



SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

Proceedings of the
International Conference

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Part 1: Participants' reports in English

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

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Foreword

We thank all participants of our conference "Scientific research of the SCO countries: synergy and integration" for the interest shown, for your speeches and reports. Such a wide range of participants, representing all the countries that are members of the Shanghai Cooperation Organization, speaks about the necessity and importance of this event. The reports of the participants cover a wide range of topical scientific problems and our joint interaction will contribute to the further development of both theoretical and applied modern scientific research by scientists from different countries. The result of the conference was the participation of 56 authors from 7 countries (China, Russia, Uzbekistan, Kazakhstan, Azerbaijan, Tajikistan, Kyrgyzstan).

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

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

Fan Fukuan,

Chairman of the organizing committee of the conference

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

Full Professor, Doctor of Economic Sciences

前言

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

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

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

范福宽，

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

人員數字能力的特徵及其對公司人員管理髮展的影響
**FEATURES OF DIGITAL COMPETENCIES OF PERSONNEL
AND THEIR IMPACT ON THE DEVELOPMENT OF PERSONNEL
MANAGEMENT OF COMPANIES**

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Candidate of Economic Sciences

General Director of "LUKOIL-PERM" LLC

抽象的。 本文分析了經濟系統數字化過程的現狀，人員數字能力的前景，數字化過程對人員管理概念的影響。 作者認為，人力資源管理旨在確保公司的有效工作和競爭力，但是，隨著工作流程的更新，需要具有一定能力和技能的人員。 已經確定，為了形成員工的有效能力模型，有必要客觀地評估成為人力資源管理趨勢的預測。

關鍵字：經濟數字化，能力，數字能力，人員管理，人員管理。

Abstract. *The article analyzes the current state of the processes of digitalization of economic systems, the prospects for digital competencies of personnel, the impact of digitalization processes on the concept of personnel management. The author determined that human resource management is designed to ensure the effective work and competitiveness of companies, however, in connection with the updating of the work process, there is a need for personnel with a certain set of competencies and skills. It has been established that in order to form an effective competence model of an employee, it is necessary to objectively evaluate forecasts that become trends in human resource management.*

Keywords: *digitalization of the economy, competence, digital competencies, personnel management, personnel management.*

The digital economy in modern conditions is based on multilateral use, stimulating the consistent scaling of profits by all participants. It is believed that the correct management of human resources contributes to the growth of labor productivity, increased competitiveness and a multiple increase in the efficiency of the company as a whole. The development of new approaches to the process of personnel management, the introduction of modern technologies has served as a regularity of the growth of attention of modern companies to increasing the efficiency of the use of human resources [1].

The emergence of the digital economy, which carries both threats and new opportunities for the development of the labor market, puts forward new requirements for the professional competence of personnel who are responsible for the digital transformation of the business sector and the creation of new products demanded by society based on breakthrough technologies. The essence of digitalization is the gradual movement of many types of human activity into the Internet - this creates prospects for the production, storage and delivery of content, in addition, it allows people to carry out communication interaction and joint project activities [2].

The observed speed of change and transformation of the economic environment, the arrival of a whole package of innovative technologies and new industries, large-scale digitalization and the replacement of routine work with automated ones (fig. 1) [3] mean that it is necessary to prepare leaders of change, in which there should be a mature thinking of anticipating the image of the future, based on the ability to recognize the key processes that radically transform the living environment, to systematically assess the consequences of these changes on long-term forecasting horizons.

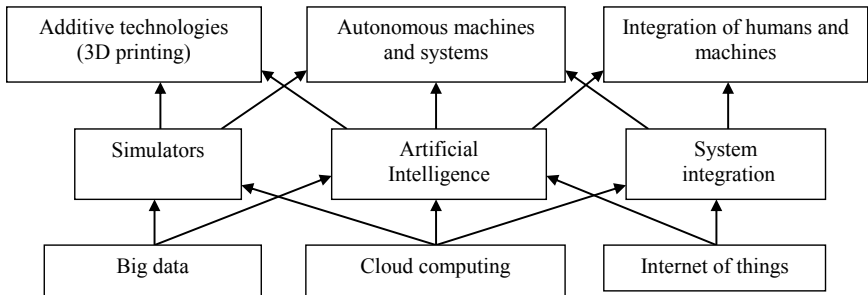


Fig. 1. New production technologies as a consequence of the interaction of digital technologies

In the digital economy, first of all, specialists are required with a formed set of supra-subject and meta-competencies that allow them to work in related subject areas, manage their intellectual development in order to master new types of labor functions in a rapidly changing digital environment.

Companies that decide to move to a new level of development need to pay attention to the changes that have taken place in personnel management (fig. 2) [4, p. 58]. HR technologies in the HR automation trend are in demand in the process of internal workflow, recruiting, training, personnel performance assessment and final certification, career monitoring, motivation, and labor distribution.

New requirements for personnel are expressed in the search for employees - talents. This is the active economic population that is able to continuously learn, improve the level and set of their competencies and skills, striving for analytics, mastering digital programs. It is worth pointing out the emergence of new learning formats - micro and macro, which are segmented depending on the amount of content. In this context, the task of personnel management is not to force the employee to undergo training, but to "guess" the requests and needs of employees and be with an educational product at the right time [5]. This is a rather subtle personnel analysis, but without it, training will not give the desired effect.

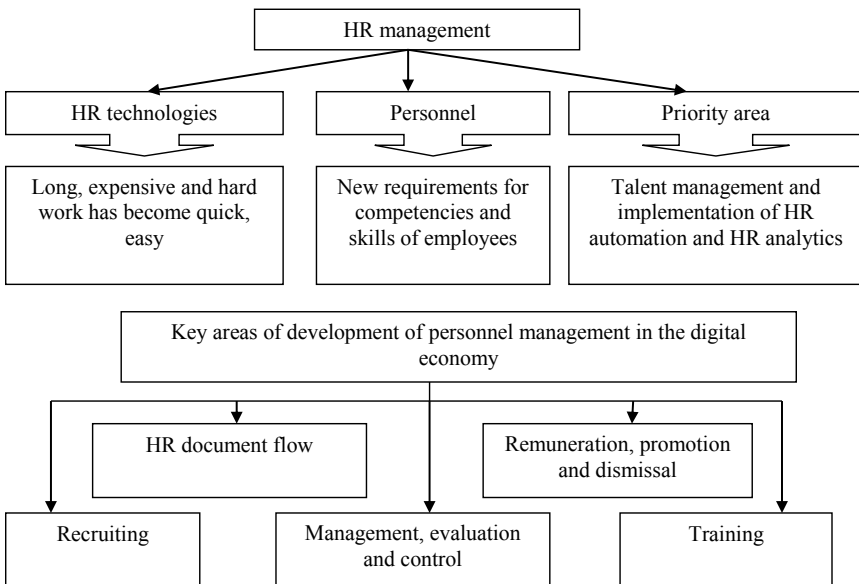


Fig. 2. Trends in personnel management in the era of digitalization of economic processes

The priority directions of development of personnel management are as follows: the use of modern recruiting tools (personnel search), namely, recruitment robots, the expansion of recruitment channels, targeted (complex methods of personnel search in the network, taking into account specially set parameters) advertising of vacancies; application of modern methods of assessing potential employees and those already working in permanent positions; internships [4, p. 61].

In our opinion, the trend of automation of HR processes is justified by the need to digitalize economic processes. When tools are created that increase the efficiency of employees, business entities tend to use them if there are no barriers in the form of implementation difficulties. Scientists have been talking about the automation of routine work for more than two decades, but today, when the economy is digitized, the relevance of this topic is constantly updated as technology and in the field of personnel management develop.

To take advantage of digitalization in HR management, it is important to adapt or even change the approach to building a company. Deloitte research has come up with a new architecture for building a company. In the future, the company will become a network of teams, and this network will be considered flexible depending on the speed of its formation or the creation of working groups for project development. It will be necessary for teams to be able to receive timely updates to develop their skills. Leaders in such networks must have high intelligence, systems thinking, and demonstrate organizational and communication skills. In such companies, there will be more opportunities for remote work, talented personnel may not move to another city for the sake of registration in the state, it will happen automatically [6].

In the company of the future, the results of work will be open, employees will be able to dynamically develop and grow in their careers. Including organizational management will not be hierarchical, but flexible, more attention will be paid not to the process, but to the project. The main focus in such an organization will be not to analyze the effect, but to training, innovation and development, taking into account the perfect work.

Companies with a similar organization of personnel management already exist, for example, that use Agil methods, the introduction of flexible management remains a trend [7].

In fig. 3 [4, p. 63] shows a diagram of the initial transformation of organizational personnel management in the era of digitalization. If earlier experts and analysts allowed such changes only in large companies, today, flexible management and other modern models of personnel management can be introduced by medium-sized businesses.

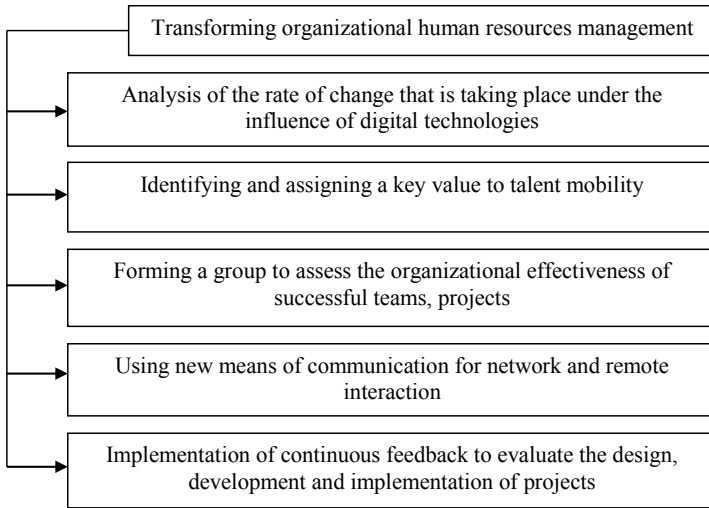


Fig. 3. Transforming organizational human resources management in the digital age

According to forecasts, in the context of the digitalization of the economy, the development of personnel management will move from the assigned educational program to a recommendatory or independent one, and if earlier training was carried out at a certain time, then in the near future it should become continuous. Training centers will be minimized, and communities of leaders and teams will begin to form, which will carry out mentoring (training when a new employee / trainee is assigned to a strong employee in order to teach him priority skills) [8].

As part of HR management, the changes affected the search and retention of talent. Decent candidates choose companies that have a strategic and digital employer brand. Social and cognitive technologies are used to find the right employee. A trend has been formed in which in the near future employers will switch their attention from certificates and diplomas to assessing the actual skills. In this regard, recruiting is of particular importance; with the development of digitalization, new methods of personnel selection have appeared, including through social networks. For example, Unilever carries out 4 stages in the selection of a candidate:

1. The applicant must fill out an online form instead of the usual resume.
2. Complete a 20-minute series of games to analyze and evaluate his skills.
3. Record a video interview.
4. Take part in the simulation "One day in the life of Unilever" [9].

This approach is very objective and allows you to immediately collect the necessary amount of information about a future employee, evaluate his digital skills and abilities, and predict opportunities. Not every company is capable of organizing talent search this way. Fig. 4 shows the activities that need to be performed on the way to finding the right employees.

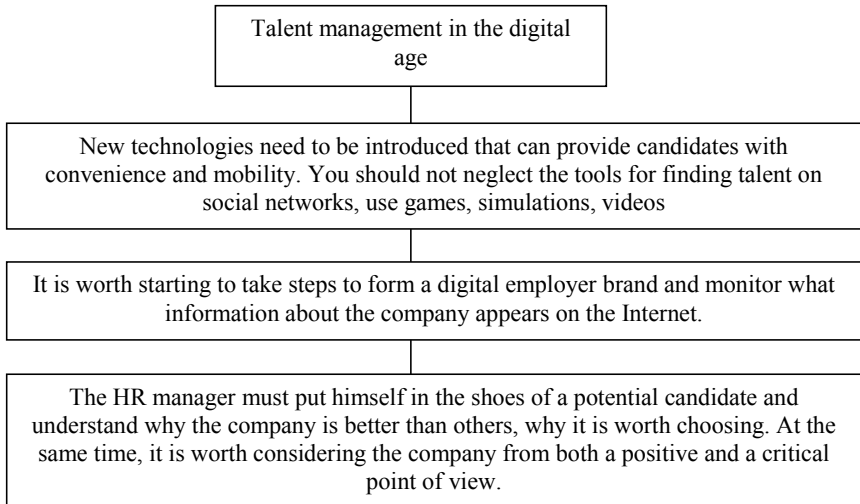


Fig. 4. *Talent management in the context of digitalization of personnel management*

As practice shows, for an employer in most companies, one of the criteria for hiring a candidate is employee experience. In the modern digital economy, the experience of employees will become a factor in the successful attraction of talent (this applies to management personnel), new requirements will be presented to managers in solving personnel issues, the latter will be distributed among different managers as follows: someone will carry out selection, the other will train, the third will assessment, rewards, fourth - career development. Well-established employee feedback will be key to creating a positive experience. Talented staff, including those who "grew up" in this company, will become its competitive advantage. It should be noted that in recent years, attitudes towards employee experience have begun to change, corporate culture has ceased to be a formality, companies have begun to create programs to maintain the health and well-being of their employees and their families, which positively affects their attitude to their work and their management, and this also fosters feedback experiences.

The new era makes it clear that the experience of an employee is not only his own business, large and medium-sized companies need a manager for the development of employee experience, because it has been proven that investments in human resources can increase the company's competitiveness more than any other investment. And also organizations of all forms of business should move from collecting information on the opinion of employees annually to a well-established feedback.

A clearly defined goal, feedback and regular performance assessment will allow the HR manager to quickly and efficiently resolve issues related to the movement of employees, their promotion, development and even dismissal. To assess the work in large companies aimed at introducing digital technologies, it is necessary to actively use HR analytics and databases, this is another trend in the development of personnel management, which is gaining more and more popularity. Companies that have not yet transferred part of their HR tasks to Digital can lag far behind their competitors with the development of digitalization, therefore, in order for HR management to keep pace with the times, it is necessary to revise the types of work, a significant part of them can be converted into digital, freeing managers from work that brings neither experience nor time to develop competencies.

This analysis of HR management trends allows to understand what is required of future candidates for future or existing companies that have embraced digitalization as an opportunity and not as a threat.

Despite the fact that many scientists and development organizations have addressed the problem of forming a competency model, there is still no fixed model of competencies [10, p. 480-483]. Experience maps, career maps and many other programs are formed that are difficult to combine in personnel management, especially when technologies in this area are rapidly developing. It is also worth noting that today the labor market has changed, it reinvents itself. Based on the analysis of trends, a modern company will need an employee who [4, p. 67]:

1. Possesses a basic set of competencies, including knowledge of some software.
2. Is open for continuing education, assessment of their activities and work in the company.
3. Capable of analytics and working with large amounts of data on digital platforms.
4. Develops feedback from his management and colleagues.
5. Sociable.
6. Strives for career growth and experience.
7. Prone to work in flexible conditions.
8. Realizes his work and importance in increasing the competitiveness of the company.

9. Seeks to understand Digital transformation.
10. Understands the modern requirements of the labor market and personnel management.
11. Able to take responsibility for his work, attentive and purposeful.
12. Keeps track of digital progress.

Human resource management trends influence the formation of a competency model of personnel that will meet the demand of the labor market. Of course, depending on the profile, the model of the employee of the future will be supplemented, but the above parameters, in our opinion, will become key.

When the digital economy began to develop rapidly in Russia, companies began to rethink the concept of an office, namely: there are much fewer of them, Internet sites are being formed, this brings additional benefits, for example, exempts companies from paying rent [8]. Also, under the influence of digitalization, the boundaries between marketing, training and communications began to blur. A modern employee must have a basic set of competencies, in which, while carrying out his work, he constantly communicates, learns and works to promote any service or product.

Human resource management is undergoing qualitative changes under the influence of scientific, technical and digital progress, these changes are for the good of society, because working with a large amount of information, which is now replaced by the program, used to take a lot of time and health. At the same time, the threat of unemployment is covered by the formation of educational programs that open up new ways of economically intensive activity.

Thus, nowadays technologies, especially digital ones, are becoming the main factor of economic growth, methods of personnel management based on big data have become complex. In this regard, the level of development of digitalization processes affects personnel management and, as a result, affects the competitiveness of the business.

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數學, 物理和電氣工程研究中的跨學科問題
**INTERDISCIPLINARY PROBLEMS IN THE STUDY OF
MATHEMATICS, PHYSICS AND ELECTRICAL ENGINEERING**

Eygrafova Irina Vladimirovna

*Candidate of Pedagogic Sciences, Associate Professor, Faculty Dean
St. Petersburg State Marine Technical University*

抽象的。考慮了高等教育中的跨學科聯繫問題。本文的目的是表明需要整合技術大學教授的各種課程。考慮了科目間聯繫在數學, 物理和電氣工程課程研究中的應用。顯示了將數學與物理學和電氣工程相結合的需求, 這將使物理學和電氣工程的陳述在其研究的各個層次上更加清晰和易於理解。解決已確定的整合各種課程的問題的一種選擇是創建跨學科任務的基礎。本文指出了具有跨學科內容的任務必須滿足的要求。顯示了數學設備在研究物理和電氣工程過程中的廣泛使用。顯示了在大學相關學科的研究中, 系統地實施元學科聯繫的重要性。解決已確定的整合各種課程的問題的一種選擇是創建跨學科任務的基礎。

關鍵詞：物理, 數學和電氣工程的跨學科交流; 整合教學課程; 跨學科任務; 跨學科的任務。

Abstract. *The question of interdisciplinary connections in higher education is considered. The purpose of this article is to show the need to integrate various courses taught in technical universities. The application of intersubject connections in the study of courses in mathematics, physics and electrical engineering is considered. The need to integrate mathematics with physics and electrical engineering is shown, which will make the presentation of physics and electrical engineering clearer and more accessible at all levels of its study. One of the options for solving the identified problem of integrating various courses is the creation of a base of interdisciplinary tasks. The article notes the requirements that must be satisfied by tasks with interdisciplinary content. The extensive use of the mathematical apparatus in studying the course of physics and electrical engineering is shown. The importance of the systematic implementation of metasubject connections in the study of related disciplines in universities is shown. One of the options for solving the identified problem of integrating various courses is the creation of a base of interdisciplinary tasks.*

Keywords: *Interdisciplinary communications of physics, mathematics and*

electrical engineering; integration of taught courses; interdisciplinary tasks; tasks of an interdisciplinary nature.

In modern conditions, higher education must correspond to the level of development of science, technology, culture, and also meet the accelerated pace of scientific and technological progress. In turn, the rate of scientific, technical and cultural progress directly depends on the level of training of engineers with higher education. St. Petersburg State Marine Technical University trains highly qualified specialists in all areas of development and creation of marine technology - from design and construction to maintenance and repair. Our graduates have the opportunity of employment in prestigious design bureaus, ship factories and shipyards in Russia and abroad. They are able to make an invaluable contribution not only in the production sphere, but also in the development of science and technology.

