slang words into the Russian translation of the author’s books.

The method of **selecting a functional analogue** in a target language is often used by translators when translating different genres of literature. The popularity of this method is also due to the fact that some phrases contain components, the meaning of which may be unclear to the foreign reader. There are some examples of selecting a functional analogue for slang words in Martina Cole’s novels. “*It’s raves, Dad. Raves*” [5, 165]. – «Я о **тусовках** папа! О Ту-сов-ках!» [4, 117]. The slang noun *rave* is translated by the functional analogue «тусовка». “*To the do, Georgie. The bloody leaving do – for Jonesy*” [5]. – «О **пирюшке**, о чем же еще? Об этой чертовой **пирюшке**... по случаю ухода Джонси!» [4, 7]. The noun “a do” has only informal forms of translation, and in the form of a noun it refers to either vernacular or slang, depending on the context.

The second way to adapt the slang in the translation of Martina Cole's novels is to use **dysphemism**, which means that to an initially neutral concept is given a crude or obscene meaning in order to enhance the expressiveness of a statement or to create a negative semantic load. All of the following slang units were translated into Russian with the help of dysphemism. "***Walking around, covered in make up and perfume. Even the very young girls***" [2, 53]. – «***Шлендрают повсюду, намазанные, надушенные! Сопливые девочки и те туда же***» [3, 40]. In this example, we see how three expressions with a neutral meaning were translated using slang to enhance the expressiveness of the statement. "***You're one of the best lifters, Vi. You can lift a wallet better than anyone I've ever known***" [5, 160]. – «***Ведь ты, Вай, любого «щипача» переплюнешь, если надо притырить бумажник***» [4, 113].

**Euphemization** is the opposite of dysphemization and is also often used to adapt slang to Russian when translating M. Cole's novels. The euphemistic translation is when a crude slang expression is replaced with another neutral word or expression.

"Cover yourself up, girl. Before you get frostbite of the **fanny!**" [2, 16] – «***Запахни пальто, красотка! А то отморозишь все свои прелести!***» [3, 14]. Initially, the slang word *fanny* has a rude and abusive translation in Russian, denoting female genitals. In this example it is obvious that the young man flirts with the girl and he does not want to offend her with a rude word, so the translator chooses the neutral slang version of the translation so that the reader does not have a feeling that the atmosphere between the characters is tense.

Martina Cole uses a large number of slang units in her novels, as slang is a characteristic feature of her writer's style. On the contrary using too many slang words is not typical for Russian literature, that is why in some cases, translators use the **omission** of slang words in their translation which is another strategy. For example, "***It's really happening to them. That's why they're called snuff or stuff movies***" [5, 22]. – «***Все в натуре, не понарошку, усек?***» [4, 16].

Slang adaptation is mistakenly confused with the selection of an equivalent in a foreign language. Slang adaptation is closely related to the process of intercultural communication. Adaptation is the correct interpretation of slang units into a foreign language, taking into account the linguocultural aspects of the target language. Despite the fact that most of Martina Cole's slang vocabulary was adapted in translation, there were also cases when slang adaptation was difficult due to the lack of equivalent concepts in Russian and due to cultural peculiarities that censor some slang units when translated into Russian.

Analyzing the translation of slang words from English into Russian, we can distinguish the main problems of slang adaptation: 1) the problem of the lack of equivalent vocabulary in the translation language; 2) the problem of translating obsolete and modern slang vocabulary; 3) the problem of linguocultural differences in different languages.

The main problem is the lack of equivalent vocabulary in the language of translation. The absence of slang analogues can be due to two reasons: an undeveloped slang dictionary (lack of study, young languages or dialects); lack of similar slang meanings in the language. As an example, we analyzed the term such as “*snuff/stuff movie*”. In Russian there is no analogue to this term and the only adaptation option would be a loan translation or an omission technique. In other words, the lack of language correspondence and the impossibility of transferring a slang unit to a foreign language is the first problem of adapting slang during the process of translation.

The second problem should include cases of adaptation of outdated and modern slang. There are times when the author uses outdated slang in his or her works, thereby complicating the work of the translator who has to make a serious choice: whether to use equivalents of the same outdated slang or resort to modern versions of slang vocabulary. In this case, it is important to consider several factors: the time interval between the year the work was written and the year of translation.

The next problem of slang adaptation includes linguistic and cultural differences in languages, as well as the current state of affairs in a particular country. Sometimes slang does not reflect the most favorable side of people's lives, which is not customary in some countries / peoples / societies to talk about.

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## THE BALKAN VECTOR OF THE BRITISH FOREIGN POLICY IN HISTORICAL RETROSPECT

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**Abstract.** The article is devoted to the Balkan vector of Great Britain's foreign policy. The author has analyzed the British policy on the Balkan Peninsula at the turn of the 19<sup>th</sup> – 20<sup>th</sup> centuries and at the present stage and have traced the geopolitical interests of the British in a comparative temporal context, motivated to use either military or peaceful methods of asserting the British presence in the region.

**Keywords:** geopolitical interests, Great Britain, the Balkans, Eastern Question, intervention, European Union, integration.

### **Research goal**

From the end of the 19<sup>th</sup> century, Great Britain constituted the largest state entity, the Empire with a capital letter, which required preservation, protection, and if possible, further expansion. In the context of geopolitical interests, the Balkan Peninsula in this respect has always occupied a special place in the British foreign policy, both in the past and in the present.

The goal of the research is to identify the essential characteristics of Britain's foreign policy and a comparative analysis of the geopolitical interests of Great Britain and their practical implementation on the Balkan Peninsula in a historical perspective. Special attention has been paid to the Balkan vector of the British foreign policy during the rule of the “new Labourites” since 1997.

### **Research methodology**

The chosen methodology was determined by the approach to the study of the British foreign policy within the framework of the theory of neoclassical realism, capable of taking into account both internal factors and the context of the international environment for studying the state's foreign policy as the main actor in its international relations. The framework of the

chosen approach engaged a combination of general methods of scientific cognition (formal-logical method, analysis, synthesis, generalization, historical descriptive and political descriptive) and special methods used in political research (institutional, systematic, method of identification of analysis levels).

### **Research results**

#### **1. Balkan policy of Great Britain in the late 19<sup>th</sup> – early 20<sup>th</sup> centuries.**

Throughout the 19<sup>th</sup> – early 20<sup>th</sup> centuries, the events in the Balkan region were perceived by the British political circles in the context of the development of the Eastern Question – i.e. a set of problems related to the fate of the Ottoman Empire (its European and Asian provinces). In the second half of the 1870s, British imperial interests were focused in the eastern regions of the Mediterranean and the countries of the Middle East. The Eastern Question, i.e. the fate of the Ottoman Empire and its relationship with the Balkan Slavic nations, despite the purely European aspect of events, acquired great imperial significance for the British during the period under review. In the period of its aggravation, there was a discussion in English society of what was included in the concept of “British interests”, what the British Empire should be and what its role was in the fate of Britain itself.

London lined up its foreign policy in the Balkans, depending on the changed alignment of forces in the Middle East, i.e. on the strengthening of the influence of another great power there and its possible predominance in Asia, which could pose a threat to British imperial communications. The policy of the British government in the period of exacerbation of the Eastern Question in the mid-70s and the British-Turkish War of 1877–1878 is a clear indication of the course.

The Conservative government, headed by Benjamin Disraeli, pursued a fairly consistent policy to protect the interests of Great Britain during the growing Eastern crisis. Since the beginning of the crisis, the Prime Minister explained Cabinet’s attitude to this issue by the need to protect the interests of the British Empire (Hansard, 1876, 271, col.1146). Disraeli (AVPRI, 1876, d. 77, p. 28) was firmly convinced that Constantinople was the key to the East, and it was there, and not in Egypt, that “there was a genuine guarantee of a way to India.” Officially adhering to the policy of “neutrality”, Disraeli repeatedly resorted to threats of military intervention by Britain in the conflict between Russia and Turkey on the side of the latter.

In October 1876, the Conservative Cabinet made a decision on the Eastern Question, one of the points of which, as the Russian ambassador

to London Count Pyotr Shuvalov (AVPRI, 1876, d. 77, pp. 20 / v.-21) reported, was “a deploy the British fleet to Bosphorus with a powerful landing troops, which was partially taken from its military units in India. The manifestations of force aimed at the defence of Constantinople from the Russian aggression, the seizure of it in case of need and its retention...”. Stationing the British squadron under the command of Admiral Hornby in the Aegean and Marmara Seas in close proximity to Constantinople from the beginning of the Russian-Turkish war, the discussion in the Parliament in the winter of 1878 of additional military subsidies and mobilization of British military reserve forces, sending a contingent of Indian troops (7 thousand people) to Malta were links of the same political course, aimed at consolidating the imperial positions of Britain in the Eastern Mediterranean.

During the period of the Eastern crisis, the conservative government also saw its task in getting out of it “not empty-handed”. The Tory ministers put forward far-reaching plans – the “possible occupation” of several ports in Syria and Lebanon – and dreamt of effective “control and management of Asian Turkey” (Ryder, 1974, pp. 3, 5).

The focus of the Tory cabinet was Cyprus. The acquisition of this island was one of the key points of London’s participation in the work of the Berlin Congress in 1878, which summed up the Russian-Turkish war, and the Eastern crisis at large. Speaking in the Parliament after his return from Berlin, Benjamin Disraeli (Hansard, 1878, 241, pp. 1753-1774), in justification and defense of his policy, stated that the Cyprus Convention (AVPRI, 1878, d. 79, v.2, pp. 371-371/v), according to which Turkey handed over control over Cyprus to England, eliminated the fears of any threat to the routes to India.

Thus, the geopolitical interests of Britain in the Balkans in the period under review were closely tied to the issues of protecting the routes to India and strengthening British positions in the Eastern Mediterranean and the Middle East. At the beginning of the 20<sup>th</sup> century, Great Britain, pursuing its policy in the Balkans, was guided by a number of factors, which included the general alignment of forces in the world, motives for bloc politics, internal political processes in the Balkan states and in the Ottoman Empire. The foreign policy of Britain as a whole was aimed at destabilizing the Ottoman Empire, orienting itself to Germany at that period, and searching for allies in the face of the young Balkan states as a possible support for their policies in the region. The complete seizure of the Balkans by Kaiser Germany and Austria-Hungary was totally unacceptable for Britain, which sharply increased its attention to the Balkan Slavs at the beginning of the 20<sup>th</sup> century.

During the period under review, the foreign policy course of Great Britain in the Balkans was distinguished by a certain flexibility, which made it relatively easy to respond to emerging problems in the region. In particular, in the period after the Bosnian crisis of 1908, Britain was actively involved in solving the Balkan problems. The tough position taken by Britain on the provision of non-aggression guarantees to Serbia by Austria-Hungary, as well as the friendly attitude towards Bulgaria during the Bulgarian-Turkish negotiations on compensation, showed that Britain partially assumed the functions of the security guarantor of small countries on the Balkan Peninsula.

As for the eve of the First World War, which took shape in parallel with the warming of Anglo-German relations in 1912–1914, the political situation in the Balkans as a result of the First and Second Balkan Wars resulted in a kind of “departure” of Britain from the Balkans. The British government believed that this allowed it to focus its diplomatic activity on other, more important directions from the point of view of British interests. The First World War ended with the collapse of the Austro-Hungarian Empire and the formation of a new state on the Balkan Peninsula – Yugoslavia. So, 100 years later, the “Balkan knot” was once again at the center of the geopolitical interests of the great powers, including Great Britain.

### **2. General characteristics of the foreign policy of Great Britain in the Balkans during the rule of the “new Labourites”.**

After the collapse of the USSR and the breakup of Yugoslavia, a new geopolitical party is being played out in the Balkans, combining the same political and economic methods of persuasion and coercion as were used at the turn of the 19<sup>th</sup> – 20<sup>th</sup> centuries. As states the Russian historian P. Iskander (2010), today, instead of the Entente and the Triple Alliance, Russia and the European Union play their Balkan parties, the latter in many cases acting in conjunction with Washington.

The British foreign policy in the second half of the 20<sup>th</sup> century was characterized by a combination of old and new methods. According to the well-known specialist in British studies Al. Gromyko (2005), the UK foreign policy strategy consisted of two components – continuity, which can be traced over long periods of time, and variability, constant adaptation to the conditions of the new historical epoch. In the second half of the 20<sup>th</sup> century, vivid examples of these qualities were the concept of “special relations” with the USA and the slogan “to hit harder than its capabilities”.

The UK policy at the turn of the 20<sup>th</sup> – 21<sup>st</sup> century in Europe, and in the Balkans in particular, was largely determined by the foreign policy course proclaimed by the Labourites who came to power in 1997. Prime Minister

Thomas Blair, in his keynote speech, “The Principles of Modern British Foreign Policy,” confirmed the role of Britain as a “bridge between Europe and the USA”. The role of Britain was defined as an “axial power”, a “regional power with global responsibility”, which, being unable to dominate the world, creatively implements the second classical principle – “strike harder than its capabilities”. Other innovations were also introduced. It was envisaged that Britain would return “to the heart of Europe” and take a leading position there. In addition, a programme of “defense diplomacy” was developed, which, unlike “gunboat diplomacy”, put priority to diplomatic, not military means of resolving conflicts (Gromyko, 2005). This course clearly manifested itself in solving the Balkan problems.

Britain’s interest in the Balkan region was determined by many geopolitical arguments. Firstly, from the standpoint of geopolitics and defense, a strong integration grouping of the countries in this region was able to influence, if not all of Europe, then its closest neighbors. This created for the Western countries and for Britain in particular, certain problems in the formation and implementation of its foreign policy towards the countries of Eastern Europe. That was why the United States and its Western European allies contributed to instigating ethnic hatred between the peoples of the former Yugoslavia (Nazemroaya, 2010). Britain came to understand that the collapse of Yugoslavia as a whole would contribute to the weakening of Russian influence in the Balkans.

Secondly, the countries of the Balkan region are an excellent territory for the deployment of military bases and missile defense systems. In this regard, the interests of Britain and the United States coincided. The collapse of Yugoslavia and, as a result, its division into a number of independent states made it possible to accomplish this task without special efforts. At the same time, as noted by domestic political scientists, the Balkans represent for Europe a unique base of the natural storehouse of resources, of almost all types, which can be privatized in reserve. In the context of the energy component of modern conflicts, one should not forget that the Balkans are the shadow battle theater for the transportation of gas (Ponomareva, 2010) as well.

Finally, the focus of British political circles was the strengthening of the position of Britain itself in this region. This could benefit from the traditional credo of the British foreign policy – “divide and rule.” By plunging a number of states of the former Yugoslavia into a crisis, it became possible to control this region for a long time, putting under its control and providing first military and then economic assistance to the newly formed states.

The British foreign policy in the Balkans at the turn of the 20-21 centuries can be divided into two stages. The first was related to the conduct of military operations against the former Yugoslav states. The second was the end of wars on the Balkan Peninsula and the transfer of the foreign policy to a peaceful course.

### **3. The first stage in the Balkan direction of Great Britain at the end of the 20<sup>th</sup> – beginning of the 21<sup>st</sup> centuries.**

The first stage for Britain resulted in its participation in the “Deliberate Force” operation against Serbia, in which the British, following the Americans, played a leading role. Since December 1996, Britain took part in stabilizing the situation in Bosnia and Herzegovina, was active in the NATO Control Commission in Kosovo, supported the NATO evacuation forces in 1998, and also sent its forces to participate in Kosovo operations conducted by in the region since June 1999. At that, the Labour government of Thomas Blair argued for England’s participation in these operations by two factors: first, by British national interests, second – by calls for high humanitarian goals (Deighton, 2005). An extensive anti-Serb campaign took place in Britain, and the British media justified the need for bombing attacks on Yugoslavia. The British military contingent in Kosovo was 12 thousand soldiers, at the same time the number of US military was 7 thousand soldiers. Since June 2001, as part of the NATO forces, the UK supported the Macedonian government in the fight against the Albanian armed forces.

The NATO war against Yugoslavia ended with an overall success for Britain. In particular, as a result of the Kosovo war, the UN Security Council resolution 1244 was adopted, according to which the new legal status of Kosovo was determined. Another victory of the British was that the region was now controlled by NATO forces and the international administration. This allowed England to exert its influence on the region, acting as part of the above mentioned forces. Great Britain’s foreign policy in the Balkans was closely linked to the actions of the United States. It should be borne in mind that the Balkan policy pursued by the United States enjoyed the support of both the Labour Party, who was in power at the turn of the century and at the beginning of the new century, and among the conservatives who constituted Her Majesty’s opposition.

In general, at the turn of the 20–21 centuries, Britain took an active part in the armed conflicts in the Balkans. This helped her to solve a number of foreign policy tasks and realize her geopolitical requests. Britain was able to implement its plans for the collapse of Yugoslavia and the decentralization of the countries of the Balkan Peninsula. By supporting the US course

on the armed scenario of the development of events in the Balkans, the British, on the one hand, showed their allied relations to the Americans, and on the other, created the conditions for economic penetration and strengthening of the British position in this region.

#### **4. The second stage in the Balkan direction of Great Britain's policy in the early 20<sup>th</sup> century**

The first decade of the 21<sup>st</sup> century was marked by the new foreign policy tactics of Great Britain in relation to the Balkan countries. The geopolitical importance of the region for the foreign interests of the British remained unchanged. However, their implementation in the new conditions after the end of the military operations on the peninsula could be achieved by peaceful means.

The political and international situation in the Balkan Peninsula is changing. There are several factors that determined the new picture in the region. First, the approach of the international community to the region has changed. Peace, security, social and economic development of the Balkan countries are recognized as important for Europe as a whole. Secondly, the majority of the peoples of Southeast Europe seek democracy and prosperity through the practice of a market economy. Thirdly, their desire to integrate with the Euro-Atlantic community is a strong argument for cooperation among themselves, motivated by the expectation of real, significant changes in the life of the Balkan peoples. Fourthly, despite the tense situation in some areas of the Balkans, the overall security situation in the region has improved overall. Fifth, the Balkan countries are striving to become "security generators" and strengthen security in the regional context. They conduct an active foreign policy and develop bilateral relations as well as cooperation within the region (Alp, 2000).

Following the new situation on the peninsula, the goal of the United Kingdom in the Balkans was a policy aimed at integrating the Balkan countries into the European Union and NATO. Control over such an important strategic region is extremely important for England, since it contributes to the solution of many tasks that allow strengthening its leadership in Europe and, in turn, to weaken the influence of other powers.

The validity of this tactic of British political circles is determined by several factors. First, the provision of economic, and above all financial, assistance to the young Balkan states within the EU allowed the UK to establish and expand its control in the region. Secondly, the peace policy towards the Balkan peoples contributed to raising the international prestige of Great Britain, which clearly suffered as a result of its participation together with the Americans in military operations. The new course allowed the British to

restore the country's reputation as democratic, peacemaking and peace-loving. Thirdly, the withdrawal of British troops from the region helped to improve the situation in Britain itself, since British soldiers did not have to participate in bloody armed conflicts any more. Another positive consequence of this was relief for the British budget, since the conduct of military operations abroad was quite a costly undertaking. Finally, strengthening the position of Britain, as well as other Western countries, in the Balkan region by pursuing a peace policy aimed at stabilizing the position of the young Balkan states, was aimed at weakening Russia's influence there.

According to researchers, the collapse of Yugoslavia and the wars in the region, including the NATO intervention in 1999 and the declaration of independence of Kosovo, were part of one scenario – NATO's expansion to the east and the road to further Western geopolitical expansion and US influence on Russia (Mitrović, 2011, p.104). In the event of an aggravation of relations with Moscow, London seeks to enlist the moral support of the countries of Eastern Europe, showing solidarity with them and relying on anti-Russian sentiments. This largely explains England's desire to integrate the Balkan states into the European Union and NATO as soon as possible.

Thus, the transition of Great Britain to peaceful methods of realizing its geopolitical interests on the Balkan Peninsula has far-reaching goals. The British actively support the policies of Western European countries, aimed at creating conditions in the new Balkan states necessary for their entry into the European Union. In particular, the mentioned conditions include the reform of the law, the fight against organized crime and corruption, and the organization of public control over power. The policy of Great Britain, like other EU members, has to a certain extent been crowned with success. So, on July 1, 2013, Croatia, not without the efforts of England, became a new member of the European Community.

Another manifestation of the UK's foreign policy in the Balkans is security. As part of their decision, the British consider it necessary to pay attention to strengthening stability in the region, reducing the risk of a new war and new armed conflicts, fighting organized crime, and carrying out reforms in the Balkan countries. To this end, a special fund of 10 million pounds was created, which was formed from the funds of the Ministry of Foreign Affairs, the Ministry of Defense and the Department for International Development.

No less important direction of the British foreign policy in the region, the British consider the development of bilateral relations. First of all, this allows establishing closer contact with individual countries of the peninsula and thus finding an ally in the region. Secondly, it gives England a chance

to increase its influence in the Balkans. Thirdly, it creates a legal and political basis for the development of economic relations with the Balkan countries. In general, this course of the UK pays off. England was able to control the entry of the Balkan countries into the European Union and exert influence on them politically, economically and humanitarially. Enlisting the support of new allies, Britain strengthened its position in the Balkans.

### **Conclusions and discussion**

For many decades, the UK has been guided by its geopolitical interests in the conduct of foreign policy in the Balkans. The Balkan direction of foreign policy of Great Britain at the turn of the 19<sup>th</sup> – 20<sup>th</sup> centuries under the “new” Labourists can be characterized as the implementation of a multi-level system of strategic foreign policy priorities, which logically combines universality (clear basic principles and specificity of the foreign policy traditions historically rooted in the national consciousness) and situational character (possibility of adjusting the declared course) depending on the understanding of goals and the political situation. Britain historically used its position in the Balkans in such a way as to avoid the strengthening of continental Europe, Germany and Russia in particular.

At the present stage of development of international relations, the Balkan vector of British foreign policy involves 1) promotion of its own mechanisms of interaction with the EU and NATO through the EU Berlin Process, the “Forces for Kosovo” (KFOR) missions, the European Union Force (EUFOR), the High Representative office in Bosnia and Herzegovina; 2) weakening of the influence of Russia and “external players”; 3) promotion of US plans; expanding opportunities for their own economic and political influence.

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## “SCIENTISTS IN POWER” IN THE MUSLIM EAST

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**Annotation.** The topic of “scientists in power” in empires and states of the Muslim East in the Middle Ages has never become an object of special research before. Meanwhile, there are stories on this topic in literary sources. We are going to pay attention to the Timurid Empire – Muhammad Taraghay Ulugh Beg, Baisunkur Mirza and Zahir-ud-Din Muhammad Babur, Genghisids – Muhammad Shaybani Khan, Abu al-Ghazi Khan and Mirza (Muhammad) Haidar Dughlat (Dulati), maternal relative of Genghisids. Alongside with them there is also Ali-Shir Nava’i, vizier, head of government under sultan Timurid, Husayn Bayqara, and a great poet who did not belong to the abovementioned dynasties.

**Keyword:** throne, empire, scientist, East, Islamic

A famous historian on the throne, who left the only coherent narrative of late history of the Uzbek ulus and early history of the Kazakh khanate in Muslim historiography, was Mirza (Muhammad) Haidar Dughlat (Dulati) from an influential Turkic tribe of dughlat (dulats), born in Tashkent and a grandson of Moghulistan ruler by the mother’s side of the family. The real full name of our hero is Muhammad Haidar ibn Muhammad Husayn Gurgan. Talented and well-educated in the spirit of the Muslim tradition, he was also a brave warrior and a gifted commander. Having fallen under displeasure of Central Asian Mongolian khans, at the court of which he had had a high position for many years, after roaming around Tibet and Badakhshan (on the territory of Afghanistan) Mirza Haidar moved to Babur, who was his cousin, and his successors in India, where using their help and his own military cunning he invaded Kashmir and founded a practically independent principality for himself there.

His charm that Indian historians note together with his diplomatic skills allowed him to keep and expand his possessions through conquests in Tibet. Indian historian Abu'l-Fadl Allami (1551-1602) noted that Kashmir had been flourishing during the governing of Mirza Haidar. State affairs and wars did not interfere with Mirza Haidar's scientific and literary work. Persian historians also thought highly of him, for instance, Amin ibn Akhmad Razi, author of the turn of the 17-18<sup>th</sup> centuries, said, "Good deeds came into the world from him, he had many great gifts: his writing was neat, style clear, verse refined. He was exceptionally brave and courageous, a skillful commander... he went through Kashgar to Tibet, entered Kashmir and planted down a standard of his rule there. Next time he invaded this vilayet through the Hind road and ruled the country for almost seven years... His "Tarikh-i Rashidi" written for Rashid Khan, the ruler of Kashgar, is well-known".

In Kashmir he wrote his famous work on the Kazakhs and nomadic Uzbeks in New Persian language (Farsi) "Tarikh-i Rashidi", where for the first time the causes of the Uzbek ulus' fall and emergence of the Kazakh khanate were mentioned together with the information on the first Kazakh khans Giray and Jani Beg, on the relations between the Kazakhs and the Moguls, Kyrgyzs, Uzbeks. Mirza Haidar's work includes rich in facts and unique material on the history of the abovementioned Turkic peoples, as well as the Tibetans, Kafirs and Kashmirs. Such are, for instance his descriptions of the manners and customs of people of Kafirstan in Afghanistan and Small Tibet and also the story of the Kyrgyz's in Tien Shan, which was of great ethnogenetic significance and resulted in a great number of research works. Eight chapters are dedicated to Kashmir, where the capital city of the area, the city of Srinagar, is described together with its multistory buildings, architecture, ceremonial arches, the art of local masters, abundance of fruit and vegetables. The story of the Kashmirs adopting Islam is given in detail. Mirza Haidar is surprised by the fact that once Kashmir had been ruled by a woman charmed by dervish Sultan Shamsuddin, who became her husband and the ruler of the territory and converted the Kashmirs to Islam. Poetry was also not alien to Mirza Haidar: he was fluent in writing in Chagatai and Farsi, had a poetical pen name "Aiaz". In our day a collection of his poems in Chagatai was found. Mirza Haidar came to the end of his life's journey in Kashmir, where he was killed by conspirators, and the tomb with his ashes is still there.<sup>7</sup>

A famous character of Central Asia history Muhammad Shaybani Khan was a descendant of Muhammad Shaybani Khan, the grandson of Genghis Khan. He lost his father at the early age and was brought up at the

court of his strict grandfather Abu'l-Khayr Khan, who had been ruling the Uzbek ulus for 40 years since 1428. When the latter died in 1468 and his branch of Genghisid dynasty lost power in the Steppe under the pressure of Kazakh khans Giray and Jani Beg from the youngest branch of Genghisid descendants, the sixteen-year-old prince had to run for his life. Ill fate made him wander around Kazakh steppes. Once he tried to settle in some fortress on Syr Darya, then he held the line in sieged Hadgi-Tarkhan (Astrakhan)... The character of Muhammad Shaybani grew stronger during long difficult challenges, fights and roams. He was really a “high-flying falcon”, as court historiographers later wrote about him. Reckless and cold-blooded, able to fight a battle for day and night together with a hundred of loyal dzhigits and conquer the more numerous enemy, Muhammad Shaybani was also a talented politician who did not lose self-control even in the worst situations.

Although almost his whole life was spent in the saddle, in marches and battles, this nomadic leader turned out to be surprisingly perceptive of book learning and poetry and dedicated two years of his life in Bukhara to studying the basics of Islam and intricacy of science, he discovered his literary talent and began writing poetry. During march rest (and sometimes on his way) he often started hot discussions of religious and scientific issues. His love to learning and poetry remained till the end of his life, and a book, a collection of poems or a poem, had always been the best present for him. The crown of Muhammad Shaybani's own work was “Divine Sea” written in Chagatai language. “Eskandar-nameh”, the “Book of Alexander”, an Osman manuscript of which was given to him as a gift in Bukhara, had a great spiritual influence on him. Final verses of this book became Muhammad Shaybani's motto for the rest of his life and inspired him to conquer the state of Timur himself. The pages of the presented book encouraged his activity and said there were no obstacles for a determined and strong-willed person. This severe warrior was also capable of tender feelings. A poetical work “Fath-nameh” by Shadi, the author of that time, tells us about the romantic side of our hero's life, about his love to Nogai ruler Musa's daughter, who he exchanged tender letters with and even raided the Nogai Horde to force Musa to let his “moon-faced, fascinating” daughter marry him. You can still see the Nogai princess getting messages from the Uzbek prince on the miniatures of Herat school. Muhammad Shaybani Khan patronised men of science, literature and art, among which were natives of Khurasan and Iran – Muhammad Salikh, Kamal-ad-Din Binai, Vasifi, Ibn-Ruzbikhan, who started working for him and favoured the creation of significant historical literature.

The lands from the Caspian in the west to Tien Shan in the east and from Syr Darya in the north to central Afghanistan in the south found themselves under the rule of nomadic uzbeks of Muhammad Shaybani Khan. Khan divided this territory into jurts-domains and gave each of them to a certain uzbek tribe headed by his emir. New rulers were interested in the jurts being properly run and peasants regularly paying taxes. In order to strengthen his young state, Muhammad Shaybani Khan carried out a monetary reform. He clearly defined the weight, size and shape of silver and copper coins, obliged to accept them for payment by the same cost in all cities and areas and forbade emirs to interfere with financial matters.

Missing his lost native country, where he had been banished from, he was driven to return to his native steppes and begin fighting Kazakh khans once again. Several years of tiresome battles did not bring Muhammad Shaybani victory and he had to bitterly admit that he was not able to conquer the Land of the Fathers. So he changed the line of his attack and conquered the remains of Timur's state – Bukhara, Samarkand, Khorezm and Khurasan – and banished his descendants to other countries. Central Asia was at his feet, and here Muhammad Shaybani found his new motherland. The price for that was slackening of his positions in the Kazakh steppe. Although Shaybani Khan himself was gradually losing interest to the native land of his ancestors, his enemies, Kazakh steppe khans craving for Central Asian treasures did not leave him alone. As an answer to the ultimatum of Kazakh khans who demanded Central Asian goods and supported their demand with acts of war, Muhammad Shaybani declared jihad, a holy war, and invaded Kazakh steppes four times. But Muhammad Shaybani Khan, “a lucky lion”, “the father of victory”, did not “drain the cup of death” from his tribesmen, Kazakh Genghisids and former congeners. Trouble came from the south, from the shah of Persian Empire Ismail I, the dynast of Turkic Safavids dynasty, fighting who near the city of Merva (now Mara) in 1510 Muhammad Shaybani, a well-known exile of Kazakh steppe, was killed. Evaluating the role of Shaybani Khan in the history one should not agree with his words, “We have neither a camp, nor a shelter, neither a place, nor fame. We are like the wind, blowing above the mountains, plains and winds...”<sup>78</sup>. And although his acts may be viewed differently, it is clear that Muhammad Shaybani has a rightful place in history and culture of Central Asia. “It is better to be the last in your native land than a sultan in a foreign land”, says a Kazakh proverb. It was unacceptable for such an outstanding person like Muhammad Shaybani, so he chose differently...

Among the descendants of Shaybani was the next historian on the throne Abu al-Ghazi Bahadur Khan. He was born in the capital city of his royal father, Khivin Khan Arab-Muhammad, Urgench, on the 12<sup>th</sup> August

of 1603. His path to the Khivin throne was thorny and also disputed by his three brothers - Isfandiari, Ilbars and Khabash. That said, the last two killed their father Arab-Muhammad Khan and were later killed by Isfandiari who became the khan of the whole Khorezm in 1623, when Abu al-Ghazi, who had escaped to Kyat and then to Bukhara, returned to his native land. But in 1625 he escaped again trying to run for his life from his crowned brother – first to a Kazakh khan Ishim (Esim) to Turkestan, where he spent about three months and then two years in Tashkent where he stayed with his ruler, Kazakh sultan Tursun-Muhammad. However, in 1629 due to his disloyalty and intrigues Isfandiari was sent as amanat (hostage) to a Persian shah Seifi Safavid who, contrary to what the sender had expected, treated the young prince with favour, gave him a house in Isfahan, the capital of Persia, and financial support. Abu al-Ghazi spent ten years in Persia and then fled. In 1643, after the death of khan Isfandiari, Aral uzbeks declared Abu al-Ghazi Khivin khan, but only in the spring of 1645 he became a sovereign governor of the whole Khorezm.

