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SCIENTIFIC
DEVELOPMENTS**



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FUNCTIONING AND MAIN COMPONENTS OF THE STRUCTURE OF THE SOCIAL AND ECONOMIC SYSTEM OF THE RUSSIAN PUBLIC SECTOR

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Abstract. This article discusses the socio-economic system of the public sector of the economy. The importance of the public sector of the national economy is substantiated. The purpose and objectives of the functioning of the public sector are determined. The issues of state regulation of the economy are considered. The structure of the state sector of the Russian economy is given. The directions of the functioning of the public sector of the economy in the context of the main elements are considered.

Keywords: socio-economic system, national economy, public sector of the economy, form of ownership, state-owned enterprises, social sector of the state, state administration, state regulation

Under the modern conditions of development, the national economy of almost all states of the world community without exception is a predominantly mixed, that is, a hybrid socio-economic system. Such a system of the national economy is characterized by symbiosis, and above all, close relationships, mutually beneficial socio-economic relations and interdependencies between all elements of the system in the process of its functioning. At the same time, the main elements of the system of the national economy are households, the state and business sectors.

Currently, the public sector is a necessary element of the national economy, and the need for its functioning is due to the fact that there are areas of economic activity that are not very attractive from a financial point of view for private business. Such areas include education, health care, social protection of the population, environmental safety, development of transport and territorial infrastructure, and a number of others aimed at the production of public goods. The public sector also contributes to the implementation of fundamental scientific research, the implementation of

projects to ensure the country's defense and information security. In addition, there are strategic sectors for the state's economy, where business interference is simply unacceptable, namely the gas and oil industries, electric power, rail transport, the postal service, etc. It is in these areas that the public sector dominates. The analysis shows that in almost all countries the public sector is a heterogeneous production unit [7, p. 139].

The entrepreneurial sector carries out business processes and builds its business activities on the use of private ownership of the means of production and the application of market mechanisms aimed mainly at maximizing the profit. The public sector of the economy, in contrast to the business sector, operates on the basis of state ownership, is managed by state institutions, is fully controlled by state authorities or local governments. Such a sector of the national economy produces the public goods and services needed by the population, which for various reasons does not want to take on the business sector, and above all, because of their unprofitability or very low profitability. Public goods and services provided by the public sector to the population include education, medical care, various forms of social services, the development of human capital, environmental and other types of public safety, the formation of a developed public infrastructure, a comfortable living environment for people, etc. In the process of its functioning, the public sector manages and uses all financial and economic resources that the state owns to increase the level of public welfare, and above all, such resources as the state budget and extra-budgetary funds, state lands, strategic state corporations and enterprises, budgetary institutions and social organizations.

In a broad sense, the public sector of the economy can be defined as the totality of enterprises, organizations, institutions owned by the state and managed by state bodies or persons appointed by them, including state bodies themselves and individuals employed in these entities [6, p. 68]. The main objective of the functioning of the public sector of the economy is to preserve and increase the country's national wealth, as well as providing prerequisites aimed at sustainable socially-oriented economic growth. Particularly important is the role of the state during the development of crisis phenomena in the economy, when it guarantees the fulfillment of social obligations to citizens and supports the business sector. Based on the factors of the impact on individual socio-economic processes, in the system of the national economy, the public sector faces a number of tasks, the main of which are:

1. Ensuring and strengthening state control over the most important socio-economic processes taking place in society.

2. Sustainable economic growth, as well as stabilization and the achievement of a balanced increase in socio-economic indicators.

3. Support and stimulation of the business sector of the national economy, as well as the provision of social transfers.

4. The solution of important socio-economic problems, including those related to employment and reducing social tension.

5. Ensuring foreign economic equilibrium and enhancing the competitiveness of the state in the international arena.

Such tasks reflect the interests of not only the business sector, but also affect the interests of the national economy as a whole. For a more efficient implementation of the tasks assigned to the public sector, it has its own specific structure, which includes state authorities of various levels together with their subordinate institutions and institutional units.

The public sector also regulates all processes taking place in the socio-economic system of the national economy, by conducting a fiscal and monetary policy, restricting the activity of monopolies, controlling the level of prices for goods and services, slowing down inflationary processes, and financial support for small and medium-sized businesses, reducing unemployment in the country, etc. Through the structures that make up the public sector, there is a fair distribution and redistribution of national income, as well as state regulation of the national economy. The main role of the public sector in the socio-economic system of the national economy is twofold. On the one hand, the state can act as a subject of economic regulation, and on the other, as the owner of various types of property, financial resources and funds. The state ownership also includes companies operating in various sectors of the national economy.

In Russia, the public sector is a subsystem of the national economy, which is represented by a set of enterprises, institutions and organizations of various industries that are fully or partially owned by the state, and are also managed by state authorities. Such a sector of the economy includes all state corporations, companies and enterprises, as well as budgetary institutions and various state organizations whose property is federal property, property of constituent entities of the Russian Federation and municipalities. Moreover, in modern conditions, the Russian Federation through the public sector is an entrepreneur, a major investor, consumer and organizer of the directions of socio-economic development [4, p. 237].

The state sector of the national economy covers all possible means of production, financial, economic, budgetary, natural and production resources that are owned by the state and which it has the legal right to dispose of, as well as use for the purpose of sustainable socio-economic

development of a particular territory of Russia. Moreover, the state is not only the owner of the property, but also the subject of management and regulation of the financial and economic activities of all objects within the state sector of the economy. Management of the public sector of the economy occurs both at the federal level and at the regional level. The federal government covers the defense industry, space development, aircraft, shipbuilding and automotive, mining and processing of strategic raw materials, nuclear energy, transport, communications and telecommunications. Therefore, the government sector of the economy includes various authorities, both at the federal level and at the level of constituent entities of the Russian Federation. Distinctive characteristics of the public sector in Russia are, firstly, the “blurring” of its borders, and secondly, the lack of a clear government policy aimed at its formation [1, p. 96]. The existing structure of the public sector of the national economy is shown in Figure 1.

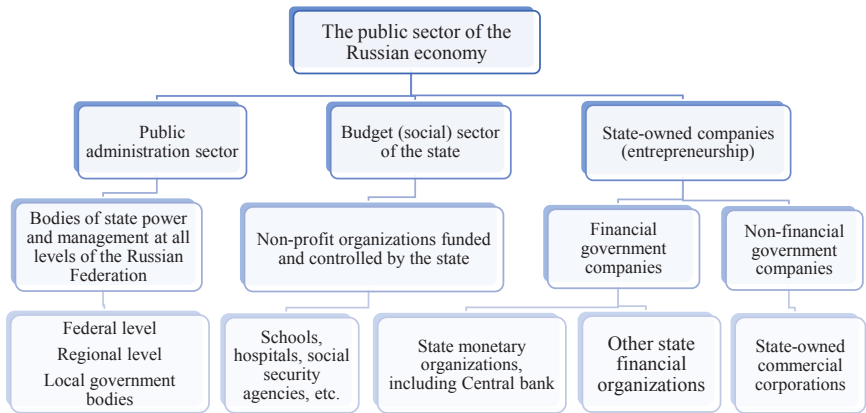


Figure 1 - Elements of the structure of the public sector of the national economy
 (compiled by the author according to sources of economic literature)

Based on the data presented in Figure 1, it can be seen that the public sector consists of a subsector of public administrations, the social sector of the state, as well as a subsector of state-owned companies and organizations operating in various fields. Each subsector of the above structure of the public sector of the Russian economy includes institutional units:

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- bodies of state power and administration at all levels of the Russian Federation (federal, regional and local) include line ministries, services, departments, agencies and other administrative and official institutions;

- non-market (social) non-profit organizations, financed and controlled by the state, include educational, medical, social, environmental and cultural-leisure organizations, as well as art and folk crafts.

- state-owned companies in the financial sector include institutions and organizations whose operation is based on the provision of financial intermediary services, including monetary. These include the Central (government) Bank, commercial banks, pension funds, insurance companies, etc.

- non-financial state-owned companies (the state's business sector) include enterprises of various organizational and legal forms that carry out their financial and economic activities in priority sectors of the national economy with the aim of making a profit and gaining additional revenue to the state budget.

The state is called upon to actively invest in the functioning and development of infrastructure facilities (transport infrastructure, construction projects) and stimulate the development of innovations [3, p. 11]. Therefore, one of the components of the public sector of the economy in Russia are various state and municipal enterprises that carry out their activities, primarily in the field of public goods production. Such enterprises include public road transport, land improvement and urban infrastructure development companies, housing and communal services, and a number of others. Also included are state corporations operating in strategic sectors of the national economy. The property of the state entrepreneurial sector of the economy is fully or partially owned by the state and is controlled by the authorized government body.

The next element of the public sector of the Russian economy are state corporations. State-owned corporations in Russia have the strongest positions in the defense industry, extraction and processing of raw materials, energy, shipbuilding and engineering, as well as transport infrastructure. Thus, in Russia priority is given to the development of strategic sectors of the national economy. In modern conditions, the innovative development of the economy in Russia is of considerable assistance to organizations carrying out research and scientific development, which are also part of the public sector. These organizations carry out fundamental scientific research that provides innovative and technical and technological development of the most important sectors and contributes to sustainable economic growth. For state enterprises, the role of planning, budget financing, and regulatory activity is more significant [2, p. 160].

Another important element of the public sector of the economy in Russia are research organizations, as well as various research institutes and higher education organizations with scientific potential. Therefore, in modern conditions, enterprises of the public sector of the Russian economy have the authority and ample opportunity to formulate an investment and production strategy for the long-term development perspective.

The public sector of the economy also includes objects of the social sphere, the functioning of which is designed to ensure the satisfaction of public needs. They fulfill state social and economic guarantees to society and produce vital public goods. The performance of public functions directly depends on the political, social and economic conditions prevailing in the country [5, p. 1954]. The activities of such state facilities lead to an increase in the quality of life of the population, an increase in the level of well-being and a decrease in unemployment, as well as an increase in life expectancy. Such objects, first of all, include educational organizations and medical institutions, as well as various social services, cultural and art institutions, and environmental organizations.

The public sector, acting as the main regulator of the socio-economic system, characterizes itself not only as the owner and major investor, but also as a producer of public goods and a consumer of final goods, works and services. Despite the fact that the state acts both as a producer and as a consumer, it has certain instruments of influence on the economy, that is, methods of state regulation of the economy. These tools include:

- macroeconomic regulation of socio-economic processes taking place in the country's national economy;
- regulation of interest rates on bank loans and deposits due to changes in discount rates, tax rates, provision of benefits;
- establishment of the state and the change in the size of minimum reserves, maintaining the liquidity of various financial institutions, etc.;
- state regulation of the national currency, foreign trade operations, as well as the volume and circulation of money supply in the country;
- operations of state enterprises, organizations, institutions in the securities market (issue of shares, purchase and sale of securities, etc.);
- establishing a minimum wage, paying social transfers to the population, maintaining employment levels, etc.;
- regulation of foreign economic activity, import and export, ensuring a positive balance of foreign trade operations, etc.

State regulation is the main of the main functions of the public sector of the Russian economy. It is carried out by the public sector through the development and implementation of state socio-economic policies.

Thus, based on the results of the study, we can conclude that the public sector is a necessary and important element of the national economy. It carries out state regulation of socio-economic processes and contributes to the growth of the country's national wealth. To ensure the sustainability of the socio-economic system, the state forms a more appropriate infrastructure of the national economy, maintains a balance of macroeconomic proportions. The structures of the public sector of the economy implement the socio-economic policy developed by the Government of the Russian Federation, carry out macroeconomic forecasting, organize state control in the system of the national economy, support economic entities during the economic crisis, help slow down inflation and increase of unemployment, fulfill state guarantees to the population and promote increase public welfare. For these purposes, the Russian public sector uses the entire arsenal of the economic mechanism of state influence on the national economy.

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MARKETING TOOLS AND METHODS IN THE EDUCATION INDUSTRY

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Abstract. In this article we analyze the need to apply marketing tools to the non-profit sphere - the education sector, define the essence of the marketing mechanism in education. The basic elements of the marketing environment of a state university are considered.

Keywords: marketing, education, marketing of educational services, marketing environment of an educational organization, marketing tools.

The sphere of education is a strategic priority for the development of any society and the state, this sphere provides opportunities for the development of culture, science, technology, social and personal well-being of citizens and the state of the country, the qualitative and quantitative increment of human capital and, as a result, being the industry of the social sphere, occupies the most important place in the system of social production. Today, educational organizations and, above all, higher education institutions, are entering into full-fledged production relations in the educational services market, which requires them to increasingly turn to market tools and methods in their activities. Marketing tools are among the most effective in the competitive market.

Marketing activity and its individual elements in modern conditions are present in schools, higher and secondary educational institutions and other educational organizations. Undoubtedly, with the formation of the education market - the market of educational services, education managers (managers of educational organizations) are primarily focused on the use of tools to promote educational services and maintain competitive positions, for this, in turn, market research is conducted, its segmentation, and positioning of services on promising segments, marketing strategies are developed and improved, marketing plans are built, etc., and, as a result, a search is underway for the most effective educational organization management system. R.B. Galeeva identifies three levels of using the concept of marketing in the management system of an educational organization, depending on the degree of its involvement in marketing: Level I - individu-

al elements of marketing (advertising, pricing based on demand, etc.); Level II - individual types (sets of interrelated methods and tools) of marketing activities (development and production of educational services oriented to market needs (based on the results of a study of demand, market conditions, etc.), etc.); III level - a comprehensive reorientation to marketing as a concept of market management (creating a service (unit, department, system) of marketing, changing the entire management philosophy) [1, p. 51]. The last level of using the concept of marketing in the management system of an educational organization allows us to talk about applying a marketing approach to managing organizations.

The marketing mechanism itself is an integral set of marketing tools, which is aimed at increasing the effectiveness of the functioning of the business entity, its market stability and the maximum satisfaction of the needs of individual consumers and society as a whole.

In recent decades, higher education institutions, in a highly competitive struggle in the education market, increasingly resort to marketing educational services. By marketing educational services, we mean scientifically grounded and focused activities in the management structure, focused on external needs (consumers, employers, etc.), aimed at improving the efficiency of the educational organization in the educational services market.

Thus, the marketing of educational services of an educational organization, in particular a state pedagogical university, is a scientifically based system for managing various types of activities in an educational organization, namely, educational, scientific, educational-industrial, and marketing. This activity: aims to study the market for educational services; provides identification of consumer needs and development of services appropriate to these needs; promotion (implementation) of educational services in the form of educational programs to consumers; getting a positive (ideally - maximum) effect; commercialization of the activities of the educational organization in order to make a profit, increase financial resources in the face of a decrease in budget financing in the field of education.

When applying the marketing approach in the management system of a higher educational institution, a significant issue is the definition of marketing functions in the general management system, which include analytical, organizational, sales, formative functions, as well as the control and management function. So, the analytical function allows you to obtain information for further development and decision-making in the field of management, includes studying the marketing environment of the university, the market for educational services, potential consumers and their needs, competitors, analyzing the structure of the institution and its educational

services, etc. Directly, the organizational function is aimed at organizing the development and implementation of new and/or improving existing educational services, providing them with the necessary material and technical resources, monitoring the quality of education (managing the quality of educational services, competitiveness of an educational institution), etc. In the field of education, the marketing function helps to resolve issues the most effective implementation of educational services, includes pricing, distribution channels (organization of topics of promoting services to consumers), the search for intermediaries, partners, etc. A formative function is aimed at developing an educational institution in the educational services market, which focuses on: generating demand for educational services, developing and implementing communications (advertising, personal contacts, public relations and etc.), branding, etc. Effective achievement of the goals of the educational organization and timely adoption of measures in case of deviation from them is facilitated by the control and management function. It includes: the organization of strategic and operational planning, information support for marketing management, feedback formation, situational analysis, monitoring the implementation of the marketing activities of the educational institution, etc. Thus, the implementation of these functions allows the educational organization to maximize the adaptation of all levels of management to the needs of the educational services market in competition.

The structure of the marketing of educational services differs from production marketing, which is associated with the specifics of the education sector - the most important social sphere of life, the non-profit sphere, which determines the intellectual and cultural condition of society, aimed, from an economic point of view, to increase human capital, which is one of the central conditions and factors of economic growth and development of the country.

The marketing environment of any enterprise is represented by an external macro and microenvironment, as well as the internal environment of an organization. The marketing environment of an educational organization also has a similar division, however, its characteristics take into account the social nature of the education sector and the impact on the educational organization of external at various levels of government (world, Russian Federation, constituent entities of the Russian Federation, municipality). Consider the generalized marketing environment of an educational organization using the example of a state higher education institution. From the point of view of the external macroenvironment, a state university is influenced by all factors and measures that arise at the global

level (for example, world politics in the field of higher education), the level of the Russian Federation (for example, changes in the legislative framework), and the regional level. The external microenvironment of a state university is represented by classical market entities with which an educational organization interacts through the markets of educational services, labor, scientific and technical products and services. These entities include consumers, competitors, suppliers, intermediaries, partners, contact audiences. The internal environment reflects the potential of the educational institution, contributing to the implementation of the marketing strategy of the university. More details about the characteristics of the marketing environment of a state higher education institution can be found in the article [2, p. 28-35].

Today in literature and practice, in addition to the marketing concept of educational organizations, marketing of educational services, the concept of "intelligent marketing" is increasingly found. So, A.A. Khayrets gives the following definition: "intelligent marketing is a marketing management system of a higher educational institution functioning in the modern conditions of the development of the global knowledge economy, oriented towards a comprehensive increase in the competitiveness of a university as the main institution for the formation of the country's intelligentsia" [3, p. 12]. Thus, a feature of intelligent marketing is its use in higher education. However, in the opinion of a number of scientists and researchers, the disadvantage of this direction of the university's marketing is its narrow focus – orientation on the final result of the educational organization's activities, otherwise, getting a ready-made specialist with his professional competencies, without taking into account a number of characteristics, conditions, approaches and provisions that determine the country's economic development trends.

So, the use of marketing tools and methods in the field of education is not only possible, but also desirable and even necessary to increase the efficiency of the educational institution, especially a state university in the conditions of high competition and low contingent of potential consumers today, increasing competitiveness in the educational sphere because of overproduction "of universities in Russia per capita, etc. Thus, the use of a marketing approach in the management of a state pedagogical university, the use of a set of marketing tools in the educational services market allows us to talk about increasing the social effect of an educational institution. Proper application of the methodology of marketing tools allows you to distinguish an educational institution from competitors, attract the required number of students and earn income.

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**FEATURES OF FUNCTIONING OF CORPORATE STRUCTURES
IN MODERN CONDITIONS: MANAGEMENT OF INNOVATIONS
AS A DRIVER OF THEIR DEVELOPMENT**

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An important role in the socio-economic development of any country and in ensuring its new quality is played by corporate structures.

Corporation (from the Latin "corporatio" - association) is the most common form of association of legal entities in order to protect and obtain certain financial benefits. It can be a union of both individual entrepreneurs and entire companies, whose activities are global. Currently, corporate structures constitute the economic basis of all developed countries [5].

The foundations of their functioning were first laid in ancient Rome, and in the United States received the deepest legal study. In the early 19th century, the US Supreme Court defined corporations as an artificial entity, invisible, intangible, and existing only from the point of view of law [21]. The very first corporation is considered the Stora Kopparberget copper mine (Falun, Sweden). The prototypes of modern corporations include the Dutch East India Company and the Hudson's Bay Company [4].

Samuelson P. and Nordhaus V. understand a corporation as "a legal entity that can independently sell and buy, borrow money, produce goods and services and enter into contractual relations; has the right of limited liability, according to which the investment of each of the owners of the corporation is limited to a strictly defined size" [18].

In accordance with Russian law - paragraph 1 of Art. 65.1 of the Civil Code of the Russian Federation - corporate legal entities (corporations) are "legal entities, the founders (participants) of which have the right to participate (membership) in them and form their supreme body" [6].

Tatarkin A.I. with colleagues in the work "Dynamics of Corporate Development" [10] justifies five approaches the definition of "corporation":

1) corporation as a legal entity: representatives - J. Winslav, W. Butler - focus on independent legal status, the presence of their own interests among the members of the association, the concentration of managerial functions in the hands of professional managers;

2) corporation as a synonym for a joint stock company; form of business organization: representatives - R. Klarko, Yu. Vinslav, I. Khrabrova - operate with the predominant distribution of this particular legal form among corporations;

3) corporation as an artificial entity, singled out according to the results of research by N. Platonova;

4) corporation on the basis of contract theory: representative - D. Rosenberg - emphasize the formation of relations between participants in such associations on a voluntary basis;

5) corporation, on the basis of a broad approach to the goals of a business organization: representatives - L. Solomon, A. Palmiter - recognize the priority of the target principle and actions for the benefit of society.

In the framework of the study, we will adhere to the definition of a corporation given in the Investor's Encyclopedia - it is "the union of production, design, trade and marketing, financial enterprises and organizations for joint economic activities, reducing the possible risk in the implementation of capital-intensive areas of industrial and commercial activity due to concentration of capital, centralization functions of providing resources, marketing products, mastering new markets, implementing more economically feasible Second strategy and development within the corporation economic units. "

Corporate structures, due to their complexity and versatility of the economic organization, are widely typified, and at the moment, several of their varieties accepted in most countries of the world can be distinguished: open joint stock company; limited liability company; syndicate; cartel; trust; pool; concern; holding company; financial and industrial groups; transnational corporations.

Corporate associations can be built according to the type of vertically integrated structures (with integration "forward" or "back"), horizontally integrated and mixed integrated structures (conglomerates). Aniskin Yu.P. singles out production, financial, investment and marketing [1] as the main motives for the integration of economic entities.

Summarizing the results of studies of the essence of corporate associations of Russian and foreign authors [7], we highlight the following characteristics:

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1) the unity of the goals of the participants in the association, in which their own target interests and business strategies of individual actors should not contradict corporate goals;

2) the presence of owners (shareholders) remote from management, all important decisions are made by the board of directors, which is why it is impossible to make decisions individually, only in a group by balancing opinions, this leads to a multi-personality influence;

3) delegation of authority is widespread, creating several "nodes" of decision-making and leading to multi-level;

4) the desire to occupy a leading position in the market through diversification, i.e. access to the most promising areas of activity for the corporate structure; as a result, the development of a corporation is characterized by multi-scenario;

5) the ability to invest in large long-term, science- and capital-intensive projects through the accumulation of own and borrowed funds;

6) conscious organization, constant support, and sometimes the artificial creation of internal corporate competition, including in the areas of intensification of innovative activity of participants;

7) the structure includes, as a rule, several enterprises of various types of business activity, which results in the distribution of risks through diversification in various areas of activity and a significant reduction in the degree of their impact through the use of large-scale information resources, an internal corporate reserve fund system, and highly qualified managerial personnel;

8) the number of employees can reach several thousand people, which complicates the process of managing them, requires a clear monitoring system, feedback and quality control.

The indicated features of corporations testify to the effectiveness of this form of management in modern market conditions for achieving competitiveness and resolving internal problems.

The largest scale of activity and influence is possessed by transnational corporations (TNC), which have business units in different countries of the world. Their number in 1970 in the world was 7.3 thousand TNC, and the turnover was about 626 billion US dollars. In the early 90s, an increase in the number of TNCs to 37 thousand with a turnover of 7 billion US dollars was noted, and in 2012 there were already about 82 thousand TNCs, the turnover of which amounted to more than 30 trillion US dollars. TNC's activities are concentrated in trade, the oil and gas industry, energy, electronics, engineering, and pharmaceuticals. Moreover, in world trade they provide more than 70% of the turnover, industrial production - about 50%, and also generate about 80% of all patents and licenses for the latest equipment, technology and know-how [17].

It is large corporations, primarily transnational ones, that have a huge influence in the political and economic spheres, and to a certain extent, form the modern landscape of the world community. Annually, Forbes magazine evaluates the largest companies in the world in terms of revenue, net income, assets over the past year, and market capitalization of corporations, making a Forbes Global 2000 rating. The top ten largest corporations in the world are presented in accordance with table 1.1.

According to Forbes magazine, at the beginning of 2016, the first hundred of the most expensive companies in the world include organizations engaged in various fields of activity: banking, IT development, automotive, mobile communications, mining, etc.

The leader for the fourth year in a row is ICBC Chinese Bank. The top three also again included two more banks from China - China Construction Bank and Agricultural Bank of China. They are followed by another Chinese bank - Bank of China. The top 10 included American Berkshire Hathaway Warren Buffett, JP Morgan Chase and oil and gas corporation ExxonMobil, Chinese PetroChina and American General Electric. The combined figures of the 2000 largest companies in 2016 are 35 trillion US dollars in revenue, 2.4 trillion US dollars.

Table 1.1 – Rating Forbes Global 2000 – “10 largest corporations in the world” in 2016 *

№	Company	Country	Activities	Revenue, billion USA dollars	Profit, billion USA dollars	Assets, billion USA dollars	Market price, billion USA dollars
1	ICBC	China	Banking	166.8	44.8	3,322	278.3
2	China Construction Bank	China	Banking	130.5	37	2,698.9	212.9
3	Agricultural Bank of China	China	Banking	129.2	29.1	2,574.8	189.9
4	Bank of China	China	Banking	120.3	27.5	2,458.3	199.1
5	Berkshire Hathaway	USA	Holding company: investments, insurance and reinsurance	194.7	19.9	534.6	354.8

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6	JPMorgan Chase	USA	Financial conglomerate: consumer and public banking, corporate and investment banking, commercial banking, asset management	97.8	21.2	2,593.6	225.5
7	Exxon Mobil	USA	Oil and gas production and processing	376.2	32.5	349.5	357.1
8	PetroChina	China	Oil and gas production and processing	333.4	17.4	387.7	334.6
9	General Electric	USA	Diversified company	148.5	15.2	648.3	253.5
10	Wells Fargo	USA	Financing, insurance	90.4	23.1	1,701.4	278.3

* Source: compiled by the author according to the official website of Forbes magazine [20].

They manage assets of 163 trillion US dollars, and have a market capitalization of 44 trillion US dollars.

The geography of the list in 2018 covers 63 countries. In the ranking, the most companies are from the USA are 587, Japan - 219 and China - 200. From Russia, 25 companies are on the list. The Russian oil company Gazprom is located at 27th place (revenue of 159 billion US dollars). On the 59th place - Rosneft with revenue of 129 billion US dollars. The Apple brand ranks 12th (199 billion US dollars), Samsung - 18 (195.9 billion US dollars), Microsoft - 25th place (93 billion US dollars), and Google 39th line with a turnover of 66 billion US dollars.

Based on the goal, the work explores modern areas of corporate development.

Foreign experience in the formation and functioning of corporations is reflected in the works of I. Ansoff, A. Thompson, T. Kono, R. Akoff and other scientists. An analysis of the work of these researchers gives reason to argue that the main areas of development of modern corporations include [2]:

1. The enlargement of corporations, the increase in their role in scientific and technological progress and the global economy. This is a reflection of the general trend of economic integration. The "corporate boom" is explained by the fact that a corporation has undoubted advantages over small and me-

dium-sized businesses, in particular, the opportunity to save on production volumes, access to cheap credit resources, the widest and most diversified sales markets, the ability to attract the best specialists and maintain research and research and development units, reserves for risky and breakthrough operations. At the same time, it is impossible not to notice the weaknesses of the excessive enlargement of corporations: the possibility of losing a flexible reaction to market needs, as well as reducing the level of manageability and the growth of contradictions between the parent company and subsidiaries.

2. The complication of the structure of corporate property, concentration, overflows and the interpenetration of capital. This trend is developing in two forms:

- the concentration of capital through accumulation (internal organic growth);
- mergers and acquisitions of companies.