In the conditions of the rapid development of science, a modern specialist must have a fundamental general scientific training, including natural and mathematical, focused on his professional activity. The teachers of the university keep up with the times and improve the methods of teaching disciplines.

Requirements for teaching methods are due to the need to establish an organic relationship between general education and special disciplines. The objective need to find the optimal construction of the learning process is also dictated by the complication of the content of curricula associated with a more complete reflection of the achievements of modern science in them, an increase in the amount of educational information that must be mastered by students within the established training period. Now an intuitive-practical approach to learning is no longer possible, and it is required to find ways that would make it possible to solve a complex set of problems without increasing the time investment [3].

The most important task of organizing the educational process in higher educational institutions of engineering orientation is the integration of the taught courses. When teaching the disciplines under consideration, such as physics and electrical engineering, mathematical apparatus is widely used. At the same time, students often have practically no ability to apply the knowledge gained in the study of mathematics when solving the assigned tasks in the process of mastering the material in these disciplines. [1]

The need of society for professionals with logical thinking skills and the availability of fundamental theoretical and applied knowledge necessary for the development of science and technology gives rise to the development of scientific foundations for optimizing the learning process. For example, the integration of mathematics with physics and electrical engineering will make the presentation of physics and electrical engineering clearer and more accessible at all levels of

its study. The modern presentation of the material requires an organic combination of experimental and theoretical methods of studying physics and electrical engineering, revealing the essence of physical laws on the basis of the concepts of elementary mathematics available to the student.

One of the options for solving the problem is to create a base of interdisciplinary problems used in disciplines adjacent to mathematics in higher education. Such tasks, of course, must meet the following requirements:

- 1) should not violate the presentation of the actual disciplinary material, but, on the contrary, should contribute to its assimilation;
- 2) must fully comply with the discipline program and textbooks in terms of the content of the facts and methods used in the process of solving them (must correspond to reality, that is, be believable);
- 3) should be formulated in an accessible and understandable language for students.

Moreover, these tasks can be used both as additional tasks and as tasks replacing similar, purely disciplinary tasks. [2]

Problems with interdisciplinary content or interdisciplinary problems in didactics are usually understood as tasks for the solution and analysis of which it is necessary to attract and use knowledge in various subjects of the general technical and special cycle. This type also includes tasks based on the material of one academic discipline, if they are used for a specific didactic purpose in teaching another discipline.

When solving interdisciplinary tasks on the chronological basis of intersubject connections, it is necessary to use concomitant, promising and previous types of connections in relation to the discipline being studied. By the informative basis - factual, conceptual, theoretical, and by the way of organizing the educational process - the creation of integrated topics and sections.

In the first year in mathematics classes, students study differential calculus of functions of one and several variables, integral calculus of functions, differential equations and other topics. Mathematics provides physics and other technical disciplines with computers. In mathematics classes, students learn to work with mathematical expressions, and the task of teaching physics and electrical engineering is to familiarize students with the transition from physical phenomena and the relationships between them to their mathematical expression and vice versa.

So, for example, for a course in physics and electrical engineering, knowledge of the derivative and integral opens up prospects in terms of the possibility of a more rigorous determination of certain physical quantities, allows students to develop a general approach to determining physical quantities and solving graphical problems of physical content. Electrical engineering also uses the concept of differential, logarithms, knowledge of surface integrals.

The choice, for example, of problems of electrical engineering content was made to identify the essence of the symbolic method and the peculiarities of its application in the study of real processes and simplify electrical calculations, the method of differential equations and the peculiarities of their application in the study of electrical processes and phenomena, as well as to demonstrate the use of the corresponding mathematical apparatus and models for studying real processes.

The study of mathematics and natural sciences occurs in parallel and, thus, mathematics is often used in physics and to a certain extent even determines the course of physical education. The development of physical theory is based on the existing certain mathematical apparatus, but the latter is being improved and developed as it is used in physics. The mathematical apparatus used in the study of physics must be determined in accordance with the fundamental facts, concepts and theories contained in the physics curriculum. Teaching physics and mathematics must be based on the mutual use of elements of mathematics in the course of physics and physical concepts in the study of mathematical analysis.

The use of interdisciplinary problems in teaching physics and mathematics plays an essential role in the formation of students' abilities and skills in using the mathematical apparatus in practice and for studying other disciplines. They allow concepts, laws and formulas previously studied in other disciplines to be organically incorporated into the system of students' knowledge and to develop their skills and abilities for further application of this knowledge in order to deeply study subsequent disciplines. In addition, solving problems, the content of which is taken from other curricula of other disciplines, is one of the most effective methods that stimulate the activity of the cognitive process, allowing to control the thinking of students and contribute to the development of interest in the discipline.

The process of knowledge formation not based on the use of interdisciplinary connections has a positive effect on the mental development of students in the learning process, contributes to the systematization of educational material and an increase in the level of acquired knowledge. The implementation of interdisciplinary connections in the learning process enhances the cognitive interest of students and allows more efficient use of study time.

The systematic and consistent use of tasks with interdisciplinary content in the study of, for example, mathematics, physics and electrical engineering will ensure a more conscious assimilation by students of theoretical knowledge and practical skills in these disciplines. Such an approach to training will contribute to a better professional training of specialists.

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世界紀錄是人類獨特能力的知識領域
**WORLD RECORDS AS A FIELD OF KNOWLEDGE OF UNIQUE
HUMAN CAPABILITIES**

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抽象的。 本文分析了某些體育學科中創造世界紀錄的動力，並以某些學科為例，確立了創造世界紀錄的頻率的規律性。 結果表明，在1至4年的時間間隔內觀察到獲得記錄的最高概率，然後下降。

關鍵字：世界紀錄，競技規律，世界紀錄打破

Abstract. *The article presents an analysis of the dynamics of setting world records in certain disciplines of athletics, and establishes the regularity of the frequency of setting world records on the example of certain disciplines. It was revealed that the highest probability of achieving records is observed in the interval from 1 to 4 years, and then decreases.*

Keywords: *world records, athletics regularity, world record breaking*

One of the greatest human traits is the pursuit of excellence in all areas of activity. Scientist, experimenter, researcher at all times strived for knowledge of various aspects of the world around us. And in this respect, sport is a social phenomenon, where the need for maximum improvement is the main meaning, the essence of human activity. In most spheres of human activity, he strives for knowledge of the most general laws inherent in nature, society, thinking, intuitively relying in his reasoning on what characterizes the object under study, the properties inherent in the phenomenon as a whole. You can often imagine a pattern as a kind of Gaussian distribution, where we operate with the results and the provisions and statements based on them, the probability of which is at the level of 95%, etc. In our study, we will consider world records that relate precisely to those 5 percent or less of all results demonstrated in elite sports and look for something inherent in achievements that determine the zone of universal human capabilities in motor types of sports activity.

Based on the above, the **purpose** of the study is to identify the main regularities in the dynamics of setting world records using the example of individual disciplines of athletics. The **object** of research is world records, and the **subject** is world records in sports with a measurable result, which avoids a certain subjectivity in assessing the achievements inherent in such sports, where the subject of assessment is mainly the technique of performing the exercise (figure skating, gymnastics, etc.). Research **methods** - retrospective analysis of world records in athletics, mathematical and statistical methods.

Experts in the field of elite sports argue that in order to establish records, as a rule, appropriate prerequisites are required, which allow predicting their occurrence with a certain degree of probability. Including the relationship of such trends as an increase in the density of leaders' results, which indicates an increase in competition, the upward dynamics of the best and average indicators in a sport or discipline [1, 2, 3].

As illustrative examples in Figures 1 and 2, the tendency of changing world records in the disciplines of athletics - high jump in men and shot put in women - is presented. The dynamics clearly traces the stages associated with the formation of the sport, this is the period from the beginning of the first world records to the end of the Second World War. This is followed by the stage of progressive development of achievements, and then - the stage of stabilization of achievements (in high jumps for men, this stage began in 1993, and in shot put for women - since 1987).

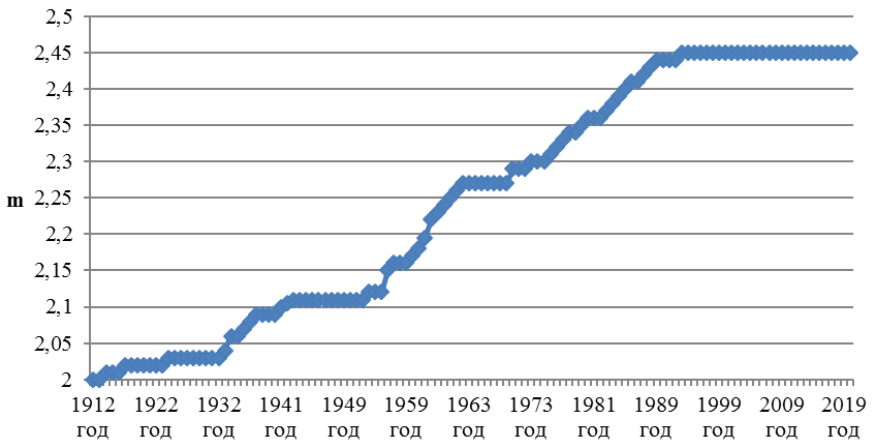


Figure 1 - Dynamics of world records in the high jump in men

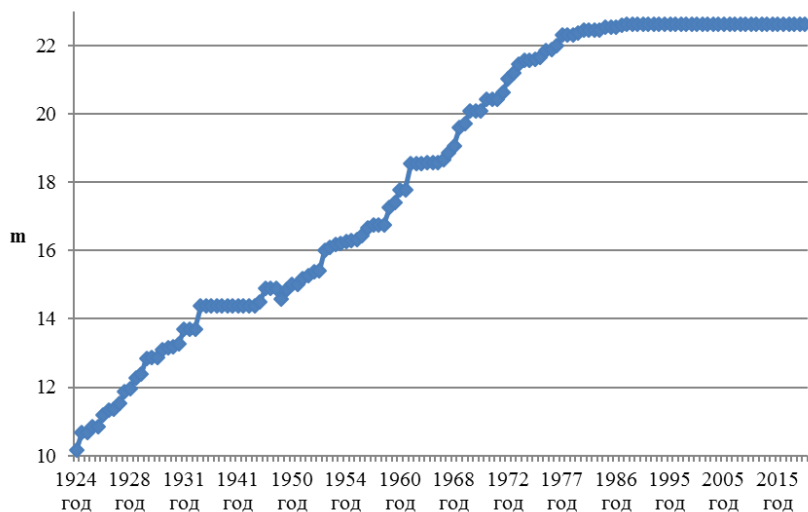


Figure 2 - Dynamics of world records in shot put in women

Of particular interest is the identification of the frequency in setting world records. Figures 3-6 show the dependence of the number of records to be set on the duration of the time intervals between them.

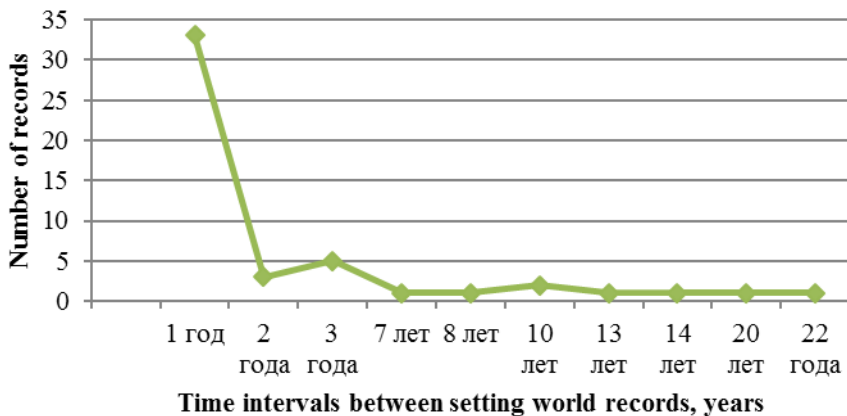


Figure 3 - Frequency of setting world records in a triple jump

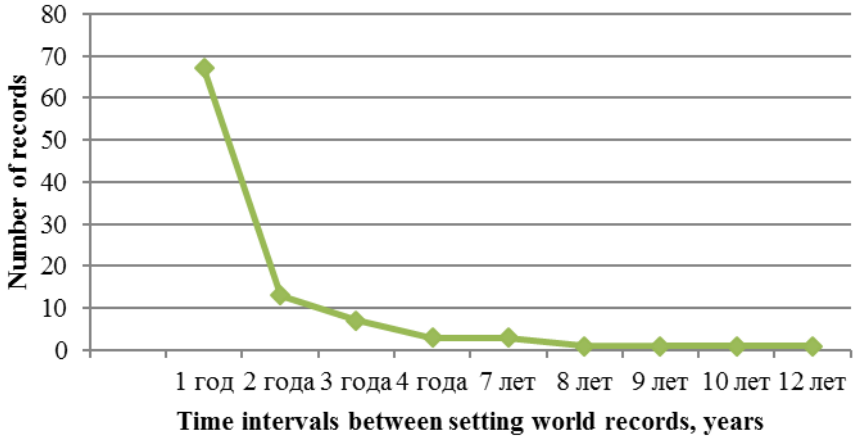


Figure 4 - Frequency of setting world records in high jump

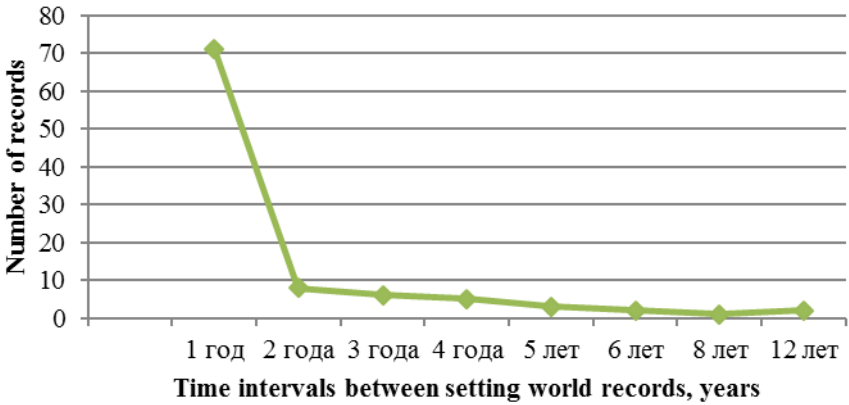


Figure 5 - Frequency of setting world records in discus throwing

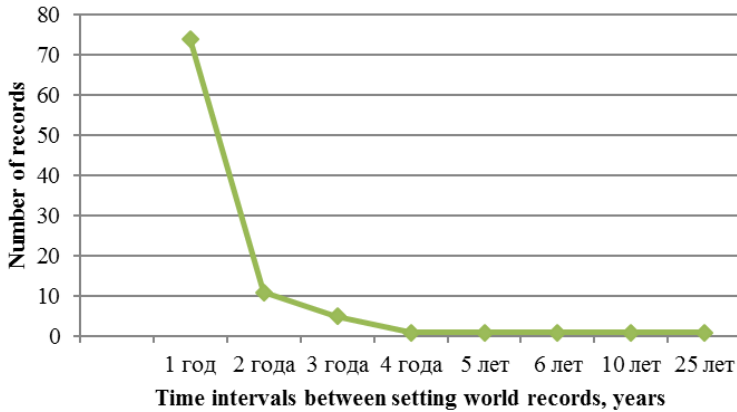


Figure 6 - Frequency of setting world records in hammer throwing

As can be seen from the figures, a similar trend is observed in the dynamics of setting world records. The highest probability of achieving records is observed in the interval of 1 year, then there is an exponential decrease in the probability of their setting in the interval from 2 to 4 or more years. A similar trend, with some variation, is observed in other athletics disciplines.

Figure 7 shows the frequency of setting world records depending on the time interval between them in individual athletics disciplines (100 m running, long jump, triple jump, high jump, pole vault, shot put, discus throw, hammer throw at men and women).

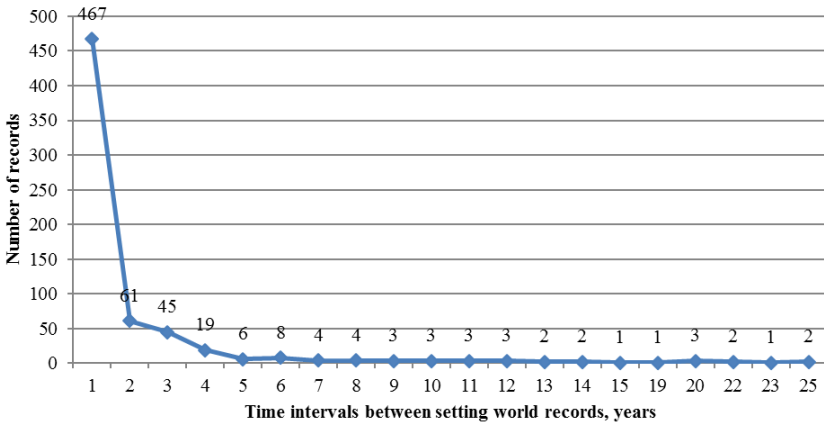


Figure 7 - Generalized results of the frequency of setting world records in individual disciplines of athletics

The data in Figure 7 indicate that the establishment of world records is more likely with a time interval of up to 4 years. However, in individual, exceptional cases, we note the possibility of achieving record results over longer periods of time.

Thus, since the presented tendency is general for a number of disciplines, it can be argued that it reflects the regularity inherent in high-performance sports.

Conclusions

1. The conducted research has confirmed the existing ideas about the stages of development of sports - formation, progressive development and stabilization of achievements.

2. As a result of the study, the regularity of the frequency of setting world records was established on the example of individual disciplines of athletics. The highest probability of achieving records is observed in the interval from 1 to 4 years, and then decreases.