Being the khan of Khivin chanate, Abu al-Ghazi wrote two important historical works in Central Asian Turki – “*Shajarayi tarokima*” (“Genealogy of the Turkmen”) and “*Shajarayi turk*” (“Family tree of Turkic peoples”). “Genealogy of the Turkmen” was written in 1660-1661 when Abu al-Ghazi had established order in the state and could devote his life to scientific writing. According to academician V.V. Bartold, this historical work is a special research of the Turkmen and there is no research of this kind on any other Turkic peoples. It was translated into Russian by academician A.N. Kononov and published in 1958. In 1663 Abu al-Ghazi had practically trusted his son Anush with the reins of government and thought of writing the story of his dynasty and started to do it himself. Here is what the author himself said: “Since our ancestors and elder relatives did not patronize any branches of science and since the people of Khorezm are unlearned... no historical works on our family had been written... I thought of giving someone the task of writing such work. But I have not found a capable person and out of necessity I wrote the chronicles of my dynasty myself following the Turkic proverb: “An orphan is born himself”... Having planned this story, I thought of giving a detailed account of genealogy of noble governors and wise Mongolian and Uzbek beys; describe all their deeds; pass their words and thus write a large work. But when I was going to carry out what I had had in mind, I fell ill. My illness continued for a long time, and I thought, “If I die the book will be left unwritten. There is no other man like me who knows this topic and especially the history of our family from Yadgar Khan to insignificant me... Nobody knows about that. If I take this knowledge with me to my grave, what

is the use of it?”. Having thought so, I found four scribes and started dictating the events from the times of Adam to Jochi Khan, sometimes looking into ancient historical works and sometimes not, since I knew all those events by heart. (When retelling historical events) from Shaybani Khan to my time I never looked into any books, but told what I remembered. But since I easily got tired due to my illness and I dictated when sitting or lying down, I shortened the stories. They are short, but their significance is immense”.

Important events of the history of Central Asia are reflected in Abu al-Ghazi’s work, when in the spring of 1633-1634 from the east, from Dzungaria there came an army of Mongolian-speaking Oirats (“Kalmyks” or “Kalmaks” in Turkic. – Auth.) and made a mess among the population on the right bank of Amu Darya. It was the first raid of Oirats to Khorezm. At that time the ruler of Khiva Arab-Muhammad Khan started chasing the Oirats and took their captives and trophies. And 30 years before that, in 1603, he won three battles with Russian Yaitsk Cossacks with ataman Nechay in charge, 500 warriors in total, who previously had managed to conquer and plunder Urgench when Arab-Muhammad was in a march. But Cossacks did not need the trophies and only few of them were lucky enough to come back home, others were killed in fights together with their ataman. After they had stepped away from Urgench, 100 Cossacks that were left fought their last battle on the banks of Amu Darya where they constructed wooden defences and fought till the end for 15 days.

Abu al-Ghazi’s illness turned out to be serious and in he died in March 1664. By the order of Anush Khan, his son and heir to Khivin throne, the work was finished by a certain Mahmud, a son of Urgench mullah.<sup>9</sup>

As the abovementioned shows, Muslim governors were capable of self-sacrifice not only on the battlefield and in their rule of the state, but also in the name of science and Abu al-Ghazi Khan is a graphic and worthy example of that.

Of course, all of them - Muhammad Taraghay Ulugh Beg, Baisunkur Mirza, Zahir-ud-Din Muhammad Babur, Alisher Navoi, Mirza Haidar Dughlat, Muhammad Shaybani and Abu al-Ghazi Khan – were the people of their time and despite the fact that they were ahead of their time they still shared many of its delusions. There is no need to idealise the image of any of them as governors. Their activity hardly corresponded to the postulates of holy Muslim books: “Al-adl asas al-hukm” – “Justice is the source of government”. It is likely that they, like Timur, followed the Persian motto “Rasti va rusti” – “Justice and power”. To keep their life and throne, most mediæval governors of both East and West removed their enemies physically. And none of our heroes was, unfortunately, an exception to this rule, which

is proved by decades of governing of each of them. In almost all mediaeval states separation of power and the wish to seize it was achieved through death of many people. And the fate and death of our heroes, especially Ulugh Beg, Mirza Haidar, Muhammad Shaybani and Abu al-Ghazi confirm that.

A combination of governor, statesman and scientist in one person is rather rare in history. This unites in the first place such different people as Muhammad Taraghay Ulugh Beg, Baisunkur Mirza, Zahir-ud-Din Muhammad Babur, Alisher Navoi, Mirza Haidar Dughlat, Muhammad Shaybani and Abu al-Ghazi Khan, despite the fact that some of them were related. This crowned heads pursued science because of their creative impulses, they took their kalams due to their personal inclinations and natural gifts in order to "show people their talent and art". They were independent from other's will and their works were usually free implementations of the author's ideas. And although their state activities, as in case of Ulugh Beg, for instance, was not equal to their achievements in science which had really immortalised their names, one should still remember that the high position of governor, of the first person in the country, significantly favoured the development of scientific thought, the flourishing of art and knowledge and moral values thanks to the patronage of the state, which was headed by our heroes, taking into account that in the mediaeval Muslim East the main figure of all the participants of historic process was the governor and, accordingly, history was considered as a the stage of activity only for governors and their high officials, although their scientific and governing deeds were also understood as the will of Allah the Almighty.

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**QUALITY OF LIFE AS A FACTOR DETERMINING THE  
MANIFESTATION OF PSYCHOLOGICAL TRAPS IN PATIENTS WITH  
TUMORS OF CHIASMATIC-SELLAR REGION**

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**Abstract.** Changes in the main structural components of health-related quality of life reflect the features of social adaptation of patients with tumors of the chiasmatic-sellar region. Successful social adaptation is the ultimate goal of the treatment and rehabilitation process. In a situation where a person inadequately perceives, interprets and evaluates information coming from the outside about his state of health, the likelihood of unreasonable decisions that can lead to negative delayed consequences increases. Based on the study of the quality of life, the nature of interaction and the degree of influence of socio-demographic parameters, the main types of psychological traps in patients with tumors of the chiasmatic-sellar area in the preoperative, early and late postoperative periods were determined.

**Keywords:** quality of life, psychological trap, tumors of the chiasmatic-sellar region.

Early diagnosis of disorders arising in tumors of the chiasmatic-sellar region, affecting the visual pathways, is an urgent problem not only for neurosurgeons and ophthalmologists, but also for psychologists, as well as specialists working with personnel. The degree of dysfunction of the visual structures determines the quality of life of patients, determines the appeal for medical care, as well as the ability to take adequate measures in a timely manner to correct these disorders [4]. An important aspect of this problem, along with early detection of a brain neoplasm and a successful operation, is the quality of life of patients in the early and late postoperative period. Changes in the quality of life reflect the degree of social adaptation of patients, which is the ultimate goal of the therapeutic rehabilitation process [1,2,4].

Decrease or loss of vision, both functionally and psychologically, is a traumatic factor [1]. Being in a stressful situation, a person becomes overly involved in a situation of illness: he experiences anxiety associated with a sharp change in the style and quality of life. In an effort to get out of the situation of cognitive dissonance, patients deliberately or unconsciously fall into their own psychological traps, i.e. situations in which a person does not adequately perceive, interpret and evaluate information coming from the outside, as a result of which he makes unreasonable decisions, acting in an erroneous way, which, as a rule, leads to negative results [3]. In most cases, when analyzing the formation of psychological traps, more attention is paid to the study of the influence of the information factor; however, insufficient attention was paid to the consideration of the quality of life as a factor that determines the manifestation of psychological traps in conditions of illness with a progressive deterioration in the quality of life.

The purpose of the work - is to determine the main types of psychological traps in patients with tumors of the chiasmatic-sellar region on the basis of studying the quality of life, determining the nature of interaction and the degree of influence of socio-demographic parameters.

### **Material and methods**

The specificity of the problem posed led to an interdisciplinary approach to research methodology, integrating different aspects of scientific knowledge: psychological, sociological, medical, economic (marketing).

As a basic sociological method, we used the methods of the version of the WHO QOL 100 questionnaire and the Short Form health questionnaire (SF36, Medical Outcomes Study (MOS)), we have developed a method that allows us to determine the patient's subjective perception of the conditions and quality of his life (in the preoperative period and after surgery), as well as to identify the main information factors that determine the patient's attitude to the disease and determine the manifestation/ formation of psychological traps. When processing the data obtained, a level gradation was applied for each criterion in accordance with the recommended assessment of the basic questionnaires. So, the low level corresponds to the point corridor -1.0 - 1.49, the average - 1.5 - 2.49; high - 2.5-3 (with a value of 1 point - the minimum severity, 3 - the maximum level).

The study took into account the patient's socio-demographic data (gender, age, education, employment, territory and region of residence). Mathematical and statistical data processing was carried out using the software packages STATISTICA 10.0 (StatSoft. Inc. 1984-2011) and Microsoft Office 2007 (Excel, Word). The significance of the difference was assessed using the parametric Student's t-test for a confidence level of  $p = 0.95$ ,

Fisher's test and Pearson's  $\chi^2$  test. The difference between the sample indicators was considered statistically significant if the probability was less than 0.05 ( $p < 0.05$ ).

The research being conducted was longitudinal and covered the period from 2013 to 2019, i.e., it took from 1 to 5 years from the moment of the operation, which made it possible to determine the dynamics of changes in the quality of life of patients in the preoperative, early and late postoperative period, as well as to correlate the data obtained with the clinical indicators of the indicated time. The study involved 253 patients (100%) with primary tumors of the chiasmatic - sellar region (pituitary adenomas - 201 (79.4%), meningioma of the sella turcica - 30 (11.9%), craniopharyngiomas - 22 (8.7 %)). The gender composition of the observed - 91 (35.9%) men, 162 (64.03%) women. The age group is from 18 to 57 years old, the average age is  $42.67 \pm 1.3$  years - before surgery,  $53.81 \pm 1.57$  years - in the long-term postoperative period). Research base: MAHCI "City Clinical Hospital №40" in Yekaterinburg, I neurosurgical department.

The study was organized in accordance with a certain logical sequence: 1) studying the patient's quality of life and clinical manifestations of the disease in the preoperative period, identifying the prevailing psychological traps; 2) study of the quality of life, types of psychological traps and clinical changes occurring in the postoperative period.

### Results

At the beginning of the study of the quality of life of patients in the preoperative period, special attention was paid to the study of medical care seeking. It was found that the average period from the onset of the disease to the diagnosis is  $10.21 \pm 0.7$  months. With the help of correlation analysis, the factors influencing the temporal aspect of seeking medical care were identified:

a) gender (correlation coefficient 0.54) - despite the fact that women predominated among the subjects, men had earlier detection of the disease (men -  $32.06 \pm 1.45$  years (before surgery) and  $39.09 \pm 1.74$  years (in the late postoperative period); in women -  $44.08 \pm 2.96$  years (before surgery) and  $53.65 \pm 1.66$  years (in the long-term postoperative period));

b) age (correlation coefficient 0.21) - in the period of adulthood, a person is dominated by an orientation towards meeting social needs associated with recognition, well-being, independence, self-reliance. Therefore, people of mature age are ambivalent about making a diagnosis. On the one hand, they fear the diagnosis as a sentence of the impossibility of satisfying urgent needs, on the other hand, the diagnosis acts as an opportunity for recovery. In a state of uncertainty, a person tends to explain

his behavior or health state by external factors (lack of sleep, long work at the computer, etc.), thereby postponing visits to the doctor for an indefinite time horizon;

c) territory and region of residence (correlation coefficient 0.67) - among patients 160 (63.24%) people lived in regional centers, district centers 55 (21.73%); 38 (15.02%) - in rural areas. 70 (27.67%) patients noted the low availability of medical care, which leads to a delay in establishing a diagnosis and starting treatment;

d) general information activity (correlation coefficient 0.44) - information activity is higher in patients living in cities. As the main sources of information about the disease, patients noted Internet sources (popular science sites, forums - 42%), television programs (27%), periodicals (newspapers, magazines - 10%), information by "word of mouth"- acquaintances, relatives (16%) and others (5%).

Differences were revealed in the definition of opinion leaders by patients (people whose opinion is trusted, whose opinion is perceived as an expert) regarding the treatment and prognosis of their disease. For the majority of rural residents (37 patients (98%)), the doctor of the regional center hospital is an indisputable expert, at the same time, for patients living in regional centers, the doctor's opinion is authoritative if there is information about work experience and competence (102 patients (63.75%)), positive reviews on review sites (ProDoctorov.ru, ekb.medportal.net, u-doktora.ru, etc.) (28 respondents (17.5%)) and based on the impression of the consultation (51 people (31.8%)). The amount exceeds 100%, since one interviewee could give several answers. In addition to the environmental factor, the gender aspect influences the choice of the opinion leader: 76 men (83.51%) consider the doctor's opinion a priority, 109 women (67.28%) are guided, first of all, by the opinion of their close ones/ relatives.

As a result of statistical analysis, the average time from the onset of the disease to surgery was determined as  $-1.27 \pm 0.33$  years ( $1.03 \pm 0.84$  years in men;  $2.26 \pm 0.43$  years in women). The factors that determine this period are: duration of treatment (0.541), dynamics of clinical changes (0.461), dynamics of functional changes (0.580), patient's subjective reasons: distrust (0.274), fear of an unfavorable outcome of the operation (0.268), life/ family circumstances (0.390), inadequate assessment of health status (0.384), existing experience/ repetition of a similar disease situation in relatives/ acquaintances (0.224), type of surgical access (0.260) (the patient assesses the risk from surgery, correlating it with possible treatment options). As a result of the patient's disagreement with surgery, the development of the disease progresses, and after surgery, the duration of

the disease affects the process and result of recovery.

Having analyzed the features of behavior, the explanation by the patients of the reasons for their behavior, the sources of information, as well as the dominant emotional state, we identified the psychological traps of the preoperative period:

- the trap of primitive automatism - patients' decision-making is based on one isolated element of information that is given excessive importance (for example, in the process of interacting with a doctor, excessive attention is paid not to the information component, but to non-verbal means of communication (posture, facial expressions, etc.)).
- avoidance trap - a person does not pay attention to the symptoms of the disease, trying to avoid negative information about his health.
- catastrophic trap - the patient exaggerates the consequences of an imaginary danger (death during the operation, the degree of probability of an unfavorable prognosis).
- the trap of underestimating the severity of the situation.

As a result of the study, differences were revealed in the average indicators of quality of life in the preoperative ( $t = 2.779$  and  $p = 0.0102$ ), early and late postoperative periods ( $t = 4.234$  and  $p = 0.0002$ ). During the indicated periods, changes in the parameters of the quality of life were noted depending on the time elapsed since the moment of the surgical intervention.

The quality of life in the early and late operational periods has its own characteristics. So, in the early period, 222 people (87.75%) are more satisfied with the quality of life, 93 (36.76%) are partially satisfied, and 24 (9.48%) are less satisfied. Significant decrease in working capacity ( $\mu-1.07$ ), physical activity ( $\mu-1.53$ ), low exercise tolerance ( $\mu-1.18$ ), high dependence on drugs and necessary treatment ( $\mu-1.94$ ), and inconsistency of postoperative ophthalmic changes with the expected result (patient position) ( $\mu-2.46$ ) are the main reasons for the effect of disappointed expectations, which leads to dissatisfaction with the quality of life.

In the long-term postoperative period, the following indicators influence the assessment of satisfaction with the quality of life to a greater extent: a decrease in the severity of headache, an improvement in visual functions, a decrease in drug dependence, an increase in working capacity and an improvement in the emotional state. 160 patients (63.24%) were completely satisfied with the quality of life in the postoperative period, to a greater extent - 76 people (30.03%), partially satisfied - 54 (21.34%), less satisfied - 5 (1.97%), dissatisfied - 2 (0.8%).

Dissatisfaction with the quality of life in the postoperative period in

women is associated with the ability to perform everyday activities (0.53), exercise tolerance (0.32), caring for family members (0.38), lower income (0.24), in men - a decrease in the level of income (0.327), self-service (0.319), a decrease in social contacts (0.356). The differences in the reasons for dissatisfaction are explained by the fact that women are more actively involved in housekeeping.

Based on the correlation analysis, we identified the most significant factors affecting the course of the postoperative recovery process: gender (0.238), age (0.305), employment (0.461), marital status (0.342), number of children (0.215) and territory of residence (0.592).

The assessment of the success of the recovery process is formed by the patient in accordance with the subjective image of the ideal quality of life. The main psychological traps of this period are:

- trap of the positive past - person constantly recalls the period of life before the onset of symptoms of the disease, experiences depression from the discrepancy between the past and the present lifestyle.

- trap of unfulfilled expectations - an unreasonably high assessment of one's own capabilities and overly optimistic expectations regarding the recovery period (unrealistically short recovery period, a quick return to the profession, etc.);

- negative forecasting trap - the patient constantly expects troubles that have not yet occurred, but with a certain degree of probability can occur (expectation of a relapse of the disease).

- the trap of exaggeration - immersion in negative experiences (constant fixation on painful sensations, exaggeration of one's own helplessness).

- victim trap - the patient constantly complains about life, health, telling the story of his illness, forcing others to show understanding and compassion towards him. By taking the position of a victim, a person avoids additional stress, while at the same time evoking sympathy and support from others.

- comparison trap - comparing their state of health with the stories of other patients, the person feels unhappy that in his mind the result could be better.

- the trap of agreements - the patient interprets the recovery prognosis from the perspective of selective perception ("hears only what he wants to hear").

### **Conclusion**

Thus, we have traced the positive dynamics of the indicators of the quality of life of patients who underwent surgery for tumors of the chiasmatic-sellar region. Changes in psychological traps were traced depending

on the dynamics of the postoperative state, socio-demographic factors and social and labor activity, and also groups of factors influencing the course of the postoperative recovery process were identified.

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## FEATURES OF AGGRESSIVE BEHAVIOR OF UNIVERSITY STUDENTS

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Currently, the world has recorded an increase in aggressive trends among young people. In these conditions, the analysis of the aggressive behavior of students as the most active part of society becomes especially relevant. The article describes the method of researching aggression Buss - Durkee Hostility Inventory, BDHI. Comparison of the levels of different forms of aggression among students in different areas of education (lawyers, economists, psychologists) showed significant differences. A gender analysis of student aggression was conducted. It was found that the index of aggression and the hostility index of male law students are higher than students of other areas of education are. Female law students have significantly lower levels of aggression than male law students. Aggression of female law students fits into the framework of the permissible norm, but slightly higher than that of female students of other areas of education. Male law students showed an increased level of physical and verbal aggression against the background of irritability and resentment. Indirect aggression for male student lawyers was not high due to the fact that it is not relevant for these students, since this is latent aggression. In addition, male law students usually expressed their aggression openly.

**Keywords:** Physical aggression (assault), Indirect aggression, Verbal aggression, Aggression index, Hostility index, Negativism, Guilt, Irritation, Resentment.

### Introduction

Conceptual issues "What is aggression?" The term aggression comes from the Latin word *aggressio*, meaning attack. The first known use dates back to 1611, in sense of an unprovoked attack. A psychological sense of «hostile or destructive behavior» dates back to a 1912 English translation of Sigmund Freud's writing. According to the views of the Austrian psychi-

atrist, the founder of the psychoanalytic direction in psychology of Sigmund Freud, the tendency to aggression and aggressive forms of behavior is the initial instinctive predisposition of each person as a representative of a specific biological species of living beings (Freud) [8]. Therefore, some scientists consider aggression a natural form of a person's reaction to stress, disappointment with his needs (relevant now). Aggression causes a number of different negative emotional states, such as hostility, hatred, anger, bitterness, etc.

According to Berkowitz [3], aggression refers to goal-directed motor behavior that has a deliberate intent to harm or injure another object or person. Bandura [1,2], on the other hand, did not conceptualize aggression to include intentions, but instead considered aggression as harmful behavior that violates social norms. Buss [6] defined verbal and physical aggression as the motor components of behavior that involve hurting or harming others. Even within the field of psychiatry, there is no generally accepted definition of aggression. For example, the DSM-IV-TR (American Psychiatric Association, 2000) mentions aggression in regard to features of intermittent explosive disorder, but states that aggressive behavior can occur with other mental disorders, and it does not give a specific definition of aggression. Aggression is a destructive form of behavior (Fromm) [9]. Aggression is in confrontation with generally accepted norms and rules in society, and also brings physical harm to a person or creates psychological discomfort for his personality. Moreover, aggression finds its manifestation both in real action, and in fantasies and intentions. When the manifestation of aggression occurs as a situational reaction of a person, it is customary to call this behavior not aggression, but aggressive actions. If such reactions repeat periodically, then this behavior is aggressive.

There is currently an unprecedented increase in aggression among adolescents and youth around the world. Scenes of violence and cruelty are posted on the Internet, and then young people discuss them with interest. In recent years, there has been an increase in crime among adolescents and young people, an increase in crimes involving grievous bodily harm, and violent acts that entailed the death of a person. Aggression is one of the most acute social problems of modern society. Among the main signs of aggressive behavior, it is customary to distinguish the following:

- A tendency to dominate other people;
- The use of other people according to their goals and desires;
- A tendency to destruction;
- Damage to surrounding people, living things and things;
- A tendency to manifest violence and cruelty.

The reasons for aggressive behavior lie both in the characteristics of the personality itself and in the influence of the surrounding society. In this regard, aggressive behavior is often defined as an ambivalent phenomenon: on the one hand, as a negative manifestation of a person, and on the other hand, as an adaptive function of a person aimed at adapting a person to living conditions.

In the scientific works, there is an opinion that reasonable aggressiveness is a necessity for the harmonious development of personality and a condition for its successful social adaptation. Reasonable aggressiveness of a person helps to overcome obstacles in his life's path, contributes to the formation of perseverance, initiative and leadership, develops the ability to uphold his ideals and fight for them. Foreign psychologists argue that a person's lack of a certain level of aggressiveness can lead to passivity and conformity of his behavior, and as a result to a decrease in his social status and position in society.

It should be noted that all people have aggression, but each person has a different level and certain characteristics. The strength of the aggressive reactions, their frequency, orientation and duration depends on many different reasons. Therefore, in each case, the analysis of aggression requires taking into account the influence on a person of physiological, psychological, social and situational factors (Lorenz) [4]. However, despite the presence of psychological, physiological social factors, the main causes and conditions for the manifestation of aggression are conflicts (interpersonal or intrapersonal, conscious or unconscious). Thus, any manifestation of aggression is the result of a person's dissatisfaction with the surrounding reality, his level of life, dissatisfaction with other people or himself (Blackburn, Savina) [7, 5].

### **Purpose of the study**

The growth of aggressive trends among young people reflects one of the most acute problems of our society: youth crime, an increase in the number of crimes against a person with particular cruelty. The purpose of this research study was to study the aggressive behavior of university students, to determine the types of aggression among students of different genders, to compare the level of aggression of law students and students of other faculties. Based on long-term observations of the behavior of law students, students of economics and students of psychology, a research hypothesis has arisen: law students have a higher level of aggression than students of other faculties. The study was conducted based on three Russian universities in three stages: 2010, 2013, and 2017. Students were 18-19 years old. In total, 155 students of different years took part in the study.

### Method

The Buss-Durkee Hostility Inventory is a widely employed multidimensional measure of aggression. To study aggressiveness among university students, the Buss-Durkee method (Buss - Durkee Hostility Inventory, BDHI) was chosen. A major reason for its popularity is the division of the inventory into seven scales: Physical Aggression (Assault), Indirect Aggression, Irritability, Negativism, Resentment, Suspicion, and Verbal Aggression. Researchers can therefore discover not only how aggressive a person is but also how the aggression is manifested. Aggression is intentional and targeted harm, including along with bodily harm and psychological discomfort. A. Buss defines aggression as «any reaction that brings harmful stimuli to another organism» [6].

Using the Buss - Durkee Hostility Inventory, we can identify certain categories of students whose aggression has various forms and quantitative indicators. Along with this, this Inventory allows us to obtain information about the intentions of students and describe the structure of motives of the student's personality. This Inventory is a questionnaire that consists of 75 statements. The test person writes «yes» if he agrees with the statement, or writes «no» if he does not agree with the statement. Here are examples of statements from this questionnaire:

«Once in a while I cannot control my urge to harm others»; «When I am mad, I sometimes slam doors»; «I don't know any people that I downright hate»; «When I really lose my temper, I am capable of slapping»; «When I do wrong, my conscience punishes me»; «I sometimes show my anger by banging on the table».

This questionnaire is one of the most frequently used instruments by psychologists to study aggression, a reliable verbal method for studying it. In Russia, A. Khvan A. Zaitsev, Yu. Kuznetsova adapted the Inventory in 2005.

When A. Buss and A. Darkee created their questionnaire, they solved the difficult task of identifying all forms of aggressive reactions. Since Buss supported the hypothesis of the influence of frustration on aggression, he proposed to distinguish two reactions: a reaction manifested in active actions («true aggression»), and a reaction manifested in a negative, distrustful attitude towards others («hostility»).

When A. Buss and A. Darkee were creating the questionnaire, they followed two conditions: 1) the question concerns only one form of aggression; 2) the wording of the question should minimize the influence of public opinion on the human reaction in the proposed situation.

Последнее условие было достигнуто следующим образом:

The last condition was achieved as follows:

Firstly, the content of the answer contains the assumption that a condition unapproved by society has already arrived (suppose a loss of self-control). This is only a statement of fact that leads away from an understanding of the reasons, such as in the statement «When people yell at me, I yell back».

Secondly, the statements were made so that there was an opportunity to justify aggressive behavior in the proposed situation, for example, «If I have to resort to physical violence to defend my rights, I will».

Thirdly, the use of habitual conversational phrases, clichés that people use to describe their internal mental state or behavior.

Inventory reveals the following forms of behavioral responses.

**Physical aggression** (assault) is the use of physical violence against another person.

**Indirect aggression** is mediated aggression using gossip, slander, ridicule, sarcasm, evil jokes that are directed at another person. This kind of aggression may not have a real object. Indirect aggression is expressed in screaming, the desire to stomp your feet, beat your fists on the table, beat dishes, slam the door.

**Irritation** is a readiness for the manifestation of temper, hotness, harshness, rudeness with minimal irritants.

**Negativism** is opposition behavior directed against recognized authorities or leaders. This expression of rejection can be volatile: from passive resistance to protest behavior.

**Resentment** is a feeling of bitterness, followed by hatred and anger at the whole world for suffering, sometimes imaginary.

**Suspicion** is distrust and excessive caution in relation to other people, prejudice in the intention of people to harm.

**Verbal aggression** is the expression of negative emotions in words in a conversation, quarrel, and showdown. This is an expression of threats, curses, and wishes of misfortunes, illnesses and troubles.

**Guilt** - remorse, the depth of the subject's conviction that he is a bad person who commits wrong things. Answers to questions on this scale express the deterrent effect of guilt on antisocial behavior, i.e. such behavior that is condemned by society.

Physical aggression, indirect aggression, irritability, and verbal aggression together form the total aggression index, and resentment and suspicion form the total hostility index. Aggression and hostility are different concepts. Arnold Buss [6] argued that hostility is a narrower state, since it always has a specific object. It often happens that people are in hostile relations, but do not show any aggression.

The proven norm of aggression is its index value, equal to  $21 \pm 4$ , and the norm of hostility is the index value  $- 6.5-7 \pm 3$ . This means that the norm of the index of aggression is in the range from 17 to 25, and the norm of the index of hostility is in the range from 3.5 to 10. The possibility of reaching a certain value indicating the level of manifestation of aggression is indicated. For all types of scales, the level of manifestation of the behavioral reaction is determined: low level from 0 to 3, average norm from 4 to 5, high level from 6 to 7 and above. Negativism is highlighted separately: low level from 0 to 1, average norm from 2 to 3, high level from 4 to 5.

**Results**

We expected gender difference (men aggress more intensely than women) and that male targets receive more intense aggression than do female targets. These two gender differences were especially evident in the aggression that can occur after harm has been done. When men aggressed against men, there was no diminution in aggression intensity after they had previously harmed a target; in the women aggression level dropped.

The study involved 78 law students and 77 students of other educational fields (economists and psychologists). The sample consisted of 86 female and 69 male people aged 18 to 20 years. A total of 155 people were examined.

All students were divided into two groups: law students and non-law students. In each group, the average values of all forms of behavioral reactions, which are reflected in the scales of aggression, were determined.

The results obtained for all groups of students are presented in the table.

**Table 1. The results of the study of various forms of aggression**

Forms of behavioral reactions	Law students		Students of other areas of education (economists, psychologists)	
	male	female	male	female
Physical aggression	7,5	5,3	6,0	4,9
Indirect aggression	5,3	5,4	5,2	5,3
Irritability	6,0	5,2	5,3	5,0
Negativism	4,8	4,1	3,8	3,5
Resentment	4,9	4,9	4,6	4,5
Suspicion	5,5	5,2	4,9	5,2
Verbal aggression	7,8	6,9	6,2	6,4
Guilt	4,9	5,5	5,1	5,5
Aggression Index	26,6	22,8	22,7	21,6
Hostility index	10,4	10,1	9,5	9,7

As can be seen from the table, the index of aggression in male law students is 26.6, which exceeds the norm (the norm is 17 - 25 points), and the index of aggression in female students is 22.8, this indicator fits into the norm. Compared to male students of other areas of education (not lawyers), the expression of physical aggression among law students is 1.5 points higher (7.5 versus 6.0). Male law students demonstrate their aggression primarily in the form of physical and verbal aggression, thus splashing out their irritability and undercurrent of resentment. All three forms of aggressive behavior significantly exceed the acceptable level of the norm. However, the level of indirect aggression is lower among male student lawyers than among female student lawyers. It almost does not differ from the level of indirect aggression among non-law students (both women and men). There is an explanation for this: the expression of physical and verbal aggression occurs in an open way and does not require indirect forms: gossip, slander, etc. It should be noted that indirect aggression practically does not differ in both groups; therefore, we can talk about the indicator 5.2 - 5.4 as an average level for all students, regardless of gender differences and differences in areas of education.

Objectively, negativism manifests itself among students of lawyers much more than among students of other areas of education (among male law students, 4.8, among other male students, 3.8; among female lawyers, 4.1, and among other women students - 3.5). Negativism is oppositional behavior that can develop into active forms of struggle against established laws and customs. The manifestation of negativism can be a real obstacle for future lawyers in their professional activities. This is further exacerbated by the fact that law students experience less guilty feelings of remorse for behavior that is not approved by society than other students of non-legal specialties.

Resentment among male law students and female law students was the same (4.9), but significantly higher than in the group of non-law students.

Perhaps their emotional experiences and sufferings in the previous period of life gave rise not only to resentment, but also suspicion, which is objectively higher in male law students than in other students (5.5 vs. 4.9), and in female students the level of resentment is the same in both groups - 5.2. In total, resentment and suspicion form an index of hostility, and it is objectively higher among male law students than other students. It should be noted that among students of other areas of education, the hostility index tends to the upper limit of the norm: 9.5 for male students and 9.7 for female students (norm from 3.5 to 10).

Based on the results, the following statements were made:

1). All university students, regardless of gender and chosen specialty of education, tend to manifest aggressive behavior in different forms. This fact indicates a dysfunctional state of society.

2). The results of the study confirmed the initial hypothesis of an increased level of aggression among law students, but only among male students. Aggression of female law students fits into the framework of the permissible norm. Perhaps this is due to the fact that the study of aggression was conducted with law students of criminal specialization. Male law students showed a slightly increased level of physical and verbal aggression, based on increased levels of irritability and resentment. Indirect aggression did not have high values due to the fact that it is not relevant for these students, since it does not have an open, object-oriented character.

3). Negativism is manifested among law students much more than among students of other areas of education. Negativism is oppositional behavior that can develop into active protests against the established order. For future lawyers, negativism can interfere with building their professional careers. Law students are not prone to remorse. Male law students are less likely to feel guilty for behavior that is not approved by society than students of all other groups.

4). All law students have an increased hostility index against a background of high suspicion and resentment. Quite high levels of hostility were revealed among students of other areas of education. In general, we can talk about the growing hostility among students, distrust of others. This is expressed in the expectation of trouble, excessive caution, manifested in suspicion, in the willingness to see the bad in a person, to see a threat to oneself. This is especially evident in female students of all specialties.

**Conclusion.** The main result of our study is that law students from different universities of different years of study (2010, 2013, 2017) and different levels of education (master's degree, bachelor's degree) had higher levels of aggression and hostility than students from other areas education. We assume that it would be correct if, before entering the university, applicants would undergo psychological testing of hostility and aggression. Law students were aware of their increased aggression. However, they chose a profession that is destined to fight aggression, namely, the legal profession. How can this fact be explained? First assumption: according to Freud [8], strong aggressive impulses can be redirected, sublimated into socially acceptable activities, for example, the job of a police officer. The second assumption: the professional activity of a person with a legal education (police officer, judge, and prosecutor) can be a kind of cover for aggressive intentions and their manifestations under the protection of the

law and / or on behalf of the law. Which of these assumptions is true? This is the task for future research.