Both directions are used in modern development and form its organizational basis. The processes of mergers and acquisitions lead to the formation of supercorporations, which are comparable in economic terms with the GDP of the whole state [16].

In management practice, the following types of merger are distinguished depending on integration:

- horizontal – association of organizations of one industry;
- vertical – association of organizations of various industries related to the finished product manufacturing process;
- occupational – association of organizations producing interconnected goods;
- conglomerate – association of organizations of different industries without a production community.

3. Application of high-speed information and communication technologies as satellites of effectively developing corporations. Since the 1980s, mankind has begun a new stage of development - the stage of building the information society, in connection with which the isolation of a corporation has been destroyed, and the rapid spread of new ideas and intellectual know-how has become a consequence. Tighter competition called on the corporation to form its own information space, where all external needs and development potential are fixed.

Currently, more than 50% of European corporations use high-speed information technology and complex intellectual work [11].

At present, information systems create and accumulate information about customers, about employees, about suppliers and production, financial results of work, and, most importantly, about the latest business ideas,

new technologies, achievements of science and technology in the field of computer science. Cell phones, electronic storage media, e-mail allow companies to respond on time and strategically to changes in the environment and work most efficiently in space and time. The advent of the global Internet information network has made it possible to transfer many management operations to on-line mode [3].

4. Accelerating the internal organizational development of corporations, increasing the relationship of business growth with management quality, increasing the role of personnel and fixed assets. This is due to ensuring survival in the face of increased competition. According to Stephen McClellan, companies that are not developing actually expect bankruptcy. Every corporation that does not have time to adapt to the constant changes that occur in the industry does not withstand competition [12]. As Gerber said correctly, "the process of business development must be constant because the world with its characteristic movement will not put up with a stationary object." The logical understanding of the processes was a theorem of outstanding cybernetics expert U.R. Ashby on the need for a variety of governance: "In order to withstand the environment, the complexity and speed of decision-making in a company must match the complexity and speed of the changes that occur in the environment" [19].

Many modern corporations, both Western and Russian, are energetically looking for the latest forms of organizational and corporate governance [8]. They adopt codes of corporate behavior, form horizontal, matrix and design organizational and functional structures of the business.

Most corporations introduce directors to their boards (including in order to protect the interests of small shareholders), attract partner international consulting and audit companies, and conduct active restructuring, freeing themselves from non-core and low-performing assets ("cleaning up" the corporation). All this in general is necessary to improve the quality of corporate governance, to increase the role of human capital [13].

5. Regionalization, in particular, transnationalization of corporations. This trend is aimed at the geographical development of corporate organizations, their introduction into the markets of other regions, which may differ in the complexity and solvency of customers, local political and social risks, and the diversity of resource potential. Regionalization allows companies to increase their stability and dramatically increase the volume of work, which makes the latest organizational formations even more powerful. In this process, corporations such as Intel, Siemens, IBM, Johnson & Johnson, Motorola, British Petroleum, British Telecom, Xerox, Hewlett-Packard and others became world leaders.

6. Formation of new external alliances and strategic partnerships. This enables corporations to become open systems and thereby rapidly capitalize their assets (closed systems, on the contrary, sooner or later come to disintegration, disorganization and decline, negative centrifugal directions develop in them). The creation of alliances by companies has a rich history, because earlier corporations of industrialized countries used them to export and introduce the least developed countries to local markets. In modern conditions, strategic alliances are a tool for general promotion and even greater involvement in activities in the global market. For Russian corporations, this concept of alliances becomes very relevant, because it allows the combined companies to direct their efforts against a common rival.

The creation of alliances is largely influenced by technological and market factors, which are formed both horizontally and vertically. The main arguments in the formation of strategic alliances in modern conditions are:

- protection (access to markets);
- imitation (strengthening competitive position);
- retention of position (obtaining maximum benefits);
- reorganization (ensuring the potential for independent work separately from the parent company).

Globalization of business, development of information networks, strategic alliances, development of value-added chains - these organizational innovations allow creating the “best in all respects” company in which any function and process is implemented on a global level. As a result, they achieve higher production efficiency, increase the capitalization and investment attractiveness of the company, and increase the possibility of innovative development [9].

7. Innovation of corporate organizations. Most large corporations form special departments of innovative development (innovation services, scientific and technical centers), forecasting and analytical departments, R&D units (laboratories and workshops) and “offices of the future”, create knowledge management systems based on innovation marketing bureaus, technology parks and agencies on technology transfers, etc. Individual companies “begin to directly specialize in innovative projects and their commercialization (technology companies, venture capital firms)” [15].

An analysis of the activities of the world's leading corporations shows that the 21st century is characterized by a transition to moving models of innovative development, which are characterized by an open approach to international innovative ideas [22]. Moreover, Russian scientists B.N. Kuzyk and Yu.V. Yakovets [14] believe that it is corporate forms of entre-

preneurship within the fifth and sixth technological structures that will be able to create the necessary conditions for the development and production of revolutionary, basic innovations due to their ability and ability to accumulate significant amounts of intellectual, technical, financial potentials, reaching the international level competition.

Studies conducted in this industry have proven that part of innovation accounts for an increasing share of economic growth, and, therefore, companies that focus on innovation are much more successful in competing with other organizations.

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THE MAIN STAGES OF THE DEVELOPMENT OF CONSTITUTIONAL REGULATION OF THE INSTITUTE OF INFORMATION SUPPORT FOR ELECTIONS IN THE RUSSIAN FEDERATION.

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Annotation. This article is devoted to the consideration of Russian legislation governing the issues of information support for elections. All legislative acts are considered from the point of view of the stages of development of constitutional and legal regulation of information support for elections. After analyzing the existing regulatory legal acts in this area, the author identifies three stages in the development of constitutional legal regulation of information support for elections and comes to the conclusion that the current Russian legislation is imperfect and the fourth stage of development of the corresponding legislation begins.

Keywords: constitutional law, suffrage, political human rights, right to information, elections.

Information support of the electoral process is the most important guarantee of electoral rights. It is no coincidence that Article 44 of the Federal Law "On the Basic Guarantees of Electoral Rights and the Right to Participate in a Referendum of Citizens of the Russian Federation" [1] says that "information support forms a conscious expression of the will of citizens and the transparency of elections. The most complete, objective, reliable and timely information regarding the election campaign, the referendum campaign, its participants, the procedure and timing of electoral actions, actions to prepare and conduct a referendum, etc. is a necessary condition for the citizens of the Russian Federation to exercise their electoral rights."

The first stage in the development of constitutional and legal regulation of information support for elections in the Russian Federation, not without justification, is considered the period from 1993 to 1996 [2, p. 27]. This stage is characterized by the emergence of new Russian legislation and a departure from socialist norms.

As rightly asserted by D. B. Katkova, E.V. Korchigo, "after the adoption of the Constitution of the Russian Federation in 1993, the highest representative bodies of the state faced the task of reforming the Russian electoral legislation. The very change in the composition of government bodies required the adoption of

federal laws on the elections (formation) of these bodies” [3, p. 46].

1993 itself was marked by the fact that the first elections of deputies of the State Duma and the Federation Council of the Federal Assembly of the Russian Federation were held “in accordance with the Basic Regulations on Elections, approved by the Decree of the President of the Russian Federation. That is, there were no legal norms or the Constitution regulating this issue. This Decree spoke not only about the procedure for elections, but also the procedure for informing about them, which allows us to consider the period of its adoption and application as the first stage” [2, p. 30].

This situation could persist for a long time because, according to the Constitution of the Russian Federation adopted in 1993, “the formation of the chambers of the Federal Assembly can only be carried out in accordance with federal laws” [4].

The second stage - 1996 - 1999 In November 1996. Federal Law “On Ensuring the Constitutional Rights of Citizens of the Russian Federation to Elect and Be Elected to Local Self-Government Bodies” was adopted [5]. This law contained a regulatory annex on the temporary regulation on the holding of elections of deputies of representative bodies of local self-government and elected officials of local self-government in the constituent entities of the Russian Federation. However, he could not fully ensure the realization by the citizens of the Russian Federation of their constitutional electoral rights. Chapter 6 spoke about the conduct and principles of pre-election campaigning, however, its provisions did not provide adequate access for citizens to information about elections and candidates [2, p.31].

At the same time, this law already interpreted the electoral rights of citizens more broadly in comparison with the previous period. As S.V. Koshemarina rightly notes, “the law established detailed regulation of practically every electoral procedure (to appoint elections, draw up voter lists, form and determine the procedure for the activities of election commissions, nominate and register candidates, conduct election campaigns, finance elections, conduct voting, count the votes and determine the election results), based on a central organizational and legal mechanism, the basis of which is represented by election commissions. Along with this, this law introduced the referendum of the subject of the Russian Federation and the municipal referendum” [2, p. 31].

Thus, there was still a positive aspect of its adoption: legislation developed, regulatory material accumulated in quantitative terms, the legal regulation of the electoral process became more complicated and detailed.

In the legal literature, it is believed that the next period of development of constitutional and legal regulation of information support for elections in the Russian Federation begins in 1999 and ends in 2005 [2, p. 32]

As a result, in 2001, the Federal Law "On Political Parties" was adopted [6]. This law is positively characterized by the disclosure of the very content of the right of citizens to unite in political parties. In particular, the right to create them, to participate in them, including through campaigning. In addition, the right to become a member or refuse to do so.

In 2002, the current Federal Law "On Basic Guarantees of Electoral Rights and the Right to Participate in a Referendum of Citizens of the Russian Federation" was adopted. The draft law on amendments and additions to the Federal Law "On Basic Guarantees of Electoral Rights and the Right to Participate in the Referendum of Citizens of the Russian Federation" was presented to the State Duma only in August 2001. During parliamentary discussions, this draft law from the law on amendments and additions was transformed into a new law with the old name [7].

In the same year, the draft law "On the State Automated System of the Russian Federation "Elections" was created, which is currently in effect as of 2014. It establishes the procedure for accessing the information resources of this system, which contain personal data (Art. 19), control over the use of this system, and the information contained in it (Art. 24) [8].

In addition, on July 21, 2005, Federal Law "On Amendments to the Legislative Acts of the Russian Federation on Elections and Referendums and Other Legislative Acts of the Russian Federation" was adopted [9]. This law was supposed to bring legislation on elections and referendums in accordance with the new law "On the election of deputies of the State Duma of the Federal Assembly of the Russian Federation" 2005

All these laws regulate in more detail the procedure for pre-election campaigning and access to information about elections than the previous ones. Their norms regulate the implementation of individual institutions of electoral law and streamline some aspects of the electoral process and its individual stages.

The formation and development of electoral legislation on information support of elections in the Russian Federation has gone its own way, aimed at democratizing the foundations of electoral law. "Democratic elections in the state are a true manifestation of democracy by the people only when they really express the direct will of the people. For the majority of citizens in the state, elections are the only form of real participation in politics" [10]. If we talk about the specifics of the stage, then we should agree that "the concept of the institution of information support for elections with its internal differentiation to inform voters and pre-election campaigning was first enshrined in 2002 in the current Federal Law "On Basic Guarantees of Electoral Rights and the Right to Participate in a Referendum of Federation"" [11].

We can say that now the fourth stage of development of constitutional and

legal regulation in this area is underway.

It is characterized by the introduction of changes into Russian normative legal acts governing the issues of constitutional and legal regulation of the institution of information support for elections in the Russian Federation.

It cannot be said that modern Russian legislation on elections effectively and fully regulates the issues of constitutional and legal regulation of information support for elections in the Russian Federation. Therefore, we can say that the fourth stage in the development of legislation in this area will not be the last, which is due to the further development of science and technology and social relations. This will increase the efficiency of legal regulation of information support for elections in our country.

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**METHODOLOGICAL AND PRACTICAL RECOMMENDATIONS
FOR THE USE OF MUSICAL AND MOTOR MEANS IN ADAPTIVE
PHYSICAL EDUCATION OF CHILDREN WITH DOWN SYNDROME¹**

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Abstract. The article discusses the main methodological and practical recommendations when building the process of adaptive physical education for children with Down syndrome based on the use of musical and motor means. In their study, the authors point to the positive effect of the pedagogical impact of rhythmic gymnastics and role-playing rhythmic gymnastics.

Keywords: adaptive physical education, children with Down syndrome, intellectual disorders.

Adaptive physical education is a compulsory educational discipline of teaching and raising children with intellectual disabilities. It is intended to ensure the formation of vital motor skills, improving health, and educating leading physical qualities. For children with Down syndrome, these settings are relevant and significant. The level of impairment of their intellectual sphere varies from mild to severe and a full-fledged motor base can create the most favorable conditions for their social rehabilitation [1,4].

The arsenal of means of pedagogical effects of adaptive physical education of children with Down syndrome should include music-motor technologies. Scientific studies conducted in this area emphasize the high developmental, formative, and corrective potential of music and motor technologies in the practice of working with children with mild intellectual impairment (mental retardation) [2], speech impairment [5], and

¹"The study was carried out with the financial support of the RFBR in the framework of the scientific project № 19-313-90038"

sensorimotor abnormalities development [3]. However, in the practice of working with children with Down syndrome, such scientific developments are rare.

In the course of our research work carried out on the basis of the Volgograd State Physical Education Academy, as part of the implementation of the state task of the Ministry of Sports of the Russian Federation (order № 1078 dated December 14, 2017), the scientific substantiation of the use of musical and physical means in the practice of physical education of children is carried out with down syndrome. Today it is already possible to cover practical and methodological recommendations of such a pedagogical process.

Its leading tasks are corrective. They must permeate the entire pedagogical process, the effectiveness of all ongoing work depends on their fulfilment. They are aimed not only at leveling violations of the health status of pupils, the formation of physical qualities, but also at correcting existing deviations in the mental sphere. Physical culture means should create conditions for the formation of cognitive processes of children, their emotional-volitional sphere. In this regard, musical and motor means are very effective. The most important component of musical rhythmic accompaniment creates the prerequisites for enhancing the attention of children, their desire to learn motor material. It is advisable to divide the material used in accordance with the rhythmic and emotional component of musical matter. The results of our pedagogical practice show that to the greatest extent children with Down syndrome perceive medium and medium-fast musical tempo, with clearly audible musical accents, equal metric proportions. Available to their perception and emotional shades of music - minor and major characteristics. Musical works with such content must be used in the work. But musical matter, characterized by a mixed musical rhythm, at a changing pace, is not accessible to the perception of these children and the combination of physical exercises with it is not effective. The use of proper musical accompaniment has a positive effect on the motivation of children to motor material, its memorization, correction of impaired motor skills, and normalization of emotional state.

The results of our studies have shown that rhythmic gymnastics is most suitable for musculoskeletal devices for children with Down syndrome. Their leading characteristic is based on coordination exercises. Their combination with musical accompaniment allows you to deepen the effect of corrective and developing effects. To some extent, a rational selection of exercises of a coordination nature allows us to talk about the compensatory effect of the impact. However, prolonged execution of exercises

on coordination of movements, differentiation of muscle efforts, rhythmic locomotion, etc., causes children with Down syndrome to experience intellectual and psycho-emotional fatigue. To counter this, such a methodical technique as alternating exercises of coordination complexity with running pauses helps. Their duration is about 2-3 minutes, they consist of simple running exercises in a circle or in a straight line and special musical accompaniment is selected for them (usually fast tempo). After they are completed, children with Down Syndrome can continue to complete the coordination plan exercises they need so much. The combination of these blocks of exercises is a specific feature of rhythmic gymnastics for this category of children.

At the same time, it should be noted that for this category of pupils, classes in subject-role rhythmic gymnastics are also suitable. The presence of the simplest plot in the lesson, role-playing actions is available to children with Down syndrome. Such a lesson must be carried out with special additional support - pictures, mock-ups, toys, simulating a losing situation. The results of our practical activities allow us to recommend such activities as subject-role rhythmic gymnastics such as "The Wolf and the Seven Little Kids", "Teremok". However, the coordination imitative actions they contain must also be alternated with running pauses.

The special organization of the musical-motor activity also requires attention. The playing space of the hall should be maximally freed from attributes, sports equipment - all that will distract children from the course of the lesson. The necessary paraphernalia should be hidden from the eyes of children and be freely available. Compliance with all safety rules is also relevant. The results of our practical activities allow us to recommend ribbons, hoops, sultans, balls of different sizes as effective attributes.

The leading method of pedagogical influence in the framework of rhythmic gymnastics is the method of strictly regulated exercises. The game and competitive methods of pedagogical influence, due to the intellectual insufficiency of the pupils, are less effective.

The structure of the musical-motor lesson for children with Down syndrome is generally accepted - three private. It clearly shows the preparatory, main and final parts. However, the duration of the first and third parts is slightly increased, since this category of children requires a longer time for insertion and recovery.

The results of our practical work on the use of musical and motor means in adaptive physical education of children with Down syndrome allow us to state a positive effect of exposure. They like them, children are engaged with desire.

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**INTERDISCIPLINARY CONNECTIONS IN HIGHER MARITIME
EDUCATIONAL INSTITUTIONS IF FORMING ECOLOGICAL
COMPETENCE**

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Abstract. The article discusses the interdisciplinary connections in the formation of environmental competence, which are used in the training of specialists in the marine industry.

Keywords: competence, greening, interdisciplinary communication, training.

Human life is closely connected with nature, which serves as a source of material and spiritual strength for it. But, despite this, human influence on nature is unilaterally aimed at exploiting natural resources, which leads to disruption of the ecological balance of the biosphere. To preserve the state of the environment, it is necessary for an individual to interact with nature on the basis of certain environmental knowledge. Such knowledge is primarily needed by future marine professionals.

Today, society needs a graduate who not only possesses knowledge, but also displays a conscious attitude to nature, knows how to make the right decisions and perform appropriate actions, given their environmental consequences. A solution to this problem is possible with the greening of the educational process component of future graduates of marine educational institutions.

The greening of the educational process is considered a requirement of our time. Therefore, there is a saturation of educational disciplines and programs at all levels of education with information about the values of animate and inanimate nature [5, p.155]. Since, each science develops a person precisely in content, and not in anything else [9, p. 44].

The problem of the formation of environmental culture has been the subject of much research. Modernization of the content of environmental

education, which develops the characteristics of environmental competence of a person in the context of fundamentalization of education, was done by L. Lipova, T. Lukashenko, V. Malyshev; the main approaches to the formation of environmental competence, the essence and structure of this concept were the point of the works of O. Kolonkova, V. Marshitskaya, N. Pustovit, L. Rudenko, L. Titarenko, S. Shmaley. The substantiation of the essence of environmental education and culture is presented in the works of G. Belyavsky, E. Zhelibo, A. Romanovich, S. Stepanenko, V. Nekos, T. Safranov, V. Sobchik and others. O. Gurenkova and L. Lukyanova devoted their research to the formation of ecological competence of future water transport specialists. In the maritime industry, S. Khanmamedov, V. Gorbov studied the relationship between professional and environmental competencies. Search work on the problem of implementing interdisciplinary relations was carried out by: G. Golubev, A. Dzhedzhula, I. Kozlova, V. Kuzmenko, N. Magura, V. Maksimova, D. Meadows, T. Miller, K. Montgomery, Yu. Nagorny, M. Reimers, V. Sharko, G. Yagodin. Along with this, the issue of interdisciplinary relations in the formation of environmental competence of cadets of maritime educational institutions in the process of vocational training remains open and not sufficiently studied.

Therefore, the goal of our article is to consider the implementation of interdisciplinary ties in the formation of environmental competence of marine industry specialists using the example of the specialty "Operation of Ship Power Plants".

Back in 1981-1982, increased attention was paid to the study of ecology; typical curricula and programs were introduced into the educational process, in which the section "Interdisciplinary communications" is provided. Such an education largely meets the social needs of society [4, p. 371-372]. Therefore, we can actively use the experience that was gained in the 80s of the twentieth century.

The use of interdisciplinary connections make it possible to combine program material in the form of a consistent knowledge system. They are one of the conditions for increasing the scientific level and improving the entire educational process, which perform the following functions in the learning process:

- ensuring coordination in time of studying topics of different disciplines;
- promoting the development of scientific concepts;
- implementation of a single approach to the formation of skills of future specialists in the maritime industry;
- systematization and generalization of knowledge acquired by cadets in the process of studying academic disciplines;

- determination of causal relationships that exist in nature and which are studied in disciplines of professional orientation [9].

The implementation of these relationships in practice involves connections between the disciplines of the cycle and connections between disciplines from other cycles. At the same time, the problem of interdisciplinary connections in the scientific and methodological literature is not yet sufficiently disclosed.

At the present stage of development of society, ecology solves a number of problems and uses methods and principles that go far beyond the purely biological sciences.

Ecology, in the broad sense, is defined as a complex integrated science that explores the environment (the planet's ecosphere), its impact on society and the inverse reaction of nature to human life. It unites all natural, humanitarian and social sciences [10].

Objects of research in ecology – are organisms, bodies, substances, the environment and processes that occur according to the laws of physics, chemistry, biology and other sciences. Ecology as an interdisciplinary science remains an exact natural science, at the same time it explores living objects, their combination, and therefore it has become humanitarian. Knowledge of these sciences makes it possible to determine a person's place in nature, shape his worldview and help optimize the development of social and production processes.

Not only his own health and life, but also the state of the environment depends on human activity. In other words, mastering professional competencies in the learning process, one of the main competencies is environmental, which we understand as:

- the ability of an individual to make decisions and act with minimal harm to the environment;
- the manifestation of the personality's ecological culture in its "zone of responsibility" (that is, that part of the environment in which each individual person carries out his own activities and therefore can really influence its condition);
- a characteristic that enables a modern person to responsibly solve life situations, subordinating the satisfaction of his needs to the principles of continuous development;
- the ability of a person to situational activities in a natural environment;
- the ability to apply environmental knowledge and experience in professional and life situations [3].

Consider some aspects of the implementation of the integration of environmental knowledge in the study of disciplines of professional and

practical training of future ship engineers. The maritime industry, being international, dictates its rules for the training of sailors. They must comply with the standard requirements set forth in the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW 78/95), which is based on a competency-based approach to training marine specialists [1]. In connection with these requirements, a number of disciplines have been introduced in maritime educational institutions that allow the formation of the environmental competence of seafarers.

For example, in the discipline "Normative marine documents" the basic documents of the International Maritime Organization (IMO) on the safety of navigation and environmental protection are studied, namely:

1. The International Convention for the Safety of Life at Sea (SOLAS-74);
2. The International Ship and Port Facility Security (ISPS Code);
3. International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW 78/95);
4. The International Regulations for Preventing Collisions at Sea (COLREG -72);
5. The International Convention for the Prevention of Pollution from Ships (MARPOL 73/78);
6. The International Safety Management (ISM Code).

Knowledge of regulatory documents, questions of the design and operation of ships makes it possible in practical classes in the discipline "Ship diesel installations" (SDI) to assess the environmental performance of diesel engines, and in the classes "Ship boiler installations" (SBI) to study issues of improving air quality and removal of gases (Annex VI to MARPOL 73/78). Analyzing the program material of these disciplines, it is necessary to pay attention to measures to improve the environmental performance of exhaust gases that are released into the atmosphere during the operation of ships. Ballast systems, purification of bilge water, fuel, oil are studied in the academic disciplines "Technology of the use of working substances" (TUWS) and "Ship auxiliary mechanisms" (SAM). SAM provides environmental knowledge in the study of topics: drainage systems, special tanker systems, cleaning systems and tank washing systems, and life domestic systems - sealed and drained sewage systems.

Studying these topics, cadets begin to understand that the separation of bilge water from ships (SBW) is a problem for all watercraft, since the concentration of impurities in the water that is dumped overboard should not exceed 15 mg/l. Therefore, it is necessary not only to purify water, but also to obtain highly concentrated residues of oil mixtures. This is necessary in order to reduce the use of natural resources and to increase control over the quality of the environment and the biosphere on a planetary scale.

The course project on “SAM” includes issues of the prospective development of ship systems, which is aimed at developing the ability to use knowledge on the environmental safety of ship equipment. In the section “Ballast Systems”, in the subsection “Requirements of the Convention MARPOL 73/78”, measures are being taken to prevent pollution of the sea and the atmosphere during the operation of the vessel.

Certain environmental knowledge is given by the discipline “Automation of Ship Power Plants” (ASPP). She is studying instruments for monitoring the oil content during dumping: automatic alarm systems for ships that are not tankers (AAS) and systems for automatic measurement and registration of dumps for tanker recorders (AMRDFTR). The indicated systems provide a signal for exceeding 15 mg/l and a command for automatic shut-off equipment, which provides a stop of discharge overboard with water containing oil greater than the specified concentration [7, p. 132].

Thus, the formation of environmental competence is significantly affected by interdisciplinary communication in the process of training. The design of greening into special disciplines for the preparation of a (ship) mechanic is promising, as it meets modern requirements of technological development.

So, in order to improve the quality of the formation of environmental competence among specialists in the maritime industry, it is necessary to:

1. In the academic disciplines “Marine Diesel Installations” and “Marine Boiler Installations”, pay attention to measures aimed at improving the performance of exhaust gases during the operation of ships that are released into the atmosphere.

2. In order to reduce the volume of use of natural resources in the disciplines “Ship auxiliary mechanisms” and “Technology for the use of working substances”, it is necessary to consider not only the purification of water, but also to show how to obtain highly concentrated residues of oil impurities.

3. In the formation of environmental competence in the disciplines of the professional cycle, preparing (ship) mechanics, it is necessary to apply the basic principles of didactics (the connection of theory with practice, science, compliance with the requirements of a future profession).

Given the above, it can be concluded that interdisciplinary communication is necessary in the educational process of marine institutions for the formation of environmental competence. This makes it possible for the graduate to apply the acquired knowledge in professional activities, which will be aimed at maintaining the quality of the environment, as it meets modern requirements today.

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UDC 378

**ORGANIZATION OF INDEPENDENT WORK OF STUDENTS (CADETS)
USING A METACOGNITIVE APPROACH**

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Abstract. The article discusses the modern problems of training specialists, including in military universities, analyzes the documents that determine the organization of the educational process of the university, on the basis of which conclusions are drawn about what a modern specialist should be. The authors based on the analysis of the concept of metacognition, determine the place of independent work and self-education in general in the development of metacognitive abilities, describe how the metacognitive approach to the independent work of cadets was used in their work. The authors concluded how effective the learning process will be when using the metacognitive approach to organizing independent training of students.

Keywords: metacognition, self-regulation, metacognitive approach, independent work, self-education.

The rapid scientific and technological growth of the human environment creates and implements new innovative technologies in the life of modern society, in these conditions, a modern specialist has to master a lot of information, develop new skills. Given these conditions, a specialist, a graduate of a modern university, in order to master the competencies provided for in the educational standards for a specialty, has to process more information, obtain sustainable skills and gain experience in implementing acquired skills. However, the time it takes to master the educational program and

the changes that take place proceed at different speeds, the competencies often mastered by a specialist lose their relevance by graduation, and new ones that have not been laid in the educational process have already come to the fore.

Analyzing legal documents in the field of education, including: Order of the Minister of Defense of the Russian Federation № 670 of September 15, 2014, issued on the basis of the Federal Law “On Education in the Russian Federation” and the State Program of the Russian Federation “Development of Education for 2013-2020”, we see that it requires from university teachers [6, 7]:

- to develop cognitive activity, independence, initiative, creative abilities in teachers;
- to form a civic position, the ability to work and live in a modern world;
- to apply pedagogically sound and providing high quality education forms, methods of training and education;
- improving the effectiveness of teachers and independent learning activities of students;
- when conducting classes with university cadets, to stimulate their dynamic cognitive activity and contribute to the formation of creative thinking.