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代表英語發音的字母和其組合[aʊ], [ɔɪ], [iə], [əʊ], [aɪ], [ʊə], [ɛə]和[eɪ]

LETTERS AND THEIR COMBINATIONS REPRESENTING ENGLISH SOUNDS [aʊ], [ɔɪ], [iə], [əʊ], [aɪ], [ʊə], and [ɛə], [eɪ] IN WRITING

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抽象的。 本文專門研究俄羅斯聯邦教育機構在英語課上的教學工作者的英語工作者在教育活動中的英語二元拼寫問題。 作者確定了音素的圖形拼寫的主要方式，即在所討論的聲音形成過程中使用的字母和字母組合。 該研究旨在定義和描述英語聲音[aʊ], [ɔɪ], [iə], [əʊ], [aɪ], [ʊə], [ɛə]和[eɪ]的圖形拼寫方式。

關鍵字：教育活動，英語，圖形拼寫，diphthongs [aʊ], [ɔɪ], [iə], [əʊ], [aɪ], [ʊə], [ɛə]和[eɪ]，教育工作者。

Abstract. *The article is devoted to the study of the problem of graphic spelling of English diphthongs in educational activities of pedagogical workers in English classes at educational institutions in the Russian Federation. The authors identify the main ways of graphic spelling of the phonemes, namely letters and combinations of letters used in the formation of the sounds in question. The study aims to define and describe the ways of graphic spelling of English sounds [aʊ], [ɔɪ], [iə], [əʊ], [aɪ], [ʊə], [ɛə], and [eɪ].*

Keywords: *educational activities, English, graphic spelling, diphthongs [aʊ], [ɔɪ], [iə], [əʊ], [aɪ], [ʊə], [ɛə], and [eɪ], pedagogical worker.*

First classes of English as a foreign language at the overwhelming majority of educational institutions in the Russian Federation make pedagogical workers

solve a lot of vital issues while training their students within the main language aspects that are Auding/Listening, Speaking, Reading and Writing (such aspects as Interpretation and Translation are being omitted here since they are in the domain of a limited number of specialized Russian universities; for this reason, transliteration, being a way of rendering lexical units in writing, is not the subject of our research). Writing universally seems to be the most complicated aspect in its mastering due to the fact that it is directly connected with Grammar, Lexicology, Phonetics, Punctuation, Spelling and Stylistics. One complexity of writing is “Phonetics [12] vs Spelling” problem. In short, we mean a case when one letter or a group of letters contained in various lexical units [1] has several ways to be pronounced, e.g.:

- vowel letter *a* in the following lexical units: *plaque* [a:], *cradle* [ei], *adorn* [ə], *gall* [o:], *acrid* [æ], *Bologna* [jə], *vintage* [ɪ], *garish* [εə], *swab* [ɔ];
- consonant letter *s*: *episode* [s], *fusion* [ʒ], *controversial* [ʃ], *liaison* [z], *Asia* [ʃ] or [ʒ], *CIS* [es] [5], [8];
- double *oo*: *blood* [ʌ], *took* [ʊ], *tattoo* [u:], *door* [o:], *brooch* [əʊ];
- a group of vowel and consonant letters *ough*: *through* [u:], *sought* [o:], *drought* [aʊ], *dough* [əʊ], *rough* [ʌf], *cough* [ɔf], *thorough* [ə];
- a combination of consonant letters *ch*: *avalanche* [ʃ], *chimney* [tʃ], *technology* [k], *Sandwich* [dʒ] [9], [10], [11].

To avoid bewildering in writing among students and to ensure that they will learn to write well is one of the primary tasks of the pedagogical workers in the initial and further stages of teaching English.

The relevance of the research work arose in the light of insufficient coverage of the multiple ways of graphical spelling of vowel and consonant phonemes and their combinations in textbooks currently applied in the educational process.

Our research is based on the material of various extracts taken for our consideration from pieces of fiction, periodicals, textbooks, the Internet. We also dealt with corporate letters, movie subtitles, pieces of advertising; off-line and on-line dictionaries; reference books to contemporary English pronunciation [13]. We examined the parts of English speech and their transformations regarding case, degree, mood, number, tense and voice categories. It seemed natural for us to view abbreviations, acronyms, clipped words, interjections, loan words, etc, paying particular attention to such toponyms as geographic names, corporate names, days of the week, months, nationalities, people's names, patronymics and sur-names, social networks, astronoms, types of drinks, meals and food, etc.

Paradoxically, some English consonant sounds can be rendered by vowel letters, e.g.:

- [f] can be rendered by vowel letter *u* (*lieutenant* [leɪ'tenənt]);
- [j] can seldom be rendered by vowel letter *e* (*Eugene* [ˈju:dʒi:n], *eureka*

[*juə* 'rikə] or [*jɔ*: 'rikə], *Europe* [*'juərəp*] or [*'jɔ:rəp*]); by vowel letter *u* (*unique* [*ju*: 'ni:k], *use* [*ju*:z], *usual* [*'ju:ʒəl*] or [*'ju:ʒl*]); by vowel letter *y* (*yacht* [*jɔ:t*], *year* [*jɪə*] or [*jɪ:*], *youth* [*ju*:θ]);

- [w] can sometimes be rendered by vowel letter *o* (*one* [*wʌn*], *once* [*wʌns*], *oneself* [*wʌn* 'self]); by vowel letter *u* (*cuisine* [*kwi* 'zi:n], *persuade* [*pə* 'sweɪd], *quake* [*kweɪk*]).

We can observe a reverse process, when consonant letters render vowel sounds if they are pronounced under their names in the English Alphabet, e.g. letter *Pp* in *PPP* (that stands for *Power Point Presentation*) [*'pi:* 'pi: 'pi:]). To be more exact, consonant letters can render one (letter *Rr*), two (letters *Bb*, *Cc*, *Dd*, *Ff*, *Gg*, *Hh*, *Jj*, *Kk*, *Ll*, *Mm*, *Nn*, *Pp*, *Ss*, *Tt*, *Vv*, *Zz*, the latter in American variant of English), three (letters *Qq*, *Xx*, *Zz*) and six sounds (letter *Ww*):

- letter *Rr* rendered by one sound [*a:*];
- letter *Bb* rendered by two sounds [*bi:*];
- letter *Qq* rendered by three sounds [*kju:*];
- letter *Ww* rendered by six sounds [*dʌblju:*].

Letters rendered by two (*Bb* [*bi:*], *Hh* [*eɪtʃ*], *Nn* [*en*]), three (*Qq* [*kju:*], *Xx* [*eks*], *Zz* [*zed*]) and six sounds (*Ww* [*dʌblju:*]) involve both consonant and vowel sounds. This postulate says that if we pronounce the consonant letters in definite positions (in abbreviations and compound words, for instance), we have to use both consonant and vowel sounds to utter them, e.g. abbreviation *CIF* [*si:ai* 'ef] and compound word *X-ray* [*eksreɪ*]:

- *CIF* is composed of letter *C* – [*si:*] rendered by two sounds, consonant [*s*] and vowel [*i:*], letter *I* [*ai*] rendered by one vowel sound [*ai*], letter *F* rendered by two sounds, vowel [*e*] and consonant [*f*];
- *X-ray* is composed of letter *X* [*eks*] and word *ray*.

Thus, a notable feature of this article is its inclusion of examples where consonant letters can take part in rendering vowel sounds.

In this article, we endeavour to compile and systematize the ways of graphical spelling of eight diphthongs ([au], [ɔɪ], [ɪə], [əʊ], [aɪ], [uə], [ɛə], [ɛɪ]) [2], [4], [6] omitting other 12 vowel (10 monophthongs, 2 diphthongoids) and 24 consonant sounds [9], [10].

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

on diphthongs and letters and letter combinations representing them, we refer our readers to Table 1 below.

The vowel sound [ɔɪ] can be represented by combinations of letters *oi* (*moist* – [mɔɪst]), *ois* (*Illinois* – [ɪlɪ'nɔɪ]), *oy* (*deploy* – [dɪ'plɔɪ]). The sound [ɔɪ] can be placed in the initial (*oyster* – [ɔɪstə]), middle (*avoid* – [ə'vɔɪd]) and final (*destroy* – [dɪ'strɔɪ]) position of words. The diphthong [ɔɪ] is represented by three combinations of letters (*oi*, *ois*, *oy*). In two cases, this phoneme is formed in graphic spelling by combinations of vowel letters (*oi*, *oy*) and in one case – by a combination of vowel and consonant letters (*ois*).

The vowel sound [ɪə] can be represented by the letter *e* (*query* – [ˈkwɪəri]) and by combinations of letters *ea* (*ideal* – [aɪ'diəl]), *ear* (*sear* – [sɪə]), *eer* (*veneer* – [vɪ'niə] or [və'niə]), *eir* (*weird* – [wɪəd]), *eo* (*theory* – [θiəri]), *eou* (*hideous* – [hɪdiəs]), *ere* (*adhere* – [əd'hɪə]), *eu* (*linoleum* – [lɪ'nəʊliəm]), *hea* (*gonorrhoea* – [gɒnə'riə]), *ia* (*guardian* – [ˈgɑːdiən]), *iar* (*peculiar* – [pi'kjuːliə]), *ie* (*nutrient* – [ˈnjuːtriənt]), *ier* (*pierce* – [piəs]), *io* (*oblivion* – [əb'liviən]), *ior* (*warrior* – [ˈwɔriə]), *iou* (*tedious* – [tiːdiəs]), *ir* (*souvenir* – [su:və'niə]), *iu* (*premium* – [ˈpriːmiəm]), *ya* (*Libya* – [ˈlɪbiə]). The sound [ɪə] can be placed in the zero (*ear* – [ɪə]), initial (*earshot* – [ɪəʃɒt]), middle (*material* – [mə'tɪəriəl]) and final (*fear* – [fiə]) position of words. The diphthong [ɪə] is represented by one letter (*e*) and 19 combinations of letters (*ea*, *ear*, *eer*, *eir*, *eo*, *eou*, *ere*, *eu*, *hea*, *ia*, *iar*, *ie*, *ier*, *io*, *ior*, *iou*, *ir*, *iu*, *ya*). In 10 cases, this phoneme is formed in graphic spelling by combinations of vowel letters (*ea*, *eo*, *eou*, *eu*, *ia*, *ie*, *io*, *iou*, *iu*, *ya*) and in nine cases – by combinations of vowel and consonant letters (*ear*, *eer*, *eir*, *ere*, *hea*, *iar*, *ier*, *ior*, *ir*).

Table 1 below displays particular cases of sounds [aʊ], [ɔɪ], [ɪə], [əʊ], [aɪ], [ʊə], [ɛə], and [ɪr] represented by single letters, groups of letters, and groups of letters with the apostrophe in English lexical units.

Table 1 – Ways of Graphical Spelling of English Diphthongs

№	Vowel Phoneme	Vowel Letters and their Combinations	Combinations of Vowel and Consonant Letters	Consonant Letter	Combination of the Apostrophe, Consonant and Vowel Letters
1.	[aʊ]	au, ou	ough, ow		
2.	[ɔɪ]	oi, oy	ois		
3.	[ɪə]	e ea, eo, eou, eu, ia, ie, io, iou, iu, ya	ear, eer, eir, ere, hea, iar, ier, ior, ir		
4.	[əʊ]	o eau, au, eou, oa, oe, oo, ou	aoh, ew, hau, ho, ol, ough, ow, owe		'ho

5.	[aɪ]	i, y	eigh, ig, igh		
		ei, ey, eye, ie, ui, uy, ye			
6.	[ʊə]	u	ewer, oor, our, uar, ueur, ure		
		ua, ue, uou			
7.	[ɛə]	a, e	air, aire, are, ayor, ear, eir, er, ere		
		ae, ai			
8.	[eɪ]	a, e, é	ag, aig, aigh, eig, eigh, er, et, uet	h, j, k	
		ae, ai, ay, ea, ee or ée, ei, ey, oa			

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

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

The vowel sound [ʊə] can be represented by the letter *u* (*rural* – [ˈrʊərəl] or [ˈrʊərəl]) and by combinations of letters *ewer* (*skewer* – [ˈskjʊə]), *oor* (*moor* – [mʊə] or [moː]), *our* (*dour* – [dʊə]), *ua* (*septuagenarian* – [septɪʃədʒɪˈneəriən]),

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

The vowel sound [ɛə] can be represented by the letters *a* (*pharaoh* – [ˈfɛərəʊ]), *e* (*wisteria* – [wɪsˈtɛəriə]) and by combinations of letters *ae* (*aerodynamics* – [ɛərədaɪˈnæmɪks]), *ai* (*dairy* – [ˈdeəri]), *air* (*fair* – [fɛə]), *aire* (*questionnaire* – [kwɛstʃəˈneə]), *are* (*welfare* – [ˈwɛlfɛə]), *ayor* (*mayor* – [mɛə]), *ear* (*forebear* – [ˈfoːbeə]), *eir* (*their* – [ðɛə]), *er* (*concierge* – [kɔnsɪˈɛəʒ]), *ere* (*therefore* – [ˈðɛəfoː]). The sound [ɛə] can be placed in the zero (*air* – [ɛə]), initial (*area* – [ˈɛəriə]), middle (*whereas* – [wɛəˈrɛz]) and final (*where* – [wɛə]) position of words. The diphthong [ɛə] is represented by two letters (*a, e*) and by ten graphic combinations of letters (*ae, ai, air, air, are, ayor, ear, eir, er, ere*). In two cases, this phoneme is formed in graphic spelling by combinations of vowel letters (*ae, ai*) and in eight cases – by combinations of vowel and consonant letters (*air, aire, are, ayor, ear, eir, er, ere*).

The vowel sound [eɪ] can be represented by the vowel letters *a* (*slate* – [sleɪt]) and *e* (*elite* – [eɪˈliːt]), by the consonant letters *h* (*PhD* – [piːeɪtˈdiː]), *j* (*J.F. Kennedy* – [dʒeɪfˈkenedi]) and *k* (*KGB* – [keɪdʒiːˈbiː]), by the French letter *é* (*protégé* – [ˈprɔʊʒeɪ]) and by combinations of letters *ae* (*Gaelic* – [ˈgeɪlɪk]), *ag* (*champagne* – [ʌmˈpeɪn]), *ai* (*maim* – [meɪm]), *aig* (*campaign* – [kæmˈpeɪn]), *aigh* (*straight* – [streɪt]), *ay* (*relay* – [riːˈleɪ]), *ea* (*steak* – [steɪk]), *ee* or *ée* (*matinee* – [ˈmætiːneɪ]), *entrée* – [ˈɔntreɪ] or [ˈaːntreɪ]), *ei* (*abseil* – [ˈæbseɪl]), *eig* (*reign* – [reɪn]), *eigh* (*freight* – [freɪt]), *er* (*foyer* – [ˈfɔɪeɪ]), *et* (*gourmet* – [ˈgʊəmeɪ]), *ey* (*fey* – [feɪ]), *oa* (*gaol* – [dʒeɪl]), *uet* (*bouquet* – [bʊˈkeɪ]). The sound [eɪ] can be placed in the zero (*Eh* – [eɪ]), initial (*eight* – [eɪt]), middle (*tame* – [teɪm]) and final (*bay* – [beɪ]) position of words. The diphthong [eɪ] is represented by six letters (*a, e, h, j, k, é*), three of which are vowels and three are consonants, five are English and one is French, by 17 graphic combinations of letters (*ae, ag, ai, aig, aigh, ay, ea, ee, ée, ei, eig, eigh, er, et, ey, oa, uet*). In nine cases, this phoneme is formed in spelling by combinations of vowel letters (*ae, ai, ay, ea, ee, ée, ei, ey, oa*) and in eight cases – by combinations of vowel and consonant letters (*ag, aig, aigh, eig, eigh, er, et, uet*).

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

the best way to specify correct pronunciation of a lexical unit remains in looking it up in off-line and on-line dictionaries. However, the ways of graphic spelling of diphthongs [aʊ], [ɔɪ], [iə], [əʊ], [aɪ], [ʊə], [ɛə], and [eɪ] in particular described by us can simplify to some extent this process in the initial and further stages of teaching English at educational institutions in the Russian Federation.

Our brief outline of the modes of graphical spelling of the eight vowel sound shows that further more careful and scrupulously detailed investigation is necessary to get the objective data by which we can more fully ascertain each method to render the vowel phonemes. Nevertheless, the research allowed us to work out and prepare for publishing a guide-book containing drills to consolidate the skills of spelling and pronunciation of lexical units. The logical outcome of our work permits to state that the data of the review can be helpful in the pedagogical reality of Russian schools, colleges, universities when teaching English phonological and spelling nuances to students who master English as a foreign language. However, we cannot purport to have covered the entire range of variations of letters, groups of letters and their combinations with punctuation marks depicting diphthongs [aʊ], [ɔɪ], [iə], [əʊ], [aɪ], [ʊə], [ɛə], and [eɪ]. For this very reason, we invite our fellow scholars to join us in further more thorough research of this issue.

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考慮到運動不對稱，6-7歲體操運動員的柔韌性得到了發展
**THE DEVELOPMENT OF FLEXIBILITY IN GYMNASTS 6 - 7 YEARS
OLD, TAKING INTO ACCOUNT MOTOR ASYMMETRY**

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註解。 本文專門介紹了運動體操運動員在初次訓練時關節的柔韌性和活動性。 眾所周知，為了發展靈活性，重要的是使用最有效的鍛煉方法及其應用方法。 為了提高柔韌性，可以使用重物，丘陵，鬆緊帶等。 應該注意的是，本文涉及使用彈性帶進行鍛煉的研究。

關鍵詞：柔韌性，運動不對稱性，藝術體操，靜態拉伸方法，帶鬆緊帶練習。

Annotation. *The article is devoted to the development of flexibility and mobility in the joints in sports gymnasts in groups of initial training. It is known that for the development of flexibility it is important to use the most effective and efficient exercises and the method of their application. To develop flexibility, weights, hills, elastic bands, etc. are used. It should be noted that this article deals with a study in which exercises were performed using an elastic band.*

Keywords: *flexibility, motor asymmetry, artistic gymnastics, static stretching method, exercises with an elastic band.*

Artistic gymnastics in the XXI century is a combination of the highest technical complexity of competitive programs, their almost perfect quality, dynamism, compositional and aesthetic harmony performed by leading gymnasts and gymnasts [3].

The development of stretching, flexibility and mobility in the joints occupy a leading place in almost all types of physical activity [9].

In artistic gymnastics, the level of sportsmanship largely determines flexibility. Lack of flexibility complicates and slows down the process of mastering motor skills, limiting the manifestation of strength, speed and coordination abilities, reduces the efficiency of work, increasing the likelihood of injuries to the musculo-skeletal system of athletes [3].

Symmetry can be considered harmonious personality development, which is closely related to the implementation and training of movements on the non-leading and leading sides, which is necessary to improve the technique of performing elements and improve the qualifications of athletes. In artistic gymnastics, symmetrical development takes a special place [1].

In gymnastics, high demands have been made recently on the performance of certain elements. For many of them, a high level of flexibility is required. The growing competition on the world gymnastics platform suggests that the championship will remain with those athletes who have a high level of flexibility and can actively combine it with other physical qualities. Therefore, an even better approach to the special training of gymnasts is required, based on the principles of individualization and advanced development in the constantly changing conditions in which gymnasts work. The research of symmetrical development showed that its necessity is the result of high-quality fulfillment of motional actions in competitive and training activities in artistic gymnastics [3].

An extremely high level of complexity of movements, their ligaments and combinations, requirements for the artistry of their performance in competitive compositions of gymnasts originates at the stage of initial training of female athletes [3].

It is very important for an athlete not only the balanced development of the parties, but also the strengthening of the skills of the non-leading side for the performance of competitive elements. Violation of symmetry will be considered a mistake when performing a number of aesthetic and technical motor actions [5].

The problem of the research is that with the current orientation of artistic gymnastics to the increased requirements for the amplitudes of movements in the elements of floor exercises and in exercises on a balance beam on the non-leading side in the theory and practice of sports and the theory and methodology of artistic gymnastics, there are no scientifically substantiated information on the methodology for the development of flexibility gymnasts 6 - 7 years old, taking into account motor asymmetry.

Purpose of the research: to develop and experimentally substantiate the effectiveness of the exercise methodology for the development of flexibility, taking into account motor asymmetry in female gymnasts 6-7 years old.

Materials and methods of research: analysis of scientific and literary data, questionnaire survey of coaches, methods for determining the features of motor asymmetry, control tests, pedagogical observation, pedagogical experiment, methods of mathematical statistics.

Research results and their discussion.

The study of motor asymmetry, and more specifically, the determination of the leading limb was carried out using tests. In total, six exercises were used: “leg to leg”, “step forward”, “step”, “long jump with a push of one leg”, “bouncing on one leg”, “jumping rope” [4, 7].