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**EVALUATION OF THE EFFECTIVENESS OF A MULTIDISCIPLINARY  
APPROACH IN CORRECTION OF SEVERE NEUROGENIC  
DYSPHAGIA IN THE ACUTE PERIOD OF STROKE**

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**Abstract.** In the rehabilitation practice of neurogenic dysphagia, it is important to take into account the patient's ability to eat normally to meet the need for nutrients and energy, the patient's ability to take food and liquids without developing respiratory complications. Thus, the result of neurogenic disorders of the swallowing function depends on the choice of adequate rehabilitation methods. The aim of the study was to evaluate the effectiveness of the dysphagia management plan by MRC specialists.

**Keywords:** dysphagia, stroke, neurorehabilitation.

Cerebral stroke as a serious complication of systemic vascular pathology causes the development of various neurological disorders and dysfunctions. These include neurogenic dysphagia, the prevalence of which, according to different authors, ranges from 19 to 81% of patients after stroke [7].

Dysphagia has an extremely negative effect on the quality of life of a patient who has suffered a stroke. Aspiration associated with post-stroke dysphagia increases pneumonia, which occurs in 7–33%, compared with 0–16% in the absence of dysphagia [7]. Neurogenic dysphagia causes dehydration, energy metabolism disorders, cachexia and deepening of disability. Mortality among patients with post-stroke dysphagia and tube feeding varies from 20 to 24%, although this figure depends more on the severity of brain damage [5,4].

It is important to note that aspiration observed in dysphagia in 30-60% of cases can be both symptomatic and latent. According to some authors, latent aspiration is observed in up to 60% of cases of dysphagia [6,8], interfering with timely intervention and correction of this pathology.

Thus, swallowing is a vital, life-supporting function of the body.

When choosing rehabilitation methods, the neurological diagnosis of

the patient, the degree of dysfunction of swallowing, general physical condition, cognitive, speech abilities, and mental status are taken into account. Each patient needs an individually - differentiated approach.

When compiling an individual rehabilitation program for patients with neurogenic dysphagia, the swallowing function was diagnosed, and, on this basis, correction methods were selected.

An integrated approach to the rehabilitation of dysphagia of patients is carried out by a multidisciplinary rehabilitation crew consisting of the following specialists: neurologist, therapist (cardiologist), neurorehabilitologist (neurologist, exercise therapy doctor), aphasiologist - speech therapist, exercise therapy instructor, psychologist, nutritionist, therapist, endocrinologist.

### **Materials and research methods:**

The study was carried out on the basis of the neurological department - the territorial vascular center (ND-TVC) KSBHCI KICH №20 named after I.S. Berzon of the city of Krasnoyarsk in 2018. We observed 25 patients aged 55 to 70 years who underwent stroke in the vertebrobasilar basin (VBB).

The study included patients with severe neurogenic dysphagia. Oral transfer, pharyngeal stage. The risk of aspiration is high - 25 people.

In the acute period of stroke, the focus was on basic therapy, early neuroprotection and angioprotection. Additionally, all patients received symptomatic therapy depending on the existing concomitant somatic pathology. Upon admission, the patients underwent screening testing of the swallowing function (stage 1, stage 2). To identify the degree of impairment of the swallowing function, we used the "KIM Swallowing Function Assessment Scale".

An initial speech therapy examination was carried out, and recommendations for feeding were given. Patient positioning techniques were used daily during feeding. A physiotherapist was consulted on the issue of the appointment of the "vokastim" apparatus.

From 1 to 5 days, patients received tube feeding through a nasogastric tube. From the 6th day of the disease, after stabilization of the condition, according to the recommendations of the attending physician, a control neurological and speech therapy examination was carried out, against the background of stabilization of blood pressure, vital functions and somatic status, correction classes were conducted with the patients to restore swallowing (speech therapy activating massage, exercises for recovery of swallowing, articulatory gymnastics, indirect, direct therapy), food of various consistencies was prescribed "pudding", "cream", "syrup". The nutritionist,

endocrinologist, and hospital dietitian are involved in the preparation of the menu, calculation of the daily calorie requirement. Special attention is paid to the nutrition of patients with a history of type 2 diabetes mellitus.

After consulting a physiotherapist, physiotherapy was carried out using the "Vokastim" apparatus.

The psychologist conducted explanatory conversations with patients and their relatives in order to: maintain a positive emotional background while eating, which led to an improvement in appetite and a gradual increase in the amount of food and liquid consumed; elimination of feelings of depression, fixation on one's own state; prevention of the development of depression and severe emotional and personality disorders. All patients were trained in proper oral care for the prevention and development of secondary infections. That contributed to the observance of sanitary and hygienic standards.

In the diary of individual lessons of each patient, such indicators as the level of consciousness, blood pressure, body temperature, and the time of the lesson were recorded. The dynamics of patients was monitored for 5, 10, 15 sessions.

### **Results:**

As a result of the work performed, the patients showed positive dynamics for the 8th lesson: Restoration of the swallowing function in 21 (84%) people, an increase in the volume of articulatory movements of the palate, tongue, lips - 19 (76%) people, a decrease in salivation - 17 (68%) people, an increase in the decreased muscle tone of the tongue, cheeks, lips, soft palate - 15 (60%) people.

Minor improvements were observed: restoration of swallowing function - 12 (48%) people, decrease in increased salivation - 4 (16%) people, increase in the volume of articulatory movements - 2 (8%) people. In 4 (16%) patients, there was no dynamics in all parameters.

### **Conclusions:**

Thus, the prognosis of neurogenic disorders of swallowing, first of all, depends on the nature of the neurological disease and on adequate methods of rehabilitation. The data obtained indicate great prospects for the declared restoration methods. The maximum efficiency of this approach lies in the combined work of multidisciplinary specialists

It is important to accelerate the normalization of the act of swallowing or to ensure adequate replacement of the lost functions, since this will create the best conditions for the work of both the nervous system and the entire body of a neurological patient and, obviously, will help improve the quality of his life.

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## CIRCADIAN RHYTHM OF MYOCARDIAL OXYGEN DEMAND IN BURN TOXEMIA IN TODDLERS

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**Abstract.** The inversion of the circadian rhythm revealed in the 2nd group indicates a more pronounced disturbance of the circadian rhythm of the heart rate than in the 1st group. To increase the effectiveness of treatment of children of group 3, it is not enough to continue the volume of intensive therapy carried out in the early stages (the first 10 days) in the third week of the toxemia period. The revealed strong direct dependence of myocardial oxygen demand on heart rate was observed throughout the entire period of toxemia and indicated the need to regulate heart rate, cardiotropic, maintaining myocardial contractility, coronary active therapy in children with severe burn injury of 2-3A-B degrees with an area of more 30% in preschool age.

**Keywords:** circadian rhythm, myocardial oxygen demand, burn toxemia, toddler age

**Relevance.** The factors that affect metabolic processes in the myocardium are constantly changing. However, the authors found that under experimental conditions they are arranged in the following order. Heartbeat. Myocardial oxygen demand almost doubles when the heart rate doubles. Oxygen uptake by the myocardium almost doubles as soon as the pres-

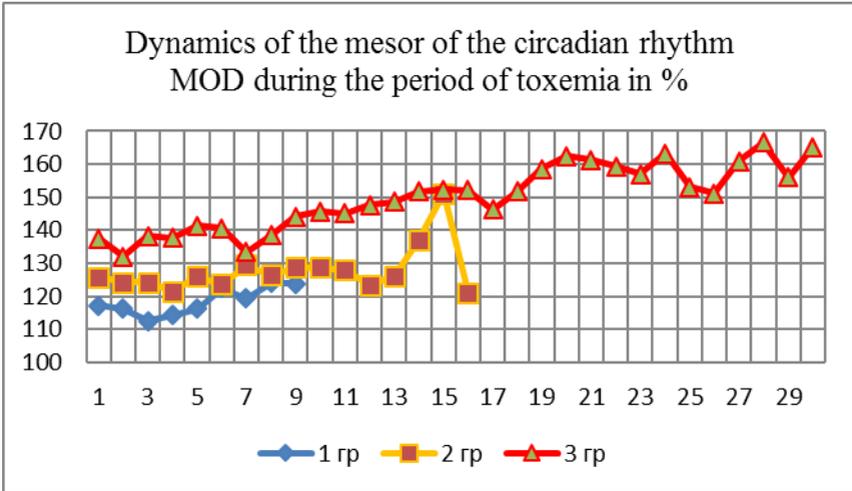
sure in the aorta rises from 75 to 175 mmHg with constant HR and SV. Myocardial oxygen demand (MOD) is approximately doubled due to the administration of norepinephrine at a constant heart rate, aortic pressure and cardiac output. Myocardial oxygen consumption increases by about 20% when SV increases by 60%. It is believed that the most important factor in determining myocardial oxygen demand is heart function (HR). However, there is not enough information in the literature on myocardial oxygen consumption in children with burns, which was the reason for the study of MOD in children during toxemia.

**Purpose of the work.** Study and assess changes in the circadian rhythm of myocardial oxygen demand during toxemia of burn disease in preschool children.

**Clinical material and research methods.** Data of studies of 24 children aged from 3.1 to 7 years were examined. Patients were considered depending on the severity and area of damage, age, duration of treatment in ICU. Thus, the number of children in the ICU for up to 10 days was 10 (1 subgroup), 11-20 days - 8 children (2 subgroup), more than 21 days (21-54 days –6 children). The severity of the burn was assessed by calculating the surface area of the damaged skin and using the Frank index. A detailed analysis of reliably significant deviations, intergroup differences of the studied indicators was carried out. The results were obtained by monitoring with hourly registration of hemodynamic parameters. The research data were processed by the method of variation statistics using the Excel program by calculating the arithmetic mean values (M) and mean errors (m). To assess the significance of the differences between the two values, the parametric Student's test (t) was used. The interrelation of the dynamics of the studied indicators was determined by the method of paired correlations. The critical level of significance was assumed to be 0.05. Intensive therapy from the moment of admission was aimed at removing burn shock by adequate anesthesia and intravenous administration of crystalloids, volemic solutions under the control of hemodynamics, and the volume of urine output. Intensive therapy also consisted of regular, every 8-12 hours, introduction of cardiotoxic, desensitizing, stress-limiting, vasodilators. Hormones and blood substitutes were used according to indications. Inhalation of humidified oxygen and physical heating methods were carried out. In all children, vitamins C and group B, antipyretic and hyposensitizing agents, as well as drugs against stress damage to the gastrointestinal tract, septicotoxemia and toxemia were used. According to indications, early, delayed surgical necrectomy, prevention of coagulopathy, energy deficiency, volemic disorders, correction of "tachycardial syndrome" were performed.

**Results and discussion.**

In group 1, the average value of the mesor of the circadian rhythm MOD for the period of toxemia was  $118 \pm 4\%$ , while the average daily indicator was  $120 \pm 4\%$ , the average night  $116 \pm 3\%$ .



**Fig.1**

Throughout the entire period of toxemia, the indicator of the mesor of the circadian rhythm of MOD in children of group 3 was significantly higher than in group 2 and 1 (Fig. 1). So, in group 1, mesor of MOD ranged from 110% on day 3 to 123% on day 6. That is, against the background of clinical signs of positive dynamics, a tendency to increase in MOD was revealed, which characterizes the advisability of continuing metabolic, coronary active therapy even with a decrease in the systemic inflammatory response and an improvement in the overall clinical picture in group 1 of burned children aged 3.1-7 years. In group 3, a wave-like increase in the mesor of the circadian rhythm MOD by 60-65% by 20-30 days of intensive therapy was revealed, which was most likely due to the insufficient effectiveness of the intensive therapy after 17 days with burns with an area of 3B degree more than 25% and an IF of more than 100 units (with a constant volume of drug load, parenteral nutrition, timely correction of certain deviations in homeostasis parameters). In this regard, it can be considered insufficient to continue the volume of intensive therapy carried out in the early stages (the first 10 days) to increase the

effectiveness of treatment in the third week of the toxemia period. In this regard, it is logical to intensify the correction of deviations in homeostasis by increasing detoxification, metabolite therapy, against the background of monitoring the effectiveness of etiotropic antibiotic therapy in 2 - 3 groups of children.

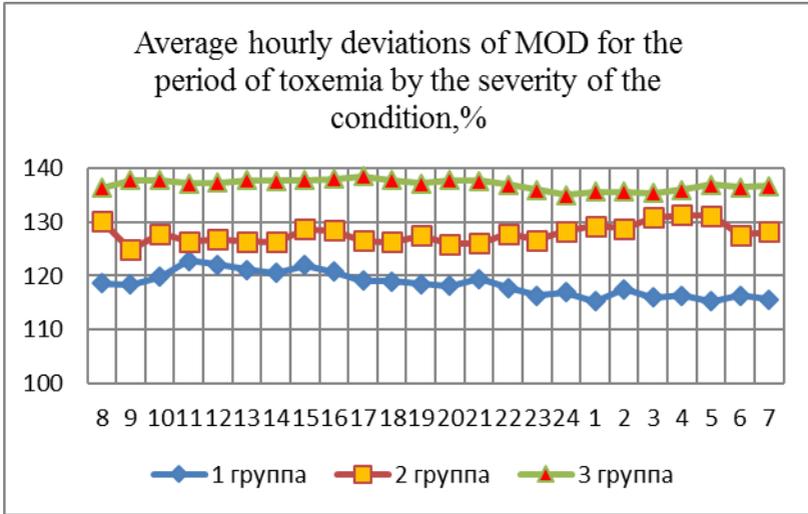


Fig.2

As shown in Fig. 2, the hourly average circadian rhythm of MOD varied significantly with the severity of the burn injury. Thus, in group 1, during the day, MOD indicator in bathiphase was in the range from 115% at 1 a.m. to 123% at 11 a.m., that is, MOD indicators in acrophase and bathiphase were projected at the physiological hourly level of sympathetic regulation activity. In group 2, the projection of bathiphase at 9 o'clock and acrophase at 3-5 o'clock was revealed, that is, an increase in burn injury caused an inversion of the circadian rhythm of MOD. In group 3, MOD fluctuations of smaller amplitude took place, but at a much higher level (from 135 to 139%), an increase in myocardial oxygen demand up to 40% during the day was observed, which required more effective coronary active, metabolic, oxygen therapy. Since a significant increase in myocardial oxygen demand increases the risk of developing acute heart failure, negatively affects the blood supply to other organs and systems, worsens the prognosis of treatment in children with severe burn injury.

The HR index on the first day was increased (HR norm  $112 \pm 6$  beats per minute) relative to the age norm by 17%, in 2 - by 15%, in 3 by 20% ( $p < 0.05$ , respectively) (Table 1). In dynamics during the period of toxemia, no statistically significant changes were observed in group 1, in group 2, there was a decrease only in the third HR by 9% ( $p < 0.05$ ), and on the 15th day it increased by 8% ( $p < 0.05$ ) relative to the indicator on the first day after a burn injury.

In the 3rd group of children, the increase in tachycardia on the 16th day by 8% ( $p < 0.05$ ), 19 - 8% ( $p < 0.05$ ), on the 24th day by 9% ( $p < 0.05$ ) draws attention. The revealed deviations of cardiac function corresponded to an exacerbation of the systemic inflammatory reaction, intoxication, insufficient effectiveness of antibacterial, anti-inflammatory and detoxification therapy in the most severe patients.

**Table 1**  
**Dynamics of the mesor of the circadian rhythm of heart contractions during the period of toxemia**

	group 1	group 2	group 3
1	132±7	129±5	135±4
2	129±2	123±2	126±2
3	124±3	118±1*	127±2
4	126±2	122±3	129±2
5	126±2	124±2	129±2
6	132±2	122±2	131±2
7	130±2	127±4	130±2
8	133±4	126±3	133±2
9	133±4	128±3	131±2
10		130±2	133±2
11		129±3	134±2
12		123±4	137±2
13		123±4	136±3
14		137±3	139±2
15		139±2*	140±2
16		135±2	143±2*
17			135±2
18			142±2
19			145±3*
20			139±2
21			136±2
22			139±3
23			139±3
24			147±2*
25			143±2
26			141±3
27			139±5
28			143±1
29			142±2
30			148±3

\*- relative to group 1

"- relative to group 2

**Table 2**  
**Average hourly heart rate dynamics**

Hours	group 1	group 2	group 3
8	129±3	128±6	136±5
9	128±3	126±6	138±5 <sup>""</sup>
10	132±8	126±6	138±6
11	133±7	127±6	137±6
12	132±4	126±5	137±6
13	131±4	126±5	138±7
14	130±4	126±5	138±7
15	130±4	127±5	138±5 <sup>""</sup>
16	131±5	127±5	138±5 <sup>""</sup>
17	130±4	127±6	139±5 <sup>""</sup>
18	131±4	128±6	138±5
19	131±4	128±6	137±5
20	130±4	127±5	138±5
21	130±5	128±6	138±6
22	130±4	127±6	137±5
23	129±3	127±5	136±5
24	127±4	127±5	135±6
1	127±4	130±4	136±5
2	127±2	129±4	136±5*
3	128±3	128±6	135±5
4	127±3	129±5	136±5*
5	127±3	128±5	137±5*
6	127±3	125±5	137±5*
7	127±3	125±6	137±5*

The most pronounced dependence of the mesor of the circadian rhythm HR on acrophase was found at 13-19 hours, 21-24 hours, at 2-6 hours. These time intervals correspond to hours of decrease in the physiological activity of the sympathetic nervous system.

Direct correlations were found between the dynamics of the mesor of the circadian rhythm of the heart rate and changes in the mesor of the circadian rhythm of myocardial oxygen demand, which were (+0.889) in group 1, (0.708) in group 2, and (+0.998) in group 3. The revealed dependence of myocardial oxygen demand on the heart rate was observed throughout the entire period of toxemia and indicated the need to regulate the heart rate, since the more tachycardia, the more oxygen starvation of the myocardium with the inevitable development of acute heart failure in these conditions. However, when conducting corrective heart rate therapy, it should be remembered that one of the common causes of tachycardia is not only secondary metabolic disorders of myocardial fibers caused by myocarditis, sympathotonic reaction, and changes in the function of other organs. But tachycardia can have a compensatory effect. In these conditions, it is necessary to first establish the cause of the malfunction of the body's homeostasis, the correction of which will lead to the normalization of the heart rate.

As presented in table 2, analysis of changes in hourly average HR data during toxemia revealed a significant predominance of HR throughout the day (from 135 to 139 beats per minute). In group 1, the average hourly HR values varied during the day from 133 per minute at 11 a.m. to 127 per minute at 1-7 p.m. In group 2, the average minimum HR values were detected at 9-12 am, the maximum - 130 per minute at 1 a.m.

Thus, in group 2 (Fig. 3), a seemingly less pronounced tachycardia was observed, but inversion of the circadian rhythm indicates a more pronounced violation of the HR circadian rhythm than in group 1. Where a more frequent heart rate of 6 beats per minute was detected than in the first. However, at the same time, the normal projection of acrophase in the morning hours and bathiphase in the night hours indicates a less pronounced violation of the HR circadian rhythm in children of group 1.

Hourly daily dynamics of the mesor of the circadian rhythm HR depending on the severity of burn injury

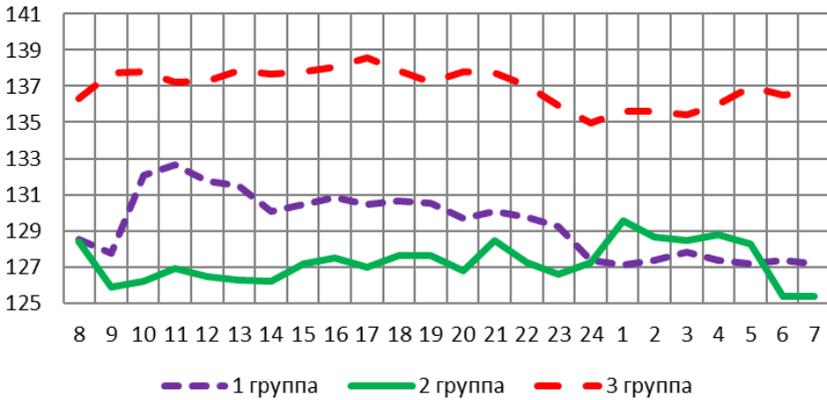


Fig. 3

As shown in Fig. 4, in children of groups 1 and 2, the direct dependence of MOD on heart rate significantly weakened in the morning hours (8-12 hours), in group 3 this relationship remained as strong as in the rest of the day. Apparently, a more significant increase in heart rate with aggravation of the condition naturally determines an increase in myocardial oxygen demand, one of a number of pathogenetic mechanisms for the development of AHF in children with IF of more than 100 units. In this regard, it is advisable to enhance the metabolic therapy supporting the heart function.

Hourly degree of correlation of acrophase and mesor of circadian rhythm MOD depending on the severity of toxemia

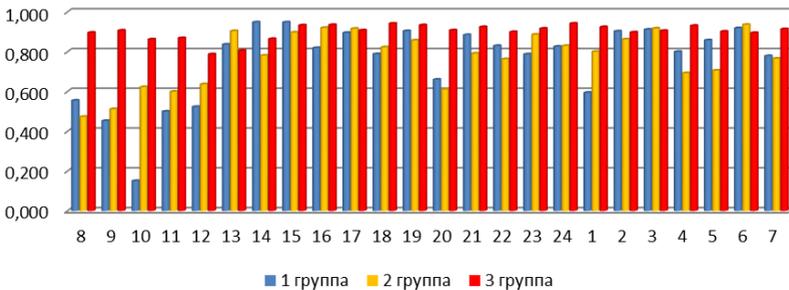


Fig.4

No reliably significant correlation was found between the mesors of the circadian rhythms of body temperature and MOD during the period of burn toxemia in children aged 3.1-7 years. Thus, the dependence of the mesor of the circadian rhythm MOD on body temperature was 0.4119 in group 1, 0.2412 in the second, and 0.6841 in the third.

**Conclusion.** The inversion of the circadian rhythm revealed in group 2 indicates a more pronounced violation of the HR circadian rhythm than in group 1. To increase the effectiveness of treatment of children of group 3, it is not enough to continue the volume of intensive therapy carried out in the early stages (the first 10 days) in the third week of the toxemia period. The revealed strong direct dependence of myocardial oxygen demand on heart rate was observed throughout the entire period of toxemia and indicated the need to regulate heart rate, cardiotropic, maintaining myocardial contractility, coronary active therapy in children with severe burn injury of 2-3A-B degrees with an area of more than 30% in preschool age.

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## THE ROLE OF CLINICAL GUIDELINES IN QUALITY AND SAFETY MANAGEMENT OF DENTAL CARE BASED ON THE PROCESS APPROACH

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**Abstract.** The purpose of this article is to study the role of clinical guidelines in the process approach in quality management of medical care. In the course of the work on the article, the approaches to the development of clinical guidelines in foreign countries, the history of the development and implementation of clinical guidelines in the Russian Federation, as well as the current regulatory legal acts regulating the use of clinical guidelines in the provision of dental care were studied. The role of clinical guidelines as a tool for the implementation of the process approach in the organization of dental care has been determined.

**Keywords:** clinical guidelines / quality of dental care / safety of medical care.

Since the XIX century, various concepts of production quality management and improvement of work management processes in various fields, including healthcare, have been developed and implemented in the world community. Today, it is probably difficult to find such a sphere of human activity where the advantage of the process approach in management has not been proven. The process approach to the organization of dental care involves the creation of a matrix structure in management, the main principle of which will not be a breakdown into structural units by function (therapeutic, surgical dental care, etc.), but a systemic (process) approach aimed at obtaining the final result - curing the patient using all possible and necessary methods of treatment.

The correct implementation of the basic principles of the process approach presupposes obtaining a qualitatively new level of medical care

both in terms of increasing its availability, improving service, equipping medical organizations, and in terms of the quality of the clinical component of dental care itself. The role of clinical guidelines in operational management, coordination of work within a single treatment process can hardly be overestimated. A dental organization cannot be perceived as a structure consisting of departments that provide specific services. An analysis of the forensic practice in dentistry shows that the greatest difficulties arise precisely in the assessment of complex dental care provided to one patient by dentists of various specialties, when the processes of interaction between doctors and clinics are disrupted, the foundations of continuity in the treatment of patients are undermined. The share of such cases is 45% of the total number of conflicts in dentistry resolved in court. Table 1 shows the structure of court cases on poor quality dental care in the Russian Federation in 2013-2017. [1].

**Table 1 - Distribution of cases according to the profile of dental care (DC) (2013-2017)**

Dental care profile	Number of cases	
	abs. val.	P± m, in %
DC on surgical dentistry	161	12,25±0,91
DC on therapeutic dentistry	254	19,33±1,90
DC on orthopedic dentistry	214	16,29±1,02
DC on orthodontics	30	2,28±0,41
DC on surgical dentistry with the use of dental implants	61	4,64±0,58
Complex DC rendering by several specialists simultaneously	137	45,21±1,37
<b>Total amount</b>	<b>1314</b>	<b>100,00</b>

Clinical guidelines should play an important role in the prevention of such complications. At its core, clinical practice guidelines are systematically developed documents containing information on the prevention, diagnosis, and treatment of specific diseases and syndromes, with the aim of assisting in decision-making by a practitioner to ensure appropriate medical care for a patient in a specific clinical situation [2]. In Russia, the implementation of recommendations for the provision of medical care for medical practitioners began almost 20 years ago, and currently the Ministry of Health of Russia is actively working on legislative regulation of the development and application of clinical guidelines. This process has been a worldwide trend over the past 30 years.

A key event in the history of the creation of clinical guidelines is considered the decision of the US Congress to establish the Agency for Health Care Policy and Research, later renamed Agency for Healthcare Research and Quality, as well as the definition of the principles for the development of clinical guidelines by the USA Institute Of Medicine in 1989-1990 [3]. This document had an official status and contained the basic requirements for the structure, including the mandatory presentation of the evidence base (results of clinical trials) for each recommended medical intervention.

In Europe (England, France, Holland, etc.) at this time there was also a growing need for national clinical guidelines to create uniform standards for the provision of medical care and optimization of health systems, which gave impetus to the development of the Institute of Clinical Guidelines in these countries [4]. As a result of the collection of information on the use of clinical guidelines in different countries, conducted in 1999, it was found that they have been introduced into the health care system of the USA, Great Britain, Holland, France, Canada, New Zealand and many others [5]. Subsequent studies of the effectiveness of the application of clinical guidelines in practical health care have shown an improvement in the quality of medical care and a decrease in the cost of treatment [6].

In this regard, and taking into account the importance of clinical guidelines for the health care system, standards have been created in many countries that include the basic requirements for the development of CR. In the USA, in 2008, the Institute of Medicine developed standards that approve the requirements for the creation of development teams, control of conflicts of interest, use in the development of a systematic review, creation of an evidence base, providing for the assessment of the persuasiveness of recommendations by external reviewers and their regular updating. With minor differences, these guidelines are used in many countries in which clinical guidelines are being developed.

In addition, there are different methods of regulating the development of clinical guidelines in different countries. Currently, according to approaches to managing the development and regulation of clinical guidelines, four types of countries can be distinguished:

- countries with one central organization responsible for both the development and regulation of clinical guidelines; this type includes, for example, Great Britain (in England the regulatory body is NICE, in Scotland - the Scottish Intercollegiate Guidelines Network), Finland (the regulatory body is Finnish Medical Society Duodecim);
- countries with many organizations involved in the development of clinical guidelines (most often professional medical communities)

and one central regulatory body; these countries include, for example, Germany (regulatory body - Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften), France (regulatory body - Haute Autorité de Santé), USA (regulatory body - National Coordination Center), Australia (regulatory body NHRMC);

- countries in which professional organizations develop clinical guidelines without a single coordination mechanism - African countries, India, South Korea, Singapore, etc.;

- countries that do not develop their own clinical guidelines; this type, as a rule, includes countries with a low standard of living, with political instability. Such countries are usually dependent on foreign aid and use clinical guidelines developed by the World Health Organization or other countries [7].

Accordingly, the legal status of the clinical guidelines of the listed countries also differ, but often the legal status of clinical guidelines is more pronounced at the federal level in countries with more effective health systems.

In modern Russia, clinical guidelines were preceded by patient management protocols. The main goal of creating these protocols was to establish uniform requirements for the provided medical services, unify the calculations of the cost of medical care, as well as control the indicators of medical care.

In order to standardize the processes of developing protocols in 1999, the Ministry of Health of Russia introduced the industry standard GOST 91500.09.001-1999 "Protocols for patient management. General requirements". The standard contained information on the proper procedure for the preparation, examination, testing and implementation of protocols, it also established the requirements for the creation of working groups and the very structure of the preparation of the protocol. An important element of the standard was the division of medical services into mandatory and optional, which was supposed to help doctors rationally prescribe examinations and treatment of a patient, taking into account his individual characteristics and the real capabilities of specific medical institutions. Also, this standard provided for the assessment of scientific evidence of the clinical efficacy and safety of each proposed medical service and drug in order to verify the appropriateness of their inclusion in the protocols. However, in the process of implementing this standard, the working groups faced a number of difficulties. The most common of them were the lack of a clear algorithm for including a medical service in the protocol, the difficulty of determining the line between compulsory and recommendatory medical

services, the inaccessibility of information resources (electronic databases, Internet access is difficult, the inaccessibility of literature), as well as difficulties in assessing the evidence base.

In 2007, the National Standard GOST R 52600.0-2006 "Protocols for the management of patients. General Provisions", which, in fact, was a new version of the industry standard and was developed taking into account the goals and principles of standardization, the rules for the application of national standards of the Russian Federation. It is important to note that National Standards are not obligatory, since in accordance with the law on technical regulation, the application of standards is voluntary and is advisory in nature.

In 2012, the Ministry of Health of Russia initiated the development of national clinical guidelines, and in 2014, GOST R 56034-2014 "Clinical guidelines (treatment protocols). General provisions" was created. However, an analysis carried out later in 2015 showed that there is no uniformity among the clinical guidelines approved by the professional community, both in form and in content, which significantly hinders their effective use in practical health care and cannot provide an adequate quality of medical care.

Most of the clinical recommendations do not provide a full scope of medical care for a specific disease or condition, and include a different informative approach, which does not improve the efficiency and quality of medical care and the health care system as a whole. With this approach, the practitioner excludes the possibility of obtaining complete information about the organization of medical care for a specific nosology, as well as ensuring the continuity of its provision, which, in turn, significantly affects the quality of the medical and diagnostic process as a whole.

In this regard, the Russian Ministry of Health initiated a unified methodological regulation for the development and approval of clinical guidelines and its legislative consolidation. By 2016, amendments to the Federal Law of 21.11.2011 № 323-FZ "On the basics of protecting the health of citizens in the Russian Federation" in terms of clinical guidelines were developed and submitted for public discussion. In accordance with the presented rationale, the key task of the amendments is to streamline the development and application of clinical guidelines, including the definition of requirements for their structure and design. On January 1, 2019, these amendments entered into force.

According to the amendments, medical care in the Russian Federation will be organized and provided in accordance with the procedures for the provision of medical care and on the basis of clinical recommendations,

taking into account the standards of medical care approved by the authorized federal executive body.

To improve the quality of clinical guidelines, methodological regulation by the Ministry of Health of Russia of the process of their development is proposed: approval of the development procedure, standard form, requirements for the structure and scientific substantiation of the content, as well as the procedure for approval of clinical guidelines by the Russian Ministry of Health. A new regulatory body for clinical guidelines has been introduced - the Scientific and Practical Council of the Ministry of Health of Russia.

Thus, until 2019, the Russian Federation belonged to the countries in which professional organizations developed clinical guidelines without a single coordination mechanism, however, with the entry into force of amendments to the Federal Law of 21.11.2011 № 323-FZ "On the basics of protecting the health of citizens in the Russian Federation" The country has a single central regulatory body - the scientific and practical council of the Ministry of Health of Russia.

The introduced changes allow harmonizing the existing normative and recommendatory documents on the issues of medical care. The heads of medical organizations must provide conditions for the application of clinical guidelines in accordance with mandatory procedures for the provision of medical care throughout the Russian Federation, which determine the stages of this process and the equipment of medical organizations (their structural units). In this regard, the basic principles of organizing dental care using the process approach in its organization should be:

- The principle of ensuring the relationship between the processes that ensure prevention, all stages of treatment and rehabilitation, as well as further observation of the patient. Clinical guidelines should logically ensure continuity in dental care.

- The principle of mandatory control of standardized processes (treatment algorithms) and indicators determined by clinical guidelines for the relevant nosologies.