Thus, it becomes obvious that in the modern educational conditions of a university it is necessary to train a specialist who has some universal competencies and expertise that contribute to his rapid adaptation in the current conditions, while he should strive to analyze, coordinate and correct his own mental activity, as required by guidance documents on educational activities, and that today is one of the necessary conditions for education in higher military training institution. That is, a modern specialist should be able to effectively organize independent work on mastering the qualities that are necessary at the moment and, moreover, have the ability to foresee what qualities he may need in the future, allowing him to remain in demand, and most importantly, a competitively capable specialist in professional activities.

According to P.N. Lashchenko continuing his work on self-improvement, the military leader is obliged to instill in his subordinate officers an interest in self-education. This task is important, difficult. One order, directive, command cannot solve it. It should be borne in mind that some officers want and know how to work independently, while others also would like to do this, but they do not have the skill, but still others simply cannot do that, and also do not want to study independently. Consequently, educating subordinates to the desire for self-improvement, you need to approach the officers individually, taking into account the characteristics of each one [p.122, 3].

Such outstanding scientists of psychology and pedagogy as: L.S. Vygotsky, A.V. Hutorsky, M.A. Kholodnaya, A.V. Karpov, J. Flavell, H.D. Hartman et al., give above characteristics to a personality with developed metacognitive abilities. At the same time, researchers note that these abilities can be both innate and acquired in the course of educational and professional activities, that is, developed [1, 2, 8, 9, 10, 11].

Metacognition – super-knowledge, “sub knowledge”, that is, the ability to consciously evaluate at what level of knowledge acquisition a person is, and what else he has to do to move further along the steps of knowledge. Otherwise, this definition can be formulated as the ability to assess how developed a person is, what else he has to learn and how to move on in his learning, education or development process, the ability to self-develop, self-organize, self-educate and self-discipline [4].

Thus, we see that the priority task of education at present is the training of specialists with developed metacognitive abilities. Since the properties listed above are inherent in individuals with these abilities. Military education is no exception.

Given the specifics of training of future officers, independence in self-education is a priority, since a military leader should be a creative person, capable of self-education, not standing still and constantly evolving, he should possess cognitive activity.

Self-training in higher education institutions is the main form of self-education, it takes up almost 50% of the time budget of educational programs. Moreover, taking into account the personality-oriented paradigm, the organization of independent work should allow the cadet to show his personal qualities in the organization of self-education. From this it follows that in the university there should be a wide selection of methods and technologies that contribute to the cadet's productive manifestation of self-educational skills [5].

Obviously, in order to meet the requirements of modern scientific and technological progress for the professional preparation of a university graduate, it is necessary for him not only to successfully master the program, but at the same time to conduct dynamic cognitive activity, showing skills in the proper organization of independent work, and demonstrating developed creative thinking, being able to organize self-educational or self-learning process. This should be expressed in the specialist's desire to take a new approach to achieving a high professional level, the desire for constant self-development, self-education, to carry out self-regulation of their own cognitive activities. The demonstration by man of such abilities is nothing but the manifestation of metacognitive abilities.

Our study of scientists' studies on the problem of metacognitive processes, metacognitive abilities led us to the need to use this knowledge in our pedagogical activities, in order to improve the learning ability of cadets.

Moreover, the analysis of pedagogical research on the application of the metacognitive approach, the definition of which was introduced by A.V. Karpov [2], showed that it was actively used and is used by teachers in education of students in primarily foreign languages, as well as mathematics and physics. At the same time, we did not find studies that would tell about the application of this approach in the educational process in the development of disciplines related to technology or working with it. In this regard, the application of the metacognitive approach to the organization of the educational process in the special disciplines of our university "Diving training" and "Airborne training" was new and before that, in the study of such disciplines in other military universities was not used.

Considering that the main creative, independent, individual work of the student takes place during self-preparation, we used this approach to organize it during the experiment. The use of the metacognitive approach led to a revision of the content of educational, teaching and didactic materials for conducting classes, in which we took into account the need to focus on the organization of independent work when studying the material, taking into account individual characteristics of thinking, suggested metacognitive strategies, made recommendations, and also, at the beginning of the experiment, examples of solving similar problems. Students were motivated to use metacognitive activity in the course of independent work by issuing developed individual and group tasks, working on which, students (cadets) were involved in metacognitive activity.

The work on introducing metacognitive approach is aimed at creating such conditions under which the student (cadet) himself would seek to find new information, try to generate the necessary knowledge in the field of the studied disciplines. This resulted in frequent questions about the composition of the equipment sets: - "Why is this equipment supplied? It seems to me that it is necessary to assemble in another way (and an example is given). " In addition, there were more cases of manifestation of an initiative to improve the available equipment and gear, which led to successful rationalization proposals. That is, the students began to think, and not remember the information, because it must be told on the exam.

Based on our own experience in applying the metacognitive approach, we conclude that by constructing the educational process in such a way that, in the course of mastering the curriculum, the student is forced to resort to the activation of metacognitive processes, we contribute to their

development. With the systematic use of this approach and in conjunction with other disciplines, we help the student develop the need for constant use of metacognitive abilities. This leads to the formation of an active creative personality, which will need a constant search for new knowledge, the formation of new skills. This is what will contribute to maintaining professionalism at a high level, and will also make a specialist competitive and relevant relative to time and place.

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ORGANIZATION OF WORK ON CORRECTION OF PROFESSIONAL BURNOUT OF PRESCHOOL EDUCATORS

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Abstract. The article discusses factors contributing to professional burnout among preschool educators. The article also describes the art of pedagogical technologies used in the preparation of programs for the prevention of professional burnout of workers of a preschool educational organization.

Keywords: burnout, art-pedagogy, preschool education, therapy with creativity.

The results of modern research show that the profession of a preschool teacher is one of the professions most prone to emotional "burnout". That is due to the fact that the activities of the teacher are associated with constant emotional stress and tension.

To maintain the image of a socially successful person, so demanded in modern society, the teacher needs to have internal resources, but his activity is associated with stressful factors that contribute to the emergence of professional burnout. According to our many years of observation of the activities of preschool teachers and their corresponding emotional state, we came to the conclusion that after three to four years of work in one organization, they are subject to professional burnout: a state of dissatisfaction in their work, irritability, apathy, tension, exhaustion. All this cannot but affect the professional activity of teachers in a preschool organization: relations with colleagues, parents of children, children. In this regard, it is appropriate to introduce preventive measures in the preschool organizations to prevent the occurrence of professional burnout of teachers. [2]

The relevance of prophylactic measures aimed at preventing the occurrence of professional burnout of teachers of preschool organizations is due to the requirements of society for teachers in terms of their professional

and personal qualities: knowledge, skills, emotional stability, empathy. The desire to meet these requirements forces preschool educators to improve their professionalism, which rigorously leads to overloads, both physical and emotional and intellectual.

In view of this, at MBEI Development Center Kindergarten № 53, we developed a program aimed at the prevention and correction of professional burnout of teachers by means of art pedagogy.

The goal of the program was to weaken the emotional tension of kindergarten teachers and harmonize their inner world through the application of art pedagogy methods.

The objectives of the program were:

- creation of conditions conducive to the prevention and correction of professional burnout of teachers in kindergarten;
- promotion a positive emotional background in the team;
- information of teachers of the preschool organization about the techniques and methods of prevention and correction of professional burnout of teachers;
- development of a system for the prevention of stressful situations and psychoemotional stress through the use of art-pedagogical technologies, their development in practice;
- formation and improvement of internal personal resources, imagination, creative thinking, sensory experience of teachers.

This program was implemented from December 2018 to December 2019 in the form of practical exercises in a training mode with a frequency of 1 time per week for 30-40 minutes.

Stages of the implementation of the program objectives:

I. Organizational phase. At the initial stage of the study, diagnostics (test by V.V. Boyko) of the stages of professional burnout of kindergarten teachers and observation were carried out, which made it possible to establish the state of increased tension and exhaustion in four respondents. [1]

II. The main stage. The results of the diagnosis proved to us that it is necessary to test the program with a set of practical measures based on art pedagogy techniques aimed at the prevention and correction of professional burnout of kindergarten teachers.

The number of participants in the classes is 8 people (4 teachers with identified stages of professional burnout and 4 teachers to prevent this disease).

An important area of the conducted classes in their free time and at the personal request of the participants is the use of anti-stress exercises based on art pedagogical techniques.

The main techniques of art pedagogy that we applied during the implementation of the program for the prevention and correction of professional burnout of teachers of preschool organizations:

- 1) threadography;
- 2) plasticineography;
- 3) testoplasty;
- 4) technique of landscape applied art;
- 5) techniques for listening to relaxation music and performing arbitrary dance;
- 6) techniques of artistic activity: batik; stamping (printing with foam rubber, corks, natural materials, leaves); drawing with wax crayons (candle), followed by applying watercolors; creation of drawings from the palms; blotography usual and with a cocktail tube; drawing with soap bubbles, salt, sand, crumpled paper, cotton buds, on wet paper; technique "transparent canvas"; spray, "bedraggling."

These art pedagogical techniques for the entire duration of the practical classes allowed teachers to increase the emotionally-positive background of the entire staff of the preschool organization; harmonize the emotional state and relieve psychoemotional stress; find for each of the teachers individual ways of self-regulation of emotions and behavior; increase self-esteem; enrich sensory experience and enhance imagination and creative thinking.

III. The final stage. At this stage, we monitored the effectiveness of the implementation of the program for the prevention and correction of professional burnout of teachers of preschool organizations.

The diagnosis was repeated using the same methodology as at the organizational stage. Its results proved the effectiveness of the implemented program for the prevention and correction of professional burnout of preschool teachers by applying various techniques of art pedagogy: there were no teachers with stages of exhaustion and tension. This allowed us to judge the stabilization of the psychological climate within the team, the level of satisfaction with the professional work of the educators.

Of course, we understand that the system of measures taken to prevent and correct the professional burnout of teachers of a preschool organization cannot be fully completed and preserve the psychological health of the entire teaching staff of the kindergarten, however, on the basis of the positive results, we recommend that appropriate work be carried out using art-pedagogical technologies in organizations with a high risk of professional burnout.

In conclusion, it should be noted that the psychological health of preschool educators is an urgent problem today, as educators often have extremely low indicators: constant stress, exhaustion, leading to professional burnout.

Timely prevention and correction of professional burnout reduces the likelihood of its negative consequences. In this regard, the work on the correction of professional burnout of preschool teachers is relevant in the system of organization of professional activity.

The implemented program for the prevention and correction of professional burnout of teachers of preschool organizations through the application of art pedagogy methods has proved its effectiveness: the psychological climate in the teaching staff has improved; anxiety and emotional tension of teachers decreased; their self-esteem and self-confidence increased.

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THE SPECIES COMPOSITION OF THE GRAM-NEGATIVE MICROBIOTA OF NOSOCOMIAL PATHOGENS IN A SURGICAL HOSPITAL

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Abstract. A high mortality rate, a wide range of clinical manifestations and significant economic damage caused by hospital-acquired infections (HAI) make this problem a priority. According to the data of domestic and foreign authors, HAI are observed in 2-30% of hospitalized patients. Mortality in various nosological forms of HAI ranges from 3.6 to 60%, and in generalized septic forms of infection it reaches a level before the antibiotic period.

Hospital-acquired infections, as a rule, are more often observed in surgical departments, primarily in the intensive care unit, which is considered to be a high-risk department, due to the large number of manipulations, the increased density of the placement of seriously debilitated patients, often with impaired immune status. Usually, HAI pathogens in surgical hospitals are multiresistant hospital strains of gram-negative microorganisms.

Keywords: hospital-acquired infections, pathogen, gram-negative bacteria, purulent-septic diseases, multiresistant strains, microbiological diagnostics, chromogenic nutrient media.

Introduction. Despite significant successes in the fight against human infectious diseases, hospital-acquired infections (HAI) remain one of the main problems of modern medicine worldwide. A high mortality rate, a wide range of clinical manifestations, and significant economic damage caused by hospital infections make this a priority problem. According to domestic and foreign authors, HAI is observed in 2–30% of hospitalized patients [3, 6]. Mortality in various nosological forms ranges from 3.6 to 60%, and in generalized septic forms of infection reaches a level before the antibiotic period [6,7,8].

Hospital-acquired infections are more often observed in surgical departments, primarily in the intensive care unit (ICU), which is considered to be a high-risk department, due to the large number of manipulations and the increased density of severely debilitated patients, often with impaired immune status [5, 6.7].

According to the literature, 2/3 of HAI cases are caused by conditionally pathogenic gram-negative microorganisms, and in more than 40% of cases, the cause of their occurrence is the hands of staff. Gram-negative microorganisms can colonize the hands of staff who are a passive conductor of hospital infection. These microorganisms have the ability to exist and multiply under conditions of a minimum amount of nutrients (in shells, physiological solutions, and even in solutions of antiseptics and disinfectants, etc.). All this makes it possible for bacterial contamination of the hands of medical personnel not only in contact with patients, but also when working with medical equipment and wet household items [1,2,4].

In recent years, much attention has been paid by microbiologists to the study of the microflora of an operating unit, the microflora of the patient and the environment of an intensive care unit, where there are postoperative, patients, often with immune status disorders, both as a result of and as a result of surgery and general anesthesia [6]. These patients are most susceptible to colonization by opportunistic microflora with the subsequent possible development of an infectious process. This is facilitated by prolonged hospitalization (colonization of the skin and gastrointestinal tract with hospital strains), the duration and severity of surgical intervention, and concomitant diseases. According to recent years, the risk of HAI in the intensive care unit is the highest and ranges from 3 to 27%, and for certain types of pathology (multiple trauma or acute pulmonary failure) it reaches 45-60%, or even 70%.

Long-term artificial lung ventilation, catheterization, repeated bronchoscopy and a large number of manipulations, the presence of infected patients, the circulation of pathogens in the environment, colonization of the hands of medical personnel, colonization of the mucous membranes, skin and gastrointestinal tract of patients contribute to the spread of pathogens and the occurrence of postoperative - purulent-septic diseases.

The purpose. The study of the species composition of etiologically significant gram-negative pathogens of hospital-acquired infections in a surgical hospital.

Materials and methods. As you know, an important part of HAI epidemiological surveillance is monitoring of the contamination of the external environment of hospitals with opportunistic microorganisms. In this regard, in

2007-2009, a center study of the ICU of the surgical hospital in Makhachkala was conducted. The lack of registration and accounting of cases of hospital-acquired infections in patients in the examined surgical hospital poses a constant threat of the spread of infections. A microbiological study of the working surfaces of apparatus and equipment, household items, sinks. A total of 123 sowing was performed from dry and wet surfaces.

Bacteriological research of material from personnel and samples from environmental objects was carried out in accordance with the order of the Ministry of Health № 535 dated 04/22/1985 "On the unification of microbiological (bacteriological) research methods used in clinical diagnostic laboratories of medical institutions". Clinical samples of various origins were studied according to the current regulatory documents: "Guidelines for the determination of gram-negative potential pathogens of hospital-acquired infections" (M., 1986) and "Guidelines for the bacteriological diagnosis of *Pseudomonas aeruginosa*" (M., 1984).

To isolate and identify cultures of microorganisms, we used dry nutrient media produced by NPO "Nutrient Media" in Makhachkala: dry nutrient agar (DNA), dry nutrient broth (DNB), endo agar, yolk-salt agar (YSA), CPH – agar (nutrient medium for the isolation of *Pseudomonas aeruginosa*), *Candida* - agar, *Klebsiella* - agar, etc. In order to optimize the process of isolation and identification of microorganisms, we used experimental series of chromogenic nutrient media. For phagotyping of the selected cultures, bacteriophages produced by NGO "Biomed", FSUE NGO "Microgen", Ufa, were used.

Determination of the biochemical properties of the isolates was carried out using microtest systems (MTS) for the species identification of staphylococci (MTS-S) and enterobacteria (MTS-M 12E) produced by the NGO "Nutrient Media" Makhachkala.

Identification of microorganisms to a species was carried out on the basis of a complex of tinctorial, morphological, biochemical and serological tests. Belonging to hospital strains was determined by the spectrum of resistance to antibiotics and phagotype.

The sensitivity of the selected cultures in relation to chemotherapeutic drugs was determined in accordance with the current Methodological Instructions of MUK 4.2.1890-04 "Determination of the sensitivity of microorganisms to antibacterial drugs by the disk diffusion method (DDM)" using antibiotic discs of various pharmacological groups manufactured by NIICF, St. Petersburg.

Identification of uncultivated forms of microorganisms was carried out by PCR (polymerase chain reaction).

Research results and discussion. Studies have shown that a significant amount of diverse microflora is found in the environment of the department.

The data obtained indicate that gram-negative microorganisms were often isolated in the hospital environment of the reanimation department and intensive care unit. The growth of microorganisms was noted in 89.2% of all seedings, of which the growth of gram-negative microflora - in 53.0%. Most gram-negative bacteria were isolated from wet surfaces, however, differences in the frequency of detection of gram-negative microorganisms from dry (42.5%) and wet (62.8%) surfaces were unreliable. A comparison of these results with similar data on the study of the microflora of the surgical unit indicates a more frequent allocation of gram-negative microflora in reanimation department and intensive care unit, where patients are after surgery.

In total, 26 cultures of gram-negative bacteria were isolated and studied from dry surfaces of the ICU, and 53 cultures were examined in studies of wet surfaces. So on dry surfaces of environmental objects 7 species were found, up to 12 species of gram-negative bacteria were isolated from wet surfaces. Both on dry and wet surfaces, representatives of the Enterobacteriaceae family were more common than representatives of other families ($P > 0.05$ for dry surfaces, $P > 0.001$ for wet). In the course of the study of samples from the surfaces of the shells (predural, dressing room, postoperative wards), it was found that *Serratia marcescens* (15.1%) and *Pseudomonas aeruginosa* (13.21%) were more often distinguished, less often *Escherichia coli* and *Citrobacter freundii* (according to 9.4% of all selected crops).

When examining postoperative chambers among gram-negative microorganisms, the leading positions were occupied by *E. coli* (12.4%), *Klebsiella* spp. (11.4%), *Enterobacter* spp. (12.8%), *Citrobacter* spp. (3.3%), *P. aeruginosa* (1.2%).

In the studied samples of w from the hands and nasopharynx of medical personnel, 47 examined (18 doctors and 29 nurses) identified: *Staphylococcus aureus* (2 strains isolated from the nasopharynx), *Staphylococcus saprophyticus* (7 strains isolated from the hands), *Staphylococcus epidermidis* (11 strains, of which 3 were isolated from the nasopharynx, 8 from hand washes), *P. aeruginosa* (2 strains), *E. coli* (12 strains), *Enterobacter* spp. (15 strains). A total of 49 strains of microorganisms were isolated. The number of opportunistic bacteria in the hands of 47 employees of the surgical department did not exceed $3.2 \times 10^2 - 2.5 \times 10^4$ CFU/ml.

In general, in the spectrum of identified microorganisms isolated from washes from environmental objects, washes from the hands and nasopharynx of medical and maintenance personnel, there were practically all types of opportunistic bacteria - the most likely causative agents of HAI. The leading microflora of the examined hospital was represented by *Escherichia coli*, *Klebsiella*, *Enterobacter*, *Pseudomonas aeruginosa*, *Staphylococci*, that is, those microorganisms that are more likely than other types of bacteria to cause hospital-acquired infections.

The study of clinical material with wound infection (57 sputum samples, 34 samples of bronchial swabs, 58 samples of wound secretions for various surgical purulent complications) from patients in the surgical department also showed prevalence among the selected cultures of gram-negative microorganisms.

In a bacteriological study of 91 sputum and bronchial swab samples, 124 cultures were isolated, including 89 (71.8%) representatives of gram-negative bacteria: *P. aeruginosa* (31.5%), *Klebsiella* spp. (19.1%), *E. coli* (15.7%), *Enterobacter* spp. (10.1%) and others.

Enterobacteria isolated from the wound surfaces of surgical ICU patients were assigned to 11 species. *E. coli* was isolated in almost half (49.2%) of patients with primary purulent and in 9% with wound infections. *P. aeruginosa* was detected in 32.1% of patients with wound infection. Representatives of other genera - *Klebsiella* spp. (5%), *Enterobacter* spp. (5.2%). In open processes, *Klebsiella* spp prevailed. (5.4%), *Enterobacter* spp. (5.6%), *P. aeruginosa* (9.8%).

Study of the hemolytic properties of the selected cultures showed that isolates of gram-negative bacteria, agglutinating human and sheep erythrocytes, were found with a frequency of 16.7% to 72.6% and indicate the presence of virulence factors in the isolated cultures that contribute to the development of purulent-septic diseases in patients of a surgical hospital.

When analyzing the frequency of isolation of antibiotic-resistant variants among enterobacteria, it was found that all studied isolates of gram-negative bacteria were characterized by high frequency of resistance to ampicillin (76.4%), amoxicillin, carbenicillin (88.8%), cefazolin (71.6%), cefuroxime (48.9%), tetracycline (86.4%), doxycycline (60.2%), streptomycin (79.4%), kanamycin (76.5%), gentamicin (46.9%), rifampicin (78, 4%) and chloramphenicol (57.6%). High activity in vitro against enterobacteria was shown by cefoperazone (62.3%), cefepime (59.8%), amikacin (56.8%), ciprofloxacin (74.6%) and pefloxacin (71.7%).

As a result of studying the resistance of *P. aeruginosa* cultures, it was found that the level of resistance to the tested antibacterial drugs was as

follows: carbenicillin (46.1%), piperacillin (44.9%), amikacin (45.3%), meropenem (43.4 %), cefepime (42.7%) and imipenem (40.2%).

Conclusions. Studies have shown that gram-negative bacteria are dominant among the microorganisms isolated and circulating in the examined departments of the surgical hospital and play a significant etiological role in the development of bronchopulmonary and purulent-septic hospital-acquired diseases. Isolated strains are characterized by different frequency, level and spectrum of antimicrobial resistance.

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NUTRITION DETOXIFICATION IN ACCOMPANYING SUPPORT PROGRAMS FOR CANCER PATIENTS WITH COLORECTAL AND PANCREATIC CANCER

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Abstract. Infusion-nutritional accompanying therapy provides the prevention of metabolic complications and their correction. **Materials and methods.** In patients with colorectal cancer (CRC) and pancreatic cancer (pancreas), the effectiveness of detoxification was evaluated. **Results.** A relationship was found between indicators of homeostasis and endotoxemia, as well as a more positive trend when using detoxification nutrition schemes with the addition of remaxol. **Conclusion.** In case of CRC T3 – T4, it is advisable to use a combination of nutritional supplements with the addition of hepatotropic pharmacological nutrients. **Keywords:** detoxification diet, hepatoprotectors, nutrition science.

Purpose of accompanying nutritional support (NS) for tumors of the digestive tract is the prevention of metabolic complications and their correction. This takes into account the known basic metabolic syndromes characteristic of cancer patients. So, from the peculiarities of the metabolic response in cancer, it should be noted that the ebb phase may not have a clear clinical picture and, with pronounced oxidative stress and inhibition of CARS, can quickly go into the flow phase. The presence of anorexia-cachexia syndrome (CACS) with a decrease in appetite, body weight by more than 5% in 6 months, muscle mass index (MMI) leads to varying degrees of severity of precachexia, cachexia, or even refractory cachexia

(from 0 to 100 points). Hypermetabolism/hypercatabolism syndrome, expressed in the reaction of muscle proteolysis, sarcopenia, increased levels of cytokines, increased energy and plastic needs, high lipid oxidation rate, the body's tolerance to nutrients as a whole with a decrease in glucose oxidation rate and increased protein loss (Pt loss up to 6 g per day correspond to the first degree, 12 g/day - the second and more than 12 g/day - severe), is reflected in the nutritional risk index (NRI) [1,7]. Thanks to the works of Yu.M. Halperin, A.M. Ugolev and their associates (L.N. Kostyuchenko, T.Z. Ivanova, M.V. Rudenskoy, M.Ya. Simonov, etc.), intestinal insufficiency syndrome was also identified, and the fundamental principles of enteral probe alimentation were determined (the principle of chemical resemblance, the optimal osmoticity of rations, the depth of their hydrolysis, the ratio of nutrients, water and solids in them, the safety of heterophasic cavity digestion on flocs, the need to correct intestinal microbiota, etc.). In general, the processes of muscle catabolism and proteolysis mechanisms are described in a number of studies [2, 3, etc.], which revealed the pathways of protein degradation, muscle wasting due to the ubiquitin-proteasome system [4,5], dystrophin protein, ferroptosis, cytoplasmic hypoxia, etc. In the choice of compositions for nutritional support, an important role is also played by information on the metabolism of tumor cells. For example, a normal cell can metabolize glycogen, and a cancer cell can metabolize glucose; normal cells absorb little folate, and cancer cells have receptors for uptake of this vitamin; cancer cells absorb boron 3-4 times more than healthy cells, etc. The level of total and extracellular water of the body plays a prognostically important role, as is the value in the choice of nutritional correction (their growth is prognostically unfavorable and often indicates refractoriness to the absorption of nutrients). The tumor process features that are important for calculating NS were also the stage of the tumor process [6], the volume of the operation performed [7], the initial nutritional status (NS), the phase of carcinogenesis (initiation, promotion, progression) [6], the regimen of chemotherapy [8, 9], metabolic complications that have a toxic effect. All this contributed to the emergence of new areas of nutritional support therapy in the complex treatment of tumors.

Materials and methods

Patient groups were distinguished: 1) with low nutritional risk (NR), requiring only surgical rehabilitation; 2) with an average NR, receiving chemotherapeutic correction and continuing to maintain a relatively satisfactory quality of life after surgery; 3) with low NS and extremely high NR (severe palliative patients). In each group, the effectiveness of detoxification alimentation was evaluated using a special program. Nutritional deficiency

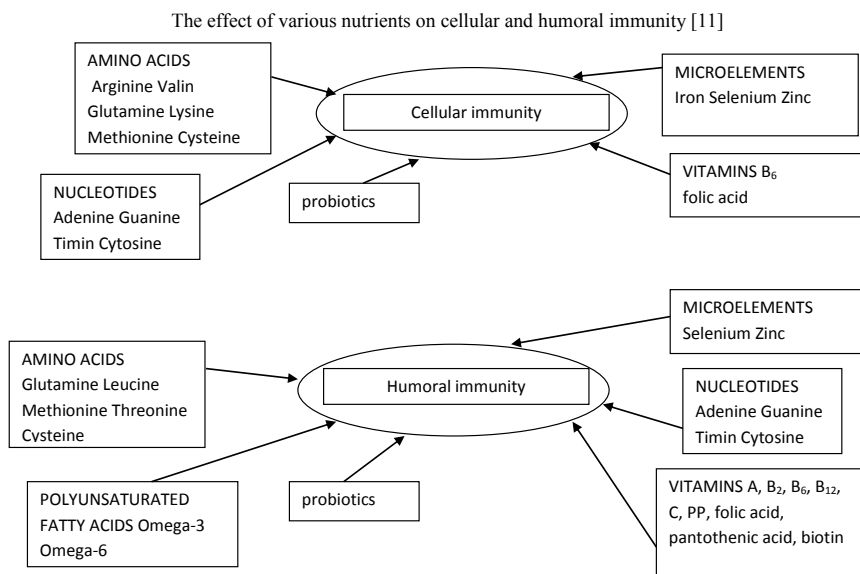
was assessed by the parameters of alimentary-volemic diagnosis (AVD), NR - by NRI, sarcopenia - by bio-imidansometry. Hematological intoxication indices (Krebs, the index of the ratio of leukocytes and ESR) were calculated according to well-known formulas. Hepatological parameters (total protein, albumin, bilirubin, ALT, LDH) were determined by standard methods. Intestinal detoxification capabilities were monitored by plasma citrulline levels and intestinal microbiota activity (based on a study of short-chain fatty acids of coprofiltrate [SCFA]). In addition, we studied the content of urea and blood creatinine, its electrolyte composition. The severity of the condition was evaluated by APACHE II, quality of life - by ECOG. For objectification, mathematical methods were used - factorial analysis and the method of variation statistics using Student's criterion.