Table 1 shows the results of determining the leading leg among gymnasts for each of the above exercises.

Table 1 - The results of determining the leading leg among gymnasts 6-7 years old

Test	n = 20	
	Object under study	
	Right leg	Left leg
«Foot to foot»	13	5
«Step forward»	17	1
«Step»	17	1
«Long jump with one leg jerk»	15	3
«Bouncing on one leg»	13	5
«Jumping rope»	17	1

When analyzing the results, it can be concluded that in almost all subjects the working (power) leg is the right leg, and the jogging leg is the left leg. This can be explained by the fact that a specific feature of artistic gymnastics is that such elements as some rotations, balances and jumps are performed on the right (leading) leg. Not the leading leg, as a result, is a jogging or supporting leg. Thus, the non-leading leg is not sufficiently developed for rotations, jumps and balances necessary for the implementation of competitive activity.

Before starting the experiment, the level of flexibility development was assessed using control exercises in two groups of gymnasts, 10 people each. In the future, all gymnasts took part in the pedagogical experiment.

The following control exercises were used as criteria characterizing the development of flexibility: left twine, right twine, right and left hold, right and left side hold, left and right back hold.

The results of the initial level of flexibility development (before the experiment) in the control and experimental groups are presented in Table 2.

Table 2 - The initial level of development of flexibility in the control and experimental groups.

Control exercises	Group	Statistical quantities			
		X	σ	t	p
Twine (leading) (centimeters)	Control	16,2	2,1	0,9	>0,05
	Experimental	17	1,7		

Twine (not leading) (centimeters)	Control	14,3	2,4	0,5	>0,05
	Experimental	13,8	2,1		
Hold (leading) (angle gr.)	Control	85,5	7,6	0,1	>0,05
	Experimental	85	8,2		
Hold to the side (leading) (angle gr.)	Control	88,5	3,4	0,2	>0,05
	Experimental	88	6,3		
Hold back (non-leading) (angle gr.)	Control	72,5	7,5	0,3	>0,05
	Experimental	73,5	8,2		
Hold (not leading) (angle gr.)	Control	76	6,6	0,9	>0,05
	Experimental	73	7,9		
Keep to the side (not leading) (angle gr.)	Control	78,5	6,7	1,1	>0,05
	Experimental	75,5	6,0		
Hold back (leading) (angle gr.)	Control	66,5	5,8	0,4	>0,05
	Experimental	65,5	6,0		

When comparing the indicators of the level of development of flexibility in female gymnasts of 6-7 years old, by the beginning of the experiment, it was found that there were no statistically significant differences between the control and experimental groups ($p > 0.05$). It follows that these groups are homogeneous.

In our study, an experiment was conducted in which gymnasts (twenty people) of groups of initial training of the first and second years of study (6-7 years old) took part in the department of theory and methodology of gymnastics at Moscow State Academy of Physical Education and had the same initial level of flexibility development. For the experiment, we have developed complexes of exercises using an elastic band with strong resistance (elastic bands have several levels of elasticity; usually there are three levels of resistance: strong, medium and weak) and the method of their application. The control group trained according to the generally accepted method with the same number of repetitions of exercises on the leading and non-leading sides. The experimental group in their trainings used a methodology developed by us with a predominance of work on the non-leading side. The complexes were included at the end of the main part of the training session (classes were held three times a week for one and a half hours). The duration of each complex is 10-15 minutes. As a rule, the developed complexes included 5 - 7 exercises. During the exercises, the static stretching method was used. Each exercise was held for 20 to 30 seconds.

After five months, we re-evaluated the level of flexibility development in gymnasts using the same control exercises.

The results of the level of development of flexibility after the experiment in the control and experimental groups are presented in table 3.

Table 3 - The level of development of flexibility in the control and experimental groups after the experiment.

Control exercises	Group	Statistical quantities			
		X	σ	t	p
Twine (leading) (centimeters)	Control	9,8	1,3	3,6	<0,01
	Experimental	6,7	1,4		
Twine (not leading) (centimeters)	Control	7,8	1,3	2,3	<0,05
	Experimental	6,2	1,1		
Hold (leading) (angle gr.)	Control	96,5	2,6	2,1	<0,05
	Experimental	102,5	2,4		
Hold to the side (leading) (angle gr.)	Control	100	2,3	2,5	<0,05
	Experimental	107,5	2,8		
Hold back (non-leading) (angle gr.)	Control	85,5	2,9	2,2	<0,05
	Experimental	94,5	3,1		
Hold (not leading) (angle gr.)	Control	86,5	6,7	2,5	<0,05
	Experimental	94,5	7,6		
Keep to the side (not leading) (angle gr.)	Control	88,5	7,1	4,0	<0,01
	Experimental	101	7,0		
Hold back (leading) (angle gr.)	Control	76,5	6,7	3,9	<0,01
	Experimental	89	7,7		

When comparing the results, we found that the level of flexibility development significantly increased in the two groups, but among the gymnasts who used the complexes developed by us and the methodology for their use in training, there was a significant improvement in flexibility on the non-leading leg and a decrease in asymmetry, compared to the beginning of the experiment. ... The experimental group surpassed the indicators of the control group and in each control exercise showed statistically significant increases in indicators ($p < 0.05$). Thus, the experimental method for the development of flexibility in female gymnasts 6-7 years old, taking into account motor asymmetry, turned out to be effective.

Findings:

1. Individual features of motor asymmetry were determined using tests. When comparing the indicators of the level of development of flexibility among gym-

nasts of 6-7 years old groups of initial training before the experiment, it turned out that in the experimental and control groups these indicators are approximately homogeneous and do not have statistically significant deviations.

2. An experimental method of flexibility development, taking into account motor asymmetry in 6-7 year old gymnasts of primary training groups, was developed and introduced into training sessions.

3. The results of the study confirmed the assumption that the use of the developed complexes and methods of their use in the training process of female gymnasts of 6-7 years old is more effective in comparison with the use of the generally accepted methodology for the development of flexibility.

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馬什科夫 (Mashkov) 的菱形是武術初始階段降冰片型體質的第二個童年時期男孩姿勢的指標。

MASHKOV'S RHOMBUS AS AN INDICATOR OF POSTURE IN BOYS OF THE SECOND CHILDHOOD PERIOD OF THE NORMOSTHENIC TYPE OF CONSTITUTION AT THE INITIAL STAGE OF MARTIAL ARTS

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目的：研究武術訓練初期階段的等量運動型體質的第二個男童的馬什科夫菱形的年齡特徵以及頸椎和腰椎水平的脊柱前凸深度，作為姿勢指標。

材料與方法。我們檢查了19歲的正常兒童體質類型的第二個孩子（8-12歲），他們根據以V. G. 命名的CYSS№3進入武術領域。秋明Khromin。憲法的類型是根據Chernorutsky確定的。馬什科夫菱形的評估是根據公認的方法進行的。使用我們提出的設備（實用新型№30253的RF專利）評估了頸椎和腰椎

水平的脊柱前凸深度作為姿勢的指標。

結果。 Mashkov菱形側面的年齡相關尺寸首先表明沒有脊柱側凸病。其次，隨著體態正常的男孩的護照年齡的增加，脊柱的頸椎和腰椎水平的脊柱前凸深度增加，在腰椎中更為明顯。

結論。 根據馬什科夫菱形的指標，正常體質型的第二個童年時期的男孩沒有脊柱疾病。腰椎脊柱前凸的深度超過了頸椎前凸的深度，在普通學校的體育課和CYSS的訓練過程中，在進行體育鍛煉時應考慮到這一點。

關鍵詞： 男孩，體質正常的人，武術，姿勢，馬什科夫菱形。

Purpose: *to study the age characteristics of Mashkov's rhombus and the depth of lordosis of the spinal column at the cervical and lumbar levels as indicators of posture in boys of the second childhood period of the normosthenic type of constitution at the initial stage of martial arts training.*

Material and methods. *We examined 19 boys of the second childhood (8-12 years old) of the normosthenic type of constitution, who go in for martial arts on the basis of CYSS № 3 named after V.G. Khromin, Tyumen. The type of constitution was determined according to Chernorutsky. Evaluation of Mashkov's rhombus was carried out according to the generally accepted method. The depth of lordosis of the spinal column at the cervical and lumbar level as an indicator of posture was assessed using the device we proposed (RF patent for utility model №30253).*

Results. *The age-related dimensions of the sides of Mashkov's rhombus, firstly, indicated the absence of scoliotic disease of the spinal column. Secondly, as the passport age of boys of the normosthenic type of constitution increased, the depth of lordosis at the cervical and lumbar levels of the spinal column increased, more pronounced in the lumbar spine.*

Conclusion. *According to the indicators of Mashkov's rhombus, boys of the period of the second childhood of the normosthenic type of constitution do not have disorders of the spinal column. The depth of lordosis of the spinal column at the lumbar level exceeds the depth of the cervical lordosis, which should be taken into account when dosing physical activity both in physical education lessons in a general education school and during the training process in CYSS.*

Keywords: *boys, normosthenic type of constitution, martial arts, posture, Mashkov's rhombus.*

Relevance

The issues of diagnostics, treatment and prevention of postural disorders and scoliosis in children, adolescents and young people during their education at school and university, during physical education and sports, have been given close attention for many decades [8, 10, 13, 16, 19, 20, 25, 32, 33, 34, 35]. An analysis of the available medical and pedagogical literature indicates that a significant part

of high school students are diagnosed with a posture disorder [14, 15]. The results of clinical studies and medical statistics show that a large number of university students retain clinical manifestations of posture disorders [7, 11, 18, 31].

One of the clinical signs that allow judging the presence of deformity of the spinal column is Mashkov's rhombus [1].

For many years, martial arts have been widely cultivated in our country [12, 17, 29], therefore, the interest of children to engage in various types of martial arts has significantly increased [3, 5, 6, 24]. This requires, firstly, a thorough medical and pedagogical selection for training in wrestling sections and, secondly, control of their morphological and functional state at the initial stage of martial arts training.

In connection with the order of the Government of the Russian Federation dated October 17, 2018 № 2245-r in accordance with clauses 6 and 7, the problem of sports selection in the modern conditions of the development of children and youth and elite sports becomes especially urgent.

Purpose: to study the age characteristics of Mashkov's rhombus and the depth of lordosis of the spinal column at the cervical and lumbar levels as indicators of posture in boys of the second childhood period of the normosthenic type of constitution at the initial stage of martial arts training.

Material and methods

The survey was carried out in 19 boys of the second childhood (8-12 years old) who go in for martial arts training on the basis of CYSS № 3 named after V.G. Khromin, Tyumen, under the guidance of a highly qualified coach D.I. Mitasova. We adhered to the age periodization of human ontogenesis, adopted in Moscow in 1965, according to which boys 8-12 years old correspond to the second childhood.

Evaluation of Mashkov's rhombus (cm) was carried out according to the generally accepted method. The type of constitution was assessed using the method of V.M. Chernorutsky. The depth of lordosis of the spinal column at the cervical and lumbar level as an indicator of posture was assessed using the device we proposed (RF patent for utility model № 30253).

The research was carried out in the first half of the day in compliance with the principles of voluntariness, individual rights and freedoms guaranteed by Articles 21 and 22 of the Constitution of the Russian Federation.

Results and discussion

There are the following variants of posture disorders, in which there is a change in the correct ratios of the physiological bends of the spinal column [22, 23, 28]:

- "stoop" - an increase in the thoracic kyphosis in the upper sections with smoothing of the lumbar lordosis [26, 30];

- "round back" - an increase in the thoracic kyphosis throughout the thoracic spine [2, 26];

- "round-concave back" - an increase in thoracic kyphosis and an increase in lumbar lordosis [27];
- "concave back" - increased lordosis in the lumbar region [9];
- "flat back" - smoothing of all physiological curves [4].

In order to study the presence or absence of postural disorders in boys of the second childhood in Tyumen, at their initial stage of martial arts training, we carried out age measurements of Mashkov's rhombus. For this, the following anatomical points were designated on the back surface of the boys' torso with a marker:

- spinous process of the VII cervical vertebra (point 1);
- the lower corner of the left scapula (point 2);
- spinous process of the V lumbar vertebra (point 3);
- the lower corner of the right scapula (point 4).

A rubberized tailor's measuring tape was used to measure the distance between the 1st and 2nd points (L 1), between the 2nd and 3rd points (L 2), between the 1st and 4th points (L 3) and between 4 -th and 3rd points (L 4) (tab. 1).

Table 1
Age indicators of Mashkov's rhombus (M±m)

Age	Distance between points
8 years	L 1 - 13.27 ± 0.39 L 3 - 13.27 ± 0.39 L 2 - 15.19 ± 0.45 L 4 - 15.19 ± 0.45
9 years	L 1 - 14.80 ± 0.41 L 3 - 14.80 ± 0.41 L 2 - 16.86 ± 0.48 L 4 - 16.86 ± 0.48
10 years	L 1 - 16.00 ± 0.44 L 3 - 16.00 ± 0.44 L 2 - 17.75 ± 0.50 L 4 - 17.75 ± 0.50
11 years	L 1 - 16.94 ± 0.47 L 3 - 16.94 ± 0.47 L 2 - 18.45 ± 0.53 L 4 - 18.45 ± 0.53
12 years	L 1 - 18.73 ± 0.55 L 3 - 18.73 ± 0.55 L 2 - 20.24 ± 0.58 L 4 - 20.24 ± 0.58

The study of age-related changes in the values of the sides of Mashkov's rhombus testified, firstly, that they are in strict accordance with the physiological processes of growth and physical development of boys inherent in the studied period of ontogenesis. Secondly, as the passport age of boys increased, they did not have clinical signs indicating scoliotic disease of the spinal column, because the distances between the measured currents were evenly expressed on the right and left. Third, the dimensions of the sides L 3 and L 4 in absolute terms were larger than the distances between points 1-2 and 1-4. Based on this, it can be concluded that, according to the Mashkov's rhombus indicators, boys of the second childhood period of the normosthenic type of constitution do not have abnormalities from the spinal column.

The dynamics of the age values of the length (cm) of the sides of Mashkov's rhombus deserves attention. So, for the period from 8 to 9 years, the length of the sides L 1 and L 3 in absolute terms increased by 1.53 cm, from 9 to 10 years - by 1.20 cm, from 10 to 11 years - by 0.94 cm, from 11 to 12 years old - by 1.79 cm (fig. 1).

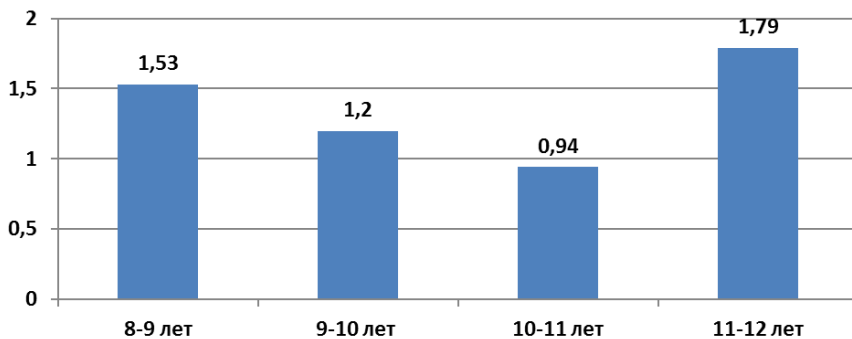


Fig. 1. Age-related increase in the lengths of the sides L 1 and L 3 Mashkov's rhombus in boys of the normosthenic type of constitution at the initial stage of martial arts training

As for the length of the sides L 2 and L 4 Mashkov's rhombus in boys of the second childhood of the normosthenic type of constitution at the initial stage of martial arts, then for the period from 8 to 9 years in absolute terms it increased by 1.67 cm, from 9 to 10 years - by 0.89 cm, from 10 to 11 years old - by 0.70 cm, from 11 to 12 years old - by 1.79 cm (fig. 2).

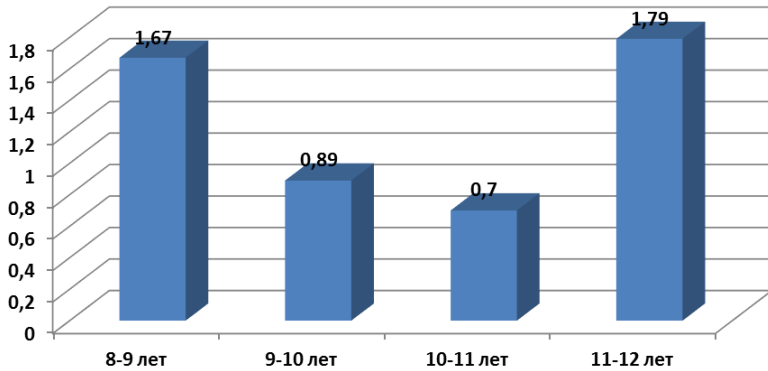


Fig. 2. Age-related increase in the lengths of the sides L 2 and L 4 Mashkov's rhombus in boys of the normosthenic type of constitution at the initial stage of martial arts training

Thus, the analysis of the values of the lengths of the sides of Mashkov's rhombus testified to the uneven age-related growth of the spinal column, more intense in the period from 11 to 12 years. We explain this by the peculiarities of the course of physiological processes of growth and physical development of boys during the second childhood. We believe that this circumstance should be taken into account both when dosing physical activity in physical education lessons in a general education school, and when conducting the training process in CYSS.

In the available literature, we came across studies that shed light on the severity of lordosis of the spinal column in the cervical and lumbar regions in boys of the normosthenic type of constitution during the second childhood, who go in for single combats. The results of studying the dynamics of the severity of the depth of lordosis at the cervical and lumbar levels of the spinal column in boys from 8 to 12 years old testified that it is deeper at the lumbar level (tab. 2).

Table 2
The severity of lordosis of the spinal column ($M \pm m$)

Age	Depth of cervical lordosis	Lumbar lordosis depth
8 years	2.624±0.165	4.027±0.242
9 years	2.789±0.183	4.133±0.295
10 years	2.860±0.196	4.471±0.304
11 years	2.911±0.214	4.880±0.326
12 years	3.091±0.221	4.994±0.337

Over the period from 8 to 12 years, the depth of lordosis of the cervical spine in boys of the normosthenic type of constitution of the studied age increased from 2.624 to 3.091 cm, which is statistically significant ($p < 0.05$). So, the depth of lordosis of the cervical spine for the period from 8 to 9 years in boys in absolute terms increased by 0.165 cm, from 9 to 10 years - by 0.071 cm, from 10 to 11 years - by 0.051 cm, from 11 to 12 years - by 0.180 cm (fig. 3).