- The principle of responsibility for the process of providing medical care to a patient, especially when it comes to long-term multistage treatment, such as, for example, in the rehabilitation of patients using methods of dental implantation with preliminary orthodontic preparation and therapeutic debridement of the oral cavity. The role of clinical guidelines in the implementation of this principle in practice should consist in a clear division of the areas of responsibility of specialists and the provision of clinical indicators of the completeness of the treatment stage

and the possibility of demonstrating the achieved results and difficulties and unresolved problems obtained at each stage of treatment.

In addition, clinical guidelines should contain all the elements of the process approach:

- process input (initial picture of the disease, patient's condition);
- process outputs (treatment results, disease outcomes);
- resources (required materials, methods, equipment, etc.);
- responsible for the process (dentist);
- process indicators (providing information about the work being done and allowing making management decisions).

The use of clinical guidelines as a tool for the implementation of the process approach in the organization of dental care should ensure:

- increasing the efficiency and effectiveness of the work of dentists and the quality of dental care due to the targeted impact on treatment processes;
- safety of dental care due to the transparency of mechanisms and increased predictability of results and possible errors.

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**CLINICAL AND RADIOLOGIC EXAMINATION AND ANALYSIS OF  
COMPLICATIONS OF FIXED DENTAL PROSTHESIS BASED ON  
DENTAL IMPLANTS IN THE DISTAL PARTS OF THE UPPER AND  
LOWER JAWS**

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**Abstract.** Clinical and radiological analysis of the condition of 78 fixed orthopedic structures supported by 174 dental implants in the distal parts of the upper and lower jaws was carried out. The survival rate of supporting dental implants was 100%, the overall survival rate of orthopedic constructions was 98.2%.

The results of the study showed that the overall survival rate of dental implants and fixed prostheses was 100% and 98.2%, respectively, after an average follow-up period of 5.5 years for dental implants and 3.5 years for fixed orthopedic structures. Biological complications (87.18%) affected 148 dental implants in 68 orthopedic constructions. The need to develop a strict protocol for clinical and technical examination, focused on periodic checking of occlusion and assessment of the condition of the components of the orthopedic construction, was established.

**Keywords:** dentistry / dental implants / complications / statistical analysis

Currently, dental implant therapy is one of the main and widespread methods of treating patients with partial or complete absence of teeth due to the excellent treatment efficiency, long-term survival, as well as a high level of success in achieving and maintaining osseointegration and functioning of fixed orthopedic structures [1, 2, 3, 4, 5, 6].

Despite the importance of the professional aspects of dental implant treatment, there is great interest from the patient's point of view in the

success of this treatment associated with long-term function without any complications. However, there is still insufficient clinical information on the biological and technical complications of orthopedic structures based on dental implants [7], which is extremely important for designing a new orthopedic structure and further improving its characteristics. Indeed, most authors only report on survival rates (availability of a prosthesis) or failure (absence), without specifying the nature of these complications [8].

Technical and biological complications of fixed orthopedic structures increase the cost and time spent by the doctor and the patient [9]. These complications have a multifactorial etiology [10], in which patient-related factors (occlusion, parafunctional habits) and treatment-related factors (material characteristics, type of fixation) must be taken into account for a positive treatment result [11, 12].

The Eighth European Workshop on Periodontics highlighted the importance of introducing patient-reported measures to improve the assessment of treatment outcomes based on patient perception and not just clinical parameters.

A clinical and X-ray study was carried out to analyze the nature of complications of fixed orthopedic structures based on dental implants in the distal upper and lower jaws after an average observation period of 3.5 years.

This study (2016 - 2020) involved 37 patients (19 women and 18 men aged  $62.35 \pm 10.39$  years) of the FSBI NMRC "CRIDMS" department of orthopedic dentistry of the Russian Ministry of Health and private dental clinics in Moscow.

The selection criterion was the presence of a fixed orthopedic construction, cement or screw fixation, supported on dental implants in the distal parts of the upper or lower jaw. The initial diagnosis when contacting the clinic is a partial absence of teeth in the lateral region (ICD-10 K08.1).

The criteria for inclusion of patients in the study group were as follows: the presence of a fixed orthopedic structure, cement or screw fixation, supported on dental implants in the distal upper or lower jaw (from 2 to 4 supports); types of antagonists: natural teeth or non-removable orthopedic constructions made of cermet or zirconium dioxide on non-vital teeth, non-removable teeth or non-removable orthopedic constructions made of cermets or zirconium dioxide on non-vital teeth, non-removable orthopedic constructions made of cemented or screw fixation supported on dental implants; the term of functioning of a non-removable orthopedic structure supported on dental implants in the distal parts of the upper or lower jaw is at least 1 year; the presence of a panoramic radiograph at the stage of installing the gingival cuff former on the dental implant.

The criteria for not including patients in the study group were as follows: the presence of a fixed orthopedic structure based on dental implants and natural teeth in the distal upper or lower jaw; the term of functioning of a fixed orthopedic structure supported on dental implants in the distal upper or lower jaw is less than 1 year, the presence of a cantilever element in a fixed orthopedic structure supported on dental implants; antagonists in the form of partial or complete removable dentures; non-removable orthopedic structures made of metal-plastic, metal-composite, all-metal, all-ceramic structures; the number of supports of a non-removable orthopedic design supported on dental implants is less than 2 and more than 4; replacement of a defect in the dentition in the frontal part of the upper or lower jaw.

In order to eliminate factors affecting the reliability of the study, the general exclusion factors were supplemented: patients with exacerbations of dental diseases; poor oral hygiene (hygiene index below 2) and lack of motivation for it; patients with exacerbations of general and psychosomatic diseases.

The visit included the study of the dental patient's medical history, clinical and X-ray examination, and receiving intraoral photographs in accordance with the standard protocol. Intraoral photographs were used to identify the presence of complications of orthopedic structures. Clinical studies were conducted in accordance with the principles of evidence-based medicine. The study protocol was approved by the ethical committee FSBI NMRC "CRIDMS" of the Ministry of Health of Russia. All patients were informed about the purpose of the study and signed a written consent form for the processing of personal data.

In 37 patients under study (18 men and 19 women), 174 dental implants were installed, of which 111 were on the upper jaw and 63 on the lower jaw, 76 were the support of a fixed orthopedic structure with cement fixation and 98 dental implants were the support of a fixed orthopedic structure with screw fixation.

A total of 78 non-removable orthopedic structures based on dental implants in the distal upper and lower jaw were manufactured: 49 structures on the upper jaw and 29 structures on the lower jaw. The number of cement-retained constructions was 37, with screw-retained ones - 41.

According to the clinical examination of 37 patients, there were no complaints about supporting dental implants and the orthopedic structure itself, and there were no complaints about the condition of the corresponding antagonist teeth.

A total of 174 dental implants were evaluated, 111 in the upper jaw and 63 in the lower jaw. The average follow-up time for dental implants was 5.5 years.

A total of 78 fixed orthopedic structures based on dental implants were examined: 49 on the upper jaw and 29 on the lower jaw; 41 screw-retained, 37 cement-retained; 43 metal-ceramic prostheses, 35 zirconium dioxide prostheses.

The survival rate of supporting dental implants was 100%, the overall survival rate of orthopedic constructions was 98.2%.

The results of the study showed that the overall survival rate of dental implants and fixed prostheses was 100% and 98.2%, respectively, after an average follow-up period of 5.5 years for dental implants and 3.5 years for fixed orthopedic structures.

Biological complications (87.18%) affected 148 dental implants in 68 orthopedic constructions. Soft tissue recession was the most frequent (66.6%) biological complication, followed by peri-implantitis (7.3%). Soft tissue recession occurred in 113 dental implants supporting 52 fixed orthopedic structures out of a total of 78 fixed orthopedic structures. Peri-implantitis occurred in 7 dental implants supporting 5 fixed orthopedic structures out of a total of 78 fixed orthopedic structures, with an average bone loss of 0.8 mm (0.6 to 1 mm).

There were more biological complications in the group of cement-retained fixed structures ( $n = 35$ ) compared to the group of screw-retained fixed structures ( $n = 33$ ). It is obvious that the contours of the alveolar ridge of the jaw and careful removal of excess cement are critical at the stage of choosing and developing the type of fixation of the future fixed orthopedic structure.

The results of the study showed that there is no significant difference between the number of dental implants with soft tissue recession in orthopedic structures with screw ( $n = 27$ ) and cement fixation ( $n = 25$ ).

Minor technical complications affected 15 orthopedic structures and were more frequent (98.8%) compared to significant (1.2%), which were detected in 1 fixed orthopedic structure.

The most frequent minor technical complication ( $n = 37$ ) was partial or complete absence of material covering the screw shaft, affecting 15 screw-retained prostheses. This was followed by damage to the facing material ( $n = 21$ ), identified in 16 orthopedic structures (9 cermet and 7 orthopedic structures made of zirconium dioxide). In cases of damage to the facing material, the antagonists were: for metal-ceramic structures - 6 orthopedic metal-ceramic structures supported on dental implants (4 with screw fixation and 2 with cement) and 3 fixed metal-ceramic structures based on natural teeth; for zirconium dioxide constructions - 2 fixed orthopedic structures made of zirconium dioxide with support on dental implants (1 screw-

retained and 1 cement-retained design) and 4 fixed structures based on natural teeth.

Also, in the course of our study, 7 cases of damage to the facing material of the antagonist structures were recorded. Of these, in 3 cases, the antagonists were represented by a fixed orthopedic construction made of cermet with support on dental implants, in 2 cases - by a fixed orthopedic construction made of zirconium dioxide supported on dental implants, and in 2 cases - by a fixed orthopedic construction based on natural devital teeth. Therefore, it seems important to check the condition of the antagonist teeth when choosing a fixed orthopedic structure (material, type of fixation) based on dental implants. The access occlusal opening is a critical point that reduces the overall resistance of the ceramic, thereby contributing to more chipping in these areas.

As a result of the patient survey (based on the Spanish version of OHIP-14), it was found that the presence of complications associated with fixed orthopedic structures does not affect the satisfaction and quality of life of patients with these orthopedic structures.

OHIP-14 results showed similar scores for participants with and without technical complications. This can be explained by the fact that technical complications do not have a negative impact on quality of life and therefore can be considered minor complications. Another possible explanation is that these complications may have gone unnoticed by patients.

In our opinion, adherence of patients to regular clinical examinations is important to quickly identify the problem in order to prevent serious complications.

A rigorous clinical and technical examination protocol is required, focused on periodically checking the occlusion and assessing the condition of the prosthetic components.

The noted technical complications associated with the anatomical contour of the coronal parts of non-removable orthopedic structures (damage to the veneering material; partial or complete absence of material covering the screw shaft; chips, loss of the anatomical shape of the veneering material) are a determining factor in the long-term result of treatment and, consequently, technical complications in the course of functioning of a fixed orthopedic structure based on dental implants, it can lead to an increase in clinical and laboratory alterations.

Therefore, the creation of proper functional occlusion allows the masticatory system to work with minimal occlusal stress, which will protect both natural teeth and any orthopedic structures from future damage.

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## ULTRASOUND AS USEFUL TOOL FOR EVALUATION AGE-RELATED CHANGES AND PATHOLOGICAL LESIONS OF THE FACE SKIN

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### Summary

**Introduction.** Various skin parameters such as the thickness of the epidermal echo, dermis and subcutaneous tissue, the surface area of individual layers, the thickness of the subepidermal layer with a low echogenic effect, the caliber of blood vessels, as well as the presence or absence of blood flow in the vessels, can be investigated with ultrasound. The **aim** of our investigation was to evaluate age-related changes and pathological lesions of the face skin using ultrasound examination of the different anatomical areas of the face in young and older women.

**Materials and methods.** The thickness of different skin layers (epidermis, dermis, hypodermis) was measured in the area of the interbrow zone, chin, nasolabial folds and cheeks in 52 patients aged 15 to 75 years (mean age  $44.3 \pm 11.9$  years) using an ultrasound scanner Mindray DC-8. The study was carried out in Department of Fundamental Medicine of the Immanuel Kant Baltic Federal University. Statistical processing for the study results was performed in Microsoft Excel 2017 using average values (M), the reliability was determined using Student's criterion, and its critical level in this study was taken to be 0.05.

**Results and its discussion.** The thickness of the epidermis was minimal in the nasolabial fold (0.039 cm) and the maximum (0.043 cm) in the chin. The thickness of the dermis was maximal in the interbrow zone (0.081 cm) and the smallest in the chin (0.062 cm). The thickness of the hypodermis was the biggest in the cheeks area (0.136 cm and 0.137 cm to the right and left, respectively), the smallest hypoderm thickness

was recorded in the chin area (0.019 cm). A thickening of the dermis was established in patients after 40 years in all anatomical areas of the face with the achievement of a statistically significant difference in the nasolabial folds ( $p = 0.027$ ) and cheeks ( $p = 0.01$ ). It was found that the dermis was thickened in patients who used fillers in all anatomical areas of the face with a statistically significant ( $p < 0.05$ ) difference in the nasolabial folds. **Conclusion.** Until now, little attention has been paid to the study of age-related changes and some pathological lesions in the face skin by using ultrasound, so there are no standard parameters for assessing its thickness, which requires further research.

**Keywords:** facial skin, epidermis, dermis, hypodermis, age, ultrasound examination of the skin, women older than 40 years, fillers.

### Introduction

Facial aging is the result of the interaction of changes occurring in the skeleton, ligaments, muscles, adipose tissue of the face and, of course, the skin [1, 2, 3]. These changes occur with each mentioned structure at a different rate, begin in each person at different ages, and differ depending on ethnic origin [1, 3].

Age-related skin changes, known as "chronological aging", are modulated by genetic, behavioral, catabolic, endocrine, and gravitational factors [4, 5]. Besides, chronic exposure to sunlight causes many clinically important degenerative changes in various parts of the skin, the so-called photo-aging [4, 5].

Skin ultrasound study is becoming an increasingly popular method of research, as evidenced by the growing number of scientific publications, as well as the number of scanners for skin imaging available on the marketplace [4, 6]. Ultrasound images of healthy skin show three main layers: the epidermal echo, dermis, and subcutaneous tissue, which correspond to the anatomical structure of the skin [4, 6, 7]. Various parameters are taken into account for ultrasound skin assessment: the thickness of the epidermal echo, dermis and subcutaneous tissue, the surface area of individual layers, the thickness of the subepidermal band with a low echogenic effect, the caliber of blood vessels, as well as the presence or absence of blood flow in the vessels.

The study of all face layers thickness using ultrasound is a topical issue of contemporary medicine since age-related skin changes can be slowed down or prevented by appropriate clinical procedures (dermatological and surgical interventions). Even though cosmetic fillers are increasingly applied to improve the aesthetic characteristics of the skin, several authors

have noted the growth of complications associated with their usage [8, 9, 10, 11]. At the same time, ultrasound has been successfully used to detect and identify common types of fillers and has become a first-line visualization method for working with these exogenous components [8].

The **aim** of our investigation was to evaluate age-related changes and pathological lesions of the face skin using ultrasound examination of the different anatomical areas of the face in young and older women.

### Materials and methods

The thickness of different skin layers (epidermis, dermis, hypodermis) in the area of the glabellar area, chin, nasolabial fold and cheeks (salivary gland) was measured in 52 patients aged 15 to 75 years (average age  $44.3 \pm 11.9$  years) using the Mindray DC-8 ultrasound scanner. There was group I of 21 women under 40 years (average age  $32.4 \pm 1.8$  years) and the group II of patients over 40 years consists of 31 women (average age  $50.0 \pm 2.4$  years). The study was carried out in Department of Fundamental Medicine of the Immanuel Kant Baltic Federal University. Statistical processing of the obtained research results was conducted in the Microsoft Excel 2017 software using average values (M), the reliability was determined using the Student's criterion, and its critical level was assumed to be equal to 0.05.

### Results

The results of the facial skin layers in different anatomical areas are presented in table 1.

**Table 1. Thickness of facial skin layers, depending on the anatomical area (M)**

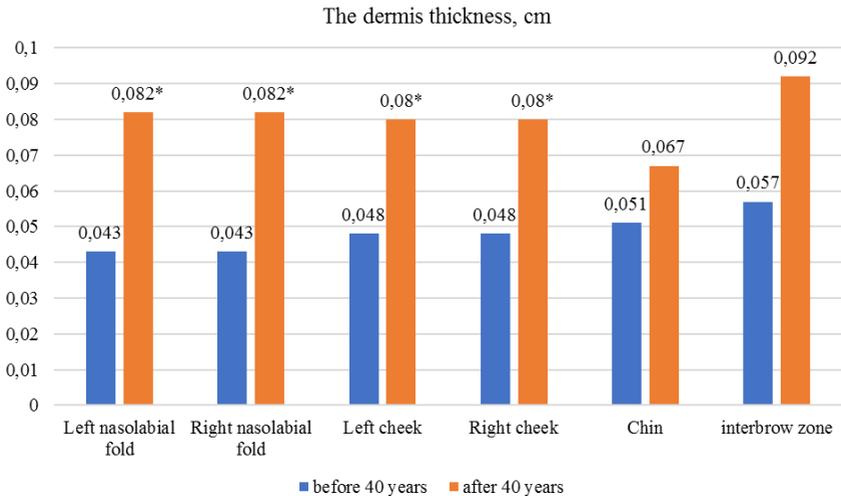
Skin layer	Thickness of skin layer (cm) and anatomical region					
	Inter-brow zone	Chin	Left nasolabial fold	Right nasolabial fold	Right cheek area	Left Salivary gland
Epidermis	0,040	0,043	0,039	0,039	0,040	0,040
Dermis	0,081	0,062	0,069	0,069	0,069	0,070
Hypodermis	0,126	0,119	0,128	0,131	0,137	0,136

We found that the thickness of the epidermis was minimal in the nasolabial fold (0.039 cm) and the maximum (0.043 cm) in the chin area. Analysis of the dermis thickness indicates the largest size was in the interbrow area (0.081 cm) and smallest in the chin (0.062 cm). The hypodermis thickness was greatest in the area of the salivary glands (0.136 cm and 0.137 cm on the left and right sides, respectively). The smallest thickness of the

hypodermic, according to the obtained data, is registered in the chin area (0.019 cm).

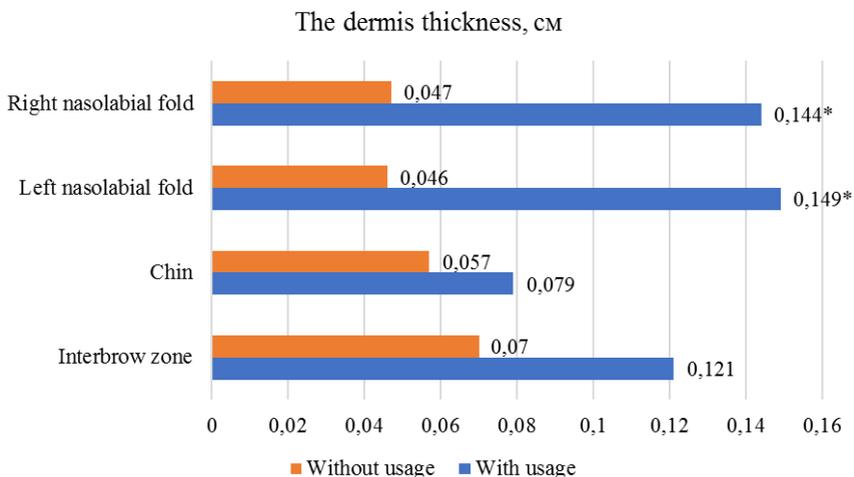
It should be noted that in the surveyed patients, the thickness of the dermis and hypodermis was the smallest in the chin area in comparison with other investigated areas of the face, and the epidermis thickness was the largest.

The analysis of the thickness assessment of all skin layers (epidermis, dermis, hypodermis) shows that it's thickening with age occurs due to the dermal layer. We found a thickening of the dermis in patients after 40 years in all anatomical areas of the face with a statistically significant difference in nasolabial folds ( $p=0.027$ ) and cheeks ( $p=0.01$ ) (Fig.4). We had found that in patients under 40 years of age, the smallest thickness of the dermis was diagnosed in the nasolabial folds area – 0.043 cm, and over 40 years – it was 0.067 cm (Fig. 4). The maximum thickness of the dermis is documented in the interbrow area, regardless of age.



**Fig. 1. Comparative analysis of the dermis thickness of different face anatomical areas in surveyed patients under and over 40 years. \*-  $p<0.05$**

We had revealed that the dermis is thickened in patients who use injectable cosmetology (fillers and filaments) in all face anatomical areas with the achievement of a statistically significant ( $p<0.05$ ) difference in the area of nasolabial folds (Fig. 2).



**Fig. 2. Comparative analysis of the dermis thickness of different face anatomical areas in patients depending on the use of injectable cosmetic procedures. \*- p<0.05**

It should be noted that the thickness of the dermis in nasolabial folds in patients using dermal fillers was more than 3 times greater in comparison with surveyed women without it.

**Discussion.** The first layer visible in the place if the contact of the ultrasound probe is a hyperechoic line that histologically corresponds to the epidermis [4]. Under the epidermis is the dermis, which is anatomically divided into papillary (the upper part of the dermis lying under the epidermis) and reticular (the layer located under the papillary dermis) layers [4]. The papillary part makes up about 20% of the dermis and contains blood vessels and irregularly located thin collagen and elastin fibers [4]. On the other hand, the reticular dermis, which composes approximately 80%, regularly contains collagen, elastin and reticular fibers [4]. The third layer, visible in ultrasound images, is subcutaneous fat.

The first age-related changes of the facial skin in women (the roughness and wrinkles appearance) are already noticeable at the age of 20-30 years, and the most significant occur in the postmenopausal period, which is mainly due to the influence of hormonal status [12]. According to Lephart E. D. [13] and Tobin D. J. [14], degenerative changes in the skin of the face associated with the loss of basic collagen (sagging skin, reducing its thickness, etc.) may be due to an age-related decrease in the level of estrogen.

It is proved that 30% of skin collagen is lost in the first five postmenopausal years with an average decrease of 2% per year for 15 years [15]. Marcos-Garcés V et al. [16] using methylation levels as markers of epigenetic aging, menopause was found to accelerate biological aging.

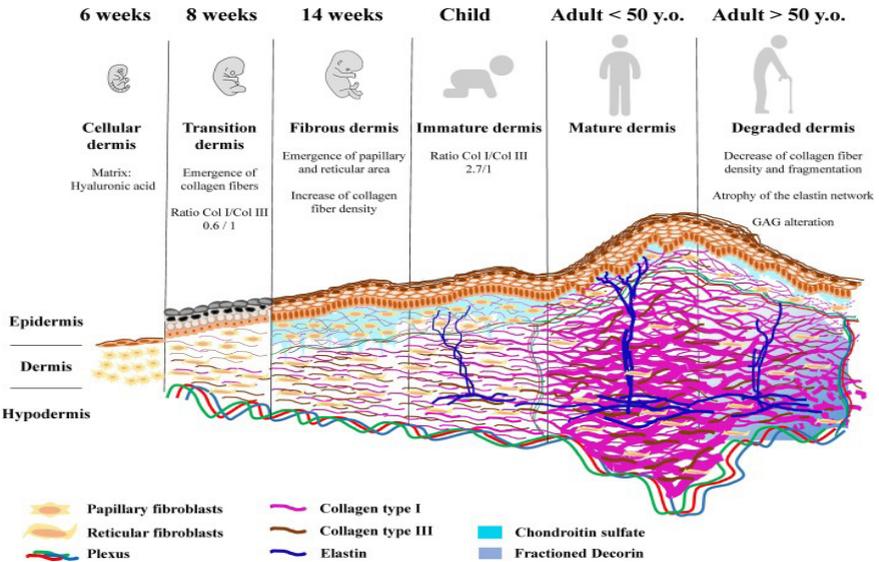
The thickness of the facial epidermis *stratum corneum* does not change significantly with aging, but there is a decrease in the number of lipids in it [14]. It has been proved that in middle-aged people (50 to 80 years), abnormal acidification of the *stratum corneum* leads to deferred lipid processing, slowed restoration of the permeability barrier and violation of its integrity, and delays in ion transport [17].

In contrast to the stratum corneum, keratinocytes in the basal layer of the epidermis show increasing atypia with age [17]. Tobin D. J. [14] notes that basal keratinocytes suppress the expression of certain  $\beta$ -1 integrins, which indicates their pathological proliferation and adhesion in photo-damaged elderly skin, what also confirms the data of Kawabata K. et al. [18].

The organization of the papillary part of the dermis also changes with age (Fig. 3) [14, 19]. In the area of wrinkles in the dermis, there is the disappearance of chondroitin sulfates, which are known to provide water retention in the skin, and a change in the oxytalane fibers - thin fibers of an elastic network organized perpendicular to the skin surface [19]. In the area of wrinkles, the number of oxytalane fibers decreases significantly, or they disappear altogether; a change in the orientation of collagen fibers is also noted [19]. Humbert P. et al. [20] proved the presence of atrophic changes in both the dermis and hypodermis at the location of wrinkles. Marcos-Garcés V. et al. [16] during histological examination of skin biopsies of 45 people aged from several months to 95 years revealed a significant increase in the thickness of the papillary part of the facial dermis after reaching the age of about 50 years. According to the authors, the thickness of the reticular dermis increases by about 2 times, while the average thickness in the first months of life is about 1.6 mm, reaching about 3.2 mm by the age of 50 [16]. Our results on the thickening of the dermis in patients after 40 years in all anatomical areas of the face with the achievement of a statistically significant ( $p < 0.05$ ) difference in the nasolabial folds and cheeks confirm the data of Humbert P. et al. [20] and Marcos-Garcés V. et al. [16].

As for the macroscopic organization of collagen bundles, the papillary and reticular areas of the dermis also develop differently. While the average thickness of the collagen bundle decreases from 1.0 mkm to 0.8 mkm in the papillary area, this parameter increases from 5 mkm to 10 mkm in the reticular area [16]. The thickness of the collagen bundles decreases simultaneously with dermal atrophy, and the space between the bundle's

increases, what leads to a decrease in tissue density in both the papillary and reticular areas (Fig. 3) [16].



**Fig. 3. Schematic representation of the dermis evolution in the process of human development and aging [adopted from 19].**

Mizukoshi K. et al. [21] claim that after 50 years, the quality of the dermis gradually deteriorates: the thickness decreases, in parallel with the progressive weakening and loss of fibrous dermal-epidermal connection. Age-related changes in the dermis papillary area were confirmed by ultrasound: echogenicity changes and a subepidermal anechoic band appears between the epidermal echo and the dermis in aging skin, the so-called SLEB (subepidermal low-echoic band) or SENEb (subepidermal non-echoic band) [19]. It should be noted that in our patients' cohort under 40 years of age, the smallest thickness of the dermis was diagnosed in the nasolabial folds area – 0.043 cm, and over 40 years – it was 0.067 cm. The maximum thickness of the dermis is documented in the glabellar area, regardless of age. In addition, according to Mlosek R. K. et al. [4] increased SLEB thickness is associated with water retention in the papillary dermis. Oh J. H. et al. [22] and Ahmed T. et al. [23] consider that this modification of the echogenic properties of the tissue may indicate changes in the organization and composition of the matrix with a decrease in the density of perlecan and hyaluronic acid and the density of collagen fibrils.

Age-related changes are not only limited by structural elements of the entire skin dermis, including the face but also by the vessels located in it [24]. Results of the study by Gomi T. et al. [25] testify to the general deterioration of blood vessels in the upper lip dermis during aging. The authors found that both the area and number of blood vessels in the upper lip dermis decreased with age [25].

Until now, little attention has been paid to the study of age-related changes in the skin of the face using ultrasound. Pellacani G. et al. [5] evaluated the echographic aspect of the facial skin in young people at different sites and changes in the thickness and echogenicity of the skin that develop with age. The authors found that the thickness of the skin is significantly higher on the upper and lower lips, chin and under-eye area than on the forehead and cheeks. In older people, an increase in the thickness of the facial skin on the forehead, cheeks, lips, chin and nose and thinning of the sub-ocular areas were verified compared to younger subjects. The increase in skin thickness values was statistically significant in the lateral areas of the forehead, upper and lower lips, and nose [5]. According to Pellacani G. et al. [5], skin echogenicity was higher in the upper part of the face (forehead, infraorbital areas and cheeks) than in the lower part (lips and chin), as evidenced by a decrease in hyporeflexive echo and an increase of 30-100 and 100-200 pixels. That also proved by our results.

We found in surveyed patients, that the thickness of the dermis and hypodermis was the smallest in the chin area in comparison with other studied areas of the face, and the thickness of the epidermis was the largest. According to the morphometric study of facial skin features by Karymov O. N. et al. [26], the thickness of the epidermis in the chin area is significantly more ( $p < 0.05$ ) than other anatomical zones.

In 70% of elderly people, a subepidermal hypoechoic band was visualized in the central area of the forehead and cheeks, in 80% - on the infraorbital areas, in 100% - on the upper lips. In the elderly, there was an increase in values related to the expansion of areas of medium and high amplitude (amplitudes 30-100, 100-200, and 201-255) and a decrease in the elongation of areas that affect hyporeflexivity [5]. The differences were significantly significant in the under-eye area (for band 0-30), on the cheek (for band 100-200), and on the upper lip (for all intervals). The lower lip and chin showed the lowest reflectivity with small hyperreflective areas (intervals of 100-200 and 201-255), especially in young subjects. A subepidermal hypoechoic band was documented on the lower lip in 50% of elderly subjects and on the chin in 70%. The ultrasound image of the nasal skin had a special picture: the lower part corresponding to the skin cover-

ing the cartilage was visualized poorly echogenic in both young and elderly people, while the upper part representing the skin above the bone shows a hypo-echogenic subepidermal area, which is especially pronounced in the elderly people [5].

Currently, age-related skin changes can be slowed down or prevented by appropriate clinical procedures: dermatological, surgical, and cosmetic interventions [27]. At the same time, skin examination is an effective and reliable tool for real-time diagnostics of the implant used type, its location, and the study of possible complications [28].

Considering the literature data that dermal fillers used for the treatment of age-related skin atrophy lead to the dermis thickening by neocollagenogenesis, it was interesting to assess the presence of changes in the thickness of skin layers depending on the use of injectable cosmetic procedures by patients. Chiang Y.Z. et al. [9] identify the following key complications associated with the use of fillers: pigment changes, hypersensitivity reactions, infections, nodule formation, granulomatous reactions, vascular occlusion, and filler migration. However, quite often patients do not know or remember the exact details of the procedure or the filler used type [29, 30]. Therefore, the usage of such an accurate and non-invasive diagnostic tool as ultrasound can help clarify the relationship between the procedure and the resulting pathology [29, 30]. We found that the dermis thickness in the area of nasolabial folds in patients using dermal fillers was more than 3 times greater in comparison with surveyed women without it. The obtained data are comparable with the results of Kim JS. [31] and Kim JA et al [32], who with histological examination of dermal biopsies, found its thickening lasting up to 4 years or more after intradermal cosmetic injections with polycaprolactone-based drugs.

**Conclusion.** We have detected a thickening of the dermis in patients over 40 years old and in surveyed women that using injection cosmetology methods. The results obtained in relation to the difference in the thickness of the skin layers depending on the anatomical area of the face, confirm the previously conducted morphometric measurement of the skin, and the detected changes in the dermis as a result of fillers – histological studies of its biopsies, which indicates the reliability of the ultrasound method for assessing the state of the organ under discussion. The advantages of this method are its non-invasiveness, the possibility of repeated research, and mobility. Until now, little attention has been paid to the study of age-related changes and some pathologic lesions in the face skin using ultrasound, so there are no standard parameters for assessing its thickness, which requires further research.

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## DO PATHOLOGICAL PROCESSES BRING NOTHING BUT HARM?

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Strengthening the homeostasis of biological systems by screening out some of their constituent elements is a universal adaptive response. One way of this dropout is natural selection, and one way of natural selection is disease. With the help of diseases, populations of wild animals, biocenoses and biosphere are genetically rearranged. This allows them, despite the action of the pathogenic factor, to continue to exist. It is unacceptable for a person to strengthen the homeostasis of societies by screening out sick people. But the long-term consequences of abandoning this way of strengthening the reliability of the existence of societies are also unacceptable. In societies, the genetic burden is growing due to the refusal to use this adaptive universal response. It reduces the homeostatic properties of societies and will continue to decline in the future. The growth of the genetic load is a common problem for humanity. It is necessary to discuss how to solve it now, and not to postpone it for the future, when its severity increases.

**Keywords:** natural selection of supraorganic and multi-species systems, genetic load, interdisciplinary approach, evolutionary approach.

“But the role of science is to understand how the world works, not to tell us what we want to hear”.  
[11] p. 8.