Results and discussion

For personalized creation of accompanying NS programs, we have developed criteria to form groups of patients requiring separate alimony schemes. Thus, characterizing metabolic complications due to inadequate nutritional correction, one can note a deficit of unesterified fatty acids (UEFA), necessary for the synthesis of phospholipids and the construction of cell membranes, encountered in 30–32% of cases. It develops after 2-3 days of parenteral nutrition (PN) without the use of lipids, that is, 1-2% of the caloric need to provide these substances is necessary [10]. At the same time, one should keep in mind the threat of fat overload syndrome (a very formidable metabolic pathology with the development of hyperlipidemia, fever, hepato- and splenomegaly, anemia, leukopenia, thrombocytopenia, impaired coagulation, hemolysis and reticulocytosis, deviations of functional liver tests), often associated with iatrogenic triglyceridemia in the appointment of fat emulsions without regard to contraindications to their appointment (bilirubin more than 90, lipid nephrosis, hypoglycemia, decompensated diabetes, etc.). The development of induced azotemia and hyperaminoacidemia is possible when media containing L-ornithine-L-aspartate (aminosteryl-hepa, etc.) are indicated. We should not forget about the prognostically unfavorable increase in the level of extracellular water in cancer patients, and according to our data (bioimpedansometry) and the level of total water [7]. Iatrogenic dysglycemia is less common, since the revealed insulin resistance even in case of surgical diabetes provides for an obligatory consultation of the endocrinologist. In some cases, the observed had dyselectrolytemia (iron deficiency or overload, imbalance of calcium, magnesium, selenium, zinc). In our observations, patients with colorectal cancer (CRC) encountered more often correctable iron deficiency conditions, the tactics of which we described in a number of works [7]. Consider-

ing that in PN environments there are no micro and macro elements, one should pay attention to this fact when prescribing accompanying nutritional therapy programs. One of the significant directions of modern nutritional support in oncology is immuno-nutritional science, which dictates the need to include compounds with immunomodulatory effects in the structure of accompanying nutritional correction (Table 1) - at least arginine, omega-3 fatty acids, RNA, etc.).

Table 1
The effect of various nutrients on cellular and humoral immunity [11]

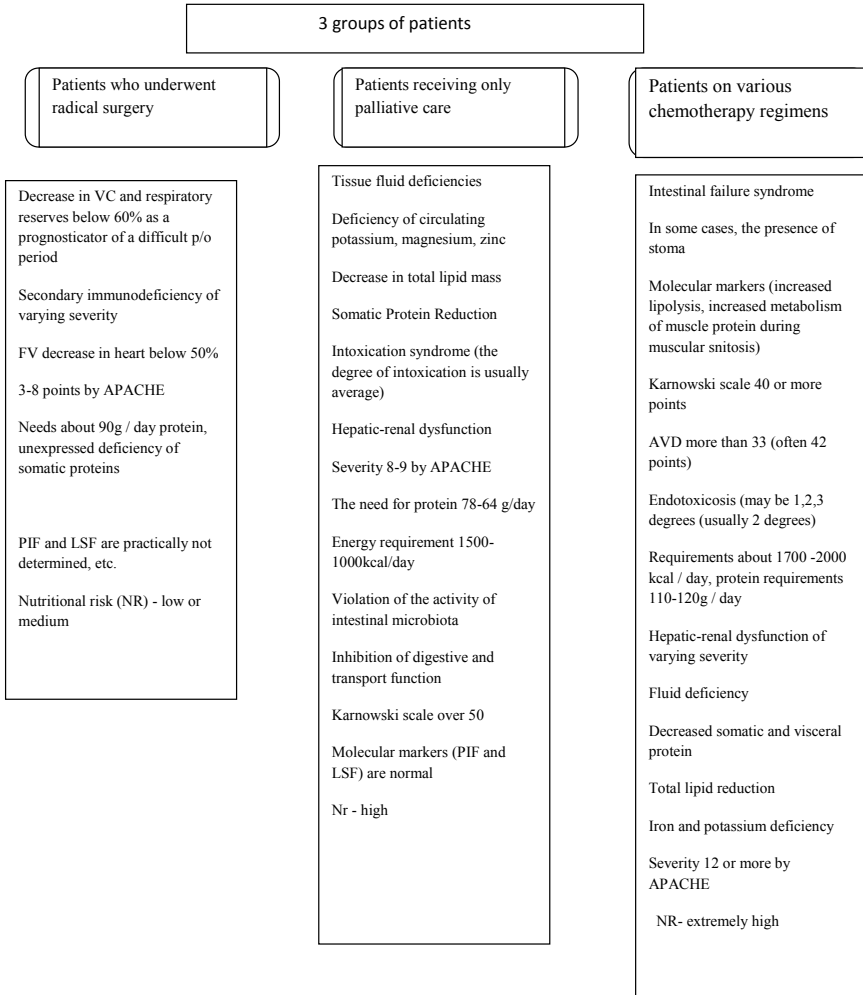


Undoubtedly, the basic principle of NS is personalization. At the same time, a number of authors (including us) recommend paying special attention to the functional reserve (FR) of organs that limit assimilation. We have shown in previous works that when inhibiting the functions of the intestine, in particular with cancer, one should choose the tactic of gradually pumping up the food load (first use saline enteral solutions, then partially split formulations, only then switch to balanced mixtures) (IASGO, 2018). When choosing an accompanying NS program, attention should also be paid to the volume of surgical interventions [7]. For example, when performing various types of pancreato-duodenal resection (PDR), the anatomical and functional relationships of organs change in different ways. When perform-

ing standard PDR, when one-third to two-thirds of the stomach, duodenum (completely or partially to the mesenteric vessels, and after crossing the stump of the intestine "goes" under these vessels) are removed, the pancreas head with a hook process, gall bladder, distal part of the bile duct), the nutritional program should be supplemented with digestive enzymes, microbiota correctors and regulators of enterohepatic circulation, measures for the prevention of dumping syndrome. With pyloric preserving PDR, the NS program may be softer. When choosing a program, we also took into account the effect of concomitant diseases and drugs for their treatment on NS. For example, when administering nutritive mixtures in combination with opioid analgesics, the inhibitory effect of the latter on peristalsis and, as a consequence, on absorption processes should be taken into account. Therefore, it is advisable to introduce dietary fiber - nutrients (lactulose, etc.) into the composition of nutritional programs. In assessing the microbiome, we were able to identify three types of changes, depending on which the NS program was supplemented with the corresponding pharmaconutrients. In case of inhibition of microbiota, mucofalk or actoflor C was introduced into the program, with dumping-like syndrome - correctors of motor activity, with SIBR - nifuroxoside or analogues. When evaluating the data, it turned out that each of the 3 groups of patients corresponds to characteristic metabolic disturbances and the degree of NR (Table 2). These violations allow you to choose personalized NS programs for selected groups. In each of the groups, a leading symptom complex is manifested, which determines the need for additional pharmacological correction in the structure of NS. So, it is evident that in the second and third groups, intoxication syndrome is particularly distinguished, which determines the severity of the condition, quality of life and other body functions and nutrient requirements. Intoxication, developing with oncology, occurs in almost every patient. This is due to the fact that during malignant neoplasms normal metabolic processes are disrupted, and toxic endogenous elements accumulate in the tissues and biofluids of the body.

Endogenous poisoning in oncology is caused by: a) a violation of metabolic processes; b) the decay of a malignant tumor; c) the accumulation of drugs used during treatment; d) the release of specific substances by tumors (PIF, etc.), immunosuppressants; e) complications of chemo- or radiation therapy; f) iatrogenic associated with underestimation of metabolic complications of nutritional correction. It is clear that the cause of intoxication in the early stages of oncology is the circulation of the products of the metabolism of neoplasm cells in the blood, and in the later stages, the decay of the tumor. To this the intoxication effects of chemo- and radia-

Table 2
Patient groups depending on the nature
of metabolic changes identified on the basis of the parameters
of the alimentation-volemic diagnosis



tion therapy and possible general surgical complications are added. With the decay of a tumor in the blood, the following electrolyte and metabolic disorders occur: uric acid content increases (sedimentation of its crystals

in the tubules of the kidneys can result in acute renal failure, the process is aggravated by dehydration and lactic acidosis); the content of phosphates in the blood increases (which is accompanied by a decrease in calcium levels and leads to an increase in nervous excitability and seizures, and calcium phosphate, deposited in the kidneys, also provokes a violation of renal function); the content of potassium in the blood increases (its excess is dangerous with the probability of a failure of the heart rhythm). The metabolic products of a decaying tumor damage the membrane structures of normal cells, lipid peroxidation is initiated, and dangerous particles are formed - free radicals. Due to this, a tendency to erythrocyte hemolysis is noted and hemoglobin level decreases, toxic anemic syndrome develops. With intoxication, cancer patients experience headache, fever, nausea, vomiting, unstable stools, decreased appetite, general weakness, fatigue, drowsiness, sensation of interruptions in the heart, tachycardia, changes in blood pressure, weight loss, shortness of breath, pale skin, acrocyanosis, signs of renal and liver failure; in the blood - leukocytosis, an increase

Table 3
The structure of nutritional diagnosis (AVD)

1. External signs of metabolic disorders
2. Anthropometry (TJC, deficiency of visceral and somatic fat according to nomograms)
3. Deficits of the main plasma components
4. Somatometry (main and specific metabolism, water sections, muscle mass index-MMI, active cell mass-AKM)
5. The severity of the condition according to APACHE, the presence and level of cachexia, the phase of the metabolic response (ebb- or flow), anabolism or eubolism, the severity of the syndrome of hypermetabolism / hypercatabolism (at the stage of protein breakdown)
6. Nutritional deficiency in points according to AVD, taking into account the functional reserve of organs - FR, which limit assimilation
7. The degree of intoxication
8. Needs
9. Protein-energy deficiency –BEN (E-46)
10. Sarcopenia (M 62.84)
11. Nutritional risk (NR)
12. Recommendations for clinical alimentation regimens (PN, EP, mixed and at what rate of rehabilitation or habilitation)

in ESR, the level of protein, erythrocytes, etc. decreases. Therefore, it is especially important to use the well-known nutritional diagnosis for the diagnosis of metabolic disorders, the structure of which is shown in Table. 3. The use of a full examination of nutritional parameters allows us to evaluate the functional reserve of organs that limit the absorption of nutrients and ensure metabolic safety, and prevent the development of intoxication. In this case, the modulation of the detoxification response is carried out due to the following main mechanisms: 1) monooxygenase system of the liver; 2) specific and non-specific immune systems; 3) excretory systems of the kidneys, intestines, lungs. Preventing cancer intoxication is difficult. It is necessary to regularly monitor the electrolyte content, liver and kidney function, monitor the level of hemoglobin, blood coagulation. At the same time, detoxification nutrition is shown - another new area of onco-nutrition science.

To assess the severity of cancer intoxication, standard indicators and scales are used. Scales for assessing the severity of hepatotoxicity and hepatotoxic reactions when using various antitumor drugs are also known. Highlighting the degree of intoxication at the same time allows for personalized correction of the arisen disorders, a special place among which is held by reduction of the effect of hepatotoxic effects, including the use of various antitumor drugs. In terms of severity, intoxication in oncology is divided into: a lung that can be treated; moderate severity - prolonged exposure to systems and organs with the development of complications; severe - a dangerous form in which all organs and systems are subject to damage, the tumor at this time breaks up more intensively, leading to the death of the patient. Most often, at the final stages of oncopathology, general intoxication of a severe degree develops. When assessing the possibilities of detoxification alimentation in CRC in stages T3 – T4, we used the Krebs, Garkavi and other intoxication indices. We supplemented the detoxification diet with hepatotropic drugs, in particular, remaxol. It should be noted that the traditional treatment of cancer intoxication is symptomatic, including, as a rule, antiemetic, laxatives, enemas, sorbents, iron preparations for anemia), painkillers, antiarrhythmic, sedatives, enterosorption, in the presence of severe electrolyte disorders - hemodialysis or plasmapheresis. However, to date, several dietary factors affecting the endogenous production of N-nitroso components have been studied, many of which have pronounced carcinogenic and mutagenic activity. Thus, it has been shown that the addition of bifidogenic bacteria and soy oligosaccharides to food leads to a significant decrease in the content of total N-nitroso components in feces [12]. The detoxification role of the protein of natural products

due to the specific bioadsorption system for glutathione, the role of omega 3, the role of carbohydrates through the formation of glucuronic acid and NADP-N were revealed [13]. There are a number of recommendations on the use of natural nutrients depending on the phase of carcinogenesis [6] (Table 4).

Table 4 Nutrient use based on phase of carcinogenesis

INITIATION PHASE	
Mutations	<p>(membrane: AMK, FL, UEFA, VitE, etc. - Physalis, Solanum oil)</p> <p>Metabolic antimutagens: P-450 (1st phase of detoxification): sulfides, their oxides in garlic, onion, citric acid, ellagic and gallic acids, tea flavonoids, etc.;</p> <p>Reparation: Ginseng, Leuzea, Eeuterococcus, Zn, Co, Se, Vanillin, etc.)</p>
PROMOTION PHASE	
Transcription factors, free radicals, Bc1-2 proteins, apoptosis	<p>Apoptosis inducers: lectins (Ivan tea, beans, peas), cytochrome C (heart of cattle and pigs), caffeine (coffee), UEFA (vegetable oils), panaxosides (ginseng), glucosinolates (horseradish, radish), protease (meat, pancreas, testes, kiwi, papaya, figs), selenium (garlic, Brazil nut, bran), curcumin (ginger, turmeric, pumpkin), resveratrol (grape skin, red wine), vit. D, triterpene saponins (ginseng), fucoidan (fucus), ginestein (soy, corn, hops, clover, etc.)</p>
TOXIC CARCINOGENESIS	

In recent years, metabolic erology has emerged - the science of metabolic complications (including iatrogenic), which include fat overload syndrome, NEFA deficiency, induced azotemia and hyperaminoacidemia, dyhydria, iatrogenic dysglycemia, and severe protein-energy deficiency-BEN, dyselectrolytemia (including deficiency of circulating potassium, sodium, magnesium, etc., iron deficiency or hemosiderosis, deficiency of other electrolytes and trace elements, etc.). As a result of such complications, both various deficient conditions and intoxication syndromes arise. One of the areas of metabolic erology is detoxification nutrition - detoxification nutritional correction, especially necessary for patients with cancer of the digestive apparatus. We, as mentioned above, have introduced hepatotropic drugs in the structure of NS of patients with high and extremely high NR in a severe stage of intoxication. Remaxol was administered from 3 to 6 days at 400.0 per day at a rate of 40 drops per minute. A certain positive effect was obtained (Table 5).

Table 5
Endotoxiosis in patients with CRC in stages T3 – T4 treated with the traditional NS regimen and detoxification nutrition regimen

when applying the traditional NS scheme (COMPARISON GROUP)			when applying the detoxification nutritional scheme (MONITORING GROUP)		
Krebs Index	ILESR	Garkavi Index	Krebs Index	ILESR	Garkavi Index
4,0± 0,53 (at normal 1,8 ± 0,46)	1,61± 0,46 (at normal 1,48 ± 0,76)	2,3± 0,46 (at normal 0,3-1,12)	3,1± 0,49 (at normal 1,8 ± 0,46)	1,47±0,46 (at normal 1,87 ± 0,76).	1,8± 0,41 (at normal 0,3-1,12)

To objectify the endotoxiosis indices, a factorial analysis was used (Table 6). In this case, for a quantitative characteristic of the signs, an indicator was used that reflects the percentage deviation from the norm of the studied parameter: where A is the initial, B is the changed value of the parameter being evaluated, $\Delta\% 1$ - in relation to the norm, $\Delta\% 2$ - in relation to the control (comparison group).

Table 6.
Laboratory parameters in patients with CRC in stages T3 – T4, depending on the treatment regimen

parameters	norm	Observation group	% ¹	% ²	Comparison group	% ¹
White blood cells, 10 ⁹ /l	6,5±2,5	7,8±1,9	20,0	-67,2	13,1±1,8	101,0
Hemoglobin	120	91,0±3,4	-24,1	-19,0	97,2±2,9	6,37
White blood cells,	4,1	3,2	-0,9		2,8	-39
Citrulline plasma, units/ml	3,8	2,9±1,8	-23		1,9±1,8	34.1
Albumin, g/l	45±3,7	31,1±2,9	-30,0	5,7	29,4±1,7	76
Phase angle (bioimpedance)	4,2	6,7	59,5	-2,9	6,9	2,9
Extracellular water	7,0	9,2±1,9	31,0	-20,2	11,1±1,7	58,2

, where

%¹ - in relation to norm indicators,

%² - in relation to control (comparison group)

Thus, detoxifying NS with remaxol allowed to more effectively reduce the increase in disorders in the homeostasis system, and the frequency of hepatotoxic complications of chemotherapy, as in the literature, varied from 14.3 to 100.0%. At the same time, as can be seen from the factorial analysis, to further improve detoxification measures, not only hepatopro-

tective correction can be used, but also nutritional, aimed at the mechanisms of intestinal detoxification, which, as is known, is associated with the cycle of transformations of ornithine-citrulline into safe urea, as well as with the detoxifying effect of proteins, lipids. This allowed, apparently, for a long time to prevent metabolic complications during basic treatment.

Conclusions

1. When conducting NS in patients with pancreatic head cancer and CRC, it is necessary to clarify the nutritional diagnosis and, based on it, distinguish groups 1) with low NR and a practical absence of intoxication and pain syndromes; 2) with an average NR and an average degree of intoxication syndrome in patients receiving chemotherapy; 3) group of palliative cancer patients.

2. The inclusion of hepatoprotectors in the program of nutritional detoxification allows you to reduce the Krebs, Garkavi, ESR intoxication indices, even at extremely high NR.

3. The introduction of microbiota correctors is another factor in detoxification in patients with CRC in stages T3 – T4.

4. The combination of nutritional compositions containing proteins, lipids, microelements with hepatotropic pharmaconutrients helps prevent metabolic complications in the correction of nutritional status in patients with CRC and pancreatic cancer.

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UDC 551.4

REGIONAL FEATURES OF CLIMOMORPHOGENESIS RUSSIA'S FAR EAST

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Abstract. Kurums and scree in the mainland of the Far East are quite widespread, but are marked by torn areas throughout the tundra and forest natural zones, where local natural contrasts, primarily bioclimatic, affect the development of these geomorphological systems in different ways.

Purpose of the research – to reveal the spatio-temporal patterns of development of talus and kurum morpholithogenesis in the conditions of the monsoon and continental climate of the mainland of the Russian Far East.

Materials – data of long-term geomorphological and geocological studies of the author in Chukotka and Wrangel Island (1957-1959, 1971-1972), in the river basin. Kolyma and Priokhotye (1971-1972, 1974-1975), in the lowlands (1974-1979) and in the mountains (2007-2011) in the south of the Far East (in the Khabarovsk Krai and Primorye), as well as available literary and stock sources were used. When solving common thematic issues, the achievements of our earlier long-term studies in the mountains of the Western and Eastern Sayan and on the Central Siberian Plateau (1961-1970) were involved.

Methods – comparative geographic, geophysical, cartographic, informational.

Main results. The modern distribution of screes and kurums as zonal formations in the mainland of the Russian Far East is controlled primarily by climate [1]. The originality of the latter is created by: 1) seasonal changes in oceanic and continental situations; 2) local contrasts (annual, monthly, daily) of heat and moisture; and others. The relief-forming effect of climate is manifested not only directly, but also indirectly (through vegetation). Under the conditions of this climate, the studied geomorphological processes are most intense here in the middle segment (between 54 and 64° N) of the vast transitional band from the inland areas to the mega-coasts of the Pa-

cific seas. The thicknesses of the considered formations are everywhere limited by the depth of the active layer, the maximum values of which are noted near the southern boundary of the permafrost region. The level of organization of kurum-talus climomorphogenesis is an important diagnostic feature of the dynamic state of the continental Far Eastern landscapes, which can be used in paleogeographic reconstructions, as well as in the development of background and operational geographical forecasts necessary to select the best options for regional nature management.

Keywords: kurums, screes, organization levels, stability, expositions, climomorphogenesis, differently oriented slopes, natural zones, the mainland, the Far East.

Introduction

At present, against the background of general climate warming, it has stopped in the Arctic [1], but at the same time there has been a tendency toward cooling [2]. As our observations show, in the Far East there is an additional strengthening of continentality [3].

Climomorphogenesis is understood by us as a diagenetic or inherited relief formation determined by the action of groups of exogenous agents generated by the main geophysical essence of certain climates (continental-cryosic, continental-thermos, oceanic-cryosic, oceanic-thermos). It is climomorphogenesis that gives the features of uniformity to relief in homogeneous climates and creates differentiation zones at the borders of different climatic influences. It should be noted that geomorphological diagenesis, in contrast to inherited relief formation, manifests itself as a result of a sharp change in geophysical conditions in the development of the modern relief, which is reflected in the creation of new forms of the earth's surface.

Purpose of the research – to reveal the spatio-temporal patterns of development of talus and kurum morpholithogenesis in the conditions of the monsoon and continental climate of the mainland of the Russian Far East.

Materials – the data of long-term geomorphological and geocological studies of the author in Chukotka and Wrangel Island (1957-1959, 1971-1972), in the basin of river Kolyma and in Priokhotye (1971-1972, 1974-1975), in the lowlands (1974-1979) and in the mountains (2007-2011) in the south of the Far East (in Khabarovsk Krai and Primorye), as well as available literary and stock sources were used. In solving common thematic issues, the achievements of our earlier long-term studies in the mountains of the Western and Eastern Sayan and on the Central Siberian Plateau (1961-1970) were involved.

Methods – comparative geographic, geophysical, cartographic, informational.

Results and discussion

General characteristics of the organization of kurums and screes.

Kurums and scree in the mainland of the Far East are quite widespread, but are marked by torn areas within the entire tundra and forest natural zones, where local contrasts, primarily bioclimatic, affect the development of these geomorphological systems (GS) in different ways. In this regard, the level of their organization, according to the author, is an important diagnostic feature of the dynamic state of the continental Far Eastern landscapes, which can be used for paleogeographic reconstructions, as well as for the purpose of geographic forecasting.

In the north of the Far East, in the mountains, kurums and talus are combined with tundra and mountain-tundra vegetation, forest-tundra shrubs and creeping forests of cedar elfin and alder. In the mid-altitude mountains of the forest zone, the considered formations are confined to the high level of the birch twigwood and the belt of elfin creeping forests, while simultaneously entering the belt of coniferous forests (in the south of Sikhote-Alin - and coniferous-deciduous forests). On the border with the Amur forest-steppe, kurums fragments are traced at low altitudes within the Amur peneplain, where they lead to the appearance of separate “spots” among the massifs of the northern variant of coniferous-deciduous forests and secondary white birch and aspen forests with larch.

The results of many years of research show that the modern distribution of talus and kurums as zonal formations in the mainland of the Russian Far East is controlled primarily by climate [4]. The relief-forming effect of the climate is manifested not only directly, but also indirectly (through vegetation). Recall that the processes of talus and kurum formation, *ceteris paribus* (homogeneous rock lithology, the same absolute heights of specific areas, etc.), occur most actively with a certain moisture and thermal conditions of soils (optimal moisture content, large amplitudes and frequent temperature transitions through 0°C, etc.) in a powerful active layer.

Mechanisms of generation and further development of kurums and screes. These are well known (V.G. Chigir, 1964; Yu.G. Simonov, 1972; E.E. Titov, 1976; etc.). The process of displacement of kurums is complex, represented by slope and permafrost components (desorption, deflux, solifluction, permafrost slip landslides, permafrost creep.) It should be added that the above is sufficient to explain the development of kurums only in areas with prevailing continental climate.

To successfully reveal the specifics of the functioning of kurums in monsoon regions and in territories with approximately equal oceanic and continental relief-forming influence, the following cause-effect relationships and factors must be taken into account.

The climatic conditions of the Far East, especially Primorye, predetermine the development of kurums almost throughout the year. This is due to the fact that here the horizons of chemical weathering of rocks significantly exceed the thickness of physical weathering layers (active layers or freezing and thawing soil strata annually). As a result, gravel-block formations are lying on a powerful dusty-clay pillow, subject to various kinds of plastic deformations even with slight moisture. Seasonal and annual differences in the moisture content of these fine-grained soils, when their consistency can vary to extremes (from semi-solid to liquid-flowing), give rise to local contrasts in the intensity of movement of screes and kurums even in neighboring areas of the same exposure. That is why screes and kurums on generally better-moistened screes (due to different wind and radiation desiccation of soils, redistribution of snow cover in winter, etc.) slopes of the northern and western expositions in the Sikhote-Alin ridges develop more actively and in separate periods, and in the total annual output than on oppositely oriented inclined surfaces.

The high mobility of Far Eastern scree and kurums, especially Sothotailinsky, unlike those developing in the continental climate itself, is supported in summertime (July, August) and is often even more activated by abundant precipitation, causing saturation and supersaturation of the fine-grained layer in their soles with moisture. The rates of displacement of detrital material down the slope are so high that landslides-floats and landslides occur quite often.

The distinctiveness of the climate and the development of kurums and screes.

Seasonal abrupt changes in oceanic and continental situations create a distinctive climate. Under the conditions of this climate, the studied geomorphological processes are most intense here in the middle segment (between 54 and 64° N) of the vast transitional band from the inland areas to the mega-coasts of the Pacific seas. When moving away from this area, in full accordance with the modern climatic conditions, actively developing kurums and screes change in different ways:

to the west and east, their area and capacity generally decrease (and in the east, these changes are much faster than to the west);

to the north, an increase in areas is accompanied by a significant decrease in their thickness (for example, in Chukotka and Wrangel Island kurums are very widely developed, but they are often represented by the so-called "film" forms);

to the south, the areas of kurums and screes are reduced, and the capacities are noticeably increased.

In addition, we note that the thicknesses of the considered formations are everywhere limited by the depth of the active layer, the maximum values of which are noted near the southern boundary of the permafrost region. Some of these conclusions, formulated mainly on the basis of our many years of research, are confirmed by the few data of other authors. So, for example, S.S. Voskresensky notes that “the area occupied by modern kurums in the mountains of Transbaikalia and Pribaikalye reaches 3-4% in some ranges, in Dzhugdzhur - up to 5-7% and even more in the mountains of the Stanovoye Upland” [5, p. 115].

Local contrasts of heat and moisture in the study area is determined by sharp differences in the intensity and seasonal phases of the development of talus and kurum climomorphogenesis from its background characteristics. At the same time, it should be clarified that such differences, ultimately associated with different exposure conditions, are most characteristic of regions with sharply continental climate within the temperate zone and monsoon regions (with the maximum morphogenetic effect in the “meridional-latitudinal” transitional band) and are of little significance - for areas in the subarctic and, especially, the Arctic zone. That is why, according to separate publications (E.E. Titov, 1976) and our materials, in the north there is no confined kurums to the slopes of a certain exposure. For the same reason, most of the examples in this article are given in the south of the Far East.

Screes and kurums are formed as a result of crushing rocks into large blocks (size classes: crushed stone - blocks). Screes are more often characteristic of steep slopes (the angle of inclination is more than 30°), and kurums develop both on gentle (10-20°) and steep slopes (respectively, kurums of the first and second kind - [5, p.114]). Very often, a single row arises on the stepped mountain slopes: the stone sea (kurum of the 1st kind) - talus - stone river (kurum of the 2nd kind).

Scree and kurum processes are critical in the chain of agents leading to the active removal of clastic material from the zone of no erosion and the transformation of slopes. Despite the fact that they are usually placed in different groups (according to S.S. Voskresensky and D.A. Timofeev, 1970), in our article they are considered together and in close connection.