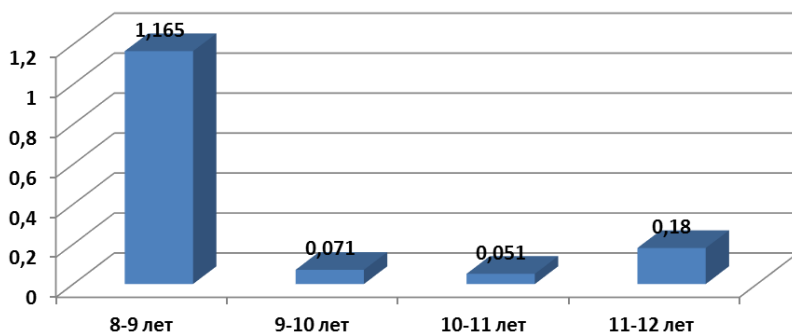


Fig. 3. Age-related increase in the depth of lordosis of the cervical spine in boys of the normosthenic type of constitution at the initial stage of martial arts training

As for the depth of lordosis of the lumbar spine, the measurements showed, firstly, in absolute terms it was greater than at the cervical level. Secondly, as the passport age of boys increased, lumbar lordosis became more pronounced. So, if at the age of 8 years the depth of the lumbar lordosis was 4.027 cm, then at the age of 12 it was equal to 4.994 cm, i.e., in absolute terms it increased by 0.967 cm, which is statistically significant ($p < 0.05$).

The depth of age-related increase in lordosis of the lumbar spine in absolute values for the period from 8 to 9 years in boys increased by 0.106 cm, from 9 to 10 years - by 0.338 cm, from 10 to 11 years - by 0.409 cm, from 11 to 12 years - by 0.114 cm (fig. 4).

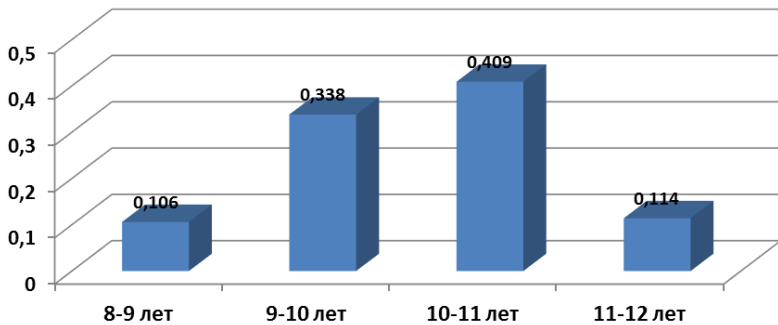


Fig. 4. Age-related increase in the depth of lordosis of the lumbar spine in boys of the normosthenic type of constitution at the initial stage of martial arts training

Based on the study, the following **conclusions** can be drawn.

1. Mashkov's rhombus is one of the indicators by which one can judge the sagittal axis of the spinal column of a growing child's body, especially with gradually increasing dosed physical activity during sports, in particular, martial arts. As the passport age of boys increases, a physiologically conditioned uniform development of the spinal column occurs in the sagittal plane. Martial arts do not cause in boys of the period of the second childhood a normosthenic type of constitution of disorders of the spinal column in the sagittal plane.

2. The results of studying the dynamics of the severity of the depth of lordosis at the cervical and lumbar levels of the spinal column in boys of the period of the second childhood of the normosthenic type of constitution indicated that it gradually increases in connection with the passport age and is significantly deeper at the lumbar level.

The authors declare that they have no conflicts of interest.

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急性拐彎性腸胃炎並發四歲兒童食管自發破裂

**THE ACUTE INFLECTIONAL GASTROENTERITIS CASE
COMPLICATED WITH THE SPONTANEOUS ESOPHAGUS RUPTURE
IN A FOUR-YEAR-OLD CHILD**

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抽象 這篇文章描述了一個4歲兒童同時患有急性腸道感染性疾病的自發食道破裂（Boerhaave綜合徵）的情況。 延長診斷過程的主要原因是大多數醫學專家對Boerhaave綜合徵認識不足，該疾病的稀有性和臨床意義的多樣性。 任何伴有這種孤兒疾病的病例都需要緊急手術。 在大多數情況下，Boerhaave綜合徵的發展會致命地結束。

關鍵詞：自發性食道破裂，Boerhaave綜合徵，兒童急性屈折性腸胃炎

Abstract. *The article describes a case of the spontaneous esophagus rupture (the Boerhaave syndrome) in a 4-year-old child developed simultaneously with an acute intestinal infectious disease. The main reasons of prolonged diagnostic process are most medical specialists' poor awareness about the Boerhaave syndrome, the rarity of the disease and the diversity of clinical implications. Any case complicated with this orphan disease needs an emergent surgery operation. The development of the Boerhaave syndrome ends fatally in most cases.*

Keywords: *the spontaneous esophagus rupture, the Boerhaave syndrome, an acute inflectional gastroenteritis in children*

The Dutch physician Herman Boerhaave was the first to describe spontaneous rupture of all layers of the esophageal walls (Boerhaave syndrome) in 1724. There are some isolated cases of spontaneous esophagus rupture in newborns introduced in medical literature (I. Aaronson et al. 1975), but the disease occurs very rarely in

children over one year of age and adolescents [1]. A case of spontaneous esophagus rupture (SER) in a newborn was first described by J.Fryfogle in 1952. However, the case can hardly be identified as spontaneous since during the operation there was revealed a membrane completely overlapping the lumen distal to the rupture.

The concept “spontaneous” indicates that the reasons for the violation of the integrity of the esophageal wall are unknown. There are various supposition on the origin of the suffering. Thus, S. Beraud et al. (1969) believe the perforation occurs because of an increase of air pressure in the esophagus during a newborn’s first swallowing. At the same time V. Chunn and L. Geppert (1962) revealed that the strength of esophagus in children is greater than in adults. So in order to break its integrity the pressure in its lumen should fluctuate within very wide limits. Some authors (N.Myers, 1972; N.Khanna et al., 1978) believe that vomiting or manipulations to revive a child may cause the rupture [2].

According to G.Harell et al.(1970) the lower right part of esophagus may rupture because the right wall at this level is only covered by a thin plate of the parietal pleura while the left esophagus wall is reinforced by the descending aorta. The authors prove their point of view by their own observation of the case with the left esophageal wall rupture in a child. It was revealed during the operation that the patient had the unusual location of the descending aorta – on the right. Some researchers involved in children’s topographic anatomy also point to insufficient protection of the right esophageal wall at the level TB-7 [T.I. Morozova 1967,1977; A. Andronescu 1970; Yu.F. Isakov et al. 1978]. The hole in the esophageal wall was longitudinally located. Its dimensions ranged from 2 mm to 5 cm. Tissues immediately adjacent to the rupture were with necrotic inflammation in all the cases. In addition, one of the observations (S. Beraud et al. 1969) noted extensive ulceration of other parts of esophageal mucous membrane and the presence of the gastric type glands. If we consider that the affected part of the esophagus have been intercommunicating with the pleural cavity filled with purulence we cannot suggest what was the primary – esophagitis or perforation.

Consequently, the most noticeable anatomical feature of the SER in newborns is the location of the rupture – the right wall of the lower section. This feature largely determines the diagnosis of the damage.

The incidence of SER (Boerhaave syndrome) in the lower section in adult patients varies from 3.9 to 16.7% [3]. Moreover, it often occurs that the damage is located on the left lateral esophageal wall with the involvement the mediastinal pleura and the esophagus and stomach contents flow to the left pleural cavity.

Changes in the esophageal wall muscle layer may be a predisposing factor for the spontaneous esophagus rupture. The exciting cause is a sudden pressure increase inside the esophagus with the closed pharyngeal-esophageal sphincter

combined with the negative intrathoracic pressure. This occurs while intense and repeated vomiting after a heavy meal, or an increase of gastric and then esophageal pressure during straining, bowel movements, intense coughing or convulsions. SER is characterized by the occurrence of large defects in esophageal walls (from 4-5 to 10-12 cm). They most often locate in the left wall of the lower thoracic esophagus (in 90% cases). The overwhelming majority of cases demonstrate longitudinally oriented ruptures located in the weakest section – directly above the diaphragm (3-6 cm above it) [4]. The rupture of all the esophageal walls (transmural rupture) is typical for Boerhaave syndrome. It is rarely accompanied by massive bleeding.

The formepleine of Boerhaave syndrome appears with Makler's triad:

- vomiting of food (some patients have an admixture of blood in the vomit);
- subcutaneous emphysema in the cervicothoracic part caused by the air accumulation in the subcutaneous tissue;
- severe cutting pain in the chest (less often in the abdomen) that suddenly occurs during the vomiting attack (the stomach or duodenal ulcer-like symptoms), may radiate to the left shoulder girdle and lumbar region and augments when swallowing.

It is diagnosed by endoscopic and radiation (X-ray, computer tomography) research methods.

Clinical case description

A 4-year-old patient in serious condition was admitted on the 4th day of illness. The child had been vomiting 1-2 times a day during the week, but had normal temperature. The other symptom was unstable stool. No medical consultation had been required. The child continued to attend kindergarten. Three days before admission the temperature had been increasing to febrile digits, there had the sore throat registered when trying to swallow. There was diagnosed ARVI accompanied by rhinopharyngitis. The medical prescription was to take Nurofen, Zodak and Miramistin irrigation of the oropharynx. Against the medication intake, the temperature dropped, but the state of health deteriorated sharply. There was registered repeated vomiting. The patient refused to eat and drink. Flaccidity and weakness was growing. Because of the lack of positive dynamics, he was sent for inpatient treatment with a diagnosis of suspected case of acute intestinal infection accompanied by ARVI, rhinopharyngitis. Anamnesis record was usual. Epidemiological, vaccine anamnesis was with no pathology as well. The patient had demonstrated no somatic pathology. Considering the severe condition caused by intoxication, water-electrolyte, hemodynamic disorders and metabolic acidosis and shock symptoms, the child was admitted to the intensive care unit. Body temperature was subnormal (35.40 C). While examining the doctor paid attention to significant lips and nasolabial triangle cyanosis, acrocyanosis and "marble pattern"

of the skin. Sensorium was in a soporific state, the patient did not comply with instructions, answered in monosyllables. Asked for a drink, but his attempts to swallow water ended in vomiting. During the examination, the patient was urged to vomit, then twice vomited with substance of "coffee grounds" type. There were prominent dehydration symptoms: the skin was dry, cold, with "marbled pattern", facial features were pointed, eyes sunken. The lips, mucous membranes of the mouth were dry, pale cyanotic, the tongue was thickly coated with a dirty white coating. As for the lungs, there was registered shallow breathing, weakened on both sides while auscultating, though there was no wheezing heard. Respiratory rate registered at 32 times per minute. Heart sounds were muffled; slight systolic murmur was diagnosed at the apex of the heart, heart rate counted 160 beats per minute. The pulse was at the periphery of weak filling and tension, blood pressure was 80/53 mm Hg. The abdomen was of normal shape, slightly swollen in the upper sections. The abdomen palpation demonstrated it was soft, with palpation tenderness along the intestines and the vivid sound of peristalsis. There were no symptoms of "acute abdomen" defined. Meningeal and focal symptoms were negative. Urine flow was not impaired. The preliminary diagnosis was an acute gastroenteritis of infectious etiology, exsiccosis accompanied by toxicosis of the 2nd degree, with the risk of disseminated intravascular coagulation, with severe course, acute respiratory infection, acute tonsillitis.

There was antibacterial, infusion, hormonal and symptomatic therapy started. Within 7 hours, the condition of the sick child remained grave, with a sudden deterioration in his condition. Bradypnea developed acutely up to 10 breaths per minute, bradyarrhythmia - 40 per minute, followed by cardiac arrest. Emergency tracheal intubation with mechanical ventilation with 100% oxygen, resuscitation measures within an hour had no effect, biological death was registered.

Pathological examination revealed the catarrhal gastroenteritis of unspecified etiology (bacteriological examination of intestinal contents for flora did not show growth); hyperplasia of the spleen, mesenteric lymph nodes, accidental involution of the thymus 2 tbsp. There was revealed a longitudinally oriented rupture of the lower thoracic esophagus left lateral wall extending in the distal part to the right lateral wall (rupture length 10 cm) with the exit of gastric contents into the pleural cavity on the left and right, posterior mediastinum; the shock of mixed genesis (hypovolemic, endotoxic) with the stage 1 respiratory distress, nephron necrosis and DIC syndrome.

Conclusions

1. The localization of SER in newborns and adult patients can differ significantly due to the anatomical features of the esophagus structure in newborns. The described clinical case showed a combined transmural injury to both the left and right esophagus lateral walls in a longitudinal orientation with a significant perforation.

ration and exit of gastric contents into the pleural cavity on the left and right, the posterior mediastinum.

2. The leading symptoms are respiratory distress, vomiting and bleeding. Signs of respiratory failure appear a little earlier, but after a few minutes vomiting or regurgitation, often mixed with blood, join them. During the physical examination one should pay attention to weakened breathing in the lungs. The clinical picture, even with most of the listed symptoms marked, does not allow to reliably identify SER. An immediate X-ray examination of the lungs is necessary to clarify the diagnosis.

In view of a short hospital stay (7 hours at night), marked symptoms of toxicosis with exicosis, shock, no X-ray of the lungs, the patient was not suspected of a surgical pathology that complicated a secretory type acute intestinal infection with the leading symptom in the form of vomiting.

3. Boerhaave's syndrome in an infant developed against the background of a secretory type acute intestinal infection with repeated vomiting complication is an extremely rare pathology in most cases ending in death. An intrathoracic esophagus closure by laparotomy, carried out up to 72 hours after the wall rupture could possibly give a chance for a favorable outcome of the disease. We did not manage to find any case described in medical literature to prove our supposition.

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順行胰腺造影在預防遠端胰腺切除術並發症中的臨床應用。

**CLINICAL APPLICATION OF ANTEGRADE PANCREATOGRAPHY
FOR THE PREVENTION OF COMPLICATIONS OF DISTAL
PANCREATIC RESECTION**

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抽象的。手術發展的主要指標之一是術後並發症的減少。在導致不良手術結果的客觀原因中，最重要的原因之一就是錯誤的手術策略。這在很大程度上取決於外科醫生的資格，手術室的設備，並取決於醫療機構的診斷依據。缺乏信息，某些器官研究的複雜性可能導致錯誤的結論並影響手術結果。為了研究胰管系統遠端切除術，我們建議使用順行胰腺造影。當使用所提出的技術時，解決瞭如何完成手術的問題，即：縫合腺殘端或在由Roux斷開的小腸環上施行胰空腸吻合術。我們認為，針對該問題的正確解決方案可降低術後並發症的風險。在各種病因的胰腺尾巴和身體病變患者的治療中，通過實驗研究和成功的臨床觀察證實了這一點。

關鍵詞：胰腺切除術，順行引導描記術，預防胰痛。

***Abstract.** One of the main indicators of the development of surgery is the minimization of postoperative complications. Among the objective reasons for the development of an unfavorable outcome of operations, one of the most significant is erroneous surgical tactics. This largely depends on the qualifications of the surgeon, the equipment of the operating room, and is determined by the diagnostic base of the medical institution. Lack of information, the complexity of the study of some organs can lead to erroneous conclusions and affect the outcome of the operation.*

To study the pancreatic duct system during its distal resection, we suggest using antegrade pancreatography. When using the proposed technique, the question of how to complete the operation is solved, namely: suturing the stump of the gland or imposing pancreatojejunostomy on the loop of the small intestine disconnected by Roux. The correct solution to this issue, in our opinion, reduces the risk of postoperative complications. This is confirmed by experimental studies and successful clinical observations in the treatment of patients with lesions of the

tail and body of the pancreas of various etiologies.

Keywords: *Pancreas resection, antegrade vigsungography, prevention of pancreatic fistulas.*

Introduction

Surgical interventions for pancreatic tumors, as well as for complications of destructive pancreatitis, are the most difficult category of surgical interventions [3]. The standard scope of operations includes distal and proximal resections, but median resections or Frey's or Beger's operations are often required [3]. There is no doubt that the success of surgical treatment depends both on a complete diagnosis and on the technical equipment of the operating room, the surgeon's personal experience, all this is possible in large medical institutions [5, 8, 17, 18]. Despite the fulfillment of all these conditions, the outcomes of operations are not unambiguous [5]. The incidence of postoperative complications remains high and reaches 60% [10,11], however, surgical treatment is the only way to provide care [7]. The most common complications are acute postoperative pancreatitis (APP), intra-abdominal bleeding, limited fluid accumulation in the abdominal cavity, and postoperative pancreatic fistula (PPS) [2, 6, 9].

According to data from various centers, the PPF frequency reaches 15-80% [10, 12, 15, 20]. The development of this complication is based on a high body mass index, an edematous gland, the tissue of which erupts during suturing, and massive blood loss [16, 19]. To reduce the risk of developing pancreatic fistulas, special importance in distal resection is given to the processing of a cut of the gland stump; for this, the following methods are used: ligation of the stump [2]; stitching, incl. and hardware suture, but some surgeons [13] consider mechanical suture of the gland undesirable; isolated ligation of the main pancreatic duct [2, 6].

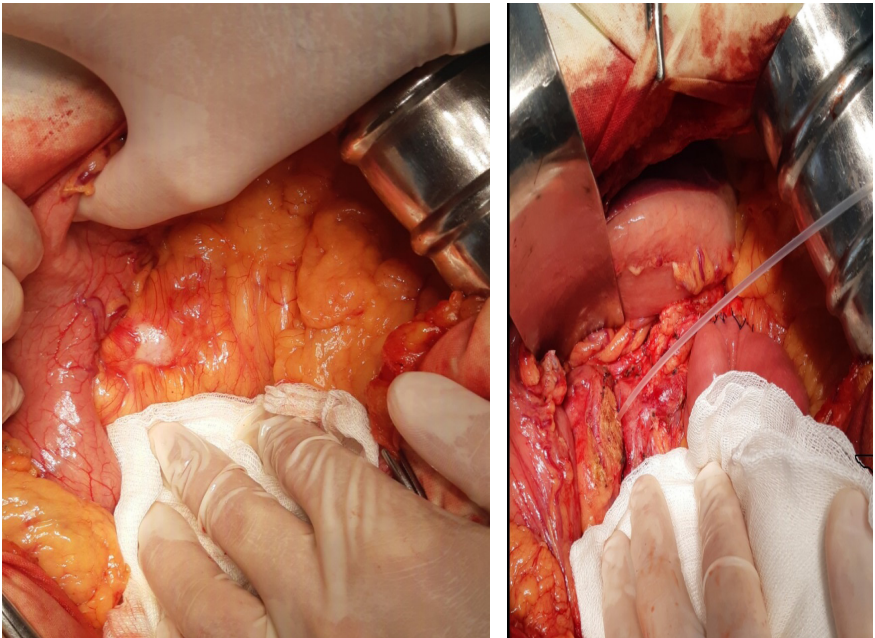
Also, for the prevention of PPF, it is proposed to impose pancreatojejunostomy or cover the stump of the gland with plastic material [11]. Like 50 years ago, the current lack of consensus among researchers on this issue indicates that it is still not resolved.

We believe that antegrade pancreatography is advisable to visualize the Wirsung duct after distal resection of the pancreas before the end of the operation.

This diagnostic method makes it possible to solve important tactical questions, namely: is it possible to suture the stump of the resected gland while maintaining its patency in the terminal section, or is it necessary to impose pancreatoenteroanastomosis in case of a detected violation of the outflow of pancreatic juice into the duodenum 12. Neglect of this circumstance can lead in the postoperative period to the outflow of pancreatic juice into the omental bursa through the gland cut, and cause the development of intra-abdominal abscesses or postoperative pancreatic fistulas [7, 14].