Man was formed as a result of natural selection, which continues today [10, 13, 15, 19, 26, 28, 30]. But now its direction has changed. The role of natural environmental factors, including diseases, has decreased, and the role of factors of the artificial environment, which a person has created for himself, has increased [16, 18, 20, 27]. The direction of natural selection is now strongly influenced by medicine. Its achievements are not only of great positive importance, but also lead to undesirable consequences that become apparent only a few generations after the widespread use of medi-

cal care [23, 25, 28, 31]. The number of cases in future generations will grow due to the activities of doctors. Thus, the high frequency of cases of difficulties during childbirth is a consequence of the fact that they are carried out, as a rule, with obstetric care, including with the help of caesarean section [23, 24]. The incidence of cesarean section is increasing and in developed countries it is higher than in less developed ones. It is higher because in the past it was used in them more often than in less developed countries [14].

Diseases are adaptive reactions [1, 2]. But they serve to adapt to a deteriorated environment not of individuals, which, on the contrary, are destroyed, but to strengthen the homeostasis of higher-ranking systems, of which the diseased are a part. Unlike all other Metazoa species existing on Earth, human populations do not use diseases as an adaptive response to pathogenic factors. Culture allows disease to be prevented and sick to heal. The homeostasis of human societies now largely depends on the success of the efforts of doctors. The health care system is expanding and improving. Societies require more and more energy to take care of the health of their citizens. The energy requirements of the societies providing this care are growing and will continue to grow in the future. This will increase the dependence of societies on energy sources and make them increasingly fragile.

However, it is unacceptable for human societies to adapt to disease-causing situations by screening out sick people. We cannot leave our patients without treatment, just as we cannot leave women in labor without obstetric care. Nor can we refuse measures aimed at counteracting the spread of diseases, at their prevention and elimination. Societies face the challenge of ever-increasing energy costs for health care. Since the energy capacity of societies will not always be high enough to afford them, an increase in the energy consumption of societies threatens to develop a state of energy deficiency in them. And its emergence is fraught with the disintegration of societies. One must not turn a blind eye to the problem of the genetic load. Now we need to think about how to solve it. The purpose of the article is to discuss the adaptive role of diseases.

### **Strengthening the homeostasis of the system by screening out some of its constituent elements - a universal adaptive process**

Strengthening the homeostasis of the system by screening out some of its constituent elements is a universal adaptive process. It is a consequence of the fact that some of the elements that make up the system

cease to strengthen it. Such elements include, for example, the cells of the body, which previously played an important role in it, but the need for which at this stage of ontogenesis has disappeared, as well as mutated, damaged and infected cells. The body gets rid of them by apoptosis.

Each individual of social insects by its activity strengthens the homeostasis of the community of which it is a part. But in the aging queen bee, it is getting worse due to the decrease in her fertility. The community needs a fertile womb. Therefore, the bees grow a new queen, which kills the old one. Worker bees take part in its destruction. They also kill drones when they become redundant in the hive [3, 5]. The need to kill some of its citizens sometimes arises in human societies. Whether this need is fictional or real, there is no consensus. It arises in a society when its needs come into conflict with the actions of its individual members. The death penalty for especially dangerous criminals is legalized in many countries. Its admissibility is controversial. Its supporters believe that it contributes to the prevention of crime and excludes the possibility of repeated crime.

The release of the system from the elements that reduce its homeostasis increases the reliability of its existence and thereby reduces the risk of its death. Systems of all levels are at risk of death due to the fact that some of the elements that make up the system weaken its homeostasis. In order for systems to be units of natural selection, the following conditions are necessary and sufficient: 1) they must exhibit phenotypic variability, 2) phenotypic modifications of systems should be associated with their different usefulness for systems, and 3) useful properties of phenotypic modifications must be inherited [21]. Populations of wild animals, communities of social insects, human societies, species and biocenoses meet these conditions [17, 29, 32]. In all these systems, phenotypic variability is observed, their phenotypic modifications are associated with different usefulness for the systems, and the properties of these systems are inherited. They are inherited because they have an analogue of the organism's genotype. In the supraorganism systems, it is the set of genotypes of the individuals constituting them and the set of hereditarily fixed interactions between individuals. In human societies, interactions between people are fixed not only genetically. They are also determined by upbringing, education, customs and legal laws that are passed down from generation to generation, that is, inherited. In biocenoses, an analog of the genotype of an organism is a set of genotypes of individuals of different species and a set of hereditarily fixed interactions between individuals of the same and different species [8, 9]. The risk of a system dropping out by natural selection is the less, the fewer elements in its composition that reduce its homeostasis.

**Disease is a special case of a universal adaptive response - strengthening the homeostasis of the system by screening out some of its constituent elements**

Sick individuals can also be elements that reduce the homeostasis of the system. During the existence of the biosphere, many biocenoses and species were eliminated from it by natural selection. Biocenoses and species in which there were fewer sick individuals than others had an evolutionary advantage over those in which there were more of them. Human societies that had fewer sick people than others also had an evolutionary advantage over those that had more. For example, Tasmania from the diseases brought by English settlers in the second half of the XIX century ceased to exist the aboriginal society. The Tasmanians are all extinct. The English, who are less susceptible to these diseases, survived. As a result, Tasmania was inhabited by people resistant to diseases which made Tasmanians extinct. As a result, the reliability of human existence has increased.

The system under the action of a pathogenic factor on it, in order not to be weeded out by natural selection, needs to get rid of the elements sensitive to this factor, that is, from sick individuals, and from supraorganism and multi-species systems, in which there are many sick individuals, to get rid of. And in sick individuals and in supraorganism and multi-species systems, in which there are many sick individuals, the need is opposite. They need to continue their existence as part of a higher-standing system. The needs of the system and parts of its constituent elements become opposite under the action of a pathogenic factor. In the wild, the needs of systems are always met, not their elements. Why is this happening? Different individuals of the population, different communities of social insects, different types of biocenosis and different biocenoses of the biosphere have different sensitivity to each specific pathogenic factor. Elements that are most sensitive to it, that is, diseased individuals, as well as systems of a higher level, in which there are many diseased individuals, are eliminated by natural selection. As a result, the systems from which the sensitive elements have been eliminated become more resistant to this pathogenic factor.

But it is not only by natural selection that elements are eliminated from systems. Their elimination is a consequence of the work of the regulatory mechanisms of the systems. Apoptosis is the result of the work of the body's regulatory mechanisms. The regulatory mechanisms of the bee colony participate in the destruction of the aging queen and the drones that have become unnecessary in the hive. Under the action of a pathogenic

factor, the regulatory mechanisms of populations of wild animals are involved in the elimination of individuals that are sensitive to this factor [12]. The elimination of especially dangerous criminals from society through the death penalty is the result of the work of the regulatory system of society. It is regulated by the mechanisms of biocenosis under the action of a pathogenic factor on the screening out of species [6].

### **The disease of individuals is an adaptive process regulated by a higher ranking system**

The mechanisms causing general pathological processes arose at the dawn of the evolution of Metazoa. At first they were the mechanisms of normal ontogenesis. According to the superstructure principle of L.A. Orbeli [7] the essence of evolution is such that the previous physiological mechanisms do not disappear at all. They are only suppressed by new, more perfect mechanisms. Pathological processes are a return to the mechanisms of normal ontogenesis of ancestors. The distant ancestors of mammals were invertebrates. They lived at sea. They retained their body structure only with a slight deterioration of the environment. With its strong deterioration, they switched on the mechanism of adaptive reversible destruction of the body.

The descendants of these long-extinct animals - colonial ascidians - did not abandon this ancient adaptive mechanism [4]. Studying it in them, as well as this mechanism in other primitive invertebrates (sponges, hydroid and coral polyps, bryozoans, intra-porous and pterygobranchs), which also adapt to the deterioration of the environment by destroying their body [4], is the key to understanding the mechanisms of general pathological processes. highly organized animals and humans [22]. In these invertebrates, under the influence of a damaging factor and the threat of its seasonal action, specialized tissues are destroyed, the differentiated cells of these tissues are absorbed or dedifferentiated, and the colonies turn into clusters of reduction bodies or diapausing buds, similar in structure to early embryos. When the environment improves, the structure of the colony from these structures is restored [4]. When applied to highly organized animals and to humans, the terms "damaging factor" and "pathogenic factor" are synonyms. In their application to the above invertebrates, this is not the case. In them, the destruction of the body structure, which occurs due to the action of a destructive factor or because of the threat of its seasonal action, is not a pathology, but a component of normal ontogenesis [4].

In mammals, in response to a pathogenic factor, the defense mecha-

nisms of normal ontogenesis are first activated. If with their help it is not possible to adapt to its action, the ancient mechanisms are triggered, that is, the individual becomes ill. The destructions observed during inflammation, sclerosis, aging and cancer are atavistic destructive reactions of the normal ontogenesis of our Precambrian ancestors [22]. This destruction is regulated by the body. In the dynamics of many pathological reactions, L.A. Orbeli [7], it is necessary to see not an arbitrary destruction of structures and functions, but a natural retreat to the passed stages of evolution and exposure of the mechanisms of normal ontogenesis of ancestors leading latent activity. The destructive mechanisms of the very distant ancestors of mammals in our time no longer serve to strengthen the reliability of the existence of an individual. They have turned into pathological mechanisms that are now used to strengthen the reliability of the existence of systems of which individuals are integral parts.

Diseases are a means by which the systems strengthen their homeostasis, at a level higher than that of the organism. Regulatory mechanisms of society take part in the occurrence of diseases in humans [12]. Human diseases are the reaction of society aimed at strengthening their homeostasis. Society has properties that its constituent people do not have. One of them is the ability to strengthen one's homeostasis through screening out with the help of diseases susceptible to pathogenic factors in people. It weeds out people who are poorly adapted to life in it, that is, those who are sick, since by their presence they reduce the reliability of its existence. Doctors are struggling with this dropout. They, saving the lives of the sick, counteract the important adaptive reaction of society. Their efforts are all the more effective the higher the level of science in society and the higher the power supply of society. As a result of their activity, the genetic burden in societies is growing. It grows most rapidly in prosperous societies.

### Conclusion

Individuals of wild animals can exist only as constituent parts of populations, and people - only as constituent parts of societies. For the existence of wild animals and people on Earth to be reliable, the existence of the systems of which they are a part must be reliable. Diseases are used to strengthen the homeostasis of populations of wild animals under the action of a pathogenic factor. It is unacceptable for a person to strengthen the homeostasis of societies in this way. But the long-term consequences

of abandoning this way of strengthening the reliability of the existence of societies are also unacceptable.

Under the action of a pathogenic factor, the needs of the sick and the needs of society become opposite. The sick need to continue their existence. Society, in order to prevent a decrease in the level of its homeostasis, needs to get rid of the sick. Social satisfaction of the needs of sick citizens instead of satisfying their own need to strengthen their homeostasis leads to an increase in the genetic load, which reduces the homeostasis of societies. The growth of the genetic load is a common problem for humanity. We need to discuss it and think about how to solve it now, and not postpone it for the future when its acuteness increases.

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**MOTOR UNIT SYNCHRONIZATION AT DIFFERENT INTENSITIES  
OF MUSCLE CONTRACTION AS REVEALED BY DETERMINISM OF  
SURFACE MYOELECTRIC SIGNAL**

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**Abstract.** For the first time using Recurrence quantification analysis (RQA) of the surface EMG data we conducted an indirect assessment of motor unit (MU) synchronization of the quadriceps muscle in eccentric and concentric modes of contraction during leg extension at 25%, 50%, 80% and 100% of the individual eccentric and concentric repetition maximum. In particular, we found that % determinism (%DET), which is a sensitive variable that is able to detect motor unit synchronization, was slightly higher during eccentric contractions. It was also found that degree of synchronization decreased with increasing contraction intensity similarly in each contraction mode. The %DET calculated during the quantitative analysis showed sensitivity to changes in the mode and intensity of muscle contraction, and it can be used to assess synchronization of MUs.

**Keywords:** Recurrent quantification analysis, EMG, eccentric, concentric, synchronization.

According to classical view, the force exerted by a muscle during a voluntary contraction depends on three main mechanisms: number of active motor units (MUs), their firing rate, and synchronization of MU firing instances. The recruitment mechanism was most fully studied by E. Henneman, who proved the immutability and stereotype of the order of MU activation in accordance with the size principle [1]. While orderly recruitment appears a robust phenomenon, no consensus exists on the mechanism responsible for MU synchronization. It was believed that, with increasing muscle

contraction intensity the degree of synchronization must concomitantly rise for the graded development of muscle force. The first attempts to identify the functional significance of MU synchronization showed that the level of synchronization between pairs of motor units in the first dorsal interosseus muscle was greatest among weightlifters compared to musicians and untrained individuals [2]. Synchronization may also increase after participating in a strength training program [3]. But the researchers were never able to provide convincing empirical evidence that an increase in synchronization by itself causes an increase in muscle force. On the contrary, under experimental conditions [4, 5] and under conditions of computer electromyographic (EMG) simulations and skeletal muscle modeling [6], the relationship between synchronization and force fluctuations was not found. Moreover, results of modern studies [4, 7], devoted to the investigation of voluntary isometric contractions using the EMG decomposition technology, showed that the degree of synchronization decreases as the intensity of contractions increases, which contradicts the classical ideas about the role of synchronization in controlling the force exerted by a muscle. Until recently technical limitations precluded the study of synchronization pattern in any but stereotyped contractions of limited forcefulness. In view of the above our aim was to test the degree of synchronization for larger force outputs and for different modes of contractions (eccentric and concentric). Information on motor strategies can be extracted from the surface electromyogram (sEMG) by non-linear methods. The most promising method in this area of research is the method of recurrent quantification analysis (RQA). RQA is an efficient time-series analysis tool pertaining to the class of non-linear dynamics time-domain processing. Subtle changes in surface EMG can be detected by different indexes extracted from RQA such as the percentage of determinism (%DET), which reflects the amount of rule-obeying structure in the signal dynamic and may be a sensitive variable to detect synchronous motor unit behavior [8].

**Methods.** 9 athletes engaged in strength sports volunteered to participate in the study. Bioelectric activity of the quadriceps femoris was obtained at 25, 50, 80 and 100% of the maximum voluntary eccentric and concentric contractions (MVC) using a 16-channel electromyograph (ME6000 Biomonitor System, Mega Electronics Ltd, Finland) when performing leg extension exercise. The eccentric maximum corresponded to 140% of the concentric maximum. The duration of each contraction was 2 seconds. The EMG signal was recorded using Ag/AgCl electrodes (50 mm in diameter) placed 2cm apart over the muscle belly. EMGs were band-pass filtered from 3 to 500 Hz and sampled at 1000 Hz. To determine

the amount of synchronization from the surface EMG, we used the recurrence quantification analysis (RQA). Mathematical concepts that produces %DET are very complex. Readers interested in getting more information about this analytical tool can refer to the works [9, 10]. Recorded myographic data were embedded in an N-dimensional Euclidean space. Optimal embedding dimension and time-delay were computed for each surface EMG for eccentric and concentric contractions. The recorded time series were divided into shorter episodic windows (N = 4000 consecutive points) or epochs, each 0.5 seconds long. Adjacent windows were shifted by 2000 points (50% overlap). For each sliding window %DET was extracted, then the values were averaged. To analyze the electrical activity of the muscle the root mean square (RMS) of the raw signal was computed.

Significant main effects were assessed by a two-way analysis of variance with repeated measures (mode [eccentric, concentric] and %MVC [25, 50, 80, 100%]). *Post-hoc* testing was performed when appropriate using Bonferroni's analysis. Correlation analysis between %MCV and %DET was performed using the Pearson's r-test. Significant levels were set at  $p < 0.05$ . Values are expressed as mean and standard error of the mean.

**Results and discussion.** The results of the analysis are presented in the table 1. %DET was slightly higher for eccentric contractions than for concentric contractions (mode effect,  $F = 8,9$ ;  $p < 0,05$ ) which may indirectly reflect a more synchronous pattern of MUs activity, with *post-hoc* analysis indicating statistically significant differences between the groups only at 25 %MVC ( $p < 0.05$ ).

**Table 1. The amount of percent determinism (%DET) and the root mean square (RMS) of the quadriceps femoris electromyogram with increasing contraction intensity from 25% to 100% MVC during concentric and eccentric contractions.**

%MVC	DET, %		RMS, $\mu$	
	Eccentric	Concentric	Eccentric	Concentric
100	53,33 $\pm$ 7,99	51,07 $\pm$ 6,41	431,7 $\pm$ 174,9	507,6 $\pm$ 171,7
80	57,67 $\pm$ 7,35	54,87 $\pm$ 6,40	328,5 $\pm$ 135,6	408,2 $\pm$ 146,2
50	59,97 $\pm$ 8,28	54,60 $\pm$ 6,81	224,5 $\pm$ 96,0	307,3 $\pm$ 113,0
25	63,20 $\pm$ 8,13	56,47 $\pm$ 8,28	138,6 $\pm$ 55,1	235,0 $\pm$ 93,2

Data are presented as means  $\pm \sigma$ .

There was a significant main effect of intensity on %DET (%MVC effect,  $F = 5,4$ ;  $p < 0,05$ ). %DET decreased with increasing contraction intensity and, as a result, EMG amplitude, represented by root mean square (RMS),

in both contraction modes. There was a significant negative correlation between %MVC and %DET ( $r=0.9$  and  $0.8$  for the eccentric and concentric modes, respectively).

Our data are consistent with previous findings [4, 7] devoted to the investigation of voluntary isometric contractions using EMG decomposition method, where degree of synchronization decreased as the force increased. The authors concluded that synchronicity is nothing more than an epiphenomenon, a side effect of the pattern of motor units firing rate. A data set of 17,546 paired motor unit action potential trains (MUAPTs) [4] revealed that the degree of synchronization varies as a function of two characteristics of the motor unit firing rate: the similarity (the same recruitment threshold) and the steepness of the firing rate slope. To understand the reason for the inverse relationship between the intensity of muscle contraction and the degree of MU synchronization it is important to clarify one moment concerning the differences in the firing rate of high-threshold and low-threshold motor units. To date, numerous studies provide strong evidence, that the firing rates are arranged in an inverse hierarchical order, according to motor unit recruitment thresholds, that is, firing rate value of earlier-recruited low-threshold motor units is greater than that of later-recruited high-threshold motor units at any time and force [11-20]. Thus, during muscle contractions with gradually increasing intensity, the first-recruited low-threshold motor units that are relatively more sensitive to the voluntary excitation, have the same recruitment threshold and incrementally increasing initial firing rate, which enhance the likelihood of producing coincident firing instances at the beginning of the movement, since both factors are observed (similarity and slope of firing rate). As the force generated by the muscle increases, the low-threshold slow-twitch motor units increase their firing rate, the initial steep firing rate slope gradually transitions to a flatter, linear region, and they become progressively less sensitive to the voluntary excitation, thus reducing the incidence of synchronization [21]. The increase in the voluntary excitation further results in the recruitment of high-threshold fast-twitch motor units firing at similar lower rates. However, the firing rates of these motor units have relatively shallower slopes that lead to relatively lesser degrees of synchronization. And so on, with an increase in the force level contraction, larger motor units with relatively shallower firing rate slopes are involved in the work, and already working motor units increase their firing rate and also reduce the slope [22]. Thus, it follows from the above that the higher the target % of MVC, the lower the MU synchronization which was found in the present work.

So the question remains, why MU synchronization might increase in

muscles subjected to a strength training? One possibility is that increased levels of synchronization may play an important role during rapid contractions or at the beginning of any contraction which appears to enhance the rate of increase in force [23].

In conclusion, in our present work for the first time the method of recurrent analysis was used to assess the degree of motor unit synchronization in eccentric and concentric contraction modes ranging up to the maximal level. Our findings are in agreement with the results of previous modern studies on this topic and confirm the fact that the degree of synchronization decreases with increasing contraction intensity. This effect was observed in both eccentric and concentric contraction modes. In the eccentric mode, the synchronicity was slightly higher than in the concentric mode in the range of the studied intensities. However, a higher degree of synchronization probably does not contribute to high force production during eccentric contractions, since previous studies have not confirmed a relationship between the amount of synchronization and the force of contraction.

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## ULTRATHIN POLYETHYLENEIMINE (PEI) FILMS FOR CULTURING OF THE HUMAN MESENCHYMAL STROMAL CELLS (hMSCS)

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**Abstract.** We used the polymer polyethyleneimine (PEI) (in the 1 mg/ml concentration) to produce the ultrathin films at the culture plastic that could enhance the adhesive properties of the human mesenchymal stromal cells (hMSCs) isolated from the heterogeneous cell population of the marrow. Our study demonstrated that the PEI films prevent cell-to-cell cooperation and “glomeration” of hMSCs at the surface of a cultural plate, and enhance hMSCs adhesion and viability *in vitro*. The stimulating effects of PEI on cell proliferation are negligible. We suggest to use the PEI films in the regenerative medicine – at the stages of hMSCs isolation and growth of their biomass.

**Keywords:** mesenchymal stromal cells, polyethyleneimine, adhesion, cell proliferation

### **Introduction**

A synthetic polymer PEI is used in biomedicine and cell technologies as an agent for non-viral transfection of the eukaryotic cells [1 - 5]. PEI binds to DNA, RNA, proteins and immunoglobulin's at physiological pH (7.2–7.4) [1, 6 - 8]. Nanoscale complexes PEI-DNA (polyplexes) penetrate the plasma membranes by endocytosis [9]. This phenomenon was shown with the human fibroblasts [9], HEK293, NIH-3T3, HeLa cells [7] and epi-

thelium of the upper respiratory tracts [10]. The polyplexes are unpacked in the lysosomes of host cells and free DNA spreads into the cytoplasm and cell nucleus [1, 11]. Various modifications of PEI are used as adjuvants enhancing immune response of a body against action of a vaccine [12]. The polyelectrolyte has strong antimicrobial and antiviral properties [13, 14, 15]. On an industrial scale, PEI can be used as a chelating agent at cleaning of water reservoirs from salts of heavy metals [16].

The literature sources contain the data on the PEI application to improve adhesion of the cells with weak adherence to culture plastic, such as endothelial [17, 18] and neural cells of a mature body [17, 19, 20], while just the adhesion serves as a key factor in their proliferation and differentiation [17, 21, 22]. In case of the neural cells, the effectiveness of the customary adhesion factors from the polypeptides of the extracellular cell matrix (ECM) is much lower than the effectiveness of the PEI [19, 20]. For example, as a result of poor coupling of the primary cortical neurons with the ECM proteins (laminin, polylysine) the cells never adhere to the surface of a culture plastic and lose their potential to differentiate *in vitro* [20]. At the same time, when the culture plastic is covered with the PEI, the cortical neurons grow and differentiate on its surface, forming the functional neurites and sinus-like structures. A polyelectrolyte PEI has obvious advantages over such natural adhesion factors as collagen and polylysine [17] that was proved with the cultures of the immortal cell lines PC-12 and HEK-293.

The lower effectiveness of the eukaryotic cells culturing at the coatings from the ECM polypeptides comparatively with culturing on the coatings from the synthetic polymer PEI can be the result of the protein amide groups hydrolysis at the physiological conditions [23]. ECM debris may exert negative effects on cell metabolism, proliferation and differentiation, while the cell adhesive PEI films have, at the physiological conditions of culturing, the enhanced resistance and stability. Moreover, they keep their physico-chemical and biological properties over time, becoming an advantageous adhesive material for the isolation and culturing of the mesenchymal stromal/stem cells of the human marrow (hMSCs). In case of the hMSCs, their adhesion, sticking and spreading within the culture plastic underlie production of a homogeneous cell population [24, 25]. However the mentioned authors note that a method of ECM isolation from the marrow based on a dominating adhesion of the mesenchymal cells to culture plastic is inefficient. Various approaches can be used to improve efficiency of the ECMs isolation from the heterogeneous population of marrow cells, for example, use of the fibrin microgranules (FMB) that establish an ad-

hesive matrix for the following cell propagation *in vitro* [25]. The yields of the ECMs produced with the FMB are an order higher than the results of adhesion at culture plastic. The FMB-isolated ECM differentiate into the mesodermal derivatives, including osteocytes [25].

All abovementioned became our reason to examine the PEI films as a potential adhesive coating for hMSCs. We supposed that enhance of the adhesive properties of hMSCs will promote forming of a dense and uniform monolayer *in vitro* that, in turn, will improve the effectiveness of cultivation and, hence, will promote growth of the cell biomass. The hMSCs are a perspective material for the recovery of damaged organs and tissues, so issues of improvement of culturing efficiency are of great importance for regenerative medicine and biotechnology. The aim of the investigation was evaluation of the PEI adhesive properties and cytotoxicity towards the primary cultures of the hMSCs with the known parameters of growth, propagation and differentiation in the directions of adipo-, chondro- and osteogenesis [26]. The hMSCs were cultured in the standard media at plastic and at PEI ultrathin films. The adhesive films were prepared by the method of electrostatic adsorption of the PEI solution (1 mg/ml) on the culture plastic.

### Materials and Methods

**Objects of study.** Objects of study. A primary culture of human mesenchymal stromal cells (hMSCs) was kindly provided by the International Biotechnological Company Kintaro Cells power (Moscow Branch, Moscow). The cells were isolated from a female volunteer donor who consented to the appropriate medical procedures. The cells were characterized as positive for CD29, CD44, CD73, CD90, CD105 and negative for CD34, CD45 and HLA-DRP markers. All the experiments with the cell cultures were performed in accordance with the Guidelines approved by the IEC of the Institute of Cell Biophysics, RAS (Approval no. 57 dated December 30, 2011). The hMSCs were cultured in a high glucose medium DMEM/F12 (Gibco, USA) supplemented with 10% fetal bovine serum (FBS, Gibco, USA), 1 mM glutamine, 100 U/ml penicillin and streptomycin. The cultures were maintained in the atmosphere of 5% CO<sub>2</sub> at 37°C and high humidity in a CO<sub>2</sub> incubator (Sanyo, Japan). The cells were seeded into 24-, 48-, and 96-well plates (Nunc, USA) with films from PEI (1 mg/ml) preliminarily deposited on the surface of wells. Cells growing on the polyelectrolyte coating-free culture plastic were used as the control.

**Manufacturing of the PEI nanofilms.** The films were made from polyethyleneimine (PEI, 50 wt.% soln. in water, MW: 50-100 kDa, CAS:9002-98-6; ICN Biomedical, USA). The PBS solution of PEI in the concentration

1 mg/ml was applied with a thin layer (3 mm) on the surface of culture plates, kept at room temperature for 30 min., then the excess polyelectrolyte was removed from the plate surface, the plates were dried a little, and the formed PEI films were gently washed in PBS. The films were made under sterile conditions in the laminar box. To avoid contamination, culture plates with nanofilms deposited on the surface of the wells were additionally sterilized for 3 hours under a UV lamp before culturing.

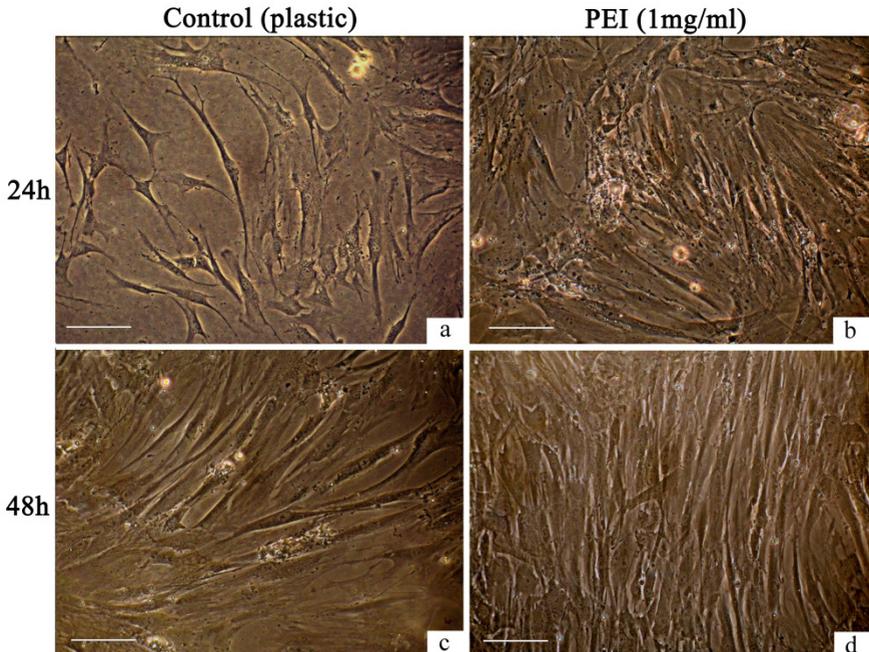
**Viability test.** Viability test. We used a vital dye 1% trypan blue (Fluka, Switzerland) revealing the cells with damaged cell membranes, and the MTT assay evaluating activity of mitochondrial dehydrogenases. The cell multiplication rate and population doubling time under different conditions of h-MSCs culture (on polyelectrolyte films and without them) were calculated in the logarithmic growth phase according to the formula:  $V = 3.32 \times \lg [X/X_0]$ , where  $X_0$  is the initial cell concentration,  $X$  is the final cell concentration in the culture medium. In order to determine the population doubling time, the following formula was used:  $[T = (\ln 2 \times dt) / \ln (X/X_0)]$  that considers the duration of h-MSCs culture.

**Determination of differential cell adhesion to the PEI surface.** The analysis was performed with a 48-hour hMSCs culture (3–4 passages after isolation from marrow). The cells were washed twice with PBS solution, trypsinized, counted and distributed in equal volumes into 4-well embryological plates (Nunc, Denmark). Three wells of each plate were pretreated with the PEI solution, while the fourth, PEI-free, served as a control. The hMSCs were plated at a concentration of  $5\text{--}7 \times 10^4$  cells/ml of DMEM/F12 with 10% FBS, then the plates were placed in the CO<sub>2</sub> incubator. After 1 or 3 hours of incubation, the cells were thoroughly washed in PBS and in trypsin-EDTA solution (2–3 min at ambient temperature). The cells remaining attached to the surface were counted in 20 fields of view of each well at a 20x objective magnification (Olympus IX70, Japan). To detect differences in the adhesive properties of the polymers, the numbers of attached cells in three parallel test were averaged. The numbers of attached cells were calculated with a cytophotometry image analysis software program (PhotoM).

**Statistical processing of the results.** The results were processed by simple averaging and standard deviation computing with computer programs Sigma Plot and Microsoft Office Excel. To assess the statistical significance of the differences between the comparison groups, we used the nonparametric Mann-Whitney test that considers  $p < 0.05$  as a significant difference between the two comparison groups.

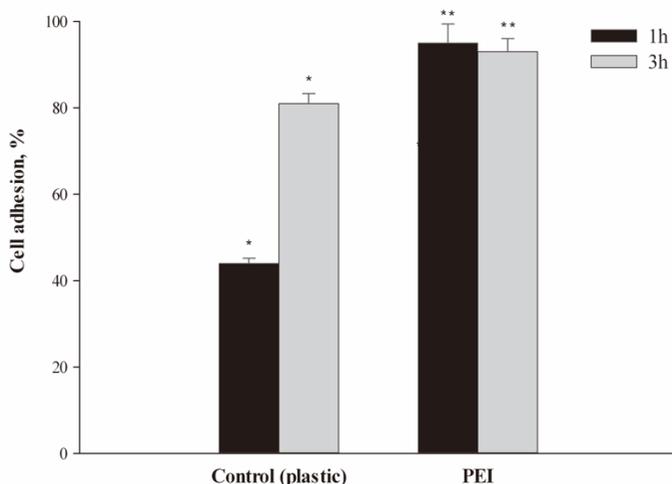
**Results**

Culturing of the hMSCs for 24–48 h in the standard medium DMEM/F12 with 10% FBS either at plastic or at PEI films showed little changes in cell and monolayer morphology (Fig. 1). However, at the PEI surface, the h-MSCs distributed more regularly and formed denser monolayers than at the culture plastic (Fig. 1 d). The PEI films enhanced the adhesive properties of the hMSCs (Fig. 2). After an hour exposition at 37°C and 5% CO<sub>2</sub> in the air atmosphere, the most part of cultured cells (over 80%) attached to the film surface and spread, forming the processes. Adhesion of the h-MSCs to the culture plastic was in this period much weaker and did not exceed 50% (Fig. 2). The main mass of cells attached to the surface within three hours of exposition in CO<sub>2</sub>-incubator.



**Fig. 1. Morphology of the hMSCs monolayer after 24 and 48 h culturing in DMEM/F12 with 10% fetal bovine serum (FBS) at culture plastic and at polyelectrolyte PEI film. The cells were taken at the third passage after isolation from human marrow.**

High rates of hMSCs adhesion and spreading at PEI films was followed by the regular distribution of cells along its total surface. These phenomena could be considered as characteristics of electrostatic interaction between negatively charged plasma membranes of live cells and positive charge of the PEI film surface.