Differences in the development of scree and kurums were revealed when they were studied *on differently oriented slopes of moderate steepness* in the highest Sikhote-Alin mountains, not affected by pyrogenic vegetation changes. So, in the south of Sikhote-Alin, scree within the southern

slopes descend to absolute heights of 800-900, and on the slopes of the northern exposure only up to 1400-1500 m. The same asymmetric shift of the scree formation border is also observed in Northern Sikhote-Alin (in river basins Samarga and Sukpai). Toward the north of the region, a different picture is noted. On the Yam-Alin and Dzhugdzhur ridges, the most developed screes are noted on the slopes of the northern and northwestern exposures, where their lower boundary is located at heights of less than 900 m, and on the eastern and southern slopes it exceeds 1200 m (Fig. 1). The noted feature is significantly violated in the alpine zone of these ranges, which underwent mountain glaciation in the Upper Pleistocene.

The asymmetric location of the lower boundary of scree formation in the marked mountain ranges is explained by us as follows. The slopes of the southern and eastern expositions in Sikhote Alin for most of the year warm up well and are more quickly cleared from snow cover in spring and from rainwater in summer. Naturally, less forested and drier slopes undergo scree formation much more intensively. These phenomena are activated by forest fires that occur here much more often in comparison with the opposite slopes.

The different altitudinal position of the lower boundary of scree formation on differently oriented slopes in the Yam-Alin and Dzhugdzhur ranges located in the area of the often-island permafrost is ultimately associated with unequal hydrothermal conditions for the growth of forest vegetation. On the slopes of the southern exposure, which are much warmer than the northern forests, they rise to absolute elevations of 1200-1250 m and higher, which greatly reduces the area of scree formation here.

Kurums, which are nascent and actively developing even in slightly inclined areas ($7-10^\circ$), generally descend well below the upper border of the forest. This rule is implemented in the Far East, regardless of permafrost. Moreover, the functioning of kurums is more differentiated than the development of screes, which is more often associated with the individual regime of atmospheric humidification of differently oriented slopes.

In the distribution of kurums developed along the thalwegs of low-order watercourses in the summit belt of Sikhote-Alin, a different ratio is noted than for scree on steep slopes and linear kurums in areas of moderate steepness (Fig. 2). So, on the well-heated southern and southeastern slopes, "stone rivers" end at about the same height as a scree. In areas of development of secondary screes, respectively, penetration of kurums along the thalwegs into the mountain taiga zone is observed. A different picture can be seen on the slopes of the northern and western expositions. There is a clear gap between the lower boundary of scree formation and elevations to which "stone rivers" descend at the tops of the catchment systems.

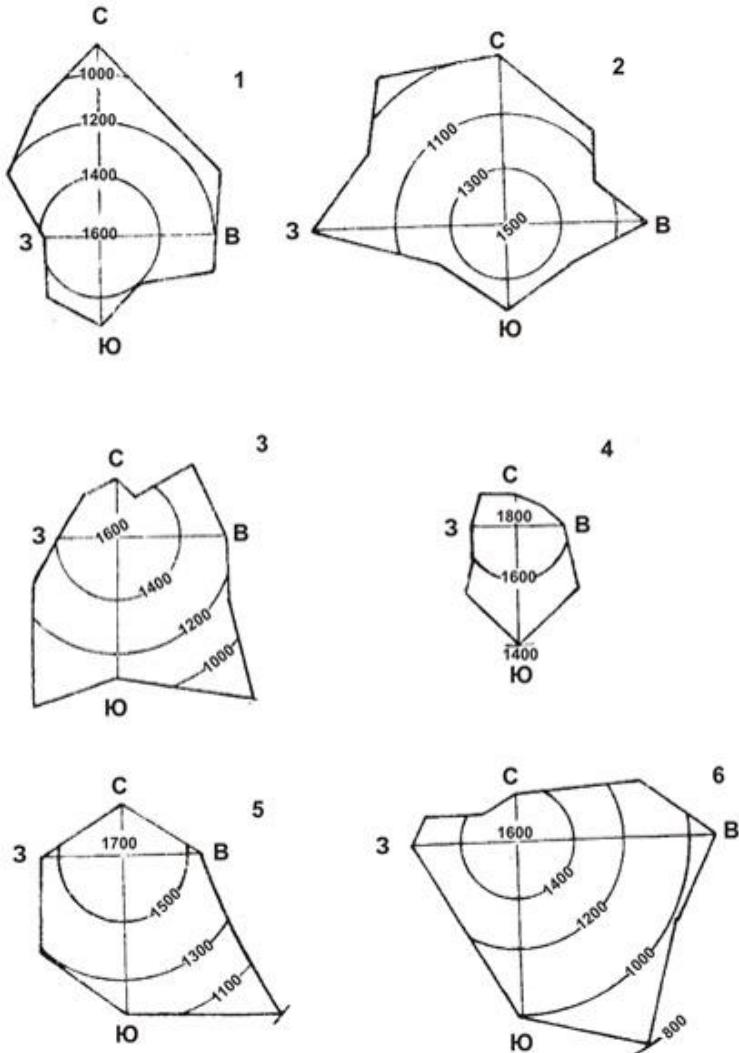


Fig. 1. Rose-diagrams of the distribution of scree and kurums in the alpine belt of the south of the Far East.

Legend: 1 – ch. Dzhugdzhur; 2 – ch. Yam Alin; 3 – Northern Sikhote-Alin (Sukpai and Samarga river basins); 4 – Middle Sikhote-Alin (basin of the Ussuri River); 5 and 6 – South Sikhote-Alin (basin of the Kievka River); 1100 – absolute heights in meters.

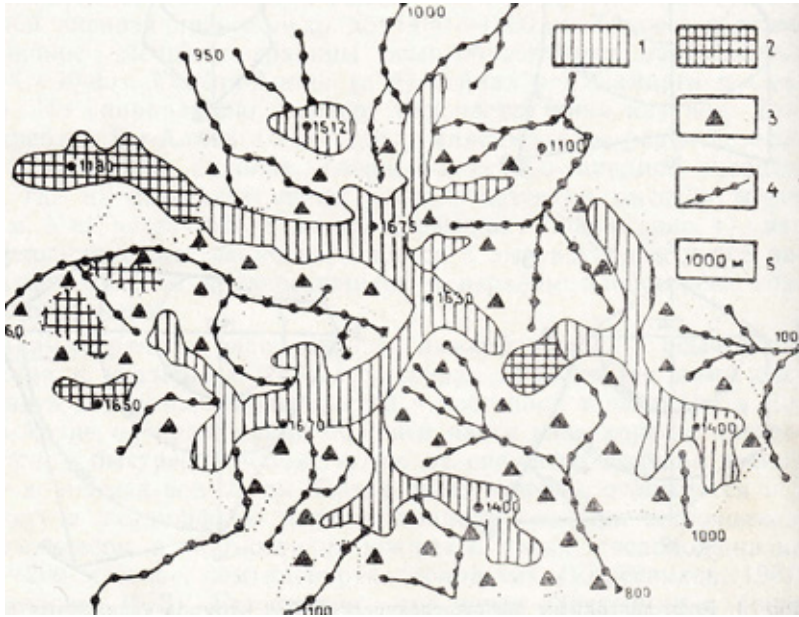


Fig. 2. Distribution of kurums and scree in the alpine and mid-mountain belt of the Sikhote-Alin (basin of Sukpai river).

Legend: 1 – active kurums ("stone seas"); 2 – the same kurums, but dead; 3 – modern scree and kurums-stripes on the slopes; 4 – "stone rivers" along the thalwegs of watercourses; 5 – absolute marks in meters.

For example, in the massif of the Cloud Mountain, the least affected by fires in Sikhote Alin, where the border of talus and kurums is close to natural, on the northern slopes "stone rivers" descend to absolute heights of 1100-1200 m (Fig. 3), and talus more often die away near the upper border of the forest edge (about 1500-1600 m).

Modern development of scree and kurums in areas of the past spread of mountain-valley glaciations (for example, in the mountain systems of the Lower Amur Region and the Northwest Priokhotye, and beyond them in the neighborhood) is also characterized by distinctive features.

In mountain ranges with absolute heights of less than 2000 m, where there are no traces of large mountain-valley glaciers, the development of talus and kurum formation is conjugate: the lower boundary of kurums and talus is generally higher on the slopes of southern and eastern exposures compared to the opposite (Fig. 4).

In the Yam-Alin, Dusse-Alin, Aesop and Dzhugdzhur ranges, elevations exceed 2000 m, well-preserved traces of mountain-valley glaciations (trough valleys, moraines at altitudes of about 1800 m, etc. - Yu.F. Chemekov, 1975). Screens developed here on steep contouring trough valley valleys descend to 800-900 m, while kurums "freeze" already in the upper trough lengths (absolute heights of about 1000-1400 m). And only in certain valleys are active kurums marked, which begin from the terminal moraines and descend to heights of 800-900 m.

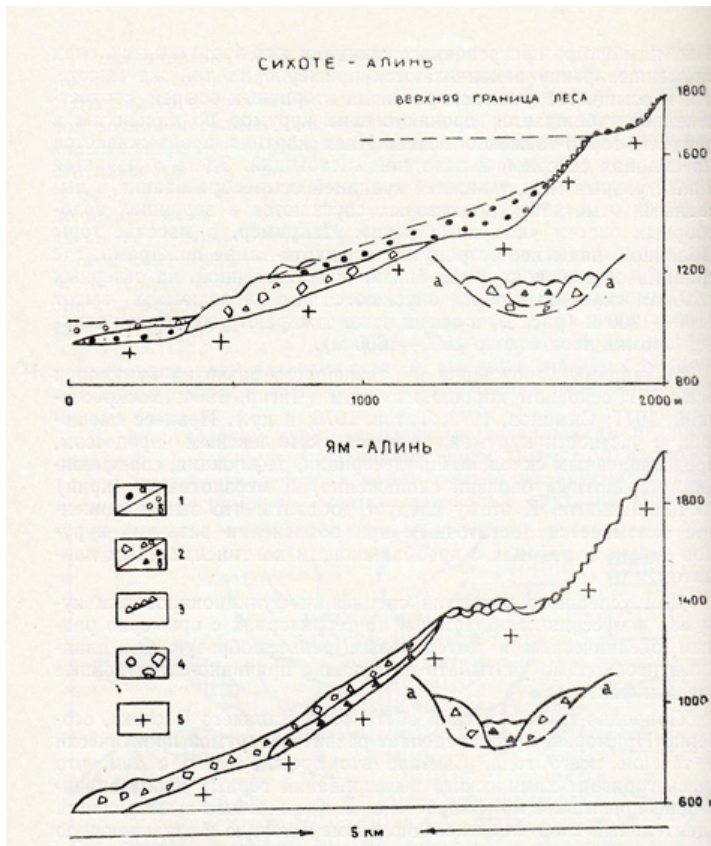


Fig. 3. The ratio of modern and late glacial "stone rivers" in the upper zone of the mountains of the south of the Far East.

Legend: 1 – alluvium: a) modern, b) late Quaternary; 2 – "stone rivers": a) ancient, b) modern; 3 – scree; 4 – glacial accumulations; 5 – bedrock.

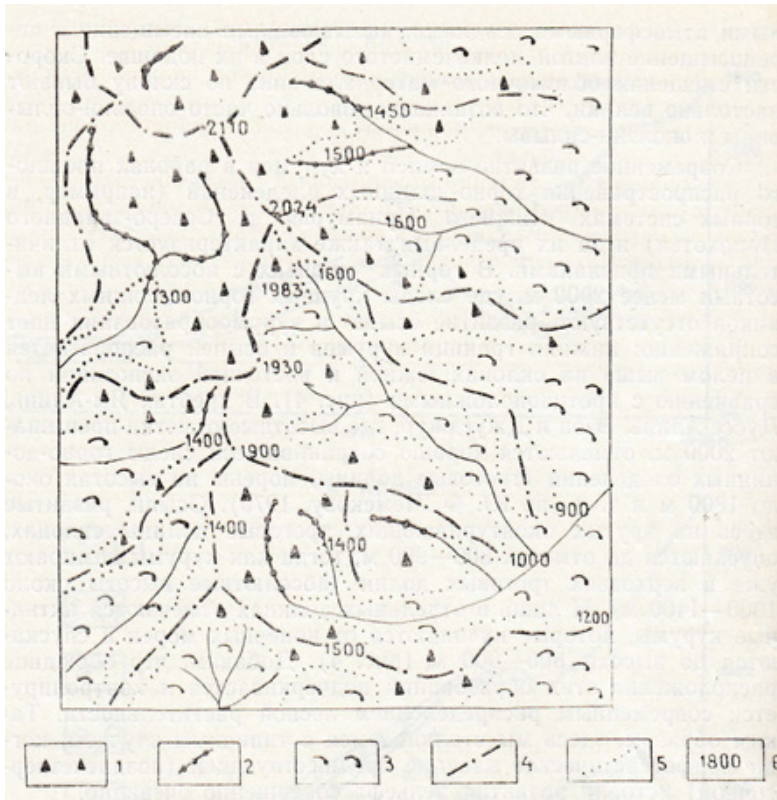


Fig. 4. Distribution of fixed kurums and mobile formations (kurums and screes) in the apex belt of the Nipninsky massif (basin of the Nimelen river).

Legend: 1 – moving kurums (stone strips) and scree on steep slopes; 2 – stone rivers; 3 – fixed kurums in the bottoms of trough valleys; 4 – watershed lines; 5 – upper border of woody vegetation; 6 – absolute marks in meters.

We add that the mutual arrangement of the considered formations is emphasized and controlled by the modern distribution of forest vegetation. Thus, here we are faced with typical cases when the morphogenetic influence of the previous (Late Quaternary) history of the relief development is quite obvious.

The materials of our studies show that the intensity of the processes of talus and kurum formation undergo sharp fluctuations in time. These fluctuations are associated with large and inhomogeneous climate fluctuations in the Pleistocene: these processes intensified during the cold eras (probably most significantly during the cryoxerotic phases), and they attenuated during the warmer eras (for example, alterminal holocene).

Currently, in the regions of the Russian Far East, there is a cooling of the climate and an increase in continentality, simultaneously with the intensification of the kurum formation [3].

Many features of sections of slope deposits and river valleys are determined precisely by the intensification or weakening of talus and kurum processes, as well as their spatial displacement in accordance with the reduction of the char zone to absolute heights of 900-1000 m in the south of Sikhote Alin and to 500-700 m in the northern part south of the Far East. Repeated alternation during the Pleistocene of intensification and weakening of the processes of scree formation led to the formation in the mountains of a multilayer section of slope deposits, general coarsening and a decrease in the rounding of alluvial strata in the upper and middle links of the hydrographic network. This follows from the materials of our studies and the data of many earlier publications (G.S. Ganeshin, 1957; V.V. Soloviev, 1961; Yu.F. Chemekov, 1975; and others).

At the same time, the ancient kurum, whose sediments were uncovered in the section of a 20-meter terrace, formed a huge cone at the mouth of the Lednikovoy stream and partially blocked the bottom of the Nipna river valley. Kurum, currently actively operating in the valley of the Lednikovoy stream, descends to absolute heights of 650-700 m.

A similar ratio of ancient and modern kurums (stone rivers) was recorded by us in other areas of the Far East (the ranges of Stanvoi, Mordjot, Yam-Alin, Tukuringra-Dzhagdy and others). Obviously, the modern talus and kurum formation within the mainland of the Far East are significantly inferior in intensity to similar processes that took place here in the late glacial horse. In the north of the described region (in the Arctic and subarctic natural and climatic zones), the arena of modern and ancient talus and kurum formation is in almost the same interval. The most significant differences between these processes are characteristic of the southern regions of the Far East (table) [6].

Table

The ratio of the heights of the end zones of modern and ancient kurums, in m

Areas (ranges)	Kurums	
	ancient	modern
Yam Alin	500-600	700-800
Sikhote_Alin		
Northern	600-700	1000
Middle	700-800	1100
South	800-900	1100-1300

Conclusion

The study of ancient and modern kurums, conducted in the paleogeographic aspect, provides the key to understanding the evolution of vertical zonality in mountainous countries. Thus, the confinement of the “stone seas” to the modern charred belt and their conjugation with formations such as upland terraces can in some cases explain the steppedness of the slopes in the mountain taiga zone as a result of a decrease in the lower border of char in the cold epochs of the Upper Pleistocene. Well-pronounced mesostability of slopes in the regional massifs of the mountains Cloud, Olkhova, Snezhnaya and others, i.e. already beyond the borders of the modern alpine belt, it is more logical to associate mainly with ancient processes, and not with modern ones. Attempts to explain here similar forms as a result of the action of modern slope processes, in our opinion, are not convincing.

Currently, according to our materials, the processes of talus and kurum formation are steadily increasing. This is due, firstly, to the already begun and directionally increasing continentalization of the climate and, secondly, to the influence of increasing anthropogenic factors. Among the latter, fires stand out. The talus associated with them (“pyrogenic”) is most prevalent in the eastern Sikhote-Alin macroslope, where a steep-slope relief, widespread development of ancient talus on effusive rocks of acidic and medium composition, areal distribution of rough skeletal soils, intensive flushing of fine earth during the summer season contribute to this - autumn monsoons, extremely slow overgrowth of burning areas due to their steepness, etc. At the same time, secondary scree, the lower boundaries of which are directed downward from south to north (for example, from Mount Snezhnaya - 600-800 m to the Chepiy Range - 150-200 m), are more characteristic of the slopes of the southern and eastern exposures, which are better than warmed, less forested and, most importantly, extremely “dry” during fire hazardous periods.

The above results of the study, according to the author, provide grounds for a more complete spatio-temporal restoration of the development of Far Eastern landscapes in anthropogenes, complement existing ideas about modern kurum and talus climomorphogenesis. and will provide significant assistance in the development of background and operational geographic forecasts necessary to select the best options for regional environmental management, taking into account the minimization of possible geocological risks.

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SOIL COVER OF THE PLANET AS A BASIS FOR ENVIRONMENTAL WELL-BEING

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Abstract. In this paper, we consider the stages of emergence of the philosophy of soil science and its importance in a global world geobio noosphere ties, show the significance in understanding these connections of fundamental soil science and some aspects of the scientific and philosophical activities of G.V.Dobrovolsky and E.D. Nikitin, the importance of special soil protection in environmental well-being is revealed.

Keywords: soil science, philosophy of soil science, geobionosphere, pedospheric-ethnospheric relations, Red Book of Soils.

The philosophical approach to the knowledge of nature and the noosphere implies an appeal to the foundations, to the principles of the existence of a particular field of knowledge, to a particular area of being. At the end of the nineteenth century, a new field of knowledge powerfully declared itself - soil science, largely thanks to the work of the founder of genetic soil science V.V. Dokuchaev. The relevance of this direction did not raise any doubts because Great Russia was covered by waves of great famine. "Not to mention the factory generations that perish on the absurd, painful and corrupting work of factories for the pleasure of the rich," writes L.N. Tolstoy, "the entire agricultural population, or a huge part of it, without land to feed on, was forced into terrible work stress, destroying their spiritual and physical strength, only so that gentlemen can increase their luxury. The entire population is soldered, exploited by merchants for the same purpose. "The population degenerates, children die prematurely, all in order for the rich - gentlemen and merchants to live their separate masters' lives, with their palaces and museums, dinners and concerts, horses, carriages, lectures, etc." [eleven]. The causes of hunger were hidden both in social relations and in the principles of attitude towards the soil caused by these relations.

Social and economic transformations of the first decades of the twentieth century contributed to the development of Russian fundamental soil science and laid the solid foundations of a reasonable human interaction with the soil. There was an urgent need for a philosophical understanding of soil science. It is significant that in the collection "Interaction of Sciences in the Study of the Earth", which was published in 1964, there was not a single philosophical and soil article. By this time, soil science had moved far enough away from the mother sciences — geology and geography — and began to interact especially closely with biology. This is evidenced by the evolution of the organizational presence of soil science at the faculties of Moscow State University in the XX century: the soil-geographical, geological-soil and biological-soil faculty - this is where soil science was developed and taught at Moscow University until the early seventies of the XX century. In 1972, at the Lomonosov Moscow State University, as is known, the first in the world special faculty of soil science was established (organized by Dean Academician of RAS G.V.Dobrovolsky).

The indicated organizational evolution of soil science in the main university of the country speaks volumes. It testifies, first of all, to the interdisciplinary fundamental nature of soil science and the groundlessness of its mechanical connection to any other branch of natural science. In this crucial issue, it is necessary to recognize the validity of Dokuchaev's assertion that soil science "remains an independent branch of natural science, with its own tasks," which, ultimately, necessitates philosophical understanding of the phenomenon of soil science on a global planetary scale with the aim, *inter alia*, of developing the right approaches to food security.

There is an urgent need to determine the relationship between soil science and applied sciences, including agricultural, despite all their importance and constant topicality. Suffice it to say that the main focus of agriculture extends to arable land, which makes up only about 10% of the Earth's land. However, the yield of these 10% is determined by the state of the integral soil cover of the planet, which remains outside the sphere of vital interests of agricultural scientific knowledge and therefore cannot be studied with due breadth and depth. A global understanding of the unity of planetary soil cover allows us to solve the problems of agriculture at a new, modern level of development of science. At the same time, in recent decades, the practical need for soil knowledge from global and regional geography and ecology, geochemistry, engineering geology and soil science, urban planning, economics, geopolitics, etc. has sharply increased.

All of the above indicates that a philosophical understanding of the place and role of soil science in science and the ways of its further devel-

opment is undoubtedly an urgent task. Of key importance in solving this problem is the scientific and philosophical work of a student and follower of the academician of the Russian Academy of Sciences G.V.Dobrovolsky, doctor of philosophical sciences, doctor of biological sciences, State Prize Laureate Evgeny Dmitrievich Nikitin, who managed to creatively comprehend the ideas of V.V. Dokuchaev and V.I. Vernadsky and to develop a number of his own fundamental achievements partially expressed in the following provisions:

1. "... structurally, the theory of the unity and relationship of nature, man, society should consist of three equal blocks: the doctrine of man as an integral multifunctional bio-socio-cosmic system, a theoretical generalization of the relationship between the various components of nature, most clearly manifested in the biosphere and soil shell Earth, and teachings on the general laws of life of natural and socio-natural systems" [2].

2) "... the methodological basis of the philosophical and scientific generalization of the ecological functions of the biosphere and soil is the provision on the universality of feedbacks in natural systems and their eco-functionality, which is one of the fundamental general laws that include structural, functional, dynamic and evolutionary laws" [2].

3) "... the effectiveness of the life of creative systems is realized when it is implemented at all interconnected levels: development, sustainability, functioning, reproduction, conservation" [2].

4) "... the most important condition for the survival and development of terrestrial civilization is the preservation and restoration of soils as an indispensable structural and functional component of the biosphere and planetary node of natural and socio-natural relations" [2].

The philosophical and methodological principles obtained by E.D. Nikitin were used to justify new approaches to environmental protection: the development of a comprehensive Red Book of nature and the noosphere, the Red Book of especially valuable soils, etc.

In the classic university textbook Soil Ecology, G.V. Dobrovolsky and E.D. Nikitin systematized on the basis of a global approach a number of geobiosociosphere functions, as shown in the table below [1].

We believe that in the above table, the noosociospheric functions of the Earth are of particular importance within the scope of the topic of our article. The principle laid down by the luminaries of soil science G.V.Dobrovolsky and E.D. Nikitin, the historical significance of whose work we have repeatedly mentioned [7,8,9,10] is the idea of planetary development, during which the emergence of man and society is a natural stage of planetary evolution, proving the unity of man and nature.

**Leading functions of the main components
of the geobiosociosphere**

(Dobrovolsky G.V., Nikitin E.D. Ecology of soils. M 2012, 410 P., P.361)

<i>Atmo- and hydrosphere, lithosphere</i>	<i>Pedosphere and bioworld of the planet</i>	<i>Biosphere as a whole, noo- sociosphere</i>
<p>Atmosphere and hydrosphere</p> <p>Blocking of the hard cosmic radiation</p> <p>Environment</p> <p>The formation factor of the bioworld, pedo- and lithosphere</p> <p>Regulation of the thermal regime of the Earth</p> <p>Resource of agricultural and industrial production</p> <p>Lithosphere</p> <p>“The foundation of the biosphere”</p> <p>Source of material and energy for global cycles</p> <p>The evolutionary factor of the biosphere and its components</p> <p>Transformation and burial of substances formed on the surface of the Earth</p> <p>Implementation of interconnections with lower located shells of the planet</p>	<p>Pedosphere</p> <p>Regulation of the cycles of matter and energy in the hydrosphere, atmosphere, biosphere</p> <p>Biochemical transformation of the upper layers of the lithosphere and their protection against erosion</p> <p>The source of the substance for the formation of minerals, rocks, fossil fuels</p> <p>The planetary node of the interconnections of the surface shells of the Earth</p> <p>Planet bioworld</p> <p>Indispensable Leading Factor in Soil Formation</p> <p>Regulation of the atmosphere</p> <p>Solar energy storage and transformation</p> <p>Qualitative activation of geochemical processes of the Earth</p> <p>The main source of home and food resources</p>	<p>Biosphere as a whole</p> <p>Integration of near-surface geospheres into a single system</p> <p>Factor of progressive full-stage development of the Earth</p> <p>Human living environment</p> <p>Source of diverse resources</p> <p>Social evolution factor</p> <p>Noosociosphere of the Earth</p> <p>Cognition of the Earth and the Universe, the preservation of ethnic groups and society</p> <p>Development of nature-saving technologies for using the planet’s natural resources</p> <p>Restoration of natural historical landscapes and zones of the globe</p> <p>Development and implementation of the theory of the unity of nature, ethnic groups and society, personality and their joint harmonizing development</p> <p>Space exploration</p>

Thus, the leading functions of the geobiosociosphere are, among others, the knowledge of the Earth and the Universe, the preservation of ethnic groups and society, the development of environmentally friendly technologies for using the planet's natural resources, the restoration of natural historical landscapes and zones of the globe, the development and implementation of the theory of the unity of nature, ethnic groups, society and personalities in the process of their joint harmonizing development [4]. The function of space exploration and the manifestation of human activity outside the planet Earth are considered by G.V.Dobrovolsky and E.D. Nikitin as a natural result of universal planetary development. However, the successful achievement of this outcome depends, among other things, on the success of the Red Book business, on the ability of modern society to overcome the negative anthropogenic impact on nature, and to ensure food security [5,6].

Of particular note is the experience of the peoples of Great Russia, and above all, the Russian people in the matter of survival in conditions of extreme agriculture. This is a separate broad topic and cannot be considered in the framework of this article. However, the presence of such an experience is very relevant for the modern world, because the anthropogenic load on soils and the accompanying climatic changes are gradually turning all the arable resources of the Earth into zones of risky farming. The definition of soil as a node of planetary-cosmic and noospheric connections [3] allows us to fix the global significance of the soil cover in the evolution of the geobiosphere, to determine the basic principles, signs, causes and consequences of the emerging pedospheric-ethnospheric connections of the modern world, to competently develop strategic and tactical provisions for the formation of ecological well-being.

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BIOTECHNOLOGY FOR THE PRODUCTION OF FUNCTIONAL MEAT-BASED PRODUCTS ENRICHED WITH JERUSALEM ARTICHOKE TUBERS JUICE

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Abstract. Currently, advances in biotechnology and modern engineering, technologies in the production of meat products require new approaches and views. If earlier meat products were produced according to traditional classical recipes, now meat products are made using new technologies, using various food additives, flavorings, bacterial preparations and ingredients that contribute to improving organoleptic characteristics, as well as increasing the yield of finished products.