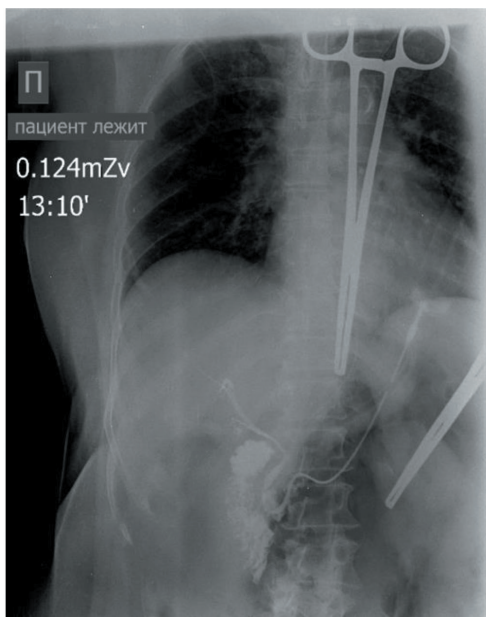
To demonstrate this, we present the following clinical observations. Patient S., born 1950 Case history № 18621. She was treated in the 1st surgical department of the COCH since 02.07.2019. with a diagnosis of "Tumor of the body of the pancreas". On 03.07.2019, the operation was undertaken: Laparotomy, median resection of the pancreas, pancreatoenterostomy on a Roux-en-Y loop.

Intraoperatively, histological data for cancer were not revealed, it was decided to perform a median resection of the pancreas. The pancreas is crossed proximal to the isthmus, distally at the level of the border of the body and tail of the gland. On a section of the gland in the head region, a Wirsung duct (3 mm in diameter) was visualized. To clarify the patency of the Wirsung duct in the proximal direction, intraoperative pancreatography was performed, contrast agent was a 5 ml trazograph, a solution of 76%. It was found that the contrast agent freely enters the duodenum. The Wirsung duct was tied, the proximal stump was sutured. With the distal stump of the pancreas, a pancreatoenteroanastomosis was applied on the Roux-off loop.



Intraoperative photo № 1 (left). Pancreatic body tumor

Intraoperative photo № 2 (right). Catheterization of the Wirsung duct

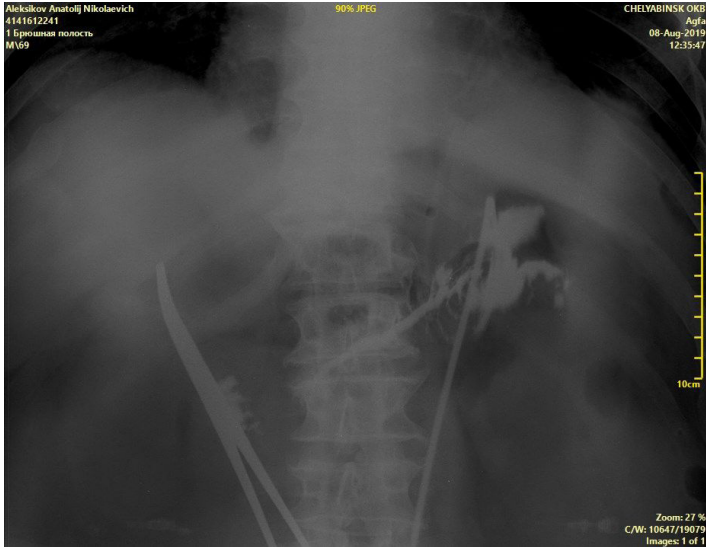


Radiograph № 1. (left). *The Wirsung duct is contrasted. The contrast agent freely enters the duodenum*

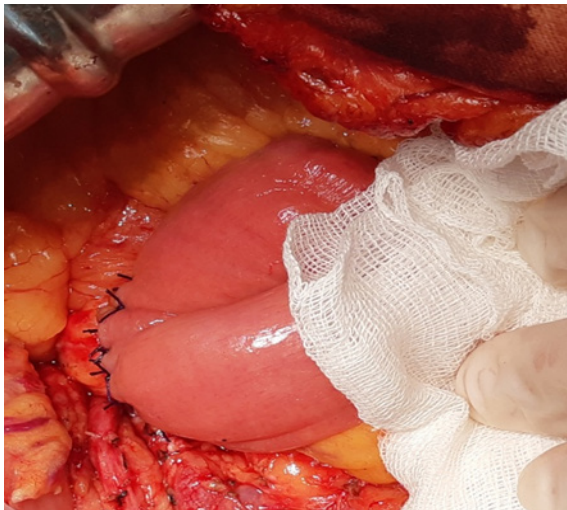
Intraoperative photo № 3 (right). *Sutured proximal stump of the pancreas*

The postoperative course was unremarkable, the sutures were removed on the 10th day, healing by primary intention. After histological examination of operating material № 25036-48, the following conclusion was obtained: "Ductal adenocarcinoma of the pancreas of moderate differentiation (3.3x1.8x2.5 cm), G2, ICD-O code 8500/3, with perivascular growth, with metastasis to the lymph node of parapancreatic tissue. Tumor growth along the lines of resection". For further treatment, the patient was referred to a chemotherapist.

Clinical example № 2. Patient diagnosed with Chronic pancreatitis, pancreatic tail pseudocyst.



Radiograph № 2. The duct blocked at the level of the Wirsung's head was contrasted. The contrast is not delivered to the duodenum.



Intraoperative photo № 4. Pakreatoenteroanastomosis

Considering the result of antegrade pancreatography, the patient underwent distal resection of the pancreas and a pancreatoenteroanastomosis was applied.

Discussion. The performed X-ray method of research in the case of treatment of these patients in the first case contributed to the identification of normal patency of the Wirsung duct, taking into account these data, the pancreatic duct was sutured. The second patient had a block at the level of the terminal section of the pancreatic duct, therefore pancreatoenteroanastomosis was imposed. The absence of complications in the postoperative period in the form of leakage of pancreatic juice through the gland stump led to a cure in a shorter time with a full clinical and functional result. In addition, no allergic reactions or other adverse effects were observed during virungography.

Conclusion. Thus, we consider it necessary to use antegrade virungography for resections of the pancreas, to determine the patency of the Wirsung duct, to choose the correct surgical tactics and, as a consequence, to reduce the risk of developing intra-abdominal abscesses and pancreatic fistulas in the postoperative period.

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接受COVID-19的真菌性胰腺炎患者的身體狀況
**SOMATIC STATUS IN A PATIENT WITH FUNGAL PANUVEITIS
WHO UNDERWENT COVID-19**

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抽象的。在眼科學和實踐之前，COVID-19大流行提出了許多挑戰。由於新的冠狀病毒感染而遭受肺部損傷的患者需要承受大量的藥理學負擔（包括抗菌，抗病毒，抗炎和糖皮質激素藥物），這會導致免疫力下降和附著真菌菌群的可能性。另外，在康復期間，糖尿病可能在伴隨的代謝紊亂的背景下發展。

關鍵詞：冠狀病毒感染；真菌性胰腺炎病因

Abstract. *Before ophthalmology science and practice, the COVID-19 pandemic has posed a number of challenges. Patients suffering from lung damage as a result of a new coronavirus infection receive a large pharmacological load (including antibacterial, antiviral, anti-inflammatory and glucocorticoid drugs), which leads to a decrease in immunity and the possibility of attaching fungal flora. In addition, during the period of convalescence, diabetes mellitus may develop against the background of concomitant metabolic disorders.*

Keywords: *coronavirus infection, panuveitis of fungal etiology*

Introduction. COVID-19 (CoronaVirusDisease 2019) is a severe acute respiratory infection caused by the SARS-CoV-2 virus (severe acute respiratory syndrome coronavirus 2) and on March 11, 2020 WHO announced the beginning of the COVID-19 pandemic [2,3,5,6]. According to Rospotrebnadzor in Russia, the

disease is asymptomatic in 23% of patients, 63% have manifestations of acute upper respiratory tract infection, and 14% develop pneumonia [3]. It is noted that in addition to the endothelium of the respiratory tract, coronavirus infection affects the endothelium of peripheral vessels, in particular the vessels of the eyeball and its adnexa [2]. In the form of isolated observations, at the present stage, ophthalmic manifestations of this disease have been described in patients suffering from this infection, in the form of conjunctivitis, anterior uveitis, retinitis and optic neuritis [1-6]. Meanwhile, it should be borne in mind that this group of patients receives a large pharmacological load (including antibacterial, antiviral, anti-inflammatory and glucocorticoid drugs), which leads to a decrease in immunity and the possibility of attaching fungal flora.

Purpose of the study. Present a clinical case of a patient with panuveitis of fungal etiology who underwent COVID-19.

Materials and methods. On 28.01.2021, patient K., 70 years old, was hospitalized in the ophthalmology department of the SBHI TO OCH №2 with complaints of a gradual decrease in vision in both eyes within 2 months. 3 days ago, vision decreased completely, previously, within 2 weeks, floating opacities appeared before the eyes. History of glaucoma in both eyes for about 5 years (dripping Timolol and Glauprost). In the period from 10.29.20 to 12.31.2020, he was hospitalized at the MIG with a diagnosis of a new coronavirus infection, community-acquired bilateral viral pneumonia. Received antibacterial drugs (Levofloxacin, Moxifloxacin, Meropenem), was discharged in satisfactory condition. The patient is constantly taking medications (Bisoprolol, Ksarelto, Atorvastatin) recommended after discharge from the hospital. He was ill with pneumonia associated with COVID-19, was discharged on 31.12. Surgical interventions: appendectomy in childhood, cholecystectomy 5 years ago. About a month ago, she was diagnosed with type 2 diabetes mellitus (Talvus takes 2 p/d, Tujeo 10 units n/a at 22:00). Glycemia is monitored daily, in the range of 8-10 mmol/l.

Results and discussion. Local status (fig. 1, 2) upon admission: Visus OD - 0.02 n/a. OS - 0.02 n/a. OU - calm. TP norm. The cornea is transparent, there are multiple loose precipitates on the endothelium. Anterior chamber of medium depth, moisture opalescent. The iris is calm. The pupil is of medium width, the reaction to light is sluggish. Partly cloudy lens in the lumen of the pupil. In the vitreous body, multiple floating opacities (exudate) are more on the right. The fundus of the eye (under the veil) OD: The optic disc is not clearly visible. Throughout the fundus, multiple different-sized foci of white color with indistinct borders will dominate. The fundus of the eye OS (under the veil): the optic nerve head is pale gray, clear boundaries, marginal excavation. Arteries are moderately narrowed, veins are dilated. On the retina, in the outer segment, there are 3 white lesions, they will be promoted into the vitreous body, with indistinct boundaries.

A comprehensive survey was carried out. ECG shows sinus tachycardia. Complete blood count - leukocytosis ($13.6 \times 10^9/l$), lymphocytopenia (8.2%), eosinophilia (1.1%), hemoglobin 113 g/l, other indicators are within normal limits. Biochemical blood test - there is an increase in urea (9.8 mmol/l), glucose (9.9 mmol/l).

Coagulogram: APTT 39 s (normal); prothrombin time 24 s (increased); INR 1.75 (increased).

Common analysis of urine - microhematuria (3.6 v_p/sp), leukocyturia (3.6 v/sp). COVID-19 AG EXPRESS from 01.17.2021 Negative.

Ultrasound examination of the abdomen and kidneys showed a postoperative absence of the gallbladder.

CT scan of the chest organs did not reveal any inflammatory changes in the lung parenchyma.

Doppler ultrasonography of the arteries of the lower extremities revealed echographic signs of atherosclerosis of the arteries of the lower extremities, without hemodynamically significant violations of the patency of the arteries of the lower extremities. Doppler ultrasonography of the veins of the lower extremities did not reveal signs of venous thrombosis of the lower extremities.

Diagnosed with Panuveitis in both eyes, fungal etiology. Open-angle glaucoma III in (m) OS, III a (m) OD. Incomplete complicated cataract in both eyes. Diabetes mellitus type 2, insulin-dependent. Diabetic micro- and macroangiopathies (the degree needs to be specified). Target glycemic control levels: HbA1c <7.5%, fasting/pre-meal plasma glucose <7.5 mmol/l, plasma glucose 2 hours after meals <10.0 mmol/l. Ischemic heart disease. Atherosclerotic cardiosclerosis. Arterial hypertension 1 degree, 3 stages, risk 4. CHF 1. Chronic anemia, unspecified genesis, mild severity. The following therapy was prescribed: antifungal (Fluconazole, solution for inf. 2 mg/ml, 300 ml 1 r, then 200.0 ml once a day for 4 days, then in 150 mg capsules three times a day until discharge from hospital), detoxification (Dextran average molecular weight 30,000-40,000 once a day intravenously drip №3), symptomatic (Esomeprazole 40 mg 2 times a day and Rebagit 100 mg 1 piece 3 times a day orally), treatment of concomitant diseases (Ferrum Lek 100 mg (before bedtime) 2 pcs 1 time per day, Atorvastatin 40 mg (before bedtime) 2 pcs 1 time per day, Tudzheo 20 units At 22:00, Galvus 50 mg 1 pc 2 times a day, Preductal 80 mg (with meals) 1 time per day; Xarelto 20 mg (with meals) 1 time per day). To the local antihypertensive treatment of the eyes, 0.5 ml of Dexamethasone solution was added parabolbar 1 time per day and 0.1% solution was epibulbar,

Tropicamide-SOLOfarm 1% three times a day, Diclofenac 0.1% solution three times a day).

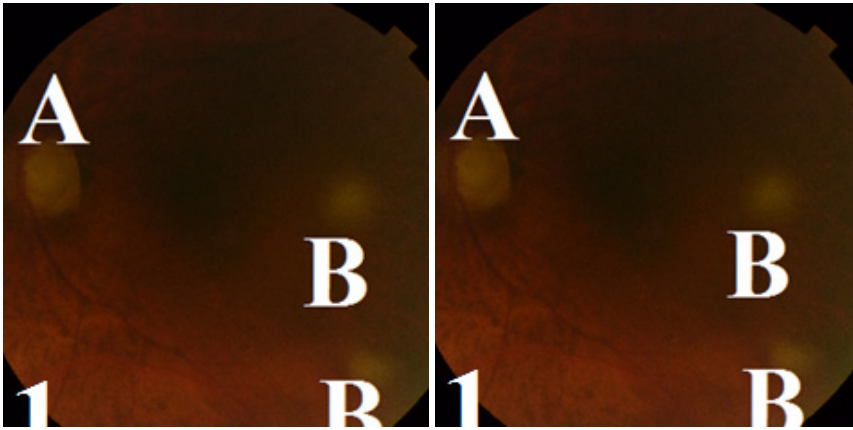


Fig. 1. Fundus image of the right eye of patient K., 70 years old
(1 - on admission, 2 - on discharge, A - optic nerve head, B - soft exudates)

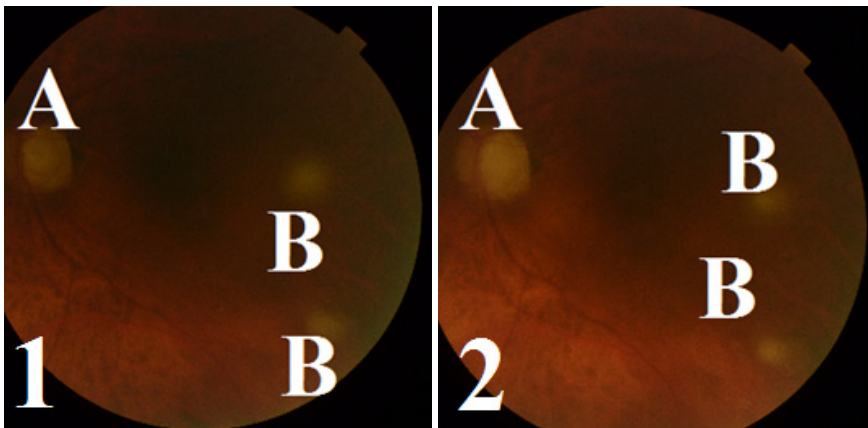


Fig. 2. Fundus image of the left eye of patient K., 70 years old
(1 - on admission, 2 - on discharge, A - optic nerve head, B - soft exudates)

At discharge, a positive trend was noted (fig. 1, 2): VIS OD/OS - 0.02 n/a/0.02 n/a. IOP - 18/18 mmHg. OU - calm. TP normal. The cornea is transparent; the precipitates on the endothelium have completely resolved. The moisture of the anterior chamber is transparent. Pupil - sluggish response to light. Partly cloudy lens in the lumen of the pupil. In the vitreous body, the exudate is much less. The fundus of the eye OD is seen more clearly: the optic disc is pale gray, the boundaries are clear, marginal excavation. Arteries are moderately narrowed, veins are di-

lated. Throughout the fundus, there are multiple white foci of different sizes with indistinct boundaries, a decrease in the height of protrusion into the vitreous body (in dynamics, it is much smaller in size and quantity). The fundus of the eye OS - under the veil: the optic nerve disc is pale gray, clear boundaries, marginal excavation. Arteries are moderately narrowed, veins are dilated. On the retina, in the outer segment, 3 white lesions, reduced in size, will penetrate into the vitreous body, with indistinct boundaries. Ultrasound of OI - multiple floating opacities persist in the vitreous body, more in the posterior regions (in dynamics less in number and size), posterior detachment of the vitreous body, the retina is adjacent.

Conclusion. The presented clinical case demonstrates that in patients with atherosclerotic vascular lesions (coronary artery disease, atherosclerotic cardiosclerosis), arterial hypertension after a new coronavirus infection with lung damage, diabetes mellitus and panuveitis of both eyes of fungal etiology may develop.