**Fig. 2. Effectiveness of the hMSCs adhesion (% of adhesive cells) at culture plastic and PEI film (1 mg/ml). This is the MSCs culture at the 3-4 passages after isolation from marrow. The cells were incubated for one or three hours in CO<sub>2</sub>-incubator in DMEM/F12 with 10% FBS. The experiments were performed in three parallels. \* - significant differences at hMSCs incubation at plastic ( $P \leq 0.01$ ); \*\* - lack of differences at the cells incubation at the PEI films ( $P \geq 0.05$ ).**

Examination of growth characteristics of hMSCs shows that rates of cell propagation and monolayer growth at PEI films are the same as that at culture plastic (Table 1). It is expected that contact of hMSCs with PEI does not affect the cell proliferation. However, when the cells h-MSCs are cultured at PEI, such key parameter as doubling time their population is significantly lower than in the control:  $22.7 \pm 4.76$  h and  $29.1 \pm 4.23$  h, respectively. At that, cell death by the necrosis mechanism at the PEI films is twice higher (Table). These results may be the indicator of the polyelectrolyte used for hMSCs with a concentration 1 mg/ml.

**Table. Growth characteristics of hMSCs after 72 h incubation at culture plastic and polyelectrolyte PEI films**

Culturing conditions	Growth rates for colonies and monolayer	Population doubling time, h	Proportion of cells with damaged plasma membranes, %
Control (plastic)	2.18±0.17*	29.1±4.23	6.2
PEI film	2.13±0.15*	22.7±4.76**	13.4

**Note.** We used hMSCs at 3–5 passages after isolation from marrow. The cells were cultured in DMEM/F12 with 10% fetal bovine serum (Sigma). By the results of the test with 1% vital die trypan blue, the cells with damaged plasma membranes were considered as inviable. Each experiment was performed in four parallels. \* - lack of significant differences in the rates of a monolayer growth ( $P \geq 0.01$ ); \*\* - significant reduction in hMSCs population doubling at the PEI film comparatively with the control culture at the plastic ( $P \leq 0.01$ ).

The adhesion of h-MSCs to the surface of a culture plate and their further spreading at this surface is a key moment at the stage of their isolation from the heterogeneous cell population of a marrow [24, 25]. Covering of the culture plastic with the PEI films solves this problem. In spite of the PEI cytotoxicity, the polymer enhance adhesive properties of the hMSCs (Fig. 2), reduce time of population doubling (Table). Reduction in time of the hMSCs population doubling at the PEI films results in the increase in total amount of cell mass in vitro and levelling of the inviable cells at the following passages.

### Conclusions

The primary hMSCs populations have limited abilities to adhesion and spreading at the surface of culture plastic. The PEI films promote the increase in: (1) rate of adhesion and (2) effectiveness of isolation of hMSCs from marrow and their culturing that leads inevitably to the increase in cell mass in vitro. A current hMSCs-based therapeutic approaches involves the transplantation of great amounts of functionally active cells into affected areas. Growth of the cell mass in course of the hMSCs culturing on the PEI films is a key issue of the regenerative medicine. In this context the PEI films can serve as an effective base for isolation and culturing of the hMSCs from the human marrow.

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**ON THE CONJUGACY OF FINITE SETS OF SUBGROUPS IN COXETER GROUPS WITH A TREE STRUCTURE <sup>1</sup>**

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**Abstract.** In this paper, the algorithmic solvability of the conjugacy problem for finite sets of finitely generated subgroups in Coxeter groups with tree structure is proved.

**Keywords:** Coxeter group, tree structure, conjugacy, subgroup.

By the Coxeter group  $G$  we mean a group with a finite number of generators  $a_i, i \in I, |I| < \infty$ , and a finite number of defining relations  $(a_i a_j)^{m_{ij}} = 1, m_{ii} = 1, m_{ij} \geq 2$  or  $m_{ij} = \infty$  for  $i, j \in I, i \neq j$ . If  $m_{ij} = \infty$ , then  $a_i$  and  $a_j$  are not related for any  $m_{ij}, i \neq j$ , defining relations.

The groups under consideration were introduced in 1934 [1] as groups generated by reflections with respect to hyperplanes and are named after H. S.M. Coxeter, who described and studied them.

However, the Coxeter groups received algebraic fame only in 1962 after the publication of the works of J. Tits.

It is known that the word problem is algorithmically decidable in Coxeter groups. Difficulties arose with the solution of the conjugacy problem, so it was studied in subclasses of this class of groups. So, in 1983 K. Appel, P. Schupp [2] singled out the large Coxeter groups ( $m_{ij} \geq 3$  for  $i, j \in I, i \neq j$ ), as well as extra-large ( $m_{ij} > 3$  for  $i, j \in I, i \neq j$ ) types, in the latter they solved the problem of conjugation of words. Today, a positive solution to the conjugacy problem is known in the general class of Coxeter groups. The generalized conjugacy of words in Coxeter groups of large type was considered by V.N. Bezverkhny and I.V. Dobrynina in [3] and [4].

If a group  $G$  corresponds to a tree-graph  $\Gamma$  so that the generators  $a_i$  and  $a_j$  are assigned to the vertices of the edge  $e$  of the graph  $\Gamma$  and the relation  $(a_i a_j)^{m_{ij}} = 1, m_{ij} < \infty$ , is assigned to the edge  $e$  itself,  $i, j \in I, i \neq j$ , then  $G$  is called a Coxeter group with a tree structure.

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The considered class of finitely defined groups was introduced in 2003 by V. N. Bezverkhny [5], it belongs to hyperbolic groups, the main algorithmic problems in it were solved by V. N. Bezverkhny and O. V. Inchenko (for example, [6]). In [7], V.N. Bezverkhny and I.V. Dobrynina described free subgroups in this class of groups.

It is known [6] that a Coxeter group with a tree structure can be considered as a tree product of Coxeter groups with two generators, united by cyclic subgroups of the second order. This corresponds to some  $\Gamma'$ , in which the vertices of each edge  $e'$  of the graph  $\Gamma'$  are associated with the Coxeter groups  $G_{ij} = \langle a_i, a_j; (a_i a_j)^{m_{ij}} = 1 \rangle$  and  $G_{jkk} = \langle a_j, a_k; (a_j a_k)^{m_{jk}} = 1 \rangle$ , and the edge  $e'$  is associated with a finite cyclic subgroup  $\langle a_j; a_j^2 = 1 \rangle$ .

**Definition 1.** The occurrence problem is the problem of the existence of an algorithm that allows, for any finitely generated subgroup  $H$  of a finitely defined group  $G$ , to find out whether an arbitrary element of the group  $G$  belongs to the subgroup  $H$ .

In the class of Coxeter groups, P. Schupp constructed an example proving the undecidability of the occurrence problem.

**Definition 2.** A group  $G$  satisfies the maximality condition if any sequence of subgroups  $H_1, H_2, \dots$ , taken in ascending order stabilizes, that is, there is a natural number  $N$  such that for any  $n, n > N, H_n = H_{n+1} = \dots$

**Lemma 1** [8]. Let the group  $\langle \prod_{s=1}^n * G_s; \varphi_{ij}(U_{ij}) = U_{ij} \rangle$  be the tree product of groups united by isomorphic subgroups of  $U_{ij} < G_i$  and  $U_{ji} < G_j$  using a fixed set of isomorphisms  $\varphi_{ij}: \varphi_{ij}(U_{ij}) = U_{ji}$ . Then if the subgroups  $U_{ij}$  and  $U_{ji}$  have the maximality condition and the following are solvable in the factors

- 1) entry problem;
  - 2) the problem of intersection of the cosets of any finitely generated subgroup  $H < G_i$  with the subgroup  $U_{ij} < G_i$ ;
  - 3) there is an algorithm that writes out the generators of the intersections of any finitely generated subgroup  $H < G_i$  with the subgroup  $U_{ij} < G_i$ ,
- then the occurrence problem is solvable in group  $G$ .

As mentioned earlier, a Coxeter group with a tree structure is a tree product of finite Coxeter groups by two generators with amalgamation over cyclic subgroups, and therefore satisfies all the conditions of Lemma 1, whence we obtain

**Consequence.** In a Coxeter group with a tree structure, the occurrence problem is solvable.

**Lemma 2** [6]. In a Coxeter group with a tree structure, the conjugacy problem of finitely generated subgroups is solvable.

**Definition 3.** In a group  $G$ , the problem of intersection of cosets of finitely generated subgroups is solvable if, for any finitely generated subgroup  $H_1, \dots, H_s$  of the group  $G$  and any words  $w_1, \dots, w_s \in G$  there is an algorithm that makes it possible to establish whether the intersection  $w_1 H_1 \cap \dots \cap w_s H_s$  is empty or not.

**Lemma 3** [9]. In a Coxeter group with a tree structure, the problem of intersection of cosets of finitely generated subgroups is solvable.

In what follows, we will consider the Coxeter group  $G$  with a tree structure.

**Lemma 4** [10]. The normalizer of an arbitrary finitely generated subgroup of the Coxeter group  $G$  with tree structure is finitely generated. There is an algorithm that writes out the generators of this normalizer.

**Theorem.** There is an algorithm that allows one to establish, for any two sets of finitely generated subgroups  $\{H_i\}$  and  $\{H'_i\}$  of a group  $G$ , whether there exists such an  $z \in G$ , that  $\&_{i=1}^n (z^{-1} H_i z = H'_i)$ .

**Proof.** The corollary to Lemma 1 implies the solvability of the occurrence problem in  $G$ .

Based on Lemma 2, for any two finitely generated subgroups  $H_i, H'_i$  one can effectively establish whether they are conjugate in  $G$  or not.

Suppose that for the sets  $\{H_i\}, \{H'_i\}, i = \overline{1, n}$ , from the group  $G$  there exists an element  $z \in G$  such that

$$\&_{i=1}^n (z^{-1} H_i z = H'_i). \tag{1}$$

For a pair  $(H_i, H'_i)$  one can define an element  $z_i \in G$  such that

$$z_i^{-1} H_i z_i = H'_i. \tag{2}$$

It follows from (1) and (2) that

$$\&_{i=1}^n (z_i z^{-1} H_i z z_i^{-1} = H'_i).$$

Thus,  $z_i z^{-1}$  belongs to the normalizer  $N_G(H_i)$  of the subgroup  $H_i$  in group  $G$ . From this we have

$$z_i z^{-1} = h_i \& \dots \& z_n z^{-1} = h_n, \tag{3}$$

where  $h_i \in N_G(H_i), i = \overline{1, n}$ .

By Lemma 4, one can effectively construct normalizers  $N_G(H_i), i = \overline{1, n}$ .

From (3) we obtain:

$$z = z_1 h_1^{-1} = z_2 h_2^{-1} = \dots = z_n h_n^{-1}. \tag{4}$$

Thus, finding  $z$ , satisfying (1) is equivalent to solving system (4). This solution is the intersection of cosets of finitely generated subgroups.

By Lemma 3, system (4) is effectively solvable.

The theorem is proved.

In [11] by I.S. Bezverkhnyaya, a similar problem was considered for free products of groups.

The theorem proved in this paper is a generalization of the result of [12] to the general class of Coxeter groups with tree structure.

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## THE ANALOGY AS A METHOD OF COGNITION IN PHYSICS

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**Abstract.** The article examines the role of analogy in the development of physics against a historical background. It is shown that the use of analogy as a method of cognition plays a fruitful role at the first stage of the study of new physical phenomena.

**Keywords:** cognition, analogy, physics, laws, modeling.

The entire history of natural science is a convincing example of the enormous role analogies and models play in gaining new knowledge about the world around us. Representatives of ancient philosophy have already seen the enormous heuristic value of analogy and models. Perhaps the first analogy as a method of cognition was used by Democritus. According to Aristotle, Democritus, observing the chaotic movement of dust particles in a ray of light, formulated a hypothesis that the world consists of the smallest particles - atoms in a state of continuous chaotic motion. Analogy played a large role in Plato's philosophy. In his opinion, a person can cognize the world of ideas only with the help of analogy with sensually perceived things and relations of the material world.

*Analogy* – is a method of cognition, in which, on the basis of the similarity of objects in some features, they conclude about their similarity in other features. An analogy with what is known helps to understand what is unknown (knowledge is transferred to a less studied object). The analogy with the simple helps to understand the more complex. From an epistemological point of view, analogy is a method of scientific knowledge based on a comparison of the properties of dissimilar objects, processes, phenomena, quantities, etc. [9]. From the point of view of psychology, analogy as a form of thinking is inductive inference. In this case, based on the similarity of two objects for some one feature, a conclusion is made about their similarity for other features. It is impossible to obtain reliable knowledge using only analogy. At the same time, it plays an important role not only in science, but also in human life. There are many different phenomena that

are different in their physical nature, but have the same signs and patterns. In such cases, we can talk about the similarity of systems or their analogy. Analogy and model is one of the methods of scientific cognition that is widely used in the formation and development of physical theories. A conclusion by analogy can be both true and false, therefore it requires experimental verification.

According to M. Bunge, the analogy can be fruitful in the preliminary study of a new scientific field [3]. The degree of probability of obtaining a correct inference by analogy will be the higher, the more the common properties of the compared objects are known, the more significant the common properties found in them, the deeper the mutual regular connection of these similar properties is known. Therefore, the method of analogies can be successfully applied to direct knowledge acquisition. G. Galileo used the method of analogy widely and skillfully to construct various physical models. Newton's idea of the analogy between the motion of celestial bodies (the Moon around the Earth) and the motion of bodies thrown on the Earth (the fall of an apple), about the similarity of the Moon's acceleration to the gravitational acceleration on Earth, led him to the foundation of the theory of gravitation. The analogy with the flow of liquid in a pipe played an important role in the creation of the theory of electric current. Its hydrodynamic model was created. The current was considered as the flow of an electric fluid through a conductor, similar to the flow of a fluid in a pipe. By analogy with hydraulic resistance, the concept of electrical resistance was introduced.

With the progress of industrial technology in Europe, mechanics has become increasingly important in physics. Therefore, reducing all physical problems to mechanics became the goal of physicists of that time. D.K. Maxwell made extensive use of mechanical analogies and models built on their basis, considering them to be important tools of cognition. Maxwell's method, which he used in research on the theory of electricity and magnetism, consists in searching for a mechanical image of the phenomenon under study, i.e. in establishing an analogy between this phenomenon and the mechanical model. The basis of his research was the experiments of M. Faraday, who discovered the phenomenon of electromagnetic induction. To create his theory, later called electromagnetic, Maxwell used the mechanical model of field lines created by him, the vortex model of the magnetic field [9]. Starting to process Faraday's representations, Maxwell set himself the task of creating a mechanical example that would reveal a greater analogy with electrical phenomena. Maxwell's model is based on the concept of vortex motions of an ideal fluid, which meant the world

ether that fills space. In his work "On physical lines of force", he builds a mechanical model of electromagnetism from hexagonal magnetic vortices, between which electric conducting spheres are located in the form of friction rollers. This speculative model provided a reliable representation of the laws of electricity and magnetism known at that time. Using his model, Maxwell generalized the previously experimentally discovered laws of Coulomb, Bio-Savard-Laplace, Ampere, the phenomenon of electromagnetic induction by M. Faraday and derived the famous equations that now bear his name. Maxwell's system of equations fully describes electromagnetic phenomena, represents a logically harmonious and perfect theory, similar to Newtonian mechanics. Very important predictions about the independent existence of an electromagnetic field not "tied" to charges followed from Maxwell's equations, i.e. that the field can independently exist and spread in space. The analogy between Maxwell's equations describing the electromagnetic field and wave equations made it possible to predict the existence of electromagnetic waves [10]. J. Maxwell compared the classical theory of electromagnetism he created with the hydrodynamics of incompressible fluids and emphasized the importance of such an approach in science: "To compose physical concepts, one should get used to the existence of physical analogies. By physical analogy, I mean that particular similarity between the laws of any two fields of science, thanks to which one of them is an illustration for the other"[5].

The mechanical analogy was also used by Maxwell when deriving the law of distribution of gas molecules by velocities. Boltzmann wrote: "... in the end, the philosophy of Maxwell's ideas was generalized in the doctrine that knowledge in general is nothing more than the discovery of analogies" [1].

When analyzing various phenomena of the material world, many processes reveal similar features, connections and relationships, which often act as similar quantitative relationships. Often, processes occurring in different physical environments are described by algebraic or differential equations that are identical in form. But quantitative determinations are always in unity with qualitative characteristics, therefore, when analyzing quantitative data, a qualitative commonality between individual objects is revealed. This allows us to draw an analogy between already known and still only investigated processes, objects and, on its basis, make inferences leading to new knowledge. L. Boltzman wrote: "... amazing and far-reaching analogies between seemingly completely different natural phenomena were discovered. It seemed that nature, in a certain sense, builds a variety of things according to the same plan, or, as the analyst dryly puts it, the same differential equations are valid for a wide variety of phenomena [1].

In physics, there are a large number of examples of the successful application of analogy as a method of scientific knowledge. The vortex motion of a liquid and a vortex magnetic field are described by similar equations, which allowed Laplace to apply the Biot-Savard law to calculate the magnetic fields generated around conductors with electric currents. By analogy, D.I. Mendeleev made assumptions about the chemical properties of still undiscovered elements, based on their position in the periodic table. Potential fluid flow and potential electrostatic and gravitational fields are described by similar Laplace equations. The established mathematical analogies allow one to simulate some physical phenomena with the help of others. For example, the gas-hydraulic (GAHY) analogy is based on the analogy between the equations of motion of an inviscid incompressible fluid in an open channel and the equations of plane potential gas motion. It is used to study supersonic gas flows around bodies by observing waves generated on the water surface when flowing around a body of the same shape.

A. Einstein widely used analogy in his works. The main ideas that led Einstein to create special relativity are based on analogy. By analogy, Galileo's principle of relativity was extended to electromagnetic phenomena. The postulate about the independence of the speed of light from the speed of the source was put forward by Einstein by analogy with the fact that the speed of sound propagation in a medium is independent of the speed of the source. The general theory of relativity is based on the principle of equivalence of inertial and gravitational forces, formulated by analogy with the principle of equivalence of inertial and gravitational masses.

M. Laue put forward the idea of interference and diffraction of X-rays by analogy with these phenomena in light rays. I.V. Kurchatov came to the conclusion about the isomerism of the nuclei of atoms by analogy with the isomerism of the molecules of chemical substances. L.D. Landau found mathematical equations describing the flow of liquid helium by analogy with L. Euler's hydrodynamic equations describing the behavior of a classical ideal fluid in which there is no viscosity and turbulence. He also derived the mathematical equation of motion of electrons in a plasma by analogy with the kinetic equation of motion of molecules in a gas. In 1927, Sommerfeld developed a theory of the metallic state based on the assumption that free electrons in a metal behave like a monatomic rarefied gas obeying Fermi statistics. On the basis of this assumption, it was possible to explain the specific heat, electrical and thermal conductivity of metals, contact phenomena, thermoelectricity, etc. [7]. In his Nobel speech, P. Dirac, by analogy with the discovery of the positron, predicted the existence

of a proton with a negative charge - an antiproton and other antiparticles. By analogy with electric charges, he put forward a hypothesis about the existence of monopoles - elementary magnetic charges.

Ya. I. Frenkel wrote about the use of analogy in physics: "An analogy, if you handle it with due care, is the simplest and most understandable path from the old to the new; we should just remember that any analogy, unless it is a physical identity, has certain boundaries. The truly new is nowhere contained in the old, and while learning the laws of nature, we must learn to see not so much the old in the new, as the new in the old, considering the latter as an approximate form of the former"[11]. Analogy cannot be considered a criterion of truth. Inference by analogy can be either true or false. Therefore, it requires experimental verification. "No one can ever establish the validity of a theory by pointing out the similarities with another valid theory. The criterion of truth should come from analysis, it should come from experience"[6].

The use of analogy in cognition often leads to the creation of a model of the investigated object. This tool was widely used in classical physics. Modeling is of particular importance in the study of the microworld. The micro-object model is a substitute for the studied subject, which cannot be directly perceived by the human sense organs. In the case of cognition of the microcosm, its objects are not directly observed, therefore physicists are forced to create a rough model of it on the basis of a few data about it. Analogy becomes an important means of creating models that replace the sensory image of an invisible material entity. The model is based on empirical data on the objects of the microworld, obtained in a material experiment. Such models help to understand the data obtained in the experiment about the studied objects of the microworld, to reveal the laws of their functioning, and their connection with the rest of the world. In cognizing the microcosm, physicists were forced to use the objects of the macrocosm and the laws of the macrocosm as analogs, and only then, as the micro-object was cognized, to make refinements and changes in the created models. M. Born wrote in connection with the analysis of the history of the study of the atom: "Studying the structure of matter, physics has always used a method based on the following principle: the laws that are valid for "macroscopic" bodies, i.e. for bodies that are familiar to the eye, they are first transferred to elementary particles unchanged for the sample; if at the same time some contradiction is revealed, then a modification of these laws is undertaken. Thus, scientific progress essentially depends on the closest cooperation between theory and experiment"[2].

Modeling microobjects began with studying the structure of the atom. Let us consider how the atomic model gradually changed and became more complex. The first model of the atom was the model of J. Thomson, according to which the atom consists of a positively charged sphere, inside which negatively charged electrons move. In 1904, the Japanese physicist H. Nagaoka, by analogy with the theory of stability of the rings of Saturn, developed by Maxwell, put forward a hypothesis that the atom consists of a heavy positive nucleus surrounded by rings of a large number of electrons, whose vibrations in the plane of the rings should be accompanied by the emission of atomic spectra. It was replaced by Rutherford's planetary model of the atom, based on a larger amount of experimental data and more accurately reflecting the processes in the atom. In this model, electrons revolve around an atomic nucleus like planets orbiting the sun. This model came into conflict with classical physics, according to classical electrodynamics, such an atom would be unstable, which contradicted reality.

In 1913 N. Bohr proposed a hypothesis that contradicted the classical electromagnetic theory, based on two postulates. According to Bohr's hypothesis, an electron in a stationary orbit does not emit. Radiation occurs when an electron passes from a higher orbit to a lower one. These transitions form the spectrum of the atom. Bohr formulated the rules for quantization, introduced quantum numbers. Based on Bohr's model, the spectrum of the hydrogen atom was calculated, which coincided well with experiment. Bohr's theory was a major step forward in the development of atomic physics and was an important stage in the creation of quantum mechanics. However, it had internal contradictions (it was based on quantum postulates, but applied the laws of classical physics to the description of the motion of an electron). It failed to calculate the spectra of more complex atoms.

Based on an analogy with the solar system, Rutherford and Bohr's crude atomic models made it possible to take the first steps in understanding the structure of the atom, which became the starting point for further study of this complex material formation. By analogy with the particle-wave dualism of light, Louis de Broglie suggested that the particle-wave dualism is inherent in microparticles. In each case, scientists have tried to make the theory similar to earlier theories. Light was likened to sound, waves of matter to a light wave. "The development of the so-called wave mechanics is a typical example of the achievement of a progressive theory, obtained through deep and successful analogies" [12]. Often, further research revealed a discrepancy in the analogy due to the specifics of the object under study, which led to the need to expand the boundaries of the theory and preserve its productive side.

Later, a quantum mechanical model of the atom appeared, taking into account the wave properties of the electron. It made it possible to more accurately understand the structure of the atom, the laws governing the interaction of the nucleus and electrons, etc. Many historians of science note that E. Schrödinger derived the basic equation of wave mechanics, which bears his name, by analogy with the de Broglie equation describing the wave properties of matter. P. Dirac noted: "With the development of Heisenberg's theory it became clear that there is a close analogy between the new Heisenberg mechanics and the old Newtonian mechanics. ... The indicated analogy made it possible to construct a corresponding quantum system using a given classical system, and it turned out that due to this connection, quantum theory leads to results very close to the results of the old classical theory when it comes to large masses" [4].

Some analogies, as it turned out later, had no physical meaning, but played a large role in the development of physics. Comparison of the motion of the electron around the nucleus with the motion of the planet around the Sun led to the question of the position and speed of the electron. Further research showed that these questions cannot be answered in the same way. But from this idea, atomic and quantum physics arose [7]. In 1925, based on the analysis of spectroscopic data, J. Uhlenbeck and S. Goudsmit put forward a hypothesis about the existence of an electron spin by analogy with the angular momentum of planets rotating around an axis. Later it was found that spin has a specific quantum nature, not associated with the movement of particles as a whole.

The more complex the object of knowledge and the deeper it is located in the structure of the material world, the more difficult it is to find an analogue for it in the macrocosm, which makes it difficult to create its model. In such cases, at first, scientists are forced to use not one, but several models, each of which helps to cognize some side, property, regularity of the most complex material formation. This is how the research of the atomic nucleus was conducted. The first model of the nucleus was the droplet model developed independently by N. Bohr and Ya.I. Frenkel (1936). It was based on the analogy between the behavior of nucleons in a nucleus and the behavior of molecules in a liquid droplet. The droplet model of the nucleus made it possible to explain the mechanism of nuclear fission and nuclear reactions. In 1949-1950, the American physicist M. Geppert-Mayer and the German physicist H. Jensen developed a shell model of the nucleus, which made it possible to explain the different stability of atomic nuclei, the frequency of changes in their properties, the spins and magnetic moments of nuclei. To explain the process of neutron scattering by various

nuclei, the interaction of a nucleus with incident particles, V.F. Weisskopf and G. Feshbach developed an optical model of the nucleus. With the accumulation of experimental data on the properties of atomic nuclei, new facts appeared that could not explain the above models. O. Bohr and B. Mottelson proposed a collective (generalized) kernel model. Later, statistical, cluster and other models of the atomic nucleus were developed.

Historical analysis shows that the search for the unity and simplicity of scientific knowledge has always been the most important strategic task of physicists [10]. And here the analogy method often helped. "In physics, it often happened that significant success was achieved by drawing a consistent analogy between unrelated phenomena" [12].

Analogy as a method of scientific cognition finds application in the latest physical research. Special attention is paid to the application of the methods of symmetry and group theory, which establish the relationship between objects, phenomena and theories that are outwardly unrelated. By analogy with 4-dimensional space-time, the concept of superspace is introduced, which, in addition to the usual space-time coordinates, includes spinor coordinates. By analogy with symmetry, the concept of supersymmetry is introduced, which unites physical systems obeying different statistics. A generalization of the notion of a bosonic relativistic string is superstrings - relativistic supersymmetric extended objects that include fermionic degrees of freedom. By analogy with the experiments of E. Rutherford, E. Madsen and H. Geiger (bombardment of atoms with alpha particles) J. Friedman, G. Kendall and R. Taylor performed experiments on deep inelastic scattering of electrons by protons and bound neutrons. The scattering occurred as if there were three point objects inside the nucleons, in which the entire mass of the nucleon was concentrated. These experiments confirmed the quark model of hadrons.

Despite the success of the analogy, M. Bunge drew attention to the limitations of the method: "Analogy ... is a double-edged thing. On the one hand, it facilitates the exploration of the unknown, inspiring us to extrapolate prior knowledge to new areas. On the other hand, if the world is diverse, the analogy should sooner or later reveal its limitations, since a radically new in its essence is something that cannot be fully explained using familiar and customary terms" [3]. The analogy is often used where a purely deductive way of thinking does not work. The history of physics knows many cases when reasoning by analogy served as a fruitful basis for the advancement of new ideas. Mathematician D. Poya calls the analogy one of the most important sources of discovery: "Perhaps there are no discoveries either in elementary or higher mathematics, or even, perhaps, in any other field that could have been made without ... analogy" [8].

Since the middle of the XX century, science has witnessed a period of intensive integration of scientific knowledge, the formation of interdisciplinary sciences. The first step in this direction is the creation of cybernetics - the science of control in machines, living organisms and their associations based on the receipt, storage, processing and use of information. Cybernetics arose on the basis of the analogy of the general principles of control of complex dynamic systems of different physical nature (living and mechanical). The next step is the creation of synergetics - a theory that studies the processes of self-organization, stability, decay and revival of the most diverse structures of animate and inanimate nature. It turns out that the laws of control and self-organization are similar in systems of different physical nature. The analogy method associated with the ideas of cybernetics and synergetics can be effectively used for the further development of interdisciplinary ties. The synergetic approach in the modern scientific picture of the world allows us to identify invariant characteristics of evolutionary processes of different types and express them in a form suitable for mathematical and information processing. It is hoped that in the future, analogy will act as a necessary and inevitable instrument of scientific knowledge.

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## LET'S TALK ABOUT AGRICULTURE OF UZBEKISTAN

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**Abstract.** At the ceremony dedicated to the Day of Agricultural Workers, the President of the Republic of Uzbekistan. Shavkat Miromonovich Mirziyoyev said: "The strategy of actions of the Republic of Uzbekistan for 2017-2021 clearly defines the most important tasks for the modernization of all sectors, as well as agriculture, and our consistent implementation is the basis for great success in this area. The President has made it clear that Uzbekistan will prosper and be no less prosperous than the developed countries of the world, and most importantly, he has determined that there are many untapped domestic opportunities in the agricultural sector to enhance the well-being of our people.

The recommendations given by the authors of the article will allow farmers and dekhkan farms to fulfill the tasks set for them by the President of the country.

**Keywords:** Grain, cotton, corn, orchards, fruits, apricots, pistachios, almonds, fields, vegetables, vegetation, fish, chicken.

It is well known that socio-economic issues play an important role in any society, therefore, even in the Holy Quran, this issue is given special attention. In Surah Al-Bakara, verse 261, it is said that if a true believer sows and cultivates a grain of wheat with good intentions in the way of Allah, Allah creates for him seven ears of 100 grains in each ear. An example is wheat, which is considered the source of human livelihood, and it should be pointed out that a farmer who earnestly earns without deceiving the land will receive from Allah 700 times or even more grain. Allah's bounty is wide and he is the most knowledgeable.

That an exemplary and dignified life was possible only by honest labor is proven in the rules established by our great scientists, as well as in the results of hundreds of scientific studies carried out by our scientists.

Indeed, the peasant works day and night, creates something out of nothing, feeds people. He finds the necessary equipment, the necessary fertilizers, and even uses a plow if necessary. An experienced farmer on his land does not wait for anyone and takes action.

Speaking at the ceremony dedicated to the Day of Agricultural Workers, the President of the Republic of Uzbekistan. Shavkat Miromonovich Mirziyoyev said: "The Action Strategy of the Republic of Uzbekistan for 2017-2021" clearly defines the most important tasks for the modernization of all sectors, as well as agriculture, and our consistent implementation is the basis for great success in this area. The President has made it clear that Uzbekistan will prosper and be no less prosperous than the developed countries of the world, and most importantly, he has determined that there are many untapped domestic opportunities in the agricultural sector to improve the well-being of our people [1-9].

In addition, when visiting each region and territory, he repeatedly emphasizes that it is time to re-examine the types and areas of crops that are no longer economically viable and do not bring income. In addition, the President gave the necessary instructions for planting high-yielding crops and varieties that are resistant to salinity in saline soils, grow well on sandy soils, tolerant to drought in arid soils, and effectively use every centimeter of land. Due to independence, the legal relations of farms are protected by special laws. The land was transferred to farms for long-term use. Today, the smart farmer considers the land his property, takes care of it, constantly increases soil fertility, cleans waterways and takes measures to efficiently use land and water resources. He sows seeds according to soil type, climatic conditions and, of course, the calculating farmer looks for opportunities to grow high and plentiful yields from crops.

If an entrepreneur uses the land and water provided rationally, he will be able to provide himself with fat, meat, carrots, onions, potatoes and other food products that are used daily for cooking. He will never buy them in the market, he will bring surplus from the farm to the market, at least he will make arrangements to provide free hot meals for the workers on the farm.

There are farms in the country that only harvest large quantities of fruits such as apricots, apples, pomegranates, grapes, dates, walnuts, pistachios, almonds, jiiida, quince planted along roadside streams and rivers. The planted walnuts, almonds and persimmons not only produce high quality fruits, but also fully ensure the well-being and beauty of the streets. In these places, only walnut, almond and palm seedlings can be planted, and without unnecessary care they will give valuable fruit trees. It really is true.

Today in the world market there is a growing demand for nuts, almonds, pomegranates and especially grapes. The soil and climatic conditions of our country are suitable for the cultivation of various export-oriented varieties of walnuts and grapes. Another advantage of these fruits is that they grow, develop and ripen in the mountains, steppes and sands.