Keywords: biotechnology, process, fermentation, nutritious, functional, emulsified, product.

The basis of modern technology of meat products are enzymatic processes, the consequence of which is the formation of specific organoleptic properties, nutritional value of the finished product.

One of the effective ways to improve the quality of cooked and cooked-smoked beef sausages, which has a more stringent consistency, is the fermentation process. In early studies it was shown that with the help of proteolytic enzymes of animal, plant and microbial origin, as well as own (natural) meat enzymes, it is possible to affect meat proteins. In order to increase the functional and technological properties of the feedstock and the structural and mechanical parameters of the finished product, a biotechnology for creating collagen ingredients was developed [1].

As an object for isolating the collagen fraction, we used waste veins of raw meat from beef, which has a high mass fraction (33.7%) of the total meat protein content, including alkali-soluble proteins (86.3%).

For biomodification of proteins of muscle and connective tissue, after washing, collagen-containing secondary raw materials were subjected to mechanical processing-crushing on a top to a particle size of 2-3 mm. Then, mechanical processing was carried out in a cutter with ice. The obtained ingredients of collagen raw materials were subjected to biochemical treatment with the addition of a bioadditive, after which complete fermentation of muscle and connective tissue occurs with the formation of a sticky, smeared homogeneous mass.

To determine the degree of degradation of collagen raw materials, the moisture-binding and emulsifying ability was taken as a criterion of functionality. These indicators largely determine the quality and structure of cooked sausages. Given the high functionality of collagen proteins in the production of sausages and its medicinal properties, replacing 10-20% of minced meat with collagen protein of muscle and connective tissue of meat is appropriate, which increases the functionality of the finished product.

It is known that a significant number of the population suffers from serious diseases of the musculoskeletal system due to the destruction of the connective tissue and cartilage of the joints, in view of the deficiency of collagen proteins in the diet. Animal protein in the form of a powder is made by foreign companies. Due to their high commercial value and questionable composition of such powders, their use do not inspire confidence in our manufacturers [2].

The technological process is a mechanical grinding of raw materials (homogenization), accompanied by the formation of a stable water-protein emulsion with certain rheological (stickiness, plasticity), technological (water-binding ability) and organoleptic characteristics [3].

The essence of the proposed technological scheme lies in the fact that, by using a food supplement from environmentally friendly local raw materials, it is possible to obtain high-quality meat products that have therapeutic prophylactic properties and enrich the finished product with protein, soluble carbohydrates, carotenoids, lipids, which have good digestibility [4].

It is recommended to use the proposed fundamentally new technology for the production of emulsified meat products in which this technology improves the quality of sausages, increase the yield of finished products and improve organoleptic characteristics.

In this technological scheme, a protein-fatty emulsion preparation is separately proposed using a food supplement containing jerusalem arti-

choke tuber powder. During homogenization of raw materials, the morphological structure of tissues is destroyed, individual structural elements are broken up, soluble myofibrillar and sarcoplasmic proteins are extracted, they are hydrated and dissolved, fat is dispersed, water is bound, protein structure matrix and, in fact, water-protein-fat (meat) emulsion are formed, mixing, heating, etc.

The process of grinding raw materials and the formation of meat emulsion proceeds in three phases.

In the first phase (during the first 2-3 minutes), mechanical destruction of the cellular structure of tissues predominates, muscle fibers are destroyed, their contents flow out.

There is an extraction of proteins in the aqueous phase (water: meat + added water), and the efficiency of the process increases in the presence of sodium chloride. In the second phase, muscle proteins begin to swell intensively, bind water added to the meat system; there is a secondary structure formation of proteins among themselves and the formation of an emulsion matrix. The value of the water-binding ability of the system increases. Moreover, for the formation of the structure of the emulsion and its absorption of water, the degree of transition of myofibrillar proteins to the dissolved state is crucial, which is facilitated by the presence of sodium chloride and the high homogenization of the raw materials.

With insufficient grinding, the proteins do not completely leave the cell structure and do not participate in the binding of water and the formation of a spatial framework, which can lead to the separation of minced meat. In the third phase, with continued grinding of the raw materials, partial dispersion of fat occurs (against the background of a local temperature increase during cutting) with the formation of finely divided fat globules, which are connected to a protein framework consisting of water and salt-soluble muscle proteins, an emulsion is formed. Water-soluble proteins are able to emulsify 30 ml of fat per 100 g of protein, salt-soluble-40 ml.

With intensive grinding, adipose tissue mainly disperses in the form of solid particles with a size of 20-75 microns, consisting mainly of intact fat cells. At the same time, the structure of adipose tissue is partially destroyed, as a result of which a fat drop follows from damaged cells [4].

As the cells break down and the temperature rises, more and more fat is released and dispersed, which must be bound and stabilized in order to prevent the destruction of the emulsion and its subsequent isolation from the product. Partial melting of the fat during cutting is also facilitated by local overheating of the raw materials in the cutting zone, which can be significantly greater than the total temperature of the emulsion. The size of

emulsified particles of fat is from 10 to 0.1 microns and is characteristic of colloidal systems.

Molecules of dissolved proteins as surface-active substances are adsorbed from the continuous phase on the surface of crushed fat particles, unfolding hydrophobic groups to fat, hydrophilic to the aqueous phase.

As a result, an adsorption film is formed around the fat particles, which keeps the fat in a dispersed state. As the meat is minced, the degree of dispersion and the total surface area of the fat particles increase, therefore, for the binding of fat, a sufficient amount of the aqueous-protein phase is necessary.

If the grinding is too strong, the amount of dissolved protein may become insufficient, and then part of the fat particles remains free, not covered with an emulsifier film.

The resulting excessive temperature increase can cause partial denaturation and destruction of protein films, including from mechanical stress during grinding and stirring.

Based on experimental studies, a technological scheme for the production of emulsified meat products was developed (Fig. 1).

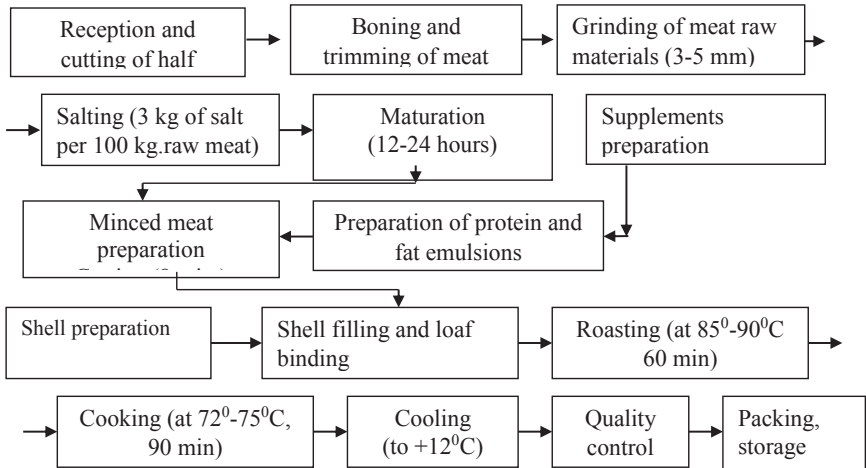


Figure 1. Technological scheme for the production of emulsified meat products.

Thus, the amount of fat and water, as well as the degree of grinding of the raw materials determine the required amount of soluble protein for the formation of a stable meat emulsion. The total grinding time should be

sufficient to form a protein matrix surrounding the dispersed fat particles. Temperature control of raw materials is an important condition for obtaining a stable emulsion. With fine intensive grinding, the minced meat is heated and exceeding the level of 18°C can lead to protein denaturation, which will cause a decrease in emulsifying and water-binding ability, the appearance of friability, broth and fat swelling in the finished product. To prevent overheating of meat emulsions, it is necessary to control the cutting time (no more than 7-11 minutes), temperature (should be in the range from 10 to 15°C), the quality of the sharpening of the cutting piece. The temperature is reduced by introducing cold water, ice or snow into the emulsion. As is known, protein extraction during grinding of muscle tissue in the presence of water and sodium chloride most effectively occurs at temperatures close to -2°C.

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CHANGES IN THE EXTERIOR OF YOUNG RABBITS DURING THE INDUSTRIAL AND CROSS-HYBRIDIZATION OF BREEDS WHITE GIANT, SILVER AND SOVIET CHINCHILLA.

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Abstract. The article presents the results of a study of the exterior of rabbits, depending on the type of crossing. The studies were carried out using domestic and imported diluents, showing the dynamics of live mass from birth to slaughter, exterior parameters including body length and girth behind the shoulder blades, slaughter yield.

Keywords: rabbits, artificial insemination, young stock, slaughter yield.

Introduction

The constitution of the animal, including the rabbit, determines all the structural features of the organism and its functions, due to the hereditary basis and the conditions of its habitat. Knowledge of the constitution contributes to the improvement of the animal organism in the direction necessary for humans.

Essentially, in rabbit breeding, there are four main types of constitution: coarse, strong (dense), tender and raw.

Rabbits of a rough constitution are characterized by a large and rough head, a massive skeleton, wide chest, thick skin, highly developed muscles and an underdeveloped fat layer. Their hairline is hard, with a large number of hairs remaining.

A rabbit of a strong constitution is vigorous, healthy, has good vitality and resistance to disease, better adapts to changes in food and natural conditions. This type of animal is characterized by a round or elongated, but not coarse head, a well-developed and strong, non-coarse skeleton, and a wide and deep chest. The skin is dense, with good fur, adipose tissue under the skin is poorly developed, the muscles are dense. Such animals eat food well and are most productive.

A rabbit of a gentle constitution is characterized by a light and coarse head, lightweight thin bone, thin, easily pulled skin, underdeveloped muscles. The hairline is soft. Deviation of rabbits of a gentle constitution towards overdevelopment further depletes the skeleton, skin, and muscles. The hairline of overdeveloped rabbits is so rare that skin is visible through it. Animals are coddled, eat poor food, are unproductive, and often get sick. As a rule, they are rejected. The appearance of a large number of overdeveloped rabbits in the herd indicates improper breeding or poor feeding conditions.

To obtain vital, strong and productive offspring from rabbits with a delicate constitution, if they are valuable in quality, pairing them with rabbits of a strong constitution is practiced.

Directed rearing of young animals strengthens the constitution.

The rabbits of the crude constitution seem massive in appearance, but their skeleton is fragile. The skin and muscles are loose, with highly developed subcutaneous adipose tissue. The hairline may be soft and sparse. Animals are picky on feed.

Exterior of the rabbits. In rabbit breeding, as in other branches of animal husbandry, the exterior is given great importance. According to its characteristics, one can judge breed features, body strength, health, development, and direction of productivity.

Different breeds of rabbits have their own characteristic features of the exterior, the knowledge of which helps the correct assessment of livestock.

Knowing the exterior of rabbits is especially important when choosing them for breeding purposes. The tribe, as a rule, is left with strong, well-developed animals, without defects in physique, corresponding to the direction of their productivity.

Live weight of rabbits

The live weight of rabbits is determined in a state of average fatness by weighing (before feeding) on the scales with an accuracy of 10 g. Based on the live weight of adult animals, one can judge their meat productivity and size. The live weight of young animals shows how individuals grow and develop.

Rabbits are examined and the length of the body and the volume of the chest behind the shoulder blades are measured. When evaluating a rabbit, first of all, it is necessary to pay attention to the exterior as a whole, and then carefully evaluate all parts of the body.

Purpose of the study: To evaluate the productive qualities of rabbits of the breed White giant, Silver, Soviet chinchilla and their crosses using artificial insemination.

Research Objectives:

- evaluate the reproductive qualities of rabbits of different breeds when clean breeding and industrial crossing;
- compare the dynamics of live weight in rabbits obtained from purebred breeding and when crossing;
- evaluate the exterior parameters of the obtained rabbits with a different breeding method.

Materials and research methods. The work was carried out in the rabbit farm "Tafo-Miacro" Kolomensky district, Moscow region. As an object of research, two males were selected according to the principle of analogs - 2 groups of females, 50 heads of the White Giant breed, five male White Giants and 5 Silver males. Similarly, 2 groups of 50 females of breed Soviet chinchilla and 5 males Soviet chinchilla and 5 White giant. In addition, there were 50 females Silver and 5 males of the same breed.

Females and males were raised under the same conditions, according to the Mikhailovsky system of keeping [6]. Artificial insemination was carried out every week, insemination was carried out according to the generally accepted method of V.K. Milovanov [3]. Females of the White Giant breed were seeded with the seed of males of the White Giant breed and Silver males. Females of the Soviet chinchilla breed were inseminated with the seed of males. Soviet chinchilla and White Giant breed. In the fifth group of females, Silver was inseminated with sperm of Silver males. After birth, fecundity and yield of rabbits on the main female were evaluated. Rabbits of each group were weighed at the age of 30, 60, 90, 120 days. We determined the length of the body of rabbits, the circumference of the chest behind the shoulder blades, and the index of incidence. Slaughter yield was determined after slaughter in 120 days. All data obtained were processed by the method of variation statistics.

Research results and discussion. The research results are shown in tables 1 and 2,3. An analysis of reproduction rates (Table 1) showed that the number of born rabbits per one successful female was significantly higher during industrial crossbreeding of White females and Silver males and the Soviet chinchilla female and White male compared to pure-bred breeding White giant rabbits, Soviet chinchilla and Silver. The number of babies born is one more main female in the groups during industrial crossbreeding: female - White giant, male - Silver and Soviet chinchilla - female, White - giant ($P > 0.95$; $P > 0.99$) in comparison with groups with purebred breeding. When comparing groups in purebred breeding, the best fertility results were obtained in females of the breed White giant, but the difference is not significant.

Reproductive qualities of females in purebred breeding and crossbreeding, heads

Breeds, type of crossing	Rabbits born on:		Yield of slaughter	
	per successful female X± Smx	per general female X± Smx	per successful female X± Smx	per general female X± Smx
♀ White Giant x ♂ White Giant	7,2± 0,18**	6,1± 0,30*	7,0± 0,06**	5,7± 0,17
♀ Soviet chinchilla x ♂ Soviet chinchilla	7,2± 0,18**	5,9± 0,12**	7,0± 0,65	5,5± 0,87*
♀ Silver x ♂ Silver	7,2±0,18**	6,0± 0,16*	6,9± 0,01***	5,9± 0,82
♀ White Giant x ♂ Silver	8,0± 0,22	7,2± 0,27	7,5± 0,25	7,1 ±0,40
♀ Soviet chinchilla x ♂ White Giant	7,9± 0,1	7,0± 0,12	7,7± 0,15	6,9 ±0,25

*P>0,95,**P>0,99*** P>0,999

In slaughter yield, rabbits per a successful female; the best results were obtained by crossing females of the Soviet chinchilla and males of the White giant, 0.8 rabbits more than the mating results of purebred White giants and 0.8 compared with purebred mating Silver. On the main female, significantly more rabbits were obtained when crossing a White giant with a Silver one compared to a purebred breeding of the Soviet chinchilla.

From an analysis of the data in Table 2, it follows that the largest rabbits were born during industrial crossbreeding, when females of the Soviet chinchilla breed are inseminated with White male giant sperm, the difference compared with the mass of rabbits in purebred is significant (P>0,99; P>0,999).

In purebred breeding, rabbits obtained from females of the White Giant breed are distinguished by the largest live weight. At the age of 30 days, rabbits of White giant females grow more intensively both in purebred breeding and in insemination with sperm of Silver males. At 60 days old, rabbits obtained from White giant females of semen inseminated with sperm of Silver breed continue to lead in terms of live weight in comparison with purebred and Soviet chinchilla obtained from females of semen inseminated by sperm of males of Silver breed, but the difference is not significant. At 90 and 120 days, the same pattern is observed: the maximum live weight of young rabbits when mating females of a White giant and Silver males, followed by rabbits from females Soviet chinchilla inseminated with sperm of White giants.

Dynamics of live weight of rabbits obtained during purebred breeding and crossing.

Breeds, type of crossing	Live weight, $\bar{X} \pm S_{mx}$				
	Age				
	at birth, g	30 days g	60 days kg	90 days kg	120 days kg
♀ White Giant x ♂ White Giant	75,0±2,3**	743±25,2	1,36±0,03	2,33±0,03	3,25±0,03
♀ Soviet chinchilla x ♂ Soviet chinchilla	66,0±1,4***	714±8,9**	1,31±0,18	2,31±0,23	3,33±0,32
♀ Silver x ♂ Silver	62,0±1,2***	601±10,6***	1,44±0,15	2,13±0,25	3,13±0,20
♀ White Giant x ♂ Silver	81,0±0,5*	754±4,9	1,80±0,06	2,88±0,32	3,75±0,31
♀ Soviet chinchilla x ♂ White Giant	84,1± 1,0	638±5,2***	1,74±0,12	2,85±0,37	3,65±0,31

* $P > 0,95$; ** $P > 0,99$; *** $P > 0,999$

Thus, the live weight of young rabbits at the age of 90 days obtained by industrial mating of a female White giant, male Silver is 23.6%, female Soviet chinchilla male White giant is 23.8% higher than when purebred. Among young rabbits obtained with purebred breeding, the best results in terms of live weight at the age of 90 days were observed for White giants, and 120 for Silver.

Exterior indices of rabbits (Table 3) indicate that when pure-bred breeding, the maximum breast girth is greater in individuals obtained by inseminating females of the Soviet chinchilla with sperm from males of the same breed. The difference with the girth of the rabbit's chest obtained from mating of females of the White giant breed with the male White giant and Silver with Silver is significant ($P > 0.999$). In industrial crossbreeding, rabbits obtained from females Soviet chinchilla seeded by White squirrel males have a significantly larger chest circumference compared to rabbits of the White giant females seeded by males of Silver breed and purebred when mating females of the White giant breed with males of White giant and Silver ($P > 0.999$). The same pattern is observed in body length: among a combination of mating, in purebred breeding, the largest body length of rabbits is observed in females of the Soviet chinchilla breed inseminated by sperm of males of the same breed, and when the received Soviet chinchilla rabbits are crossed, inseminated by sperm of White Giants. The incidence index

shows that the most downed physique of meat type in rabbits obtained by industrial crossbreeding is during insemination of females of the Soviet chinchilla breed with White Giant seed and in purebred breeding of rabbits of the Soviet chinchilla breed. The maximum slaughter mass was obtained from rabbits during industrial crossbreeding, and the minimum during purebreeding of Silver rabbits.

Parameters of the exterior and slaughter weight of 4-month-old rabbits obtained during purebred breeding and industrial crossing

Breeds, type of crossing	Chest circumference behind the shoulder blades (cm) X± Smx	Torso length (cm) X± Smx	Down index %	Slaughter mass, g X± Smx
♀ White Giant x ♂ White Giant	38,5±0,36***	59,8±0,17***	65	1746±24,4***
♀ Soviet chinchilla x ♂ Soviet chinchilla	42,5±0,36	63,4±0,28	67	1771±20,4***
♀ Silver x ♂ Silver	37,9± 0,16***	61,2±0,11***	62	1700± 22,1***
♀ White Giant x ♂ Silver	37,9± 0,15***	59,7±0,30***	64	2033± 20,9
♀ Soviet chinchilla x ♂ White Giant	40,9± 0,49	62,5± 0,49	66	1904± 17,5

*** P>0,999

Conclusion

During the artificial insemination of females of the White giant breed, they reliably gave birth (P> 0.99) to a larger number of live rabbits (8.0) per successful and general female (7.2) compared to pure-bred breeding (7.2; 5.9-6.1, respectively).

The slaughter yield of rabbits for both successful and general female was greater in industrial breeding (P>0,999;P>0,95).

Rabbits obtained as a result of industrial crossbreeding are born larger and throughout the entire period of growth are ahead of the live weight of their peers obtained by thoroughbred by 23.6-23.8% at the age of 120 days.

It was found that the maximum slaughter mass of rabbits was obtained by industrial crossing, and minimal by purebred crossing of rabbits of the Silver breed (P> 0.999).

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**A COLLECTION OF WILD SPECIES OF GENUS HORDEUM L. -
ORIGINAL MATERIAL FOR USE IN THE SELECTION**

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Abstract. Wild species of barley are resources of different traits for the improving the genetic adaptation of crops to the unfavorable conditions of surrounding area. Genomic diversity of wild cereals in situ and ex situ conservation as source for selection. The article presents data of expedition collection (2003-2014 years) and evaluation. Biodiversity of local populations of the genus *Hordeum* L. of Kazakhstan. Obtained samples of earliness productive in population of *H. spontaneum* (263 days and 8 ears / plant); to a high protein content - *H. bogdanii* (22,2%), *H. brevisubulatum* (21,5%) and *H. crinitum* (up 21.0%). Electrophoresis of seeds storage proteins of the *H. vulgare* subsp. *spontaneum* populations, revealed 2 allelic variant of hordein-coding locus Hrd A, 3 allelic variant on the locus Hrd B, 3 allelic variant on the locus Hrd F.

Keywords: resources, selection, genus *Hordeum* L, protein content, expedition collection

Wild species - relatives contain many resources of genetic adaptation to improve crops, which allows for secondary targeted synthesis (resynthesis) of crops in order to improve their "genetic content" [1]. In the national collections of Kazakhstan, wild and wild relatives of cultivated plants are represented by a small volume and are not sufficiently studied in terms of breeding utility. The urgency of the problem is based on the need to constantly maintain biodiversity, expand and replenish the genetic potential of the national gene pool through wild species and wild relatives and conduct research on their phenotypic and genotypic variability based on several indicators [2].

Kazakhstan is an important collection area for all three genetic types of barley. The collection and study of species that are relatives of the genus

Hordeum L. is associated with the presence in the wild species and genera of genes that control important agronomic traits - resistance, winter hardiness, and drought tolerance, which are therefore of interest for the transfer of cultivated barley to germplasm.

H. spontaneum - is the only wild type of barley that has a genetic affinity for cultivated barley and has two spike colors - light yellow and black, which are found on an equal footing. Of interest for selection are the genes of resistance to powdery mildew of *H. bulbosum* [3], *H. bogdani*, *H. brevisubulatum* grow on highly saline soils, which allows us to judge their importance in breeding for salt tolerance.

Assessment of genetic resources is closely linked to plant genome research. Electrophoresis of storage proteins of seeds (prolamins) has been successfully used to identify and register species, varieties and biotypes. In barley, hordeins are the most studied and widely used markers[4].

Material Samples of the local population (expeditions - 2003-2014) of wild species of relatives of the genus *Hordeum L.* - in the amount of 50 samples of 7 species: *H. bogdani*, *H. brevisubulatum*, *H. hystris*, *H. crinitum*, *H. leporinum*, *H. spontaneum*, *H. bulbosum*. As a control, a regionalized variety of barley *Donetsk 8* was used [5].

Methodology Field experiments on the study were laid in the foothill zone of Zailiysky Alatau (irrigation). Altitude 740 m, 48° N, 77° E, light chestnut soils; the number of days with precipitation of the order of 95-100, the average long-term rainfall during the growing season - 360-400 mm; the number of days with low temperature - within 125-130 [5].

Results Expeditionary gathering (2003 - 2015) amounted to 100 samples of 10 species - *H. bulbosum*, *H. spontaneum*, *H. hystris* Roth, *H. crinitum* (Schreb.) Desf-33, *H. brevisubulatum* (Trin.) Link, *H. leporinum* Link, *H. geniculatum*, *H. jubatum*, *H. bogdani* in the South - East of Kazakhstan.

In phenology, 50 samples of 7 species of the genus *Hordeum L.*: *H. bogdani*, *H. brevisubulatum*, *H. hystris*, *H. crinitum*, *H. leporinum*, *H. spontaneum*, *H. bulbosum* were studied. The type of development of the analyzed samples is optional or winter. Plant germination averaged 58.2%, with fluctuations from 20% (*H. bogdani*) to 90% (*H. leporinum*). The growing season averaged 277 days. The most precocious was the species of coarse seed barley *H. spontaneum* (263 days), the precocity of which was ensured by a shorter period before heading compared with other species. On samples of 2 species (*H. spontaneum*, *H. bogdani*), a good correlation was observed ($r = 0.61$) between the length of the period before heading and the length of the growing season. Plant height ranged from 18.0 (*H.*

bogdanii) to 83.0 cm (*H. spontaneum*) and averaged 35.3 cm. The spike length for all species was approximately the same 7-8 cm. Productive bushiness is low (1, 2, 4 ears/plant) in all species except *H. spontaneum* (8 ears / plant). Damage to the samples was noted with yellow (5-40%) and brown rust (up to 100%).

By protein content, large-seeded samples of wild local populations occupied an intermediate position between wild small-seeded forms and cultivated varieties of barley. Significant intraspecific (depending on the collection sites) and interspecific polymorphism in protein content were noted. The intraspecific range of the percentage of protein in samples of local populations of wild large-seeded forms, *H. spontaneum*, ranged from 13.7–16.3%. The high protein content was shown by the species *H. bogdanii* (22.2%), *H. brevisubulatum* (21.5%) and *H. crinitum* (14.2 - 21.0%). The protein content in samples of *H. hystrix*, *H. geniculatum* and *H. leporinum* was 14.2, respectively; 15 and 17.5%. The lowest content was observed in *H. bulbosum* species (13.5%).

An analysis of the composition of the storage proteins showed a weak manifestation in the spectrum of components of the hordein α zone (Fig. 1). The least mobile component in the upper part of the gel, detected by fractionation in an alkaline medium, belongs to glutenins and is controlled by the Hrd.3 locus located on the long arm 5 of the barley chromosome. Samples of wild barley of expeditionary collection - showed uniformity in the spectrum of hordein and only sample № 7 had a specific spectrum of storage proteins.

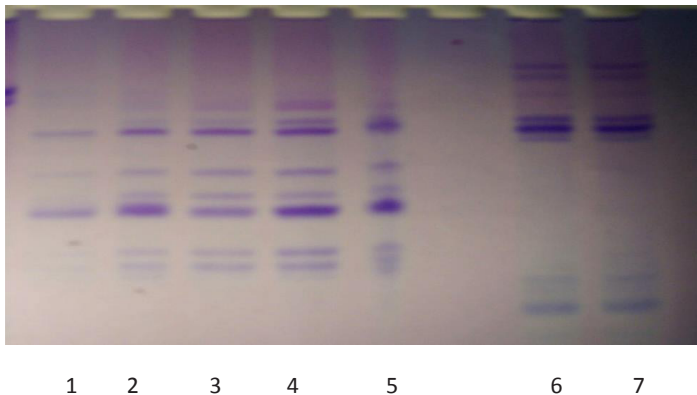


Fig. 1. – Range of prolamins of wild forms of barley: 1- *H. crinitum*, 2- *H. hystrix* Roth, 3 - *H. bogdanii* W., 4 - *H. brevisubulatum*, 5, 7 - *H. spontaneum*, 6 - *H. bulbosum*, 8-*H. geniculatum*.

2 allelic variants were revealed for hordein, the coding locus of Hrd A, 3 variants for the locus Hrd, 3 variants for the Hrd locus. Locus Hrd.3 revealed 2 alleles that control 2 variants of a high molecular weight, slow - mobile subunit (Fig. 2).

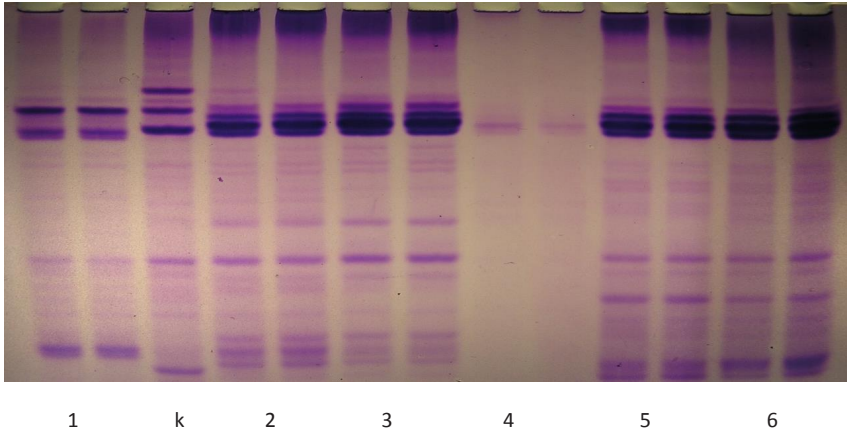


Fig. 2 - Prolamin spectrum of *H. vulgare* subspecies *spontaneum*, k - Donetsk 8.