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使用Danio rerio模型研究生理活性藥物的藥理作用的藥物代謝組學方法學：關於神經性藥物的實例

METHODOLOGY OF THE PHARMACOMETABOLOMIC APPROACH IN THE INVESTIGATION OF THE PHARMACOLOGICAL EFFECTS OF PHYSIOLOGICALLY ACTIVE DRUGS USING *DANIO RERIO* MODEL: EXAMPLES ON NEUROTROPIC DRUGS

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抽象的。代謝組學的最新優勢導致其分支機構pharmacometabolomics的建立，該分支機構使用代謝組學方法研究化學物質的作用。儘管藥代代謝組學可能是研究藥物作用的非常有用的工具，但為這些研究尋找新的生物學模型仍處於邊緣。斑馬魚（Danio rerio）是一種熱帶小魚，用於研究發育生物學和遺傳學。最近，它引起了全世界科學家的極大關注。在這項研究中，我們使用Danio rerio制定了藥物代謝組學方法的理論方法，並通過進行具有神經營養作用的藥物的藥物代謝組學研究和驗證性研究來證明其概念。

關鍵字：藥代代謝組學，代謝組學，方法學，斑馬魚，UPLC-MS / MS，神經營養，行為，兔。

Abstract. *The recent advantages in the metabolomics led to formation of its' branch called pharmacometabolomics that investigates the effects of the chemical substances using metabolomics methods. Although, pharmacometabolomics may be a very useful tool to investigate the effects of the drugs, the search for the new biological models for these studies is still on the edge. Zebrafish (*Danio rerio*) is a small tropic fish that was used for the investigation of developmental biology and genetic. Recently it gained an enormous attention of the scientists throughout the world. In this study we formulate the theoretical methodology of the pharmacometabolomics approach using *Danio rerio* and prove its' concepts with conducting the pharmacometabolomics investigations of the drugs with neurotropic effects and confirmatory studies.*

Keywords: *pharmacometabolomics, metabolomics, methodology, zebrafish, UPLC-MS/MS, neurotropic, behavior, rabbits.*

Investigation of the effects of physiologically active drugs is a very important part in both drug development procedure and the screening of the potentially new chemical substances that can be used to achieve pharmacological effects of different kinds. It takes approximately 15-30 million dollars to conduct a pre-clinical trial for a single drug, and the approximate success probability of these investigations is 30 to 40 percent (Mariger, 2019). Nowadays, most of the pre-clinical trials are conducted using “traditional” investigation techniques, such as morphological, behavioral, biochemical tests, etc., but recent advantages of the metabolomics, the scientific study of the biochemical processes, involving small organic molecule substrates, that are called metabolites, that occur in the organism, led to the conclusion, that metabolomics could be potentially used as a tool to investigate the effects of the chemical substances on the organism. As an output, the usage of metabolomics in the investigation of the effects of the chemicals of several kinds led to the formation of a branch of metabolomics, that is called pharmacometabolomics. The pharmacometabolomics approach includes the investigation of the endogenous metabolites and their concentrations in the organism after the exposure to the chemicals of interest with an aim to investigate both main and side effects of this chemical. Indeed, the applications of pharmacometabolomics nowadays find their place in drug development, personalized medicine, and forensic sciences.

Pre-clinical studies rely on the usage of the mammal's models, such as rats, mice, rabbits, among others. Although, mammal's models are the ones that are mostly compatible to the humans, pharmacological investigations using these models are connected to several disadvantages, such as high cost, the need of the high-qualified personal, the need of the complex procedures. This is the point

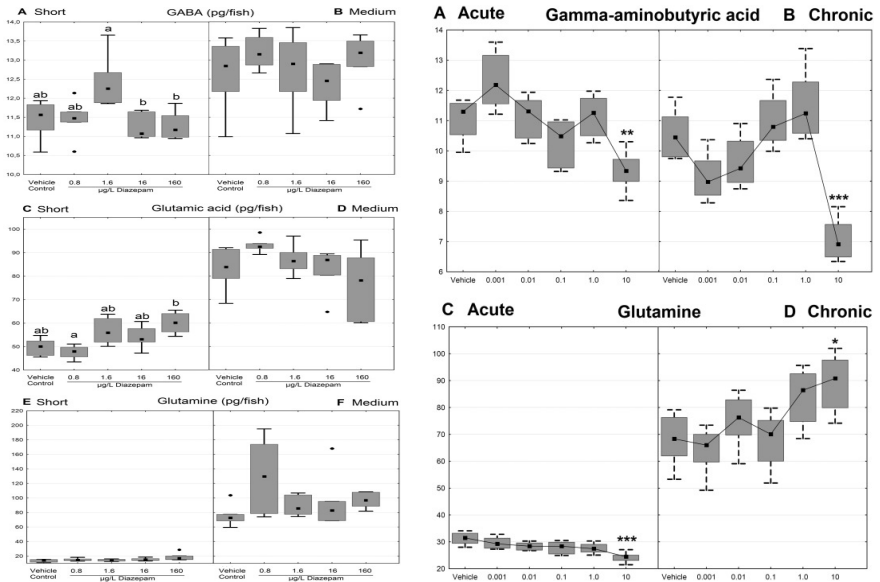
where zebrafish is “swimming into the view”. Zebrafish (*Danio rerio*) is a small fish from the *Cyprinidae* family, the close relative to the simple Carp, was first proposed 1995 as a model to investigate developmental biology and diseases (Kimmel et al., 1995). Since then, it was used to study the effects of drugs and abuse substances as an alternative to the other *in vivo* models. It has several advantages among other models, such as rapid development, high reproductive rate, low maintenance cost, the absence of the need of the highly qualified personal, and high genetic similarity to humans (D’Amora & Giordani, 2018). The objective of the study was to develop the methodology of the pharmacometabolomics approach using *Danio rerio* model and to conduct confirmatory investigations using neurotropic drugs as an example.

The developed methodology consisted of several steps. Firstly, it is necessary to make a wide literature search about the investigated drug, including, most of the time, pointing out the main receptor targets of the drug, its’ influence on the organ systems. After that, it is needed to form a targeted metabolic panel of the metabolites of interest that could be possibly affected by the drug. Next step is to develop and validate a method to quantitate these metabolites. Then, it is necessary to make a study of the well-known drug’s influence on the body in order to connect metabolomics panel to the effects of the drug. After that, the investigation of the drug of unknown effect may take place. After carrying out the study using the unknown drug it is necessary to prove the effects on the metabolism using both well-validated models (such as rabbits) and well-validated methods (such as behavioral methods). To prove the developed concept, the pharmacometabolomics approach using zebrafish was carried out using two neurotropic drugs: diazepam, the agonist of the GABA_A receptors, and 5F-APINAC, the cannabimimetic of the synthetic cannabinoid’s family; in the case of the 5F-APINAC, two confirmatory experiments (the behavioral test using zebrafish and metabolomic approach using rabbits) were conducted.

The experimental part of the study was as follows: the quantitation method of thirty-six endogenous metabolites, connected to neurotransmission, using UPLC-MS/MS analysis was developed and validated. The study design of the drugs administrations for the metabolomics analysis included the short-term (2.5 h and 4 h) administrations of the diazepam and 5F-APINAC to the zebrafish larvae at six days post fertilization-old (dpf), and medium-term administration (4 days) of aforementioned drugs to the zebrafish eggs (2 dpf) for the wide concentration range of the drugs (P.A. Markin et al., 2021; Pavel A. Markin et al., 2021). After the exposure, the samples were made and injected into the UPLC-MS/MS system. Confirmatory experiments were conducted as follows: in the behavioral test the zebrafish larvae 6 dpf old were administered with the 5F-APINAC solutions of the same concentrations. The overall moving activity was measured using Danio-

Vision hardware and software. The experiment using rabbits consisted of the infection of the 5F-APINAC solutions of various concentrations. After the injection, the blood samples were taken in several time points to assess the time-concentration profiles of the endogenous metabolites. Blood samples were analyzed using the developed UPLC-MS/MS approach.

Diazepam administration did cause several dose-dependent changes in the levels of glutamic acid, tryptophan, serotonin, phenylalanine, tyrosine, and aspartic acid. It is interesting to note that GABA concentrations were not affected by the diazepam administration. 5F-APINAC administration led to disturbances in all of the investigated neurotransmitter's systems, i.e., GABAergic, dopaminergic, serotonergic, cholinergic systems, and also in kynurenine pathway. The results of the influence of the GABAergic system are represented in the Figures 1 and 2.



Figures 1 and 2. The metabolites of the GABAergic system affected by the administration of diazepam (Figure 1) and 5F-APINAC (Figure 2)

The overall swimming activity of the zebrafish decreased after the administration of the 5F-APINAC (Figure 3).

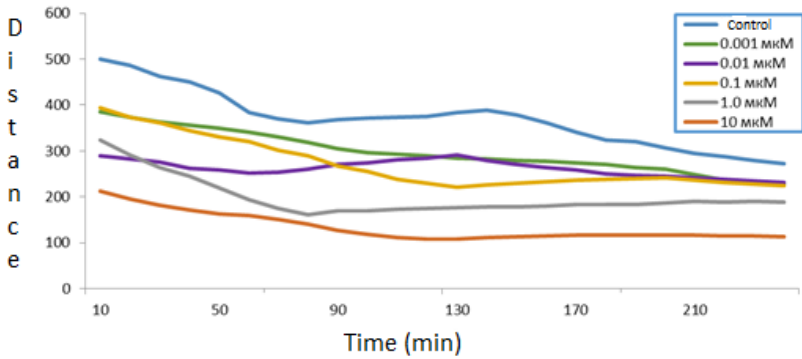


Figure 3. Total distance travelled by zebrafish larvae after exposure to 5F-APINAC.

The metabolites affected by the 5F-APINAC in rabbits were mostly connected to the kynurenine pathway and serotonergic system (Figure 4).

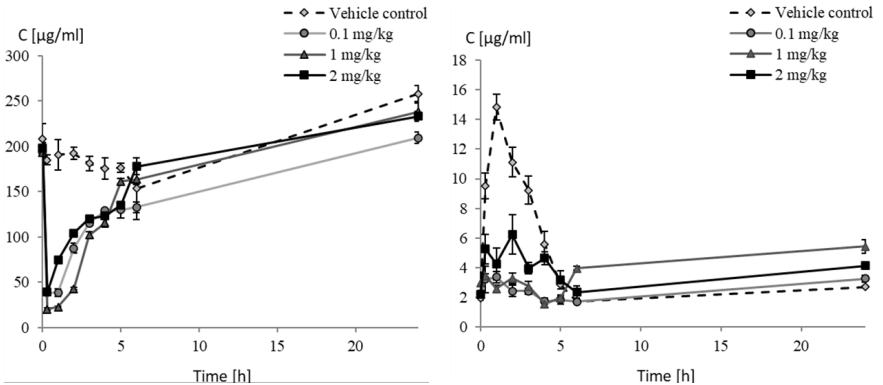


Figure 4. Time-concentration profiles of tryptophan and 5-hydroxyindoleacetic acid.

The levels of the endogenous metabolites, connected to the neurotransmission, were affected by both diazepam and 5F-APINAC. The confirmatory studies revealed that 5F-APINAC has influence on the central nervous system. The results of the study prove that zebrafish can be used as a model organism in the pharmacometabolomics investigations of the neurotropic drugs. The developed methodology was proven by practical outcomes in the studies, leading to the assumption that this methodology can be used for the investigation of the chemical

substances using *Danio rerio*. Further pharmacometabolomics studies using zebrafish as a high-throughput model organism and a screening model for the investigation of the main and side effects of chemical substances.

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非霍奇金淋巴瘤的眼眶體積形成
VOLUME FORMATION OF THE ORBIT IN NON-HODGKIN'S
LYMPHOMA

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抽象的。回顧性分析了1954年出生的R. 患者的臨床表現發展動態和占位性軌道形成的診斷。患者患有未明確的瀰漫性非霍奇金淋巴瘤。診斷是在腫瘤科進行的。當患者向眼科醫生諮詢緊急指徵（疼痛綜合症，視力下降，眼球突出）時，除了進行標準眼科檢查外，還對大腦和眼眶進行了計算機斷層掃描。診斷出眼球突出的左眼眶形成。該臨床病例表明，在67歲時患有非霍奇金淋巴瘤眼科表現的男性患者可能在2週內轉移到眼眶，臨床症狀逐漸增加（眼球移位，運動受限，眼球突出），同時保持視覺功能（視力0.7-0.8）和結膜炎的發生。

關鍵詞：非霍奇金淋巴瘤；眼眶表現；計算機斷層掃描

Abstract. *A retrospective analysis of the dynamics of the development of clinical manifestations and diagnostics of a space-occupying orbital formation in patient R., born in 1954, was carried out. The patient suffers from diffuse non-Hodgkin's lymphoma, unspecified. The diagnosis was made at an oncological dispensary. When a patient consulted an ophthalmologist for urgent indications (pain syndrome, decreased vision, exophthalmos), computed tomography of the brain and orbits was performed in addition to standard ophthalmological examinations. The formation of the left orbit with exophthalmos was diagnosed.*

This clinical case shows that male patients at the age of 67 years with ophthalmic manifestations of non-Hodgkin's lymphoma may have metastasis into the orbit with a gradual increase in the clinical picture (displacement of the eyeball, movement restrictions, exophthalmos), within 2 weeks, while maintaining visual functions (visual acuity 0.7-0.8) and the occurrence of conjunctivitis.

Keywords: *non-Hodgkin's lymphoma, orbital manifestations, computer tomography*

Introduction. One of the common reasons for the treatment of patients is exophthalmos (true - as a result of the failure of the walls of the orbit; false in inflammatory diseases, vascular malformations, neoplastic processes, etc.) [2,3,4,6]. Among neoplastic processes, the most common cause of orbital lesions (up to 36%) is attributed to non-Hodgkin's lymphomas, which belong to the group of malignant tumors of lymphoid tissue (B- and T-cell lymphomas) [3,4,6]. The most common (up to 85%) are B-cell lymphomas (lymphosarcomas), which are characterized by: aggressive growth, in 31% of cases they have a diffuse large B-cell histological type, but in 50% of cases they can be completely cured [1]. In the modern available scientific literature, single studies of the study of patients with this nosology, features of lesions of the organ of vision, depending on the anatomical preference for the localization of the tumor process with gender differences, are described [3,5,6].

Purpose of the study: To present a clinical case of orbital mass in a 67-year-old man with non-Hodgkin's lymphoma.

Material and methods: We retrospectively analyzed the dynamics of the development of clinical manifestations and diagnostics of space-occupying orbital formation in a patient R., born in 1954, a resident of Tyumen, who applied to the ophthalmological emergency room of the surgical department №3 SBHI TO "Oblast clinical hospital №2" with complaints of constant pain in the left eyeball with irradiation to the temple, occiput. At the same time, he notes double vision when looking with two eyes horizontally. The above symptoms appeared on 01.09.2021, was not examined by an ophthalmologist. According to the patient, he notes an increase in pain in the left eye and double vision when looking with two eyes for 2 weeks. From the anamnesis it is known that he suffers from diffuse non-Hodgkin's lymphoma, unspecified (C83.9), with damage to the axillary lymph nodes on both sides, soft tissues of the chest on the right, peritoneum, RT no, N no, M no, stage not applicable. Neoplasm, malignant. Chronic pain syndrome (CHS 0). The diagnosis was made in the oncological dispensary, where he was undergoing treatment from 28.12.2020 and 29.12.20, an operation was performed for resection of the soft tissues of the chest on the right, a biopsy of the axillary lymph nodes (cytomorphological picture of a malignant neoplasm). On

11.01.2021, the patient was discharged for outpatient treatment (chemotherapy) by an oncologist. The results of immunohistochemical studies of fragments of breast tissue and lymph node (dated 15.01.2021) showed the morphological picture of lymphoproliferative disease, diffuse large B-cell lymphoma immunophenotype, NOS. M968o/3. At the time of the visit to the ophthalmologist, the patient was not receiving chemotherapy.

Results. Ophthalmic status: Vis 1.0/0.7-0.8 cannot be corrected. TP is normal (both eyes). OD - no peculiarities. OS - there is a painless, mild eyelid edema, physiological skin, exophthalmos, outward displacement of the eyeball (dev - 35°), restriction of eyeball movement upward, inward, outward, conjunctival injection of the eyeball, mucous discharge from the conjunctival cavity (fig. 1). Moderate conjunctival chemosis, more at the outer corner of the eyeball. The cornea is transparent, the anterior chamber is of medium depth, the moisture is transparent, the pupil is 3.5 mm, d = s, the reaction to light is lively, the fundus reflex is pink. On the fundus: the optic disc without features - with clear boundaries, pink; the retinal arteries are sharply narrowed, sclerosed, the veins are narrowed, twisted, the Salyus-Hun II symptom (b) is determined (according to V.N. Arkhangelsky, 1960), the macular zone and the periphery are without pathology.



Fig. 1 Displacement of the left eyeball, exophthalmos in patient R., born in 1954

Laboratory research methods showed the presence of thrombocytopenia ($170 \times 10^9/l.$) According to the general blood test.

Instrumental research methods (CT of the brain and orbits) - CT signs of the formation of the left orbit with exophthalmos: intraorbital (left) a volumetric formation of heterogeneous density intimately adjacent to the lower, medial, lateral, rectus muscles, optic nerve, with an approximate size of 25x22x21mm, which pushes anteriorly left eyeball (fig. 2,3).

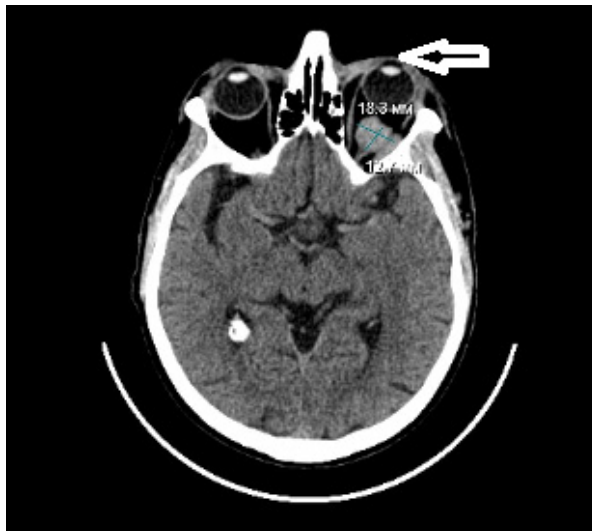


Fig. 2 CT - scan of patient R., born in 1954 (volumetric formation of the left orbit, dimensions 25x22x21mm), exophthalmos (indicated by an arrow)

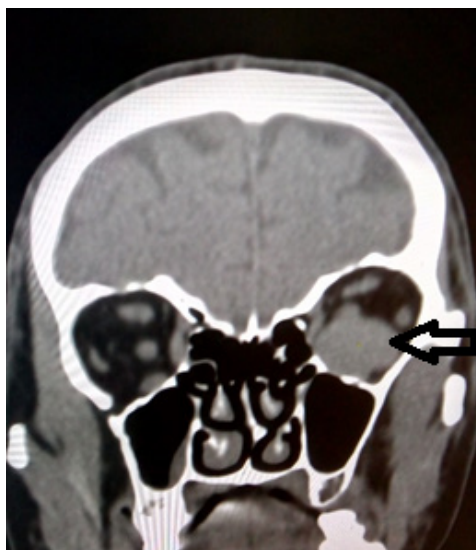


Fig. 3 CT - scan of patient R., born in 1954 (indicated by an arrow the neoplasm of the left orbit)

The patient was consulted by a neurologist regarding the pain syndrome, the diagnosis was made: Syndrome of cephalalgia, ophthalmalgia against the background of a volumetric formation of the left orbit.

Taking into account the data of clinical, laboratory and instrumental research methods, the main diagnosis was made: Neoplasm of the left orbit (metastasis of diffuse non-Hodgkin's lymphoma). Exophthalmos of the left eye. Acute conjunctivitis of the left eye.

Conclusions.

The described clinical case is of interest to ophthalmologists, neurologists, hematologists. When exophthalmos occurs (with a displacement of the eyeball and restriction of movement) in men, with damage to the conjunctiva (chemosis and conjunctival injection), good functional indicators (Vis 0.7-0.8) at the age of 60 years and older, one of the causes of the disease can be non-Hodgkin's lymphoma, requiring specific treatment from an ophthalmologist and chemotherapist. Only a simultaneous approach, the patient's understanding of the cause of the disease and the need for cancer treatment, can lead to an improvement in the somatic and local ophthalmological status. Doctors ophthalmologists in the ophthalmic emergency room need to be alert about this disease.