It should be noted that thousands of farmers in the country have established greenhouses on their farms, supplying our people with tomatoes, cucumbers, lemons, oranges and other citrus fruits in winter and summer. The result is the fact that in addition to more than 180 types of fruits that exceed the demand in the domestic consumer market, products from grapes, walnuts, apricots, pomegranates, melons and vegetables, created by our farmers, are exported to more than 80 countries around the world - this is our limitless possibilities.

At the present stage of development of our country, the modern form of growing and processing raw cotton - the cluster system, introduced at the initiative of our President, has shown its positive results in the recent past. In the cluster system, sincere cooperation and partnership relations are gradually being established between cotton farms and textile enterprises, which ensures the growing interest of all participants in this process.

Last year, in the Rishtan region, "Rus-Uzbek Tex" LLC for the first time applied the cluster method of growing cotton on the basis of an innovative project and achieved high yields. This year, cotton-textile clusters have been created in 9 districts of the region, contracts have been signed with farms.

The farms of the Yazvan region, included in the cluster system, handed over to the state 14.8 thousand tons of cotton and fulfilled the plan. This year, "Bakhodir Logan Textile" LLC, in cooperation with 119 farms, grows high-yielding, early-maturing varieties of cotton on an area of 5210 hectares in accordance with agrotechnical requirements. The most active farms of Yazyavan, such as Bakhrombek, Liberal Invest, Humo, Odiljon Gafurov, Satorov Khairulo, collected 45-50 centners of the first harvest and fulfilled the contractual plan.

In the 2019 agricultural year, Fergana Global Textile LLC for the first time in the Kushtepa region grew cotton on an area of 7240 hectares according to the cluster system. As a result, the farms supplied the state with 19.9 thousand tons of cotton and fulfilled their contractual obligations. Contracts were signed with 165 farms in the district, most of which have fulfilled the short-term cotton delivery plan in excess. Farms such as "Vakhobjon Abdulazhon Ugli", "Turdialiev Madamin", "Rustam Ravsha-

nov Yeri", "Abdurashid Zamin Gavhari", "Nasibakhon Khabibakhon Faizli Yeri", "Abdashkhon Ota", "Ravot Zamin Faizi", "Ibrohimjon Marufojon Faizli Yery", "Donishman" exceeded their yield by 45 cents.

The creation of cotton-textile clusters in our region also contributes to the development of the agricultural sector based on modern criteria. Initially, the company specialized only in the production of yarn, today it covers from the whole process of growing, processing cotton to the finished product. Of course, this brings double benefits to farms. The farms of the Rishtan region also fulfilled the contract, they grew 15900 tons of cotton on 5950 hectares of land. Based on the experience of last year, "Rus-Uzbek Tex" LLC has outlined measures to increase profitability since the beginning of 2019. As a result, the average yield of farms in the region was 30 centners per hectare.

The money for the harvested cotton was paid on time. In cotton, the cluster method is mutually beneficial. An important incentive was the increased financial interest of pickers during the season, in particular, they paid 1000 soums for 1 kilogram of cotton, and then 1200 soums for 1 kilogram of harvested cotton - this was a great incentive for workers.

If the labor is paid on time and the cotton farmer agrees with the cluster that processes cotton, then both parties will benefit, and this method is an honest way of working together in partnership, without cheating on full trust in each other.

There are hundreds of examples of diversified farms that effectively use land and water resources in all regions of the country. If we analyze the income they receive today according to the rules of simple arithmetic at the price of a kilogram of meat or flour, we will see that they have great economic potential.

Unfortunately, the banks of water-filled canals with high soil and land fertility along the main roads are still not cultivated for thousands of kilometers in each region, unfortunately, large areas of farms, gardens and houses remain uncultivated.

We should not forget that leaving fertile land and water empty for the rest of your life is also a grave sin. The following plants grow in the backyard: an eyebrow liner, planted on an area of one m<sup>2</sup>, will allow women in the same community to darken their eyebrows all year round. In addition, if green onions, parsley, dill, peppers, radishes and other greens are planted on one m<sup>2</sup>, then the family will not need greens all year round. Moreover, thousands of families live in cities, on the outskirts. who buy ordinary greens at the market, despite the fact that there is free land in the countryside.

In this large-scale global program, the management of available land and water resources requires the modernization of arable land and the placement of crops. It is necessary to plant alfalfa, white corn, rice and similar crops, which are salt-tolerant crops, on existing saline areas of different levels in the Karakalpak, Khorezm, Bukhara, Syrdarya, Jizzakh, Fergana regions of the country. The President of the Republic of Uzbekistan himself. Sh.M. Mirziyoyev especially notes the creation of plantations of various types of nuts and apricots, pistachios, almonds, olive groves, licorice in Kashkadarya, Surkhandarya and in all foothills.

President of the Republic of Uzbekistan Sh.M. Mirziyoyev noted that poultry meat is one of the treasures in the creation of food reserves, one of the most important branches of agriculture. We must not forget the notes of the President of the Republic of Uzbekistan, Sh.M. Mirziyoyev about poultry, when he walked among people and observed the regions, as he said, one of the treasures in the creation of food supplies and one of the most important sectors of agriculture, which satisfies the needs of the population for cheap meat and eggs and, in addition, brings good income in the short term. The President also reiterates that it is possible to harvest up to three times a year in exchange for the efficient use of the available land, and that families who act on the basis of the above recommendations can live comfortably and with an abundance of food, a simple homemade chicken is not only meat but also eggs. When feeding chickens to obtain meat, it is necessary to ensure that broiler chickens that have reached a live weight of 2.4-2.5 kg in 40-45 days are slaughtered in 1-2 days according to his technology, with a coefficient of 94-95 percent, taste good, protein 20 percent, fat 10-12 percent. As the President noted, farms can get a good income from poultry in a short time: if they master the system of caring for 100 birds every two months, they will be able to produce an average of 200 kg of chicken meat in two months, and up to 5100 eggs from the egg line. Even when we set the bills, that is, the cost and profit at the expense of 50/50, at least 100 kg of meat and 2550 eggs is a net profit.

As mentioned above, the farm should have at least our recommendations: suitable cages for 100 chickens and 100 ducks, four heifers and sheep that can give birth to one ram, one male goat or a female, two calves and a barn for all. A family that has a dairy cow giving 10-12 liters of milk may not know the shortage, but they already have their own small business. This is because dairy cows can be used to produce dairy products such as sour cream from milk, butter from sour cream, yogurt from butter, dulce from roasted butter, yogurt and cheese. Moreover, it gives birth to a calf every year. Even waste manure makes money or improves soil fertility.

If this small business is taken care of, it will ensure the prosperity of one family and ease its burden. This can be a pastime for retired parents, as well as grandchildren at home, they will not be left without work, they will feed and water cattle and sheep, do at least some useful work.

It should be noted that until recently, fishing on farms was in a state of disrepair. However, every farm has at least one pond filled with water, and if this is taken into account, it will be possible to grow at least one ton of fish, which can later be expanded. The realization of this home treasure is dictated by today's food demand. For this job, the farm manager only needs to work outdoors for a week.

If you put two colonies of bees in a clean and tidy place, you can get an average of about 55-60 kg of pure honey per year. In addition, bees are an excellent helper in pollination of cotton. In areas where bees are bred, the cotton yield is much higher.

These recommendations and suggestions can be made for farms at no additional cost. If a farmer has land and water resources, and he follows the above recommendations, he can have a large income in the short term, and most importantly, he will be able to receive food products, such as meat, milk, butter, which he grows. Milk, yogurt, sour cream, butter and most importantly meat do not have to be bought on the market. Every year, if a calf from a cow, a lamb from a sheep, or a lamb from a milking goat is born, he may not keep them in the barn, but he may take them to the market and sell or slaughter them for meat.

One of the other treasures in our country is sericulture, and in recent years there has been growing interest in the cultivation of silkworms, dazzling satin and silk, but the mulberry trees that the silkworm feeds on were unreasonably uprooted and cut off, the mulberry leaf from insects seriously damages the harvest of the mulberry leaf. which is a valuable food item, it's time to fix it. Today, there is a clear shortage of leaves from the mulberry tree, which is the main food source of the silkworm. It is no secret that the edges of the existing mulberry trees at the foot of some areas of the trees, especially along the edges of fields planted with trees, cotton, wheat and other crops near the villages are largely cut down for firewood.

However, the place of these mulberry trees is still empty. It's time to plant mulberry seedlings. It is known that the seedlings planted in the fall take root well and germinate quickly, because in the families growing the silkworm, an annual supply of firewood is created and collected for the stove and kiln. People's families are working. Therefore, the current task is to open and restore existing mulberry trees, fallen or felled, restore, fertilize them, water and plant them.

There are over 200 kinds of weeds in cotton and orchards of the country, including 74 kinds of weeds in cotton fields. Despite unfavorable conditions, they germinate earlier and grow faster than cultivated plants. According to Rashidov and Mukhammadaliev, in 2011, 10-12% of the harvest is lost due to weed infestation. Weeds absorb 3 times more water than cotton and 4 times more than wheat. For example, in case of a fire on an area of 1 m<sup>2</sup>, 139 kg of water evaporates in 30 days. In the absence of grass, this figure is only 37 kg. In addition, weeds assimilate 26-30% of the nutrients contained in mineral fertilizers applied to cotton and wheat in their pure form. One ton of grain gives up to 46 kg of nitrogen from the soil; absorbs up to 22 kg of phosphorus and up to 28 kg of potassium. 50 kg of nitrogen per ton of cotton; 15 kg of phosphorus; absorbs 50 kg of potassium.

Gray thorns and olabuta absorb up to 40 kg of nitrogen, up to 70 kg of phosphorus and up to 120 kg of potassium from a burnt field. When analyzed, weeds against cotton and wheat are a vital source of various pests in the field. In particular, spiders, autumn nightshade, cotton nightshade, aphids, thrips and other pests first develop in weeds and then migrate to cotton and other crops. Wherever we go, wherever we look, we see weeds at every step, but we have become very indifferent to them. In the end, we need to eradicate weeds, which reduce the risk to humans by 2-3 times. It is imperative that weed control becomes the level of government policy for every worker and employee on farms and all agricultural-related businesses and organizations to avoid unnecessary costs of unrecorded labor, electricity and fire. Otherwise, we will allow weeds to flood our large orchards, crops, vegetables and melons, cotton fields.

From 11.6% to 13% of the crop is lost due to pests and diseases. Insects see in our life the most delicious apples, pomegranates, pears, quince, apricots, walnuts, peaches that decorate our table. Melon, watermelon, vegetables are also seriously affected by the autumn cotton scoop, spider mites, corn, tomatoes, radishes, turnips, onions, and garlic. Thanks to constant protection, 12-15% of cotton, 9-10% of grain, 16-20% of beans, etc. are preserved. To preserve the yield of cotton and grain crops, the following protective measures must be taken.

- Timely carrying out autumn plowing to a depth of 35-40 cm in two-layer plows, which will ensure a decrease in the number of weeds and insects, diseases by up to 50%.

- Carrying out early autumn salt leaching, with spraying by weeding the field, which significantly reduces the number of insect pests and diseases of weed seeds and crops.

## Process Management and Scientific Developments

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- The need to expand the acreage of alfalfa as the main secondary crop. Crop rotation must be fully introduced with alfalfa. Then weeds will be destroyed from insects and crop diseases, and soil fertility will constantly increase.

- Clean reed and other straw belts along the edges of cotton and other fields that need to be harvested, composted and used as fertilizer. Harvesting is not expensive, unfortunately, many farmers for some reason do not pay attention to this simple method of killing weeds and insects.

- On agricultural land, it is necessary to clean the reeds and other weeds that have dried up along the edges of the ditches in which the ditches were previously dug, collect the waste in the form of compost in special pits and suppress them, and then disinfect the appropriate preparations.

- In early spring and autumn, it should be twice treated with a mixture of the necessary chemicals against diseases and pests of crops, depending on the conditions of the season.

- It is more efficient to use about 800 products of the country's biological laboratories, which allows growing and preserving environmentally friendly crops.

- It is necessary to carry out work to restore the existing silkworm trees along the edges of cotton and grain fields, filling in the gaps with seedlings.

- In all regions of the country, orchards on many thousand hectares will be created in autumn, although the Fergana Valley of Uzbekistan is already a blooming garden.

At the solemn meeting dedicated to the Day of Agricultural Workers on December 9, President Shavkat Mirziyoyev dwelled on the issues of modernization and accelerated development of agriculture in all sectors, as well as the strategy for the further development of Uzbekistan for 2017-2021 in terms of personnel training.

Radical improvement of personnel training, consistent development of agricultural production, provision and further strengthening of food security in the country, expansion of production of environmentally friendly products, a significant increase in export potential, reduction of economically ineffective, low-yielding cotton and wheat fields. new intensive orchards and vineyards on the land; and the expansion of the areas of the most widely consumed potatoes and oilseeds.

The main task of farms - is the rational use of every inch of land, primarily through the introduction of modern water-saving and resource-saving agricultural technologies.

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## AGROECOLOGICAL ASSESSMENT OF BEETROOT VARIETIES IN THE SOUTH-EAST OF KAZAKHSTAN

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**Abstract.** In 2018-2019, the Kaynar branch of the Kazakh Research Institute of Horticulture carried out an assessment of five varieties and hybrids of table beet of foreign selection: Wodan F1 (Holland), Zeppo F1 (Holland), Mulatto-Chocolate (Russia), WL2 F1 (Poland) and WL3 F1 (Poland) in comparison with the standard variety Bordeaux 237 (Russia) in terms of the complex of economically valuable traits. All five studied samples of table beet of foreign selection are of interest in adaptation for cultivation and distribution in the southeast of Kazakhstan, although in terms of productivity characteristics, yield structure and storage capacity, some of them were noticeably inferior to the standard Bordeaux 237 variety.

**Keywords:** beetroot, variety sample, evaluation, powdery mildew, cercosporosis, productivity, preservation.

### Introduction

Improving the economically valuable traits of beetroot is always in the field of vision of breeders. The issues of agroecological and breeding study of table beets in Kazakhstan were started relatively recently, and the study of the imported gene pool of this crop in terms of adaptation to local conditions is of great commercial importance.

The State Register of Breeding Achievements Recommended for Use in the Republic of Kazakhstan includes 14 varieties and 3 hybrids of table beet, among them only 3 varieties of table beet are fruits of domestic selection [1].

The zonal distribution and varietal composition of vegetable crops, in-

cluding vegetable root crops with a high genetic diversity and their compliance with the growing conditions is of great practical importance [2,3].

In Kazakhstan, table beets are in the forefront among root vegetable crops after carrots in terms of their area - in recent years they occupied up to 6 thousand hectares, with a production volume of 150-170 thousand tons. More than 80% of the production of table beet in the country is concentrated in the southern, southeastern, central, northern and northeastern regions of the country [4].

In the market of vegetable seeds in Kazakhstan, the superiority of a foreign gene pool is observed, and in recent years, due to the fact that the introduction of foreign varieties and hybrids began to be carried out according to recommendations, more and more varieties and hybrids began to be imported without proper adaptation assessment, therefore the need for their agro-ecological study as applied to local commercial production.

Although heteroosis hybrids of vegetable crops are increasingly in demand on the world market, the share of freely pollinated varieties of table beet is still high in Kazakhstan. Traditional varieties have high yield and quality indicators, have good ecological plasticity and adaptability to the climatic conditions of the regions, as well as a relatively high resistance to diseases during the growing season and storage.

In the conditions of free commercialization of seed material, there is an unlimited opportunity to study a variety of assortments of table beets, characterized by wide genetic diversity and breadth of ecological and geographical origin, for adaptation to local conditions [5,6].

In breeding programs, when creating new varieties and hybrids of table beets, the main emphasis is on disease resistance. Beet plants are highly susceptible to pathogens that cause damage to plants at different stages of ontogenesis. Therefore, it is very important to assess and select sources of productivity and resistance to common diseases during the growing season [7].

One of the main factors in increasing the efficiency of beet production is to reduce losses during storage. Losses during storage are due to the natural loss of mass due to the evaporation of water and the consumption of dry matter for respiration and lesions of fungal and bacterial diseases [8].

This article presents the results of evaluating foreign samples of beet-root with the best adaptive economically valuable indicators.

### **Materials and methods**

The studies were carried out at an experimental station of the "Kainar" branch of "Kazakh Research Institute of Horticulture" LLP, located on the northern slope of the Zailiyskiy Alatau, 40 km west of the city of Almaty under irrigation conditions. The soil of the experimental plot is dark chestnut,

medium loamy. The humus content in the arable layer is 2.3-2.7%. The reaction of the soil is slightly alkaline - the pH of the water extract is 7.2-7.5.

The object of study in the ecological nursery was 5 samples of beetroot with different geographical origin. The study of the samples was carried out on plots with an area of 14 m<sup>2</sup> (10 m x 1.4 m) in 4 replicates. Sowing of seeds was carried out in the first ten days of May manually, evenly, on pre-prepared aligned ridges with a row spacing of 70 cm, with a height of 12-15 cm, a width at the base of 40-45 cm, by the top - 30-35 cm. Seeds of beetroot were planted to a depth of 1.5-2.5 cm, followed by rolling. On the experimental plots, the same background of fertilizers (N80P80K80) was created, which were applied for the main tillage in the spring and for top dressing.

The agrotechnics of cultivation of table beets included the main processing (plowing by 25-27 cm - in the fall, deep cultivation in an aggregate with harrows - in the spring), pre-sowing preparation (cultivation, cropping, cutting and leveling of ridges), sowing, herbicide treatment, hand weeding and vegetative irrigation. Phytopathological surveys, harvesting and accounting of the yield were carried out in the phase of technical ripeness of root crops in accordance with the guidelines [9, 10].

30-40 days before harvesting beet root crops, when the maximum manifestation of disease symptoms was observed, a visual assessment of plant infestation by leaf pathogens was carried out on a scale (in points): 0 - no signs of disease; 1 - very weak lesion (1-10% of leaves); 2 - weak damage (11 - 25% of leaves); 3 - medium damage (26-50% of leaves); 4 - severe damage (more than 51% of leaves) [11].

To assess the resistance, the scores of damage to each considered plant in the sample were taken into account, the weighted average score of damage, the intensity of spread and the degree of development of the disease in the sample were calculated.

When harvesting root crops, the total and standard yield, the presence of cracked, under-catch, ugly, rotten and damaged root crops were recorded.

In the fall, 40 apparently healthy root crops were taken from each sample of beetroot and stored in a conventional cellar-type vegetable storehouse. The samples were placed in separate polypropylene bags, which were lined up on separate shelves in duplicate. In autumn and spring, the storage temperature ranged from 3-5°C to 6-9°C, and in winter it stabilized at 1-2°C. Diseases were recorded according to generally accepted methods [12].

The data were processed using Microsoft Office Excel 2010 software.

**Research results**

Beetroot, like many vegetable crops, is a constant target of attack by various pathogens and pests, which reduce the yield and product quality. Currently, with the increasing importance of the limited use of plant protection chemicals in breeding programs, more and more emphasis is being placed on increasing plant resistance to harmful pathogens. Numerous studies have shown that chemical measures against major diseases are often ineffective. In this regard, it is important to study resistance to common diseases.

On plantations of table beet in the southern and southeastern regions of the country, in years favorable for the development of pathogens, the lesion of plants by powdery mildew and cercosporosis began to be observed, which destroy the leaf mass, especially in the warm and humid summer season, causing crop losses. Studies have shown that beet plants affected by cercospora during the growing season are susceptible to clump rot of root crops during storage [13-16].

As shown by observations in 2019 (Table 1), symptoms of powdery mildew damage were observed in all samples with an amplitude of damage from 1.2 to 3.7 points. The WL3 F1 sample had the highest lesion score - 3.7, the disease spread by 100%, and the degree of disease development was 92.5%. Samples Wodan F1 and WL2 F1 showed the least damage by powdery mildew, respectively, 1.2 and 1.4 points, with the degree of disease development of 30 and 35%, respectively.

Taking into account the damage to beet leaves by cercospora has revealed an insignificant score of plant damage - on the studied samples, the indicators varied from 0.1 (Zeppo F1) to 0.3 (Mulatto-Chocolate, WI 3 F1).

**Table 1 - The results of screening in the nursery of the test of beetroot for the incidence of leaf diseases, 2019**

Variety samples	Powdery mildew			Cercosporosis		
	Average-weighted lesion score (M)	Disease prevalence,% (R)	Disease development degree,% (C)	Average-weighted lesion score (M)	Disease prevalence,% (R)	Disease development degree,% (C)
Bordeaux 237 (St)	3,6	100	90	0,3	30	7,5
Wodan F1 (Holland)	1,2	70	30	0,2	20	5
Zeppo F1 (Holland)	2,3	100	57,5	0,1	10	2,5
Mulatto-Chocolate (Russia)	2,2	90	55	0,3	30	7,5
WL2 F1 (Poland)	1,4	70	35	0,2	20	5
WL3 F1 (Poland)	3,7	100	92,5	0,3	30	7,5

Samples of table beet were analyzed for such main yield and size-weight characteristics as gross and standard productivity, standard and average weight of a standard root crop. The tests showed (Table 2) that, on average, over two years, the largest increases in gross yield compared to the standard Bordeaux 237 (60.3 t/ha) were shown by Wodan F1 - 74.8 t/ha and Zeppo F1 - 72, 5 t/ha. The sample Mulatto-Chocolate showed the smallest result in the nursery in terms of gross productivity - 53.0 t/ha.

In terms of standard productivity, a significant increase to the standard - Bordeaux 237 variety (47.9 t/ha), was provided by the samples Wodan F1 (Holland) - 38.3%, Zeppo F1 (Holland) - 12.4% and WL3 F1 (Poland) - 15.0%. The smallest yield of standard root crops was given by samples of Mulatto-Chocolate (Russia) - 40.5 t/ha and WL2 F1 (Poland) - 42.1 t/ha.

**Table 2 - Yield characteristics of table beet varieties, 2018-2019**

Variety samples	Gross productivity, t/ha	Standard productivity, t/ha	Accordance with standards, %	Weight of a standard root crop, g
Bordeaux 237 (St)	60,3	47,9	79,4	204,7
Wodan F1 (Holland)	74,8	66,2	88,5	214,4
Zeppo F1 (Holland)	72,5	53,8	74,6	208,2
Mulatto-Chocolate (Russia)	53,0	40,5	76,5	158,7
WL2 F1 (Poland)	60,4	42,1	71,2	159,5
WL3 F1 (Poland)	63,0	55,1	87,4	181,2
HCP(05)	7,4-8,0	6,4-5,7	4,3-9,1	16,0-17,0
Accuracy (%)	3,9-4,2	4,4-4,5	1,8-3,8	2,9-3,0

The maximum relative accordance with standards of beet root crops in the nursery was achieved in the Wodan F1 (Holland) samples - 88.5% and WL3 F1 (Poland) - 87.4%, with 79.4% for the Bordeaux 237 variety.

The weight of marketable root crops of table beet samples in the nursery varied from 158.7 (Mulatto-Chocolate) to 214.4 g (Wodan F1), with 204.7 g for Bordeaux 237 variety.

The breakdown of the harvest into structural elements showed (Table 3) that the beet samples differed significantly among themselves. So if in the samples WL2 F1 (Poland) and WL3 F1 (Poland), the main share of the non-marketable part of the crop was formed by cracked (13.1 and 4.2%), underruns (4.9 and 2.7%) and rotten (6.9 and 5.8%) root crops, then in the Wodan F1 sample (Holland) the bulk of the non-marketable part of root crops was formed by those damaged by pests (9.1%) and underruns (2.5%). In the sample Zeppo F1 (Holland), ugly forms - 1.2%, underruns

- 3.4%, rot - 3.2% and damaged by soil pests - 17.8% participated in the formation of the non-marketable part of the root crop. The sample Mulatto-Chocolate (Russia) was distinguished by the presence of ugly - 9.6%, underruns - 6.6% and damaged by soil pests - 4.6%. In the Bordeaux 237 standard, the non-marketable part of the crop was formed due to cracked root crops - 8.7%, underruns - 9.1% and damage by pests - 2.9%.

**Table 3 - Structure of the yield of table beet samples, % by weight, 2018-2019**

Variety samples	Cracked	Ugly	Underruns	Rotten	Damaged
Bordeaux 237 (St)	8,7	0,0	9,1	0,0	2,9
Wodan F1 (Holland)	0,0	0,0	2,5	0,0	9,1
Zeppo F1 (Holland)	0,0	1,2	3,4	3,2	17,8
Mulatto-Chocolate (Russia)	2,8	9,6	6,6	0,0	4,6
WL2 F1 (Poland)	13,1	1,9	4,9	6,9	2,1
WL3 F1 (Poland)	4,2	0,0	2,7	5,8	0,0

According to biochemical analysis (Table 4), the sample Mulatto-Chocolate showed the highest dry matter content in root crops - 17.9%, that is, at the level of Bordeaux standard 237 - 17.8%. The remaining samples in terms of dry matter content were below the standard and were approximately at the same level - 15.7-16.2%. In terms of the total sugar content, the WL2 F1 sample was markedly distinguished by an increased value - 12.9% than the rest of the samples - 11.5-12.0%, with 12.4% for the Bordeaux 237 standard. In terms of vitamin C content, the WL3 F1 sample (18.2 mg%) slightly exceeded the Bordeaux 237 standard (17.8 mg%), and the rest of the studied samples showed lower values - 16.0-17.5 mg%. The content of nitrates in all tested samples was insignificant - 76.0-104.0 mg/kg, at MPC- 1400 mg/kg of product.

**Table 4 - Biochemical indicators of beet root crops, 2018-2019**

Variety samples	Dry matter,%	Total sugar,%	Vitamin "C", mg%	* Nitrates, mg/kg
Bordeaux 237 (St)	17,8	12,4	17,6	104,0
Wodan F1 (Holland)	15,7	11,6	17,5	93,0
Zeppo F1 (Holland)	16,2	11,5	17,1	96,0
Mulatto-Chocolate (Russia)	17,9	12,0	16,3	102,0
WL2 F1 (Poland)	16,1	12,9	16,0	76,0
WL3 F1 (Poland)	16,0	11,9	18,2	95,0

\* data for 2018

The storage stability of beetroot against fungal and bacterial diseases should be considered as an important economically valuable trait. Analyzing the data on the persistence and susceptibility to diseases during storage of samples of varieties and hybrids, samples were identified that have a complex resistance to diseases observed during storage of table beets (Table 5).

**Table 5 - Affection of beet root crops by rot during winter storage.  
Storage period 2018 -2019**

Variety samples	Losses from diseases during storage,%	Decrease in mass	Total losses,%	Preservation, %
Bordeaux 237 (St)	7,7	8,8	16,5	83,5
Wodan F1 (Holland)	8,8	9,8	18,6	81,4
Zeppo F1 (Holland)	8,2	9,3	17,5	82,5
Mulatto-Chocolate (Russia)	11,5	9,5	21,0	79,0
WL2 F1 (Poland)	6,3	9,7	16,0	84,0
WL3 F1 (Poland)	8,8	11,9	20,7	79,3

Comparing the preservation and disease susceptibility of root crops of various samples of table beet during storage, it can be noted that the yield of marketable products after storage in 2018-2019 ranged from 7.0% for the Mulatto-Chocolate variety to 84.0% for the WL2 F1 hybrid. The total losses during storage consisted of diseases and natural weight loss, which had different shares of participation during the storage season, markedly changing, respectively, from 6.3% (WL2 F1) to 11.5% (Mulatto-Chocolate) for diseases and from 8.8% (Bordeaux 237) and 11.9% (WL3 F1) for decrease in mass.

### Conclusions

Thus, all five studied genotypes of table beet of foreign breeding Wodan F1 (Holland), Zeppo F1 (Holland), Mulatto-Chocolate (Russia), WL2 F1 (Poland) and WL3 F1 (Poland) are of interest in adaptation to economically valuable traits. for cultivation and distribution in the south-east of Kazakhstan, although in terms of productivity characteristics, yield structure and storage capacity, some of them were noticeably inferior to the standard Bordeaux 237 variety.

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**SELECTION PROBLEMS AND THE BREEDERS,  
POSSIBILITIES OF THEIR SOLUTION IN RUSSIA**

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**Summary.** There are three main concepts of a breeder: potential, upcoming and real one. Frequency of a potential breeder appearance should be the same in history of every nation. To solve main problems when developing hybrids, it is necessary to ensure conditions of breeders work and conduction of breeding process at all stages – from starting material to obtaining of a potential variety or hybrid. A breeder who has created varieties and hybrids and owns materials and methods of breeding must write and relate about this to facilitate search of ways to develop new forms of living organisms for a new generation of breeders.

**Keywords:** breeding, talent, intelligence, adaptability, resistance, regularity, potential, upcoming, real breeder

**Introduction**

Today, it is necessary to declare the presence of inherited inborn factors that determine the talent, intellectual and creative activity of generally recognized breeders and their outstanding colleagues working together with them. Great challenges, this is an opportunity for breeding and breeders of the Russian Federation to look ahead boldly. Domestic breeding is a powerful and competitive sub-sector in the Russian agricultural sector [1,2,3].

### **Material and methodology**

There are three main concepts: potential breeder, developing breeder, realized breeder [4]. The frequency of emergence of "potential breeders" should be the same in any history, every nation, where it was born and lives. Only a thousandth of potential breeders reach the level of a developing breeder or a member of his team. The huge role played by adverse conditions or the optimal conditions of its work, the implementation of its technical, technological, financial, personnel abilities, countless obstacles (especially currently) that do not give the full measure to manifest the domestic breeder, as individuals, as executor of the decrees of the President on import substitution, to create products that provide health and life expectancy of the people it represents, which called for the creation of new living systems.

The demand for a breeder of their own industry for their people is the incentive that provides bursts of mass development of breeding in the country, especially at present in Russia. A crucial role should be given to the breeder's working conditions and the development of breeding at all stages: from the problem statement, the source material to the creation and realization of the potential of the variety and hybrid. A breeder who has lived a useful life, created varieties and hybrids and knows the materials and methods of selection, is obliged to write and tell about it, in order to facilitate the new change of breeders to find ways to create new forms of living organisms [5,6].

The path from the source material to the creation and realization of the potential of the variety and hybrid provides the realization of purposefulness, the ability of the breeder to biomobilize. Great importance is attached to the environment that ensures the stability and adaptability of the selection material and working conditions of the breeder and his team:

- Simultaneous selective selection of progenitors under the action of biotico- and abiofactor conditions acting in the external environment and material, in different periods of growth and development of living systems, based on their heterogeneity of the living system, as a biovid.

- An important point is the conditions, types of crosses, their orientation, which provides the necessary selection material - homozygous, different levels of heterogeneity and heterozygosity in the creation of lines, components, varieties and hybrids.

- There should be a similar selection of the personality of new young breeders-leaders and members of their team to work with the above-mentioned selection material.

- The genius for discoveries and inventions of the breeder and his team members should be shown, which should be accompanied always, every-

where, daily, every minute, throughout the selection process, providing him with creative and intellectual strength in solving the main task - to create something new in a living system.

### Discussions

Does the genius of the breeder and of breeding as a science exist at all in the creation of new living systems? Mechanisms and factors of the highest intelligence and ability of the breeder and his team members:

1. Personal initiative, internal properties and signs of activity, historical role in the national selection of the leader, members of his team.

2. Identification of innate biological hereditary relationships and properties in living systems of organisms and the breeder, as well as his team. New initial forms are created, and domestic breeders are born and become. Not every selected form, original feature, or property develops in a living system and breeder. They can be implemented in a variety, hybrid, outstanding scientist, breeder.

3. Obtaining competitive varieties and hybrids is a problem of genetic, energy, information and bioinformatic structures (HEIS) of living systems, initial forms, lines, components, bio- and abio-factors involved in their creation.

4. Currently in Russia, the sociobiological problem is the realization of the intellectual potential of the domestic breeder – where, with whom he works, what social and financial, technical, technological, security with devices, equipment, assessment of the work of his and his team.

5. Definition of the concept of breeder, scientist and his team.

5.1. The process, act, enrichment of the intellectual world of domestic scientists with a new element-a breeder (as in the periodic system of Mendeleev).

5.2. The initial and main feature of the breeder as a scientist is the presence of a sign of truth in himself and members of his team; the desire to implement it for the benefit of his homeland through the creation of living systems that ensure the implementation of this truth in the health and longevity of Russian citizens, for whom he creates and lives by it.

5.3. The essence of a breeder is to feel, see, find particulars, signs and properties in the General system of each original form, line, component, variety and hybrid.

5.4. The peculiarity of a breeder, scientist – the ability to listen and read the past of their teachers and mentors; own, present, see and create future organisms of living systems that are important for domestic and world breeding.

The ability to independently think, read and understand the thoughts and statements of their colleagues, friends and foes, draw and make the right conclusions and actions.

5.5. The ability to endure difficulties, find ways to overcome them by creating and implementing new features and properties of living systems.