The spectrum of storage proteins of the *H. spontaneum* subspecies was close in fractional composition to cultivated barley; at the same time, spectral variants encoded by allelic variants of the loci of the coding loci were not found in cultivars and collection numbers of cultivated barley (Fig. 3).

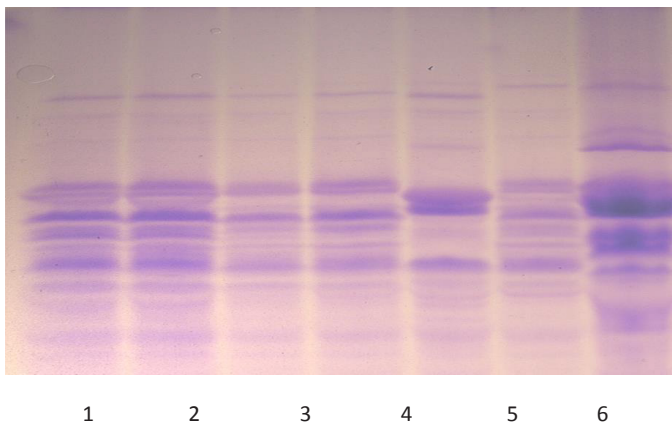


Fig. 3 - Glutenins spectrum of *H. vulgare* subspecies *spontaneum* (1-6) - Kazakhstan

Analysis of the composition of the storage proteins of 8 species - *H. crinitum*, *H. hystrix* Roth, *H. bogdanii* W., *H. brevisubulatum*, *H. spontaneum*, *H. bulbosum*, *H. geniculatum*, *H. leporinum*, wild species of barley from different places of growth showed heterogeneity of proteins in composition, significant inter - and intra-population polymorphism. The difficulty due to the small seeds of some species during the analysis is that the spectra are vague. During the analysis of 6 samples of the species *H.vulgare subsp. spontaneum* by the hordein-coding locus Hrd A, 2 allelic variants were revealed, by the locus Hrd B - 3 variants, and by the locus Hrd F - 3 variants. In general, wild forms of barley were characterized by a weak manifestation in the spectrum of components of the hordein α zone.

Conclusions

1. Samples of the local population of wild species of barley relatives were studied by phenotype. They were collected according to the habitat — speed and type of development, length of the growing season, plant height, spike length, resistance to rust, and protein content.

2. Revealed according to the analysis of the composition of the reserve proteins - heterogeneity, significant inter - and intra - population polymorphism. According to the analysis of 6 samples of the species *H.vulgare subsp. spontaneum* by hordein - the coding locus of Hrd A, 2 allelic variants were revealed, by the locus Hrd B -3 variants, and by the locus Hrd F - 3 variants. In general, wild forms of barley were characterized by a weak manifestation in the spectrum of components of the hordein α zone.

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**DETERMINATION OF DEPENDENCES OF CUTTING OF STALKS
OF SOY AND DEVELOPMENT OF THE GRINDER OF SOY STRAW**

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Abstract. The biometric indicators of soybean plants in the Amur Oblast are considered. A significant difference in the structure of thickness and stiffness of soybean stalks in comparison with cereal plants was determined, the cutting force was studied to develop a grinding device with cutting elements of a segment type. The joint work of the threshing device of the combine during threshing and the straw chopper will slightly change the value of efforts to cut soybean stalks, but in general, using the data obtained, it is possible to reliably determine the power consumption of the chopper when grinding soy straw.

Keywords: Soybean, harvesting, combine harvester, non-cereal part of the crop - straw, yield, thickness of stems, chopping, cutting force.

Soybean in the Far East ripens in the second half of September. By the beginning of harvesting, the leaves of the plants completely fall off, and the stalk and shells of the beans acquire a brown color. Soybean harvesting begins at a moisture content of grain of 14 - 16%, cusps and stems up to 30% [1, 2].

At the time of harvesting, the number of soybean plants per square meter of sown area is 40-60, and the height of the stems is 400-800 mm. The soybean stalk is solid, hard, with two to five lateral shoots. The thickness

of the stem at the root neck is from 4.0 to 8.0 mm (average 5.2 mm), in the middle part of the plant 3.5 - 6.0 mm (average 4.1 mm) and at the end 2 - 4, 8 mm (average 2.7 mm) with a moisture content of stems 25-30% (table 1).

Table 1 – The results of the research of biometric indicators of soybean plants during the harvesting period (2008 - 2019)

Sheaf selection date	Sheaf selection site	Varieties, selections of the ARSRI of soybean	The average height of plants from 1 m ² , mm	Stem thickness, mm		
				at the base	in the middle	at the end
29.09.08	EPF ARSRI of soybean	“Grace”	534	4,10	3,64	2,75
30.09.08	Agrofirm “Partizan”	“Lydia”	511	3,95	3,34	2,75
07.10.08	JSC “Dimskoye”	“Harmony”	510	5,44	4,37	3,05
14.10.08	“Amur MIS”	“Harmony”	712,6	8,0	6,08	4,85
10.10.09	JSC “Dimskoye”	“Lydia”	503	3,71	3,26	1,87
11.10.09	JSC “Priamurye”	“Dauria”	408,5	4,15	3,98	1,72
11.10.09	JSC “Priamurye”	“Lydia”	626,8	3,43	3,13	1,92
12.10.09	JSC “Dimskoye”	“Dauria”	406,5	4,01	3,72	2,1
27.09.19	ARSRI of soybean	“Sentyabrynka”	492,0	4,18	3,5	2,6
01.10.19	ARSRI of soybean	“Lydia”	709,1	7,2	4,96	3,2
09.10.19	ARSRI of soybean	“Dauria”	654,6	6,81	4,5	2,0
16.10.19	ARSRI of soybean	“Ketrosa”	668,9	7,0	4,5	3,1

In laboratory conditions, we determined the dependences of the cutting force of the stems R_{max} on the speed of the cutting element (segment), the thickness of the stems and their moisture (Figure 1, 2, 3). It should be noted that with an increase in the speed of the segment's influence on the stems at the same humidity, the cutting force decreases and increases depending on the thickness or diameter of the stems.

The analysis of the structural and technological schemes of grain choppers and spreaders of grain crops allowed us to develop a more economical version of the “IRVS-1200” soy straw chopper - spreader - swather, which is based on a constructive solution, for which patent № 2285563 was obtained.

The “IRVS-1200” shredder for the “Yenisei-1200” combine harvester contains a chopping drum made in the form of a rotor with inertial working knives of the segment type pivotally mounted on it along a helical line, working in tandem with opposing segments rigidly fixed on the knife beam. In order to interact at a certain point in time, only one working knife (segment) with a layer of soy straw coming along the guide, compacted and supported by a guide roller, the approach of the second working segment

of the rotor is shifted along the rotation axis by a certain amount, which depends on the number of working bodies placed along the length chopper rotor. The installation of chopping hammers-segments in a spiral contributes to better chopping and even distribution of the load on the rotor.

In a cross section, the second row of grinding working bodies is shifted relative to the first row by 180°, that is, each working body of one row is balanced by the corresponding working body of another row. The working bodies on the grinding rotor are arranged along a double helix and evenly around the circumference. This increases the reliability of the chopper.

The chopper's versatility lies in the fact that if it is necessary to collect straw for harvesting grain crops, it works in a swath pattern. To do this, the straw guide is set in the opposite position, and the straw coming from the straw walker is laid in a roll for subsequent selection and formation of rolls.

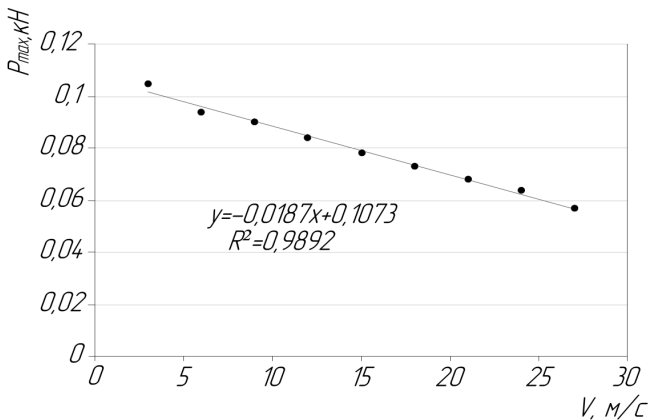


Figure 1. Change in cutting force of soybean stems depending on the peripheral speed of the segment

Considering the experimental data (Fig. 1), it should be noted that with an increase in the speed of action of a segment on stems at a humidity of 20%, the maximum cutting force decreases and reaches 60–70 N at an optimal speed of action of segments.

The data in Figures 2 and 3 show that with an increase in the moisture of the stems, the cutting force decreases and with a stem diameter of 3–4 mm and a moisture content of 25% is 60 N, however, with an increase in the diameter of the stems, the cutting force sharply increases even with a moisture content of 15–17% and the diameter of the stem 8 mm cutting force is over 100 N.

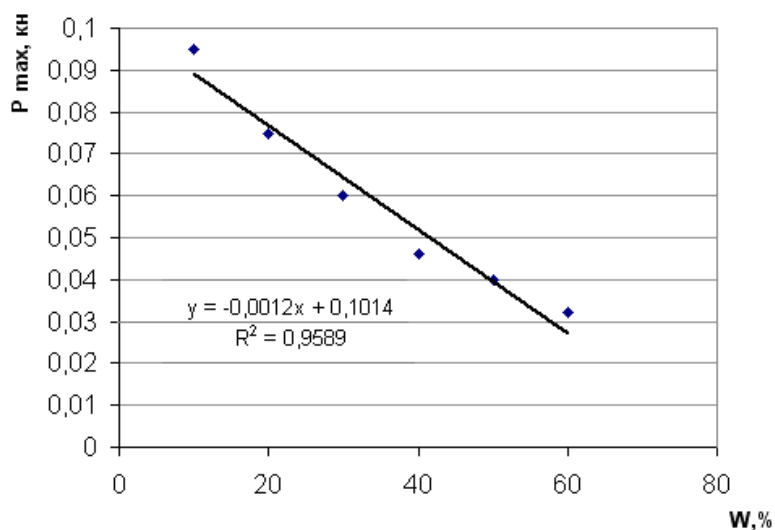


Figure 2. Change in cutting force of soybean stalks depending on their moisture

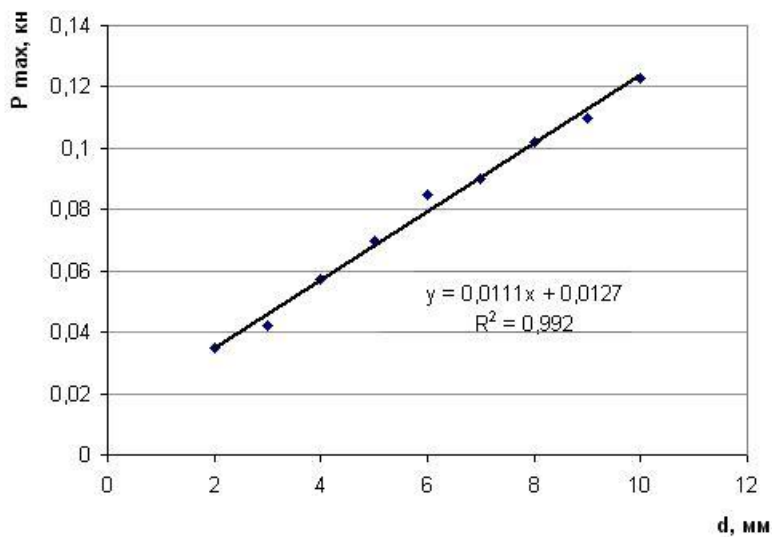


Figure 3. Change in cutting force of soybean stalks depending on their diameter

Analyzing the results of the experiments, we note that the greatest cutting force of single soybean plants is observed in stems with less moisture, as well as in stems of larger diameter or thickness. Therefore, the fewer plants of the bunch will fall into the simultaneous interaction of the knife and opposing parts of the grinder, the less power will be required for grinding. The joint work of the threshing device of the combine during threshing and the straw chopper will slightly change the value of efforts to cut soybean stalks, but in general, using the data obtained, it is possible to reliably determine the power consumption of the chopper when grinding soy straw.

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SOLAR SYSTEM FEATURES

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Abstract. A number of significant differences in the solar system are indicated. Compiled a table of the parameters of the planets of the solar system. It is shown that the evolution of the solar system occurred through the formation of two gas-dust clots. The function of potential and kinetic energies of each planet, linking data of a group of planets, is introduced. It is shown that the structure of the solar system and its rotation were significantly affected by relativistic effects. A new solution to the three-body problem in the form of Keplerian orbits is found, a model problem of beats is solved as the planets approach the stationary radius. A new scenario for the evolution of a gas-dust cloud into the solar system is proposed.

Keywords: angular momentum, gravity, Phidias number, oscillations, orbit

Introduction

The movement of the planets of the solar system is well understood. Its formation is a complex stochastic process, including the formation of protoplanetary disks, planetesimals, the migration of planets into the system and vice versa, and when moving toward the Sun, Jupiter start a chain of collisions between planetesimals. In this process, the Poynting-Robertson effect and light pressure act, and scenarios of accretion (coalescence of small particles) and gravitational collapse are realized. The structure of planetary systems is dictated by the parameters of the star (star system).

The number of giant planets depends on the metallicity of the star, i.e. its content is heavier than hydrogen and helium. The more heavy elements in the star, the more likely it is to find a giant planet next to it. Secondly, this amount depends on the mass of the parent star. The larger the star, the more likely it is to find a giant planet similar to Jupiter next to it. The stars of red dwarfs, which are lighter and much dimmer than the Sun, giant planets almost never occur, although there are exceptions. Among sun-like stars,

about 8.5% have giant planets heavier than Jupiter in orbits closer than 2.5 AU (The Sun is at 8.5%, Jupiter is located at a distance of 5.2 AU) Among the more massive stars (1.5–2.5 mass of the Sun), the proportion of giant planets is closer than 2.5 AU reaches 20%.

The stars 70 Virgo (70Vir) and 47 Ursa Major (47UMa) have two planets. The planet at 70Vir rotates in an elongated orbit in 116 days, the mass is approximately 9 times the mass of Jupiter. The planet is about 47UMa: a period of slightly less than 3 Earth years, the mass is 3 times larger than that of Jupiter, the orbital distance is 2 times the distance from Earth to the Sun.

The pulsar PSR 1257 + 12 has 3 planets with masses of 0.015; 3.4 and 2.8 Earth masses circulating in almost circular orbits with a radius of 0.19; 0.36 and 0.47 au and a period of 25.3; 66.5 and 98.2 days.

Another pulsar R8K 1828-11, about 12 thousand light years from the Sun, has 3 planets with masses of 3; 12 and 8 Earth masses, $R = 0.93$; 1.32 and 2.1 AU periods of 0.68; 1.35 and 2.79 years. Like P8K 1257 + 12, it has R (and periods of revolution) proportional to R from the Sun (and periods) of Mercury, Venus and the Earth.

The radii and masses of the seven earth-like planets of the TRAPPIST-1 system were measured.

Epsilon Andromeda is a sun-like star in the constellation Andromeda. 4 planets are known. Planet b is a typical hot Jupiter, the circulation period is 4.617 days, the major axis of the orbit is 0.059 AU, the eccentricity is 0.012. The minimum weight is 0.69 MJ. Planet c - orbital period 241.5 days, major axis of the orbit 0.829 AU, eccentricity 0.28. The minimum mass of 1.19 Jupiter. Planet D is a Class II gas giant containing water clouds. The period of revolution is 1284 days, the semimajor axis of the orbit is 2.53 AU, the eccentricity is 0.27. The minimum mass of 3.75 Jupiter. Planet e, orbit lies much further from the star than the rest. Orbits c and d are deflected relative to each other by 30 degrees.

A sun-like star is in the constellation Cancer, 5 planets are known in its system. This is a double star system. Planet e is a hot super-earth, the mass of which exceeds the mass of our Earth and has a large fraction of carbon in its composition, the circulation period is 17 hours 41 minutes The fifth planet f is 45 times more massive than the Earth, the surface temperature is slightly warmer than the Earth, because its star is dimmer and colder than the Sun. The presence of large amounts of water on surface f is assumed.

At the end of 2011, 584 multiple planetary systems (with two or more planets) were discovered.

The planets of the solar system move in orbits in the direction that coincides with the direction of rotation of the sun around its axis, counter-clockwise, if you look at the solar system from the North Pole of the Earth (straightforward direction). Around its axis, most planets also rotate in the forward direction (from west to east). Uranus rotates lying on its side, its rotation is reverse. Between the plane of the orbit of Uranus and the axis of its axial rotation is a small angle. The axis of rotation of Venus is almost perpendicular to the plane of the orbit, the rotation is reverse. For the rest of the planets, the angle between the axis of rotation and the plane of the orbit differs from the line by no more than 30° .

Note some features of the solar system.

1) The planets of the solar system rotate in one plane close to the plane of the equator of the sun. The reference to the gravitational contraction of the gas-dust cloud from which the Sun arose into the disk is untenable, since in other systems the planets do not rotate in the same plane.

2) The gravitational compression of the Sun and the increase in the speed of its rotation, which was transmitted to all the planets, occurred after the formation of the planets, the centrifuge effect drove the giant planets with a large mass to the periphery of the system. Otherwise, the light elements that make up the giant planets would be closer to the Sun.

3) All the planets of the system rotate in the same direction as the Sun. At the same time, some transit exoplanets (for example, the hot giants HAT-P-7b and WASP-17b) demonstrate the anomalous Rossiter-MacLaughlin effect, the planet rotates around the star in the direction opposite to the direction of rotation of the star around its axis, i.e. is in retrograde orbit.

Two groups of planets

We construct the complex z_i from the energy characteristics of the planet at number i , from the functions of its potential and kinetic energies, the kinetic energy is proportional to the root of its rotational energy, respectively, through the angular velocity:

$$z_i = U_i \omega_i$$

Using Kepler's second law in the circular orbit approximation

$$T^2 / a^3 = 4\pi^2 / [\gamma M(1 + m / M)] \approx 4\pi^2 / \gamma M \approx T^2 / r^3$$

we obtain: $z_i = m_i \sqrt{\gamma M} r^{2/3} / 2\pi$

Writing down the expressions for potential energy, highlighting the factors $m_i r_i$, where m – the mass of the planet, r – the distance to the Sun, and summing over i , we get an analogue of the center of gravity relative to the Sun with weight coefficients.

Table 1

	$m, 10^{24} \text{ kg}$	$R_{aw}, 10^6 \text{ m}$	$w, 10^{-6} \text{ sec}^{-1}$	$W, 10^{-7} \text{ sec}^{-1}$	$r, 10^6 \text{ m}$	$M, 10^{24}$	$L, 10^{33}$	z/z_{Earth}
Mercury	0,33	58	1,22	8,3	2,4	0,93	0,9	0,559
Venus	4,86	108	0,3	3,2	6,1	21,7	3,7	1,844
Earth	6	150	72,7	2,0	6,4	7146,7	27,0	1
Mars	0,64	228	71,5	1,1	3,4	211,6	3,7	0,038
Jupiter	1907	778	176,2	0,017	70	$6,6 \times 10^8$	19×10^9	5,152
Saturn	571	1427	165,6	0,068	58	$1,3 \times 10^8$	$7,8 \times 10^9$	0,339
Uranus	87	2869	101,0	0,024	25	$0,02 \times 10^8$	$1,7 \times 10^9$	0,009
Neptune	103	4498	109,3	0,012	24	$0,03 \times 10^8$	$2,6 \times 10^9$	0,003
The Sun	$2,2 \times 10^7$	0				$0,6 \times 10^{18}$	0	

Parameters of the planets of the solar system

M – angular momentum of the planet relative to the axis of proper rotation, L – relative to the sun. The moment of momentum of the planet - $m[\vec{v}, \vec{r}] = mr^2W$. The moments of inertia of the planets are calculated roughly, according to the formula $J = 2mr^2 / 5$. We single out the planets according to natural groups – the terrestrial planets and giant planets. It turns out that the analogues of their centers of gravity are proportional to each other

$$\sum_i U_i^C \omega_i^C \square \sum_j U_j^r \omega_j^r \square \sum_k U_k^3 \omega_k^3 \tag{1}$$

Proportionality factors – F and F^2 respectively. That is, the sums of the complexes z_i are analogues of line segments a and b satisfying the relation

$$a / b = (a + b) / a = \Phi = 1,618$$

Of course, all calculations are approximate, since the planets have satellites and rings, in the Solar there are planetoids, the main asteroid belt, Kuiper belt, other groups of asteroids, comets, and cosmic dust. However, among other things, the number F indicates that a homogeneous space has formed in the system.

Suppose a certain analogue of the system of two groups of planets is a simple oscillatory system, where the number F is involved. Consider two identical weights hanging on springs, one of which is attached to the ceiling. An expression for the natural frequency of their oscillations can be obtained from the Lagrange equations [1]:

$$\frac{d}{dt} \frac{\partial L}{\partial \dot{q}_i} - \frac{\partial L}{\partial q_i} = 0, i = 1, 2, \dots, n,$$

where L – the Lagrange function of a system with n degrees of freedom, determined through the kinetic energy T and potential energy U as follows: $L(q, \dot{q}) = T(q, \dot{q}) - U(q)$.

Here q, \dot{q} - vectors of generalized coordinates and generalized velocities, respectively.

$$L = \frac{m\dot{x}_1^2}{2} + \frac{m\dot{x}_2^2}{2} - \frac{k \cdot (x_2 - x_1)^2}{2} - mg(x_{01} - x_1) - m(x_{02} - x_2)$$

where x_{0j} - position of balance weights.

$$m\ddot{x}_1 = mg - kx_1 - k(x_1 - x_2)$$

$$m\ddot{x}_2 = mg - k(x_2 - x_1)$$

We introduce the natural frequency of individual weights: $\omega_0^2 = k/m$. Since gravity is constant, it only determines the equilibrium position, therefore, it can be excluded by redefining the coordinates. We are looking for a solution in the form $x_j = A_j \exp(i\omega t)$, $j = 1, 2$. Substitution leads to a homogeneous system of algebraic equations for determining the coefficients A_j :

$$A_1(2\omega_0^2 - \omega^2) - A_2\omega_0^2 = 0$$

$$-A_1\omega_0^2 + A_2(\omega_0^2 - \omega^2) = 0$$

The system has solutions only at certain frequencies ω . The latter should be determined from the condition that its determinant is equal to zero. We get: $\omega^4 - 3\omega_0^2\omega^2 + \omega_0^4 = 0$, where from

$$\omega_1^2 = \omega_0^2(1 + \Phi); \omega_2^2 = \omega_0^2(2 - \Phi)$$

$$\omega_1 = \pm\omega_0\sqrt{1 + \Phi}; \omega_2 = \pm\omega_0\sqrt{2 - \Phi}$$

Thus, the eigenfrequencies of synchronous oscillations of the system of two weights are not one, but four, and all are proportional to the "partial" eigenfrequency of individual weights, one below it and the other above. The proportionality coefficient is expressed in terms of the Phidias number.

A particular solution to the problem with three weights of different weights is given in [2], a general solution with many identical weights is given in [3].

A particular solution to the synchronous vibration of many oligosomes with different masses in DNA is: $w = (G/NM)^{1/2}$, where G - rigidity, N - harmonic mean: $N = (1/N_1 + 1/N_2 + 1/N_3 \dots)^{-1}$.

Mass of oligosomes $m_j = N_j M$, M - monomer mass in oligosome, N_j - the number of monomers [4]. That is, the role of mass in the formula for a spring pendulum in the form of a DNA helix is played by the harmonic mean mass of all oligosomes [4].

The motion in the field of central forces and the Keplerian problem are considered in detail in [2]. We complicate the system, but simplify the ap-

proach. We show that the oscillatory regime is also possible in the field of central forces.

Consider a system of two interacting weights (two groups of planets), where the role of a tightening spring is played by the force of gravity, which counteracts the acceleration of rotational motion around a fixed center (the Sun).

Since centrifugal acceleration $a = v^2/r$ and $v = wr$, the system of equations of motion is written as follows:

$$m_1 \ddot{r}_1 = \gamma M m_1 / r_1^2 - m_1 \omega_1^2 r_1 - \gamma m_1 m_2 / (r_2 - r_1)^2$$

$$m_2 \ddot{r}_2 = \gamma M m_2 / r_2^2 - m_2 \omega_2^2 r_2 + \gamma m_1 m_2 / (r_2 - r_1)^2$$

where M – mass of the sun, m_1 and m_2 – masses of planets, the second is more distant. This system is a three-body problem in the collinear representation of Euler, with one motionless body (the Sun) and with $M \gg m_2 > m_1$.

We show that the stationary orbits of the planets are Keplerian. We equate the derivatives to zero and add both equations: $\gamma M [1/r_1^2 + 1/r_2^2] = \omega_1^2 r_1 + \omega_2^2 r_2$. If we substitute in the left part the expression for the coarsened (instead of ellipse - circle) Kepler's 2nd law, we get the identity.

If we take into account the comparability of the difference between the radii and the second radius of smallness of the masses of the planets in comparison with the mass of the Sun and neglect the interaction of the planets, the system decomposes into two identical disconnected equations:

$$\ddot{r}_i = \gamma M / r_i^2 - \omega_i^2 r_i$$

We make the equations dimensionless, introduce $t = \omega \tau$, $\omega^2 / \gamma M = k^2$ and $r = k^{-1} y$. Then the equations can be written as:

$$\ddot{y} + y - k / y^2 = 0$$

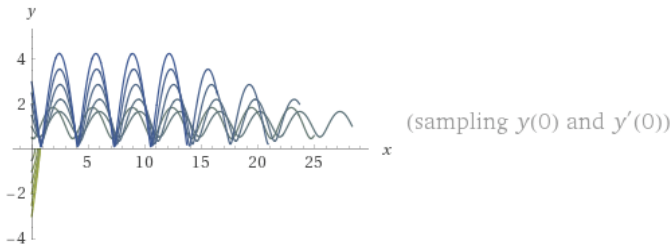
Substituting $\frac{dy}{dy} \frac{d\dot{y}}{d\tau}$ we can obtain $\dot{y} = (C_1 - 2k / y + y^2)^{1/2}$,

$$\tau = \int \frac{dy}{\sqrt{y^2 - 2k / y + C_1}}$$

which corresponds to formula 14.6 in [2]. The final decision is not expressed in analytical functions. Computer simulation shows that many

solutions are beats, oscillatory movements, damping near a certain stationary radius.

Graph 1.



Graph of the change in the radius of the planet in the field of the Sun

From *Graph 1* it can be seen that the expressions for the beat frequencies can in no way be associated with the Phidias number.

The solution for the second planet will have a similar form. This is the solution of the three-body problem, reduced to the two-body problem when their interaction is neglected. It follows that the parameters of the planets that satisfy relation (1) were established precisely due to the interaction between the planets. As can be seen from the equations, in this approximation, the value of the stationary radius does not depend on the mass of the planet. However, the interaction between the planets leads to the fact that planets of approximately the same mass are distributed in the planetary system as follows: the larger the radius of the planet, the farther it is from the star (correlation coefficient $r = 0.65$, $p < 10^{-5}$). Secondly, if the periods of revolution of the n th and $(n + 1)$ -th planets are related as 2: 1, then the periods of the $(n + 1)$ -th and $(n + 2)$ -th planets are also referred to as 2: 1 ($r = 0.46$, $p < 10^{-5}$) [5].