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COVID - 19感染患者的眼科和軀體多發病特徵
**FEATURES OF OPHTHALMIC AND SOMATIC POLYMORBIDITY IN
PATIENTS WITH COVID - 19 INFECTION**

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抽象的。我們回顧性分析了在疾病潛伏期或新病史下，新病毒感染COVID-19的患者的病史，這些患者在SBHI TO “OCH№2”的專科眼科就診。研究期間為2020年4月至2021年2月。眼球受傷及其後果25%；視網膜脫離12.5%；青光眼12.5%；血管病理學8.3%；白內障8.3%。眼睛受傷-嚴重挫傷及其後果16.7%。首次出現在患者中的疾病：雙眼視神經炎，左眼視網膜中央靜脈顛上支的部分血栓形成，右眼眼瞼血腫，右眼眼眶發炎，化膿左眼角膜潰瘍，不代償，首先發現，雙眼都是青光眼。

關鍵詞：新的冠狀病毒感染；身體狀況；眼科表現

Abstract. *We retrospectively analyzed the case histories of patients with a new viral infection COVID - 19 who were admitted to a specialized ophthalmological department at SBHI TO "OCH №2" during the incubation period of the disease, or with a history of this disease. The study period is from April 2020 to February 2021. The structure of nosologies is presented as follows: inflammatory diseases 33.4%; eyeball injuries and their consequences 25%; retinal detachment 12.5%; glaucoma 12.5%; vascular pathology 8.3%; cataract 8.3%. Eye injuries - severe contusions and their consequences 16.7%. Nosologies that have arisen in patients for the first time: optic neuritis in both eyes, partial thrombosis of the superior temporal branch of the central retinal vein of the left eye, hemophthalmus of the right eye, phlegmon of the orbit of the right eye, purulent corneal ulcer of the left*

eye, uncompensated, first detected, glaucoma in both eyes.

Keywords: *new coronavirus infection, somatic status, ophthalmic manifestations*

Introduction. The COVID-19 pandemic has highlighted a number of problems in ophthalmological science and practice: at the beginning - a large number of severe cases of the clinical course of the disease with the inaccessibility of routine specialized care, and then the provision of high-tech care for patients with eye pathology [2,3]. All this is a motivation for studying the problem of COVID-19 in ophthalmology [1,3,4]. Quite a lot of works are devoted to the prevention of the spread of viral infection in the provision of specialized ophthalmic care [3,4]. Clinical manifestations such as conjunctivitis, anterior uveitis, retinitis and optic neuritis have been reported in feline and mouse models [1,2,3]. In the form of single observations, at the present stage, these changes are described in people [2,5,6]. There are works on the clinical manifestations of the ocular surface with the provision of clinical features of the course of conjunctivitis, approaches to the treatment of these manifestations, depending on the stage of systemic manifestations [2]. However, in the available scientific literature, we have not seen works devoted to the study of the issues of existing ophthalmic pathology in patients with a new coronavirus infection who could be admitted to ophthalmological departments during the incubation period of the disease (from 7 to 14 days) without clinical manifestations. Therefore, from our point of view, any information on the topic is relevant and interesting to both ophthalmologists and doctors of other specialties (infectious disease specialists, therapists, cardiologists, etc.).

Purpose of the study. Conduct a clinical and statistical analysis of the existing eye pathology in patients admitted to the ophthalmology department during the incubation period of a new coronavirus infection for the provision of planned and emergency care, as well as ophthalmological manifestations that arose against the background of COVID-19, or had a history of it.

Materials and methods. We retrospectively analyzed the case histories of patients with a new viral infection COVID - 19 who were admitted to a specialized ophthalmological department at SBHI TO "OCH №2" during the incubation period of the disease, or with a history of this disease. The study period is from April 2020 to February 2021. The examination and treatment was carried out in accordance with the regulations of the Ministry of Health of Russia. In total, 24 patients received treatment, of which two-thirds were 16 men (66.7%) and one third were 8 women (33.3%). Median age 55.6 years (range 18 to 87). The average length of hospital stay was 12.9 days (range 1 to 27 days). Patients with eye damage, after suffering a new coronavirus infection, accounted for 20.8% (5/25), of which men 16.7% (4/24), women 4.1% (1/24). The average number of days

from diagnosis of COVID-19 to hospitalization in the ophthalmology department was 57 days (range 22 to 83 days). The results were analyzed using the Microsoft Office Excel 2007 computer program.

Results and discussion. The structure of nosologies in the analyzed group is presented as follows: inflammatory diseases 33.4% (8/24), of which in women 8.3% (2/24), in men 25% (6/24); eyeball injuries and their consequences 25% (6/24), of which for women 4.2% (1/24), for men 8.3% (5/24); retinal detachment 12.5% (3/24), of which in women 4.2% (1/24), in men 8.3% (2/24); glaucoma 12.5% (3/24), of which all women; vascular pathology 8.3% (2/24), of which all men; cataract 8.3% (2/24), of which in women 4.2%, in men 4.2%. A detailed clinical and statistical analysis of nosologies requiring hospitalization in a specialized ophthalmological hospital, in the incubation period of the disease, showed the following. Eye injuries requiring surgical treatment - severe contusion (men 64 and 28 years old) and their consequences - lens luxation into the vitreous body, secondary glaucoma of the left eye (woman 64 years old), keratouveitis, corneal ulcer with a toxic-allergic component of the right eye (the consequences of a chemical burn man 37 years old). Other nosologies that arose in patients for the first time and required hospitalization in a round-the-clock specialized hospital: optic neuritis in both eyes (35-year-old man), partial thrombosis of the superior temporal branch of the central retinal vein of the left eye (59-year-old man), hemophthalmus of the right eye (35-year-old man)), phlegmon of the orbit of the right eye (40-year-old man), purulent corneal ulcer of the left eye (62-year-old woman), uncompensated, newly diagnosed glaucoma in both eyes (61-year-old woman). In addition, clinical manifestations of coronavirus infection occurred in 37.5% (9/24) of patients who received specialized surgical treatment, including high-tech for cataract, glaucoma, and retinal detachment in the early postoperative period. A feature of nosologies in patients who underwent coronavirus infection was the predominance of corneal lesions with the development of an ulcerative process in 80% (4/5) of the patient, and in 20% of patients (1/5) of panuveitis of fungal etiology. It should be borne in mind that this group of patients receives a large pharmacological load (including antibacterial, antiviral, anti-inflammatory and glucocorticoid drugs), which leads to a decrease in immunity and the possibility of attaching fungal flora and a tendency for the emergence of complicated forms of the disease. Analysis of the structure of concomitant chronic, non-inflammatory ophthalmic pathology revealed the presence of diabetic angioretinopathy - in 37.5% (9/24); cataracts in 25% (6/24); myopias in 12.5% (3/24), peripheral vitreomacular retinal dystrophies and ruptures of the macular region - in 16.7% (4/24). Somatic pathology was represented by: hypertension in 37.5% (9/24) of patients; type 2 diabetes mellitus and atherosclerosis with the same frequency - 29.2% (7 out of 24) of patients. Anemia, diseases of the gastrointestinal tract,

hepatitis and chronic lung pathology also occurred with the same frequency - 8.3% (2 out of 24) of patients. When clinical symptoms of a new coronavirus infection appear, patients are transferred to a specialized hospital.

Conclusion. Given the infectious nature of the new coronavirus infection, patients may be admitted to the ophthalmology department during the incubation period (from 7 to 14 days). Clinical manifestations of infection occur in the early postoperative period in patients admitted as planned for surgical treatment for the purpose of rehabilitation with cataract, glaucoma, and retinal detachment. The relationship between the age characteristics of this category of patients and the presence of somatic polymorbidity (atherosclerotic vascular lesions, hypertension, diabetes mellitus) is traced. In addition, in patients with severe eyeball trauma, the clinical picture of COVID-19 also develops within the first 7 days. Acute conditions of the eyeball with vascular occlusions in the pathogenesis of the disease (retinal vein thrombosis, hemophthalmos, changes in the optic nerve, retinovasculitis) can be attributed, from our point of view, to the initial manifestations of a new coronavirus infection.

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人為因素對城市針葉林狀況的影響

THE INFLUENCE OF THE ANTHROPOGENIC FACTOR ON THE STATE OF CONIFEROUS PLANTATIONS IN THE CITY

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抽象的。本文介紹了比羅比詹市針葉林狀況的研究結果。研究了年齡，冠狀狀況，針狀狀況和整體外觀。據透露，沿街道巷道生長的樹木在不同程度上受到削弱。觀察到大的骨骼分支死亡。針頭的使用壽命減少了2-3倍。在交通活躍的街道上，雲杉，尤其是松樹，很快失去了裝飾性和中穩定性。

關鍵詞：城市系統，美化環境，針葉植物，人為影響，比羅比詹。

Abstract. *The article presents the results of a study of the state of coniferous plantations in the city of Birobidzhan. The age, condition of the crown, condition of the needles, and general appearance were studied. It was revealed that the trees growing along the roadway of the streets are weakened to varying degrees. The death of large skeletal branches is observed. The life span of the needles is reduced by 2-3 times. Spruce and especially pine lose their decorative and mediostabilizing properties relatively quickly on streets with active traffic flows.*

Keywords: *urban system, landscaping, coniferous plants, anthropogenic influence, Birobidzhan.*

The city (urban system) is today the result of the joint existence of natural and anthropogenic systems. At the same time, the social component prevails, and puts the natural system in a subordinate position. The city can and should be considered as an ecological system in which a balance between all components should be achieved.

The basis of all terrestrial ecosystems are plants, so the issues of urban greening are the subject of serious research. The growing conditions of woody plants in the city do not coincide with the natural ones, since they are connected to the state of the atmosphere, including a mass of pollutants, anthropogenic soil, and man-made factors. Studies show that as a result of the constant anthropogenic

impact that plants experience in the city, the appearance of the plant, its phytomass, growth processes, and as a result, the life expectancy of the plant changes [1]. The accumulation of information about the resistance of various plant species to anthropogenic stress will allow you to choose them correctly for landscaping purposes, and correctly distribute them in the green area.

In the city of Birobidzhan, coniferous trees are actively used for landscaping. they grow along many streets. Birobidzhan is the center of the Jewish Autonomous Region located in the Far East of the Russian Federation. It is a medium-sized city with a population of about 72 thousand people. The city streets are narrow with two-way traffic. Although the traffic flow is not comparable to the flow of cars on the streets of large cities, its impact on the condition of trees is clearly visible.

Streets and squares in different parts of the city were chosen as model sites. On the streets (platforms 1, 7-12), coniferous trees are planted along the roadway. Squares and green lanes (platforms 2-6) are located at a small distance from the roadway. The exception is site 3, which is located between two roads with heavy traffic.

Visual assessment of biometric indicators of trees was performed in accordance with the accepted methodology [3], which includes 6 categories of condition: 1) no signs of weakening (needles are shiny green, the crown is thick, the growth of the current year is normal); 2) weakened (needles are often lighter than usual, the crown is slightly openwork, the growth is reduced by no more than half compared to normal); 3) strongly weakened (needles are light green or grayish matte, the crown is openwork, the growth is reduced by more than half compared to normal); 4) shrinking (needles are gray, yellowish or yellow-green, the crown is noticeably sparse, the growth of the current year is still noticeable or absent); 5) dead wood of the current year (trees that have shrunk in the current year); 6) dead wood of previous years (old) (needles were crumbled or only partially preserved).

Of the coniferous trees on the streets of the city, two species are mainly used: common pine (*Pinus sylvestris* L) and Siberian spruce (*Picea obovata* Ledeb). They can be attributed to indigenophytes [4], that is, native species that are part of natural communities, but are artificially introduced to the anthropogenic territory. Environmental conditions are unfavorable for them.

A total of 1,191 coniferous trees were examined, including 359 pines and 832 firs. By age, the trees studied belong to class 4 (40 years). These are mature fruit-bearing trees. In natural conditions at this age, the pine can have a height of up to 25 m. Spruce grows more slowly, so by the age of 40, the height of the spruce can reach about 10 m. All the trees studied had approximately the same height no more than 10 m. For spruce and fir, this can be considered the norm, but for pines, there is a pronounced lag behind the norm, which in turn can be assessed as a response to the conditions in which the trees grow.

The analysis of the condition of the trees (Figs. 1, 2) showed that the crowns of many trees are more or less sparse, the condition of the needles is deteriorated, there is a death of the lower skeletal branches, that is, the trees are weakened. There are no healthy trees at all. According to the degree of deterioration, the trees were distributed as follows:

- pinus: 4.4% - category 2 weakened; 24.2% - category 3 severely weakened; 33.7% - category 4 shrinking; 32.8% - dead wood of the current year; 4.7% - category 6 old dead wood;

- picea: 12.8% - category 2; 47% - category 3; 27.7% - category 4; 11.1% - category 5; 1.2% - category 6.

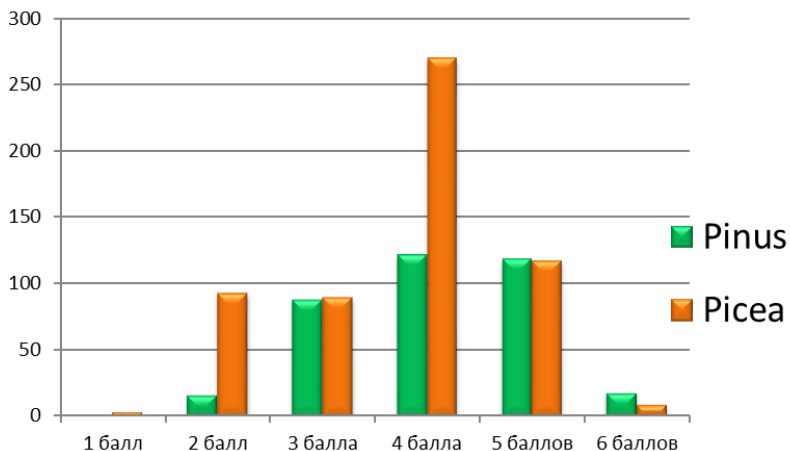


Fig. 1. Category of the condition of the studied trees (horizontal axis – points, vertical axis – number of trees)



Fig. 2. Appearance of trees on the streets of Birobidzhan (photo by D. Zhuchkov)

The stand state coefficient for the model sites (Fig. 3) was calculated as the arithmetic mean of the state coefficients of individual trees [2]:

$$K = \sum b:N$$

K- is the coefficient of the state of the view,
b - is the score of the category of the state of the tree,
N - is the number of trees of the view.

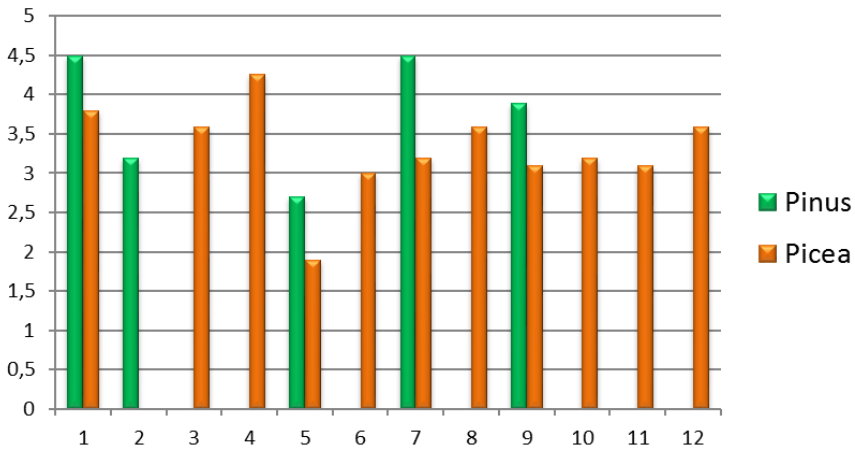


Fig. 3. The state of the stand on the model sites. Vertically – the coefficient of the state of the trees in points, horizontally-the numbers of the model sites.

The higher the coefficient value, the worse the condition of the trees. The diagram shows that pinus everywhere feels worse than spruce. The worst condition is observed in trees growing along the roadway of streets with a large traffic load (site 1, 4, 7, 9). On average, the coefficient of the state of the stand is 3 or more, which corresponds to the characteristic – strongly weakened, turning into shrinking.

The poor condition of the trees confirms the nature of their needles. The life span of picea needles has been reduced by more than half. Needles 3 years of life already have damage, needles older than 4-5 years are absent. The pinus tree is alive with needles only in the first year of life. By the end of the year, it has obvious damage. By the end of the second year of life, the pinus needles almost completely die off and crumble.

Studies have shown that in urban conditions, coniferous plants do not feel the same as in natural conditions. Anthropogenic influence affects life expectancy and growth processes. Analysis of the condition of the trees showed that almost all the trees are weakened. The pinus tree is the most sensitive to anthropogenic influence. Picea is more tolerant, but also quickly loses its decorativeness and its positive qualities if it grows along roads with heavy traffic. Another feature of conifers is the pyramidal crown. The monopodial type of branching does not allow to form a crown, as in hardwoods. The loss of the lower floors of skeletal branches by coniferous trees worsens their decorative and mediostabilizing significance for the city streets.

Thus, conifers can be used in urban landscaping, but it is better to plant them not along the roadway of streets, but in squares or parks where the level of air pollution is less.

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開發數學模型以評估渦輪功率測量過程中支架元件對瞬態過程的影響
**MATHEMATICAL MODEL DEVELOPMENT TO ASSESS THE
INFLUENCE OF THE STAND ELEMENTS ON THE TRANSIENT
PROCESS DURING MEASUREMENTS OF THE TURBINE POWER**

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抽象的。建立了數學模型，當在瞬態模式下測量渦輪機功率時，可以評估機架元素對瞬態過程性質的影響。為了闡明立式渦輪機系統的傳遞函數，在渦輪機瞬態運行中波場變化期間，採用模態分析來構造測量過程頻率範圍內的傳遞函數。

關鍵詞：模態分析，幅頻特性，波場，分頻，瞬態

Abstract. *A mathematical model is developed that makes it possible to assess the influence of the stand elements on the nature of the transient process when measuring the turbine power in transient modes. To clarify the transfer function of the stand - turbine system, a modal analysis was applied to structure the transfer function in the frequency range of the measuring process during the change of the wave field in the transient operation of the turbine.*

Keywords: *modal analysis, amplitude-frequency characteristic, wave field, partial frequencies, transient mode*

Introduction

If we make new equipment and upgrade it, it is important to ensure its high vibration reliability, which is hard to predict in the process of testing a product at the stand. Various methods and devices are offered to control vibration parameters. In works [1, 2], it is proposed to use fiber-optic sensors for vibroacoustic control. In [3], the relationship between vibration of the bearing and the number of defects in the bearing assemblies for transmission systems is determined. Therefore, it is

important to develop and implement methods aimed at assessing the dynamic reliability of products and eliminating vibration at the stage of testing them on bench equipment and determining the mutual influence in the frequency domain for possible controls of the vibration level.

In addition, at the experimental testing stage of the turbine units at the stand, significant uncalculated dynamic loads were revealed, possibly associated with the interaction of wave processes implemented both by the elements of the stand and the tested turbine. In the settled regime, it was revealed that at certain turbine speeds, a self-oscillating state