5.6. To be able to evaluate objectively, in comparison with the originals of their competitors and enemies; to turn the unit to total, temporary to long-term, eternal; to work productively, continuously, at any time and in space, to transform your thoughts into real and necessary living systems varieties and hybrids, showing their signs and their PR STV and the influence of factors internal and external environments on the basis of their and other theories, hypotheses, paradigms.

5.7. The ability not to lose an idea during its birth, to ensure the possibility of its implementation in the created features and properties of living systems, along with its possible variability, stability, adaptability, and competitiveness.

5.8. A breeder is a natural, intellectual force of an unusually high type, an exceptional ability to create new living systems, requiring originality due to the presence of thinking in itself, allowing the receipt of inventions, discoveries.

5.9. A breeder is a person's ability not only to create, but also to objectively evaluate the results of his activity in creating living systems, plants; an innate ability to create them with new features and properties necessary for production.

5.10. The breeder's activity is realized and evaluated by fundamental and applied research, both in the present and future time of domestic and international science, from which the breeder extracts material for his creativity.

5.11. The breeder and his team members do what they are supposed to do, as determined by the research program. The breeder's doom is to create something new; his hopelessness is subordination to his creative (intellectual) potential, the inevitability of straining his forces and his team members to achieve the goal - the creation of new living systems.

A breeder is a fan of his own creativity, creating a new one that is necessary for the state to ensure the health and longevity of the population.

5.12. The creation of a new living system requires the breeder to have high intelligence, its intense activity of genetic, energy, information and bio-informatic structures (GEIB), striving for its perfection. The breeder needs a social order, an incentive, the need to work on creating a new one, a huge strain on his will, the purposefulness of him and his team members. The presence of internal and external factors in the breeder's life (their torsion field) leads to the fact that not all breeders and their teams develop and implement what they are called to do - to create a new, better than the previous one.

The breeder is the presence of creative energy, giant reserve GEIB structures, their implementation and development of volitional stimulation, the ability to create new living systems for the needs of the social and food order of the people of Russia. The breeder must work in different times and spaces, always, everywhere and for everyone, and for himself. The main feature of the breeder is the ability to work hard, obsession and desire for absolute perfection of themselves, the team and the new living systems (varieties and hybrids) for which they live and work.

Thanks to a special gift of nature and a qualitative attitude to work in the process of creation, something occurs that sometimes does not happen in life or could not be.

And if you think about a problem, the question of what elements formed the beginning of creativity, it seems, first we need to recognize selfless performance; the second component is an extremely accurate knowledge of the object of work (a living system), mastery of breeding material, the ability to rise above the process of creativity, critical attitude to the results of their work and team self-assessment yourself and work evaluation team, the need in deed for your customers, benefactors and people.

The life span of a breeder depends, first of all, on the desire to accomplish everything that he was created and called to do by his ancestors, parents and nature. The secret of longevity of a breeder, a scientist, a person who thinks creatively, has a goal and a desire to achieve it by realizing the potential of the structures embedded in the living system, primarily due to the genetic component of the length of the DNA molecule, called the "counter" of life by physicist Viktor Yartsev [7]. He called the DNA molecule creative, which can preserve its length obtained at birth, because it is realized primarily by the person himself, especially the breeder, with his own creative consciousness and work.

In modern physics, there is a term "torsion field", i.e., a field that transfers information and emits energy. Each cell of a living organism receives and emits information and energy, forming a single human field. These are his soul forces, consciousness, will, feelings, reason. Everything that a breeder, scientist does, thinks, sees, hears, is embedded in DNA, RNA, etc. High spirituality, soulfulness strengthens the vital forces of the breeder's and scientist's organism, preventing DNA shortening, keeping the living body alert and young always, everywhere and everywhere.

Correct understanding and perception of the worldview creates an internal "torsion field" a field that resonates with information and energy received from outside. There is a harmony that is not afraid of any cataclysms. The disease of the living system and the breeder is only an indication from the "own soul" on the wrong path.

### Conclusion

Being in a biologically active state, living organisms exchange matter, energy, information and bioinformatics with the environment; reproduce themselves, evolve, interact with each other and the external environment (bioo- and abiofactors), ensuring the infinity of life on Earth. Breeding is an eternal movement, a continuous change of varieties, hybrids, their structure, form, and quality.

In genetics, there are structural and functional genes that provide specific, synthesizing, informational, transforming, regulatory, inhibiting, intensifying, operating, modulating, inducing properties and signs of a living system.

The main thing today is the methodology, culture, depth of scientific thinking of the breeder, his systematic analysis of the present, future circumstances and process in all contradictions and connections in order to find worthy answers to the set problems of development of especially ecological domestic breeding. In the nature of a living system, there is nothing superfluous, unnecessary, or accidental. Selection, the breeder, his life, varieties and hybrids – this is a constant struggle, this is the assertion of justice in society. The breeder is a sacred gift of nature, which a person accepts, carefully multiplies and returns to her as a testimony of what he has disposed of as a faithful servant. A breeder and his team should not be without honor in their Fatherland and home.

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## ANALYSIS OF THE INTERNATIONAL LEGAL STATUS OF THE CASPIAN SEA

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**Annotation.** The Caspian Sea is a closed body of water that has no connection with the world's oceans. The Caspian Sea is a basin rich in flora and fauna as well as natural resources. The issue of determining the legal status of this closed basin, which plays an important role in connecting the two continents, is still an unresolved issue [1,2,3,5,7].

In general, the problem of the legal status of the Caspian Sea is a very controversial and complex process, so the stages for the analysis of Azerbaijan's position in the development of this process are reflected in the article. The share of natural resources of the Caspian Sea among the countries of the Caspian region is shown in the description given in the article. The article analyzes issues related to determining the international legal status of the Caspian Sea, considers the positions of the Caspian littoral states. Special attention is paid to geopolitical processes in the Caspian region and the policy of countries outside the region [1,2,4].

**Keywords:** Caspian Sea, international legal status, analysis, closed basin, fauna and flora, geopolitical division.

### Introduction

In the 1990s, the collapse of one of the world's two superpowers, the USSR, created a number of independent states in the South Caucasus and Central Asia. In this regard, geopolitical activity in the West began to develop rapidly, the issue of radical reconsideration of many problems in the Eurasian space was raised, as well as the struggle for a reconsideration of geopolitical issues related to the Caspian region. In particular, the problem of determining the international status of the Caspian Sea between Russia, Azerbaijan, Iran, Turkmenistan and Kazakhstan has caused heated debates [3,4,5,6,7].

Only in the law on the state border of the USSR adopted in 1982, the USSR unilaterally approved the Astar-Hasangulu line as the state border. The Iranian side did not express its official reaction to this decision and in

the published maps (for example, the geological map of Iran) the Caspian Sea was shown on the Astara-Hasangulu line. Thus, Iran was forced to reconcile with the situation and did not take any official steps to change the situation. As a result, 88% of the Caspian Sea remained under the control of the USSR and 12% under the control of the Iranian side.

On the eve of the collapse of the USSR, it should be noted that the middle line (as the water border), which formed the basis of the sectoral division, was adopted as the administrative-territorial border between the allied republics. However, the emergence of new independent states in the Caspian region has radically changed the political situation here. The main reason for this was the growing interest of both the Caspian littoral states and the world's major countries in the rich hydrocarbon resources in the region; First of all, the discovery of promising oil and gas fields in the shelf zones of Azerbaijan and Kazakhstan resulted in the inflow of large amounts of capital from other countries to these regions [6,7,8,9,10,11,12].

### **Analyses and discussions**

In general, the problem of the legal status of the Caspian Sea is a very controversial and complex process, so to analyze the position of Azerbaijan in the development of this process, it is necessary to divide it into three stages: [10,11,12].

- The first stage covers 1992-1994. This stage ends with the study of the problem, the discussion of the legal status of the Caspian Sea in bilateral and multilateral meetings and the formation of a conceptual position of Azerbaijan in solving the problem and the signing of the "Treaty of the Century".

- The second stage covers 1995-1998. This stage is characterized by a clear definition of the positions of the littoral states on the status issue and the intensification of bilateral and multilateral meetings and Turkmenistan's territorial claims against Azerbaijan in the Caspian Sea.

- The third stage lasts from 1999 to the present. This stage is also marked by the achievement of bilateral agreements on the legal status of the Caspian Sea. It is characterized by a complete change in Russia's position on the legal status of the Caspian Sea and the signing of bilateral and trilateral agreements between Azerbaijan and Kazakhstan and Russia [10,11,12].

The development of promising oil and gas fields in the Caspian Sea, the use of biological resources, the development of transport and the growing environmental problems made it necessary for the countries of the region to draw up a general convention on the legal status of the Caspian Sea. A special working group with the participation of representatives of

the Caspian littoral states has been set up to draft such a convention. This reflects the importance of the issue in question for the Caspian littoral states. Although the numerous meetings of the working group in each of the Caspian littoral states have led to a convergence of positions, but this has not yet led to a full understanding [7,8,9,10].

In order to determine the legal status of the Caspian Sea, a general agreement must first be reached as to whether this body of water is a "sea" or a "lake". It is unfortunate that some Caspian littoral states, based on their geopolitical and economic interests, still ignore the norms of international law and put various pressures on the countries of the region to accept the status to their advantage.

In 1998, the Russian side ended the four-year blockade of the Volga transport routes in the direction of Azerbaijan. Russia's and Iranian-backed proposals to divide the coast into 10, 15 and even 45-mile territorial water zones have not been accepted by other Caspian littoral states. Otherwise, it is clear that the remaining water area and its natural resources would be considered common. Given that the main oil and gas reserves are located in the shelf zones of Azerbaijan, Kazakhstan and Turkmenistan, then Russia and Iran have overlapping interests in this matter [5,8,10,12].

Despite the apparent change in Russia's policy on the status of the Caspian Sea, in essence, they managed to protect their interests by correctly assessing the real situation. This is primarily due to the signing of relevant agreements with Kazakhstan in 1998 and Azerbaijan in 2002 on the division of the Caspian Sea.

Azerbaijan is the only country in the Caspian region that has been pursuing a consistent policy on the legal status of the Caspian Sea since 1993 in accordance with international law. The legal status of the sea requires official confirmation by the Caspian littoral states that it is a lake. According to the scientific classification accepted in the world of geography, it is called a "water basin with no natural access to the world's oceans". Surprisingly, some Caspian littoral states denied such an undeniable fact and intended to shape the legal status of the Caspian Sea in accordance with their interests, giving it a closed sea, inland water basin and other names. Subsequent processes have shown that these attempts have failed.

The transformation of the Caspian Sea into a center of international cooperation in 1999-2000, the growing development of cooperation with the world, as well as the realization of the West-East energy corridor, the restoration of the Great Silk Road have further increased the importance of the Caspian Sea. Leading in this direction, the influence of Azerbaijan on the geopolitical situation in the region was very strong. The restoration of the

Great Silk Road at the initiative of the country in 1999 and the adoption of the Baku-Tbilisi-Ceyhan main export pipeline as an official means of transporting oil at the OSCE Istanbul Summit on November 18 had a positive impact on determining the Caspian regime based on mutual respect [12].

During the meeting of Russian President Vladimir Putin with President of the Republic of Azerbaijan Heydar Aliyev, who paid an official visit to Azerbaijan on January 9, 2001, the political situation in the Caucasus, international conflicts, as well as the settlement of the Caspian Sea status were discussed. The "Baku Declaration" signed at that time was the beginning of a special stage in resolving the status of the Caspian Sea due to its historical significance. It was clear from this concept that the Russian Federation took a constructive position in its proposals on the Caspian Sea, where it put forward concrete proposals to bring the principles of cooperation in line with Azerbaijan's position. This was the result of many years of hard work by Azerbaijani diplomacy at the beginning of the 21st century. Of the more than 20 official documents signed, the Baku Declaration, which reflects the views of both countries on the Caspian Sea, was of particular importance. According to the articles of the document, the closeness of the positions of the two countries on the status of the Caspian Sea was officially declared, the disagreement was to some extent put an end and in principle it was the first and only document that laid the foundation for the idea of division into national sectors [4,7,9].

The middle line of the Caspian Sea In 2002, it was agreed that Azerbaijan and Russia would divide the bottom of the Caspian Sea into sectors in accordance with the principle of the middle line. This agreement should be considered the first successful step towards solving a very important and complex problem, such as the division of the Caspian Sea into sectors. As Azerbaijan borders all four Caspian littoral states at sea, it is especially important to accept the legal status of the Caspian Sea on a compromise basis. Unfortunately, Azerbaijan has to agree on its position on this issue with each of the neighboring countries at sea. There is no other state in the Caspian region in such a situation [2,3,5,6,8,10].



**Figure 1. If Caspian was a sea or lake status of the Caspian Sea**

The position of the Kazakh side in solving the problem of the legal status of the Caspian Sea largely coincides with the position of the Azerbaijani side. The Kazakh side is most interested in the division of the Caspian Sea on the principle of the middle line. Because in this case, the share of Kazakhstan in the Caspian Sea is more than any other country - 29%. Kazakhstan is the only country that has demarcated its offshore sectors with all three Caspian littoral states and has signed agreements with Azerbaijan, Russia and Turkmenistan. The demarcation of the middle sea line has forced Kazakhstan to create a navy to protect its sector and territorial waters. As mentioned above, the Iranian side in most cases does not compromise on the issue of the legal status of the Caspian Sea. However, Russia's signing of agreements with Kazakhstan and Azerbaijan on the division of the seabed into sectors has resulted in Iran being left alone in this matter.

In recent years, the Iranian side has proposed to divide the Caspian Sea into five equal parts. Other Caspian littoral states disagree. In this case, Turkmenistan is "losing" its promising fields in the South Caspian Sea. The Iranian side, realizing the absurdity of its proposal, is consciously making such claims. The goal is to get enough concessions from future compromises. It is almost impossible to solve the principle of "20% of the sea should be allocated to each Caspian littoral state" proposed by the Iranian side, both methodologically and technically. Because the constant change in sea level and the significant indentation of the coastline make it impossible to find a focal point in the water area for the even distribution of the basin.

Of course, in order to achieve progress in the legal status of the Caspian Sea, the Iranian side must build its policy in accordance with reality and the current situation. Thus, if Turkmenistan reaches an agreement with other Caspian littoral states on this issue, the Iranian side may remain isolated. The Third Summit of the Caspian littoral states held in Baku on November 18, 2010 was not only about bringing together the countries of the region and the division of the Caspian Sea, but also about issues of mutual interest such as maritime security, the five-party economic cooperation formula, protection of ecology and biological resources. was considered an important event.

During the meeting, the presidents signed an agreement on security cooperation in the Caspian Sea and adopted a joint declaration. The agreement states that security in the Caspian Sea is the exclusive right of the Caspian littoral states. The parties adopted this document based on the norms and principles of international law, including the principles of independence, sovereignty, territorial integrity, inviolability of borders, non-use of force and non-interference in the affairs of others, enshrined in the UN Charter. The document provides for cooperation in the fight against terrorism, organized crime, arms, drugs, smuggling of weapons of mass destruction, the fight against poaching, as well as joint rescue operations. The parties intend to cooperate in other areas, except for the military aspect of security. It is also noted that "nothing in this agreement determines the legal status of the Caspian Sea." The presidents attending the Baku meeting stressed the importance of maintaining the recent progress in the process of determining the legal status. President of Azerbaijan Ilham Aliyev stated that the agreement reached between Russia, Azerbaijan and Kazakhstan should be an example for other countries in the basin. The Azerbaijani side considers it necessary to take these agreements as a basis and conduct negotiations on the final status in accordance with this practice.

Protocols to the Framework Convention for the Protection of the Marine Environment of the Caspian Sea were also agreed at the Baku summit. These documents will help prevent environmental degradation of the sea. As it is known, the main bioresource of the Caspian Sea is sturgeon. Countries in the region have long been considering a moratorium on their hunting. Finally, the issue was resolved at this meeting. The Presidents of Azerbaijan, Russia, Kazakhstan, Turkmenistan and Iran reaffirmed their intention to continue working on the Convention on the Legal Status of the Caspian Sea in the Joint Declaration adopted at the end of the third summit in Baku.

Speaking at the 4th Caspian Summit in Astrakhan, Russia on September 29, 2014, President of the Republic of Azerbaijan Ilham Aliyev expressed his country's satisfaction with the results and agreements reached and expressed hope for the solution of unresolved issues. It should be noted that President Aliyev's speech was very mild and diplomatic, and he spoke about the latest processes and prospects in the Caspian Sea, without making any specific statements on the military presence of non-states in the Caspian Sea, the Trans-Caspian Pipeline and the territorial dispute with Turkmenistan.

There are several important points in the final declaration of the Astrakhan summit of the Caspian states:

- I. Non-use of force and threats;
- II. Ensuring a stable balance of armaments;
- III. The inadmissibility of the military presence of non-Caspian states.

### Oil and gas reserves in the Caspian region

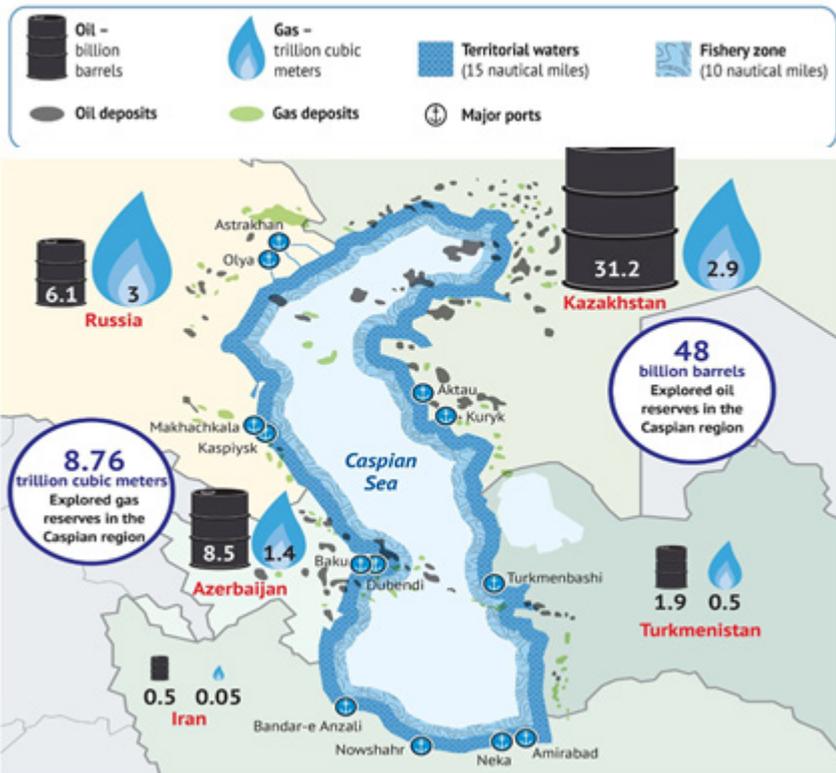


Figure 2. Convention on the Legal Status of the Caspian Sea

The fourth and sixth points are in the interests of Russia and Iran. The Convention on the Legal Status of the Caspian Sea was signed at the 5th Summit of the Caspian littoral states in Aktau, Kazakhstan. Following the 5th Caspian Summit, Ilham Aliyev, Vladimir Putin, Nursultan Nazarbayev, Hassan Rouhani and Gurbanguly Berdimuhamedov signed a document defining the legal status of the Caspian Sea. Among the main issues discussed in the press release, the heads of state noted the legal status of the Caspian Sea, cooperation in the field of economy, transport, ecology and protection of biological resources in the Caspian region, security in the region and globally. The signing of the Caspian Convention coincided with the International Caspian Day on August 12. Bilateral and multilateral meetings of the littoral states on the Convention on the Legal Status of the Caspian Sea since 1992 have come to their logical conclusion, because so far each state has approached the legal status of the Caspian Sea differently, based on national interests.

For many years, the Azerbaijani side has proposed a fair division of the Caspian Sea within the framework of international law and the principle of "win-win", but certain artificial obstacles did not allow to reach an agreement on the final status. Work on the document has been underway since 1996. On May 14, 2003, in Astana, Azerbaijan, Russia and Kazakhstan signed a tripartite agreement on the "division of the Caspian seabed into national sectors in the middle line, the common use of the water surface" and the parties signed a final agreement on the division of the Caspian seabed. The draft convention was finally agreed at a meeting of the Foreign Ministers of the Caspian littoral states on December 4-5, 2017 in Moscow. According to the Convention, the Caspian littoral states exercise sovereignty, sovereign rights, exclusive rights and jurisdictions.

The Convention can also be described as the "Constitution of the Caspian Sea." According to the signed convention, the Caspian Sea is neither a sea nor a lake. This is a novelty in the history of the world's seas. It is impossible to call the Caspian Sea the sea because it has no access to the oceans. At the same time, in terms of water capacity and geography, the Caspian Sea is not. It was agreed that the Caspian Sea will consist of inland waters, territorial waters, fishing zones and common space. Coastal states will have national sovereignty, provided that they do not exceed 15 nautical miles in territorial waters. In addition, in fishing zones within 10 miles, coastal states acquire exclusive rights within their borders. The rest of the sea area is put into general use.

The convention also does not prevent the passage of pipelines from the seabed. This issue was also interesting for Azerbaijan and Turkmenistan

in terms of the construction of the Trans-Caspian gas pipeline. The document clearly states that any country can build any pipeline with the consent of the state through which the pipeline passes. That is, we are not talking about any general agreement. However, a protocol on the environmental impact of Caspian projects could provide Russia and Iran with an additional means of blocking such projects in the future. One of the important points of the Convention is to prevent foreign countries from gaining access to the Caspian Sea. The Convention contains a provision on the inadmissibility of the participation of the armed forces of third countries (ie non-Caspian states) in the Caspian Sea. Therefore, "the Caspian littoral states will not hand over their territories to any other state acting against the contracting states and for other military activities.

**Result:**

1. It is considered expedient to follow the following proposals and recommendations to solve the problem of the legal status of the Caspian Sea: the status of the Caspian Sea should be accepted as an international lake, and its legal regime should be determined on the basis of the principle of division into national sectors along the middle line; a certain system of norms should be developed in order to regulate various aspects related to the use of the Caspian Sea; in this case, the interests of the Caspian littoral states, existing international practice and international law must be taken into account; the Caspian littoral states must take real steps to solve the problem, demonstrating a strong political will; to this end, it should strengthen its activities through high-level meetings; the consistent efforts of the Azerbaijani leadership to determine the status of the Caspian Sea are to be applauded; Azerbaijani diplomacy should expand political and humanitarian relations with the foreign ministers of the Caspian littoral states; there is a serious need to join the efforts of the Caspian littoral states in the field of Caspian ecology; there is a serious need for the Caspian littoral states to comply with international law in the use of Caspian resources; it is important that Azerbaijan and other Caspian littoral countries pay serious attention to people's diplomacy in protecting the Caspian Sea. In general, the problem of the legal status of the Caspian Sea is one of the factors affecting the current international situation in the Caspian littoral states.

2. In this regard, the solution of the problem of the status of the Caspian Sea is of great international importance in the context of the current geopolitical situation of the states. The growing demand for energy resources in the world market, such as oil and natural gas, the participation of world countries in transregional projects related to the exploitation and transportation of these resources, the security of export pipelines show the need to

resolve the legal status of the Caspian Sea. The settlement of disputes in the Caspian region, the formation of a security environment and the establishment of stability will have a positive impact on the economic development of the Caspian countries, as well as the expansion of opportunities for countries seeking to strengthen cooperation in the joint use of energy resources.

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**STUDY OF INACTIVATED EMULSIFIED VACCINE AGAINST  
DUCKLING VIRAL HEPATITIS TYPE I**

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**Abstract.** Duckling viral hepatitis type I (DHV-I) is a highly lethal, contagious and rapidly spreading infection of young ducklings, resulting in significant economic losses in ducklings. An important role in the prevention and elimination of DHV-1 belongs to specific prevention. The article presents the results of experimental studies on the use of an inactivated vaccine against hepatitis I virus type on breeder ducks that were first vaccinated with an attenuated live vaccine. Ducklings vaccinated with a live vaccine at 2 days of age and revaccinated with an inactivated vaccine against DHV-1 at 6 weeks of age had antibody titers 2-3 times higher than ducks vaccinated with inactivated vaccine alone.

**Keywords:** duckling viral hepatitis type I, blood serum, specific antibodies, vaccine.

**Introduction**

Duckling viral hepatitis type I (DHV-I) is a contagious and rapidly spreading infection of young ducklings, mainly up to 4-6 weeks of age, with predominantly liver damage and high mortality [2, 6, 9, 12, 13]. In some duck farms, up to 95% of ducklings die from this disease, which causes significant economic damage [2, 5].

Disease control is currently based on the use of the attenuated AR-RIAH virus vaccine, which is used to vaccinate one-day-old ducklings to obtain active immunity or laying ducks in order to transfer maternal antibodies to offspring [3, 4].

The inactivated vaccine is used to immunize rearing ducks or when transferring to a parent flock one month before the start of oviposition, in

order to obtain ducklings resistant to field virus infection during a susceptible period [14].

An inactivated vaccine from the 3M-USRIP strain against DHV-I was described by B.B. Trefilov et al. (2018). To prepare an inactivated vaccine, the authors used a virus grown in developing duck embryos, inactivated with aminoethylethyleneimine and emulsified with Montanide ISA 70 oil adjuvant (SEPPIC, France). The vaccine after a single vaccination of adult ducks at a dose of  $10^6 \text{ELD}_{50}$  in a volume of  $0.6 \text{ cm}^3$  induced an intense immune response in ducks, the level of specific antibodies in their blood serum was  $7.5 \pm 0.1$  and  $8.0 \pm 0.5 \log_2$ , respectively after 28 and 60 days after vaccination [10]. In an experimental study of an embryonic inactivated vaccine from the "VN-3" vaccine strain using a domestic oil adjuvant, the titers of neutralizing antibodies increased by  $9.5 \pm 1.2 \log_2$  and remained stable for 9 months. The level of maternal antibodies in the offspring was  $7.0 - 6.5 \log_2$ , depending on the timing after vaccination.

The purpose of the research was to study an inactivated emulsified vaccine against duckling viral hepatitis type I in breeder ducks, initially vaccinated with the attenuated ARSRTIP virus vaccine.

### Materials and methods

**Virus.** In the course of experimental studies, the vaccine strain "VN-3" of duckling viral hepatitis type I (DHV-I) was used, which was deposited in the State Collection of Viruses at the V.I. DI. Ivanovsky, FSBSI "N. F. Gamaleya RIEM" of the Ministry of Health of Russia and corresponds in antigenic specificity in 98% of cases to the reference and epizootic isolates of the hepatitis virus circulating in the Russian Federation [7]. The virus was stored at minus  $20^\circ$ .

**Ducklings** of one day of age were obtained from a farm free from acute infectious diseases, including duckling viral hepatitis type I. Ducklings immunized with the attenuated ARSRTIP virus vaccine were kept in isolated boxes for the entire period of the experiment.

**Virus-containing material** was obtained on developing duck embryos of 10-12 days of age, which were infected with the virus at a dose of  $10^3 \text{ELD}_{50}$  in  $0.2 \text{ cm}^3$  into the allantoic cavity. After 24 h of incubation at a temperature of  $(37.0 \pm 0.5)^\circ \text{C}$ , VSM (allantoic fluid and carcasses) were collected from the dead embryos.

The biological activity of the virus was determined by titration on duck embryos. The titer was calculated by L.J. Reed and H. Muench [1]. The virus concentration was  $7.2 \pm 0.2 \text{ lg ELD}_{50} / \text{cm}^3$ .

The sterility of vaccinated material was determined according to GOST 28085-2013 by inoculations in MPB, MPA, MPLB under vaseline oil and

on Sabouraud agar. Seedlings are kept at 37 °C for 10 days, and on Sabouraud agar at 18-24 °C for 14 days.

**The virus was inactivated** by aminoethylethyleneimine (AEEI) ("Biochim Resource" LLC, Russia) in a final concentration of 0.1% with constant stirring at a temperature of  $37.0 \pm 0.5$  °C for 24 hours [11]. The residual amount of AEEI was neutralized with 2M sodium thiosulfate solution to a final concentration of 0.03 M/dm<sup>3</sup> and kept at room temperature for 24 hours. The completeness of the virus inactivation was checked by the method of three passages in duck embryos.

In the manufacture of an inactivated vaccine against duckling viral hepatitis type I, a viral antigen and an AB-4M (W/M) oil adjuvant (CJSC "Petrokhim", Russia) were used in a ratio of 30:70.

An attenuated vaccine was prepared from vaccinated material obtained from infected duck embryos and ARSRTIP protective drying medium in a 2:1 ratio.

The attenuated virus vaccine was administered to ducklings of 2 days of age ( $p = 15$ ), once, subcutaneously at a dose of  $10^4 \text{ELD}_{50}$ , 0.5 cm<sup>3</sup> each, and 6 weeks later these ducks were immunized with inactivated emulsified DHV-1 vaccine once, subcutaneously, in the lower third of the neck, in a volume of 0.6 cm<sup>3</sup>. The second group of ducks ( $p = 15$ ) at the age of 6 weeks were vaccinated only with the inactivated vaccine subcutaneously, in the region of the lower third of the neck, in a volume of 0.6 cm<sup>3</sup>. The ducks ( $p = 10$ ) of the control group were not vaccinated.

Blood samples from vaccinated ducklings with a live vaccine were taken on days 14, 28 and 42, and from ducks after immunization with an inactivated vaccine (groups 1 and 2), on days 14 and 28. The serum obtained from them was examined for the presence of specific antibodies in the  $\beta$ -variant of the neutralization reaction (NR) [1] and ELISA [8].

The data obtained were subjected to statistical analysis using the Student's test, considering them reliable at  $P < 0.05$  [1].

### **Research results and discussion**

Before vaccination, the ducklings were divided into 3 experimental groups, and their blood serum was tested for the absence of antibodies to the hepatitis virus. The data of blood serum studies in ELISA showed that the ducklings were free of antibodies to duckling viral hepatitis type I. The ducklings of the first group were vaccinated with an attenuated virus vaccine from the VN-3 strain and kept in isolated boxes. After vaccination during the entire observation period, the vaccine induced in the ducklings the production of specific antibodies with an increasing titer in both NR and

ELISA. The level of specific antibodies in vaccinated ducks ( $p = 15$ ) on the 42nd day was  $8.0 \pm 1.2 \log_2$  in NR, and  $3612 \pm 108$  in ELISA. After revaccination with an inactivated vaccine, the average antibody titers in the blood serum of ducks increased significantly and amounted to  $12.0 \pm 1.0 \log_2$  and  $13.5 \pm 1.2 \log_2$  on days 14 and 28 in NR, and  $15252 \pm 208$  and  $18160 \pm 228$  in ELISA, respectively,  $P \leq 0.05$  (Tab. 1).

**Table 1**  
**The level of specific antibodies in vaccinated ducks ( $p = 15$ )**

№	Group names	Antibody level (NR $\log_2$ /ELISA *)				
		Time after vaccination, days				
		14	28	42	56	63
1	Ducks vaccinated with live and inactivated vaccine	6,5/1043	7,5/2412	8,0/3612	12,0/15252	13,5/18160
2	Ducks vaccinated with inactivated vaccine	-	-	-	9,0/5486	10,5/10054
3	Ducks who were not vaccinated	552±52	542±54	532±48	535±51	542±47

\* Reverse values of antibody titer in ELISA

The level of antibodies in the blood serum of the second group of ducks vaccinated only with the inactivated vaccine was 2 times lower and amounted to  $9.0 \pm 0.5 \log_2$  and  $10.5 \pm 0.8 \log_2$  on days 14 and 28 after immunization in NR, and in ELISA  $5486 \pm 112$  and  $10054 \pm 208$ , respectively,  $P \leq 0.05$ .

The data obtained indicate that a pronounced seroconversion occurred in the body of the vaccinated ducks. In a bird vaccinated with an emulsified inactivated vaccine, after immunization of ducklings at 2 days of age with an attenuated virus vaccine against DHV-I, antibody titers reached  $13.5 \log_2$  on day 28 after vaccination, and antibody titers in the yolk of eggs obtained from vaccinated ducks ranged within  $9.0 - 7.0 \log_2$  depending on the time after vaccination.

It should be noted that a single vaccination with an inactivated vaccine after the application of an attenuated virus vaccine for laying ducks has

the advantage of reducing labor costs and stress compared to its repeated use in parent stock. The inactivated vaccine is stable at 4 °C for at least 12 months.

### Conclusion

The inactivated emulsified vaccine against duckling viral hepatitis type I has high immunobiological properties and can be used for specific prophylaxis against this disease.

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