The Lagrange solution of the three-body problem gives an equilateral triangle and does not describe the structure of the solar system. Thus, we can assume that the Solar System implements yet another solution to the three-body problem, where one body is the Sun, another is the Earth group, the third is a group of giant planets, and the structure of two planet groups is such that relation (1) is satisfied.

That is, it is completely optional that this solution will be true for all planetary systems in which completely different solutions to the problem of three or more bodies can be implemented.

The above calculations indirectly confirm the erroneous discovery of the 9th planet of the solar system. On 20.1.2016, a hypothesis was put forward about its existence, outside the orbit of Pluto - to explain the movement of trans-Neptune objects. Using computer simulation, its mass was

determined, approximately 10 times larger than the Earth, diameter - 2-4 times larger than the Earth, a full revolution around the Sun - for 15 thousand years. A 9th planet would violate relation (1). However, it was calculated that the unusual orbits of some trans-Neptune objects are explained by the influence of gravity, not of the 9th planet, but of small objects that make up the disk outside the orbit of Neptune. The facts proving its existence are based on statistical imbalances in the astronomical database [6, see also 7].

Rotation

What caused the rotation of the solar system, the sun, the planets around the sun and the planets and the sun around their own axes? The reference to the asymmetry of the primary gas-dust cloud is untenable, if initially the gas-dust cloud has no angular momentum, it will be zero in the future.

Obviously, the point is the absence of the law of conservation of the classical angular momentum in GR.

In [8], the approximate Fock method was used; it was shown that the relativistic theory of gravity in comparison with Newton's theory leads to the conclusion that if there was no rotation in the system of bodies, it arises from their translational motion.

Unfortunately, the article made a mistake, it is argued that the law of conservation of the total moment - the sum of the orbital and intrinsic moments.

An elementary calculation for the solar system shows that this is not so, as can be seen from *Table. 1*. The fact that almost all the planets revolve around themselves in the same direction in which they revolve around the Sun suggests that the total angular momentum of the Solar system is not equal to zero. That is, when the system was formed from a gas-dust cloud that did not have an angular momentum, the law of conservation of angular momentum was violated.

In GR, the intrinsic angular momentum has the form:

$$L_d = \varepsilon_{abcd} (J^{ab} - Y^a p^b + Y^b p^a) p^c / m ,$$

where ε_{abcd} - 4- Levi Civita symbol, m - mass, p^a - 4- momentum, $Y^a = J^{ab} p_b m^2$, J^{ab} - angular momentum relative to the origin:

$$J^{ab} = \int (x^a T^{b0} - x^b T^{a0}) d^3x ,$$

where integration is carried out over the area occupied by the system. The law of change of the 4-angular momentum is formulated in a complex way, through the effective energy-momentum tensor obtained by adding to the usual Landau-Livshits pseudo-tensor tensor. The 4-momentum and 4-an-

gular momentum are preserved only in the linearized theory and with the introduction of gauge [9].

However, the conclusion in [8] about the generation of rotation by translational motion remains and is almost trivial: in strong gravitational fields, in curved space, translational motion should generate rotation. Thus, the expansion of the Universe created the angular momentum of the Solar and other planetary systems, as well as galaxies. Due to the isotropy of space, their total angular momentum is zero. This means that the formation of the solar system did not begin 4.6 billion years ago, but much earlier, when the curvature of space was significant. Or it must be assumed that the curvature did not fall over time as fast as it is now commonly believed.

Conclusion

From this it can be assumed that the formation of the solar system occurred as follows.

1) From a gas-dust cloud with a density of $(10^{-18} - 10^{-19}) \text{ g/cm}^3$ and a temperature of about 100 over a period of about 105 years [10], the Sun was formed, possibly due to the occurrence of gravitational instability due to external influence [ibid.].

2) The Casimir effect could play the role of external influence - with space being limited by the framework of a gas-dust cloud (see, for example, [11], where the Casimir effect of a scalar field was considered).

3) The gravitational forces of the Sun, since they are proportional to the masses, separated the heavy elements of Fe, Ni, Si, Al, Mg, O from light, H, He.

4) Since there are much more light elements, they formed a clot from which giant planets arose, the clot was displaced to a large distance due to the centrifuge effect.

Thus, the formation of the solar system did not occur according to the Kant-Laplace model, but separately: the sun and protoplanets.

5) The second gas clot was formed from heavy elements, and the terrestrial planets arose from it.

6) Relativistic effects gave the planets, the Sun and the whole system as a whole a rotational movement around the center of mass.

7) The formation of planetary groups from two clumps, the gravitational interaction between them predetermined the further rotation of almost all the planets in one plane.

8) The system acquired its final form after the start of thermonuclear fusion inside the Sun, the T Taurus wind removed the dust-cloud clusters over long distances from each other for 10^6 years, the temperature difference (from several thousand K in the inner part of the Solar System to 100 K in the outer) determined the snow line (ice line), according to the temperature of solidification of water, carbon dioxide and methane, located at a distance

of about 3 AU from the Sun, in the middle between Mars and Jupiter. Saturn and Jupiter retained the gas component, Neptune and Uranus lost most of it.

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ON THE INTERRELATION OF MATHEMATICS, PHYSICS AND PHILOSOPHY

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Abstract. The key points of the teachings of the Pythagorean school are considered. Using concrete examples from the theory of oscillations and celestial mechanics, a radical difference in research methods in both mathematics and physics is shown. An assumption is made about the possibility of the existence of new world constants that do not have dimensions, associated with time and with a number of fundamental interactions.

Keywords: World constants, methodology, frequency, planets

Introduction

The fact that mathematics was created in view of the urgent problems that stood in ancient times, is indicated by Gaidenko [1]. Using geometry, we calculated areas and volumes, using arithmetic we calculated the price of bread, wages, and mathematics was needed during construction. Among the Egyptians and Babylonians, mathematics acted as a means, the Pythagorean school turned mathematics into a separate subject of research, Gaidenko notes.

Such a transformation is an objective process of ascent from the concrete to the abstract. Physics is similar with the introduction of integro-differential notation, completed by Leibniz and Newton, with the discovery of Kepler's laws and further the Hook-Newton law of universal gravitation, etc. divided into experimental and theoretical. "Theoretical physics," Landau remarked to experimenter Joffe when discussing the quantum tunnel effect, "is a complex subject, not everyone can understand it." Nevertheless, the priority remains for experimental physics. So, Peierls and Landau theoretically proved the instability of two-dimensional lattices, the impossibility of graphene, but graphene was obtained. For in the dialectic pair "practice - theory" practice is primary, determining. Yet Holmes's question to Dr. Watson, why astronomy is needed in everyday life, is not trivial.

It would seem that cosmology, astrophysics, the detection of gravitational waves, for which more than \$ 200 million were spent only in the last project, are of purely cognitive value. However, all these disciplines are connected with the rest of physics; their methods are used both in hydrodynamics and in solid state physics. Thanks to celestial mechanics, tidal power plants were built, cosmology and astrophysics give answers to questions about the already close relocation from the Earth, if in the next centuries the rate of expenditure of Earth's resources does not slow down, after 200 years the world's population will be without resources. The Mossbauer effect has long been presented as a purely academic study. Today, this effect is used even in agriculture.

As Marx said, in science there is nothing but its practical application. On the other hand, Marx is right conceptually, but not situationally. Otherwise, the world would not have known astronomy. It would not have occurred to Aristarchus of Samos to propose a heliocentric system of the world and to determine the distances to the Sun and the Moon and their sizes. And the point is not only that cognition cannot be limited by the economy. In order for Galileo to renounce his claim that the Earth rotates around its axis, they tortured him so that they carried him to a place of renunciation on a stretcher, Giordano Bruno was burned at the stake. Science, the process of cognition require rejection of dogma, they reflect not only a utilitarian, but also a worldview aspect. No tricks and twists can obscure the fact that scientific data on the origin of the Universe and the origin of life on Earth, Darwin's theory and the synthetic theory of evolution built on its basis directly refute religious writings.

Today, unsolved problems in number theory, the hypotheses of van der Waerden, Collatz, Erdős, the problems of Waring, Goldbach, etc., seemingly, are separated from the immediate needs of mankind. Nevertheless, substantial funds are being invested in solving these problems.

But Pythagoras and his students did not simply ascend from the concrete to the abstract, they unilaterally, exaggeratedly raised one of the features, sides, faces of knowledge into absolute, they wanted to explain from the nature of everything that exists. Mathematics is methodologically separated from nature, in the mind of the Pythagorean - it loses touch with it. Then mathematical abstractions are put in the basis of matter as primary. Engels argued, for example: "Mathematical infinity is borrowed from reality ... and therefore it can be explained only from reality, and not from itself, not from mathematical abstraction. [2].

This article is not so much a criticism of mysticism in the spirit of Nordau as an attempt to present the reverse process: the ascent from the abstract to the concrete.

Scientific laws and mysticism

The laws of physics are not applicable in history, the laws of biology in chemistry. On the other hand, physical laws in the field of quantum chemistry explain some chemical processes, if experimental data are used, other physical laws are used in biology (biophysics, bionics). In the last century, it was discovered that the same differential equations (Belousov-Zhabotinsky, Andronov) describe hydrodynamic processes, chemical reactions, and even biological systems. Synergetics encompasses all of nature; catastrophe theory is able to predict the situation on commodity and financial exchanges. Similarly, the theory of probability that arose in the 17th and 18th centuries describes physical, chemical, biological, and social processes. And, although the higher forms of motion of matter are not reducible to the lower ones, mathematics is a reflection of all nature, its laws, and general necessary connections.

The only thing that mathematics cannot describe is the individuality of a person. For the reason that physics, chemistry, biology deal only with repeatable phenomena. In view of this, Aristotle did not see (in theory) a significant difference between Callias and Socrates [3]. The doctor does not treat Callias and Socrates, he treats the general in their organs, not with a specific disease, but something averaged.

The number is not contained in the substance. At the same time, it is common to various substances, manifests through them, does not exist separately from them. Substances are not identical to each other, two metal balls are identical, as if it is impossible to summarize in view of their incomplete identity. Mathematical abstraction is distracted from insignificant differences, highlighting the general. Aristotle, one of the founders of dialectics, did not yet understand the dialectics of the singular and the general, that the essence is not separate from things, because he believed that the individual cannot be the subject of knowledge. But precisely for this reason, the basic social laws cannot be described mathematically. For example, the value of the goods is tangible (see [4]), i.e. exists objectively, regardless of the consciousness of the individual, but is not immanent to the product, like mass or charge, it exists only in the heads of people. Therefore, social laws are manifested only as trends, potential opportunities that may not be realized [5].

For example, there is a tendency to centralize capital, expressed in globalization, but it runs into the opposite centrifugal tendency, expressed in the growth of nationalism. Another example - the war of the poor South with the rich North predicted in [6] was expressed not in a clash of armies, but in the ugly form of Islamic fundamentalism. At the same time, the typicality, identity of "uniqueness" is expressed not only in ethnic, national,

state forms or in forms corresponding to the manipulations of the mass consciousness, but even in identical fragments of verses that are not citation. If the former is expressed in the formulation of Marx tied to the existing mode of production, that personality is a concrete totality of social relations, the latter is an independent phenomenon.

The distinction between the Pythagorean half-pass and Aristotle's approach to mathematics is not reduced to worldviews, it concerns the way of thinking, methodology.

One of the justifications of the materialistic method in mathematics is the history of its origin. The history of numbers begins 5 thousand years ago in Egypt and Mesopotamia, when animal husbandry and agriculture are developing. The founders of the special designations of numbers are considered the Sumerians, I - II millennium BC. The Indian positional number system, which Europe became acquainted with thanks to the Arabs, made it possible to record numbers using ten digits. In the Persian era, which began with the reign of Cyrus, a special symbol appears for zero, until this time the smallest number was one, and for Pythagoras too. In the III century BC Archimedes and Pythagoras substantiated the concept of infinity of a natural number. Pythagoras was one of the first to give the number an independent existence separate from matter. He created the philosophy of numbers, turned upside down the history of the emergence of numbers. The Pythagoreans "recognized the mathematical principles for the beginnings of everything that exists," Aristotle noted [7]. Pythagoras believed that "all things are numbers," numbers are ultimate, the primary basis of the world, because they are present in the living, and inanimate, and in the earth, and in the sea, and in heaven. This discourse in its unchanged form has survived to the present day, a variety of authors argue that, since the number is invariably present in completely different changing things, being a single basis, the number can be considered the beginning of the world. Among the adherents of this direction of the Pythagorean school, it comes to funny things, they believe that the interaction of independent numbers among themselves leads to a variety of things, the whole natural world is built of numbers, the world of spirit is reduced to number: love and friendship are identified with the figure eight, justice with multiple numbers. Thus, the whole world is a consistent deployment of an ideal entity - numbers. That is, various specific numbers endow with supernatural, magical properties, both in the era of Pythagoras and to this day: 5 - the number of happy marriage, in Judaism 7 - the number of luck, prosperity, 666 - the number of the devil, etc., the sum of the numbers date of birth supposedly determines fate.

The logical conclusion of the discourse - at the curiosity level, they say that the positive nucleus of an atom has a negative nucleus inside, a nucleus in the nucleus, in the form of a complement to the whole, to unity, the numerical axis in the sum and in the product of all members is equal to one, since it was born like a world from one, etc.

Moreover, the philosophy of Pythagoras was not something abstract, a certain game of the mind. His doctrine of harmony had a clear political goal - to put the demos in complete submission to the power of the aristocracy. The worldview, morality of Pythagoras is the worldview and morality of an aristocrat. Each member of the Pythagorean Union was required to follow virtue, and among virtues - the virtue of obedience. In one of his Golden Poems, Pythagoras writes: "First of all, honor and love gods, heroes, creatures, between gods and heroes, but don't ask them for anything in your prayers, you yourself don't know what is good for you, it's but only they know".

For Pythagoras, the number 7 connects a person with a deity, since 3 is a deity, and 4 is a person.

We owe the Pythagorean teaching a theorem on the connection of the sum of squares of legs with the square of the hypotenuse in a right-angled triangle, the theorem on the sum of the angles of a triangle, distinguishing even, odd and even-odd numbers, studying the motion of celestial bodies. But, as we see, the significance of the Pythagorean school is far from exhausted. Quantitative abstraction was opposed to nature, arose as a system of mysticism of numbers. Instead of a moving, diverse, developing nature, the Pythagoreans have empty, devoid of movement abstractions. According to Pythagoras, the body for the soul is something random [8]. The teachings of Pythagoras, Architus, Eudoxus, Philolaus, as an attempt to idealistically comprehend the quantitative side of nature, became the basis of the Plato system.

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The teachings of Pythagoras, Architus, Eudoxus, Philolaus, as an attempt to idealistically comprehend the quantitative side of nature, became the basis of the Plato system. Mathematical symbols do not exist either in objects or outside them, they do not precede being. Symbols are the result of abstraction, highlighting in the subject of its certain side, the rest is discarded.

But does the common exist only in the form of similarities of many individual objects, only as one of the parties, separately only in the human head, in the form of a symbol? - asks a question Ilyenkov. And he answers: in fact, such a formulation of the question does not abstract the side, but the whole thing, pulls it out of its physics, its history. General - is a clan relationship in the objective world.

Is the singular in the sense of development as an ascent from the simple to the complex and from the lowest to the highest? Yes, if it itself is a minimum is a special variety.

The "Pythagorean" type of thinking is seen in Eckhart, Boehme, Jung, Aurobindo, James. Physicists are engaged by no less than journalists, along with interpretations within the framework of various expositions of the Copenhagen concept, there is also a mystical version of the quantum mechanics of Eddington - Jeans - Schrödinger - von Neumann in the spirit of primitive subjective idealism of Hume - Berkeley. In attempts to create a unified field theory, in the theory of gravity, a whole direction, represented, for example, by J. Wyndham, J. Wheeler, etc., is associated with an attempt to put geometric symbols at the basis of the world, replace dynamics with geometrodynamics, quantum fluctuations of matter with quantum fluctuations of the metric space.

Space-time is eternal and unchanging, Plato believed. The concept of empty space having its own being goes back to Thales, Anaximander, Leucippus, Democritus, Epicurus, Lucretius Carus. Galileo, Descartes, Hobbes, Newton affirmed the concept of substantial, absolute, independent of the subject of time. Hume, Mach considered space-time phenomena of consciousness, Augustine - time. The connection between the material world and the space-time form appears in Einstein's theory: the greater the mass, the greater the curvature of space and the slowing down of time. The empty Minkowski space is formed by the material Higgs vacuum [10].

In Einstein's theory, the energy-momentum tensor defines the structure of space-time. However, in many scientific articles the opposite is true: material filling is adjusted to the chosen metric. As a rule, such articles contradict new discoveries in cosmology.

Similarly, the physical characteristics of motion are endowed with a mystical meaning: mass, speed, energy. Energy is separated from the carrier, "energy particles", "energy fields", and "pure energy" that do not exist in nature are used, just as information is separated from the carrier, the "information field of the universe" is created, information is recorded on some carriers up to the state of a healthy organism. Finally, quantum mechanics is used to justify the supernatural, which is why the EPR paradox and quantum entanglement are very useful. Although it is well known that the laws of macroscopic physics do not work at the quantum level, it is pointless to discuss the excess of the speed of light in the stretched wave packet of a system of quantum particles, to detect the influence of the future on the past, to state that information is transmitted not in matter with quantum entanglement, etc. Obviously, the connection between entangled objects exists, but cannot be understood within the framework of classical determinism. As Lenin said, causal communication, which we usually understand, is only a part of global communication. "Every movement includes a mechanical movement and the movement of large or smallest parts of matter ... But this mechanical movement itself does not at all exhaust movement" [11]. The quantum world does not have to be microscopic, but can extend a thousand kilometers.

If the origins of the mysticism of the Pythagorean school, first of all, are epistemological and only in the second, as we saw - social, now the decrease in the level of generalization to animism, fetishism, totemism is generated primarily by the collapse of the economy and only in the second, as a result - by a decrease in the level of educational qualification. These processes gave rise to an idea (e.g., A.P. Gurevich) of mysticism, i.e. about crowning, etc., as part of a spiritual culture.

World constants

The number of world constants with dimension includes the electron charge, Planck's constant,

Boltzmann constant, speed of light in vacuum, electric constant (determines the value of the peak of the process of emitting a virtual photon) and gravitational interactions.

In gauge theory, the coupling parameter g has the dimension \sqrt{hc} . The strong interaction constant has the same dimension. Finally, the weak interaction constant (Fermi constant) determines the value of the peak of the muon decay process. The cosmological constant and the Hubble constant are also referred to world constants, although the latter change during the evolution of the Universe. There are no restrictions to consider other dimensional world constants changing with time. This hypothesis was first put forward by Henri Poincare in the early twentieth century.

For example, Australian physicists, led by theorist Paul Davis of Mc-Quare University in Sydney, suggested that when billions of light-years pass, the speed of light in a vacuum decreases. Astronomical observations showed that for the light from the selected quasar to reach the Earth, it will take about 10 billion years. In this case, the key constant characterizing the ratio of light photons and electrons on the quasar has changed, i.e. after 12 billion years of travel, the characteristics of light traveling from a quasar to the Earth do not correspond to those predicted by SRT. This discrepancy can be explained either by a change in the charge of the electron, or by a change in the speed of light. It may turn out that 6-10 billion years ago the speed of light could be higher than now. From dimensional world constants such relations are obtained, for example, Planck radius or Planck time.

World constants that do not have dimensions include ρ - the Archimedes number, the base of the natural logarithm of e (Euler or Napier number), the Phidias number (golden ratio), and the Feigenbaum constants. Another world constant, a fine structure constant, does not have dimensionality, but it can be represented as a ratio of other world constants having a dimension.

Feigenbaum numbers are clearly associated with processes occurring in nature. These are universal constants characterizing an infinite cascade of period doubling bifurcations during the transition to deterministic chaos. First constant $d = 4,66920016\dots$, characterizing chaos, sets the form of fractals associated with chaos. The second Feigenbaum constant $a = 2,502907\dots$ is defined as the limit of the relationship between the width of the branches in the bifurcation diagram. This constant also arises in the description of many dynamical systems.

The Napier number stands out from the other bases of the logarithms in that $(e^x)' = e^x$.

The first to pay attention to the "harmonic" "division of the segments was Pythagoras. In 1509. Fra Luca Pacioli called this division the "Golden Section". The Phidias number corresponds to the homogeneity of space, the Archimedes number - to the isotropy of space in non-Euclidean geometry, they are transformed. So, by the Gauss-Bonnet theorem, the integral of the Gaussian curvature on a compact 2-dimensional Riemannian manifold is equal to $2\pi c(M)$, where $c(M)$ - is the Euler characteristic of the manifold. As Engels wrote, "a unit, no matter how it appears identical to itself, contains infinite diversity" [12].

Number theory is occupied by various numerical sequences, for example, Fibonacci numbers, curly numbers, Fermat or Mersenne primes, etc. The extension of the field of real numbers is complex, hypercomplex

numbers (quaternions, Cayley numbers or octaves), vector spaces. p -adic theory (expanding the field of rational numbers \mathbb{Q} with the abandonment of the Archimedes axiom), which is used in quantum mechanics, as well as fractal geometry, with fractional dimensions and corresponding differentiation and integration, opens up wide possibilities for introducing additional world dimensionless constants. Fractional dimensions are expressed in probability theory.

The Euler number is related to such contradictory concepts as infinity and continuity; these very concepts connect it with the Archimedes number via the Gaussian integral: $\int_{-\infty}^{\infty} e^{-x^2} = \sqrt{\pi}$ - since the Archimedes number

can also be represented as the sum of the members of a numerical sequence. The first Feigenbaum constant is elementarily expressed in terms of the Phidium number $\delta = \Phi^{3/2}(1 + \sqrt{\Phi})$. Thus, the first Feigenbaum constant is not fundamental, and the Phidias number is also involved in the theory of fractals and the dynamics of chaos.

Distinction methodologies

Unfortunately, one has to pay attention not so much to criticizing scientific errors as to explicit engagement that is not related to science. For example, in the literature on the golden section, Butusov's article [13] is widely used. Butusov tried to explain from the numbers the trajectories and masses of the planets of the solar system. It is claimed that Butusov discovered the laws associated with the number of Phidias, and even quantum effects in the structure of the solar system, on the basis of which he predicted the parameters of the three supposed planets beyond Pluto. Butusov calculated that in the Earth's orbit at the libration point beyond the Sun there is another planet similar to the Earth. However, the STEREO satellites launched in 2007 observed the area of the Lagrange point and did not find objects there.

Butusov is also credited with the prediction of 10 unknown satellites of Uranus, they say that in 1974 he predicted the discovery of Sedna. In fact, the prediction of 6 new satellites of Uranus was made by two Soviet scientists who received a state prize for this. The orbits of the satellites are calculated according to their resonance model. And in 1973 no one predicted the existence of Sedna.

Let us give an example of a scientific methodology.

In a problem with two identical weights suspended on springs and oscillating synchronously, their frequencies $\omega_1 = \pm\omega_0\sqrt{1+\Phi}$; $\omega_2 = \pm\omega_0\sqrt{2-\Phi}$ are determined through the "partial" frequency of individual weights ω_0

= k/m ... Thus, the eigenfrequencies of synchronous oscillations of the system of two weights are not one, but four, and all are proportional to the "partial" eigenfrequency of individual weights, some lower than it, others higher. The proportionality coefficient is expressed in terms of the Phidias number. A particular solution to the problem with three weights of different weights is given in [14].

A general solution with many identical weights connected by springs is given in [15]. A particular solution with many different weights (oligosomes in DNA) for the frequency of synchronous vibrations is given in [16]; the frequency of a spring pendulum in the form of a DNA helix is inversely proportional to the square root of the average harmonic mass of oligosomes.

Now we give an example of a reverse, upside down, mystical methodology. It is presented in [17], where an abstract system of two equations is considered. According to the author himself, he allowed himself to "move away from any physical reality", however, he writes about oscillations with a set of frequencies. In fact, the equations under consideration correspond to oscillations of a system of two weights with different masses on springs.

However, instead of its general solution, a solution is sought that would lead to the number of Phidias. With the same success, one could look for a solution leading to the Archimedes number or to the Euler number.

Similarly, in numerous publications, including in [ibid., P. 441], attempts are being made to detect certain resonances in celestial mechanics. And it's not just about trying to derive a formula similar to the Titius-Bode rule of thumb, according to which the radii of the orbits of all the planets of the solar system except Neptune, the planets lie on the sequence $R_n = 0,4 + 0,3 \times 2^n$, where R – the radius of the planet, n – its number starting from Mercury. Researchers, not understanding the essence of the resonance model, are trying to attract the constructed empirical formula precisely to the Phidias number. Moreover, they are not confused that some planets fall out of the resulting structures, in which case it is claimed that they are "approaching" the resonance. Approximate non-integers are identified with Fibonacci numbers only by the coincidence of their integer parts, the resonance model itself is perverted, it is argued that for resonance it is enough that the rotation periods of the planets relate to each other as integers, even with decimal additions.

"Orbital resonance in celestial mechanics is a situation in which the periods of revolution of two (or more) celestial bodies" are correlated as small natural numbers. As a result, these bodies periodically come together, being at certain points of their orbits. The resulting regular changes in the force of gravitational interaction of these bodies can stabilize their orbits. In some

cases, resonant phenomena cause instability of some orbits "(Wikipedia). Those resonances either stabilize the upholstery or cause their instability.

In fact, the meaning of the resonance model is as follows.

If a particle rotates around the planet in 10 hours, and a satellite in 20 hours, this ratio is called a 1: 2 resonance. Every second passage, the particle meets the satellite, the influence of resonance accumulates, under the influence of the resonance satellite, the particle's orbit stretches, increasing ellipticity. For example, if the circulation period of one ring of Uranus is 6 hours, and the other 8 hours, these two rings have a common resonant orbit with a period of 12 hours, which with a ring has a resonance of $6:12 = 1: 2$, and with a second of $8:12 = 2: 3$. The Phidia number, Fibonacci numbers, as we see, are nothing to do with.

The Phidia number in the mechanics of the planets of the solar system appears only in the connection between the functions of the potential and rotational energies of the Earth's group of planets and giant planets, as a proportionality coefficient. And not the coefficient, but the connection itself indicates the features of their origin.

Conclusion

By Noether's theorem, the law of conservation corresponds to each continuous symmetry. The homogeneity of space corresponds to the law of conservation of momentum, conservation of angular momentum corresponds to the isotropy of space. From the homogeneity of time follows the law of conservation of energy, from the isotropy of time - the conservation of parity. Lorentz covariance implies the invariance of the convolution of the 4-momentum, gauge invariance corresponds to the conservation of charge.

It is possible that each symmetry corresponds to a world constant that does not have a dimension.

The group of time shifts corresponds to the Pauli matrices, which, in turn, are generators of infinitesimal rotations for nonrelativistic particles with a spin of $\frac{1}{2}$.

At the same time, neither time nor gauge transformations or strong interactions have a dimensionless fundamental number. For time, even with some tension, the dimensional constant cannot be taken equal to H^{-1} , because other constants are tied to the classical world and are not fundamental in non-Euclidean geometry. Perhaps the fact is that time, as a form of the existence of matter, already in SRT is "confused" with space through a fundamental constant, the speed of light. However, it is also possible that these constants are still awaiting discovery. Accordingly, by analogy with the second constant of Feigenbaum - new mathematics and a new understanding of determinism.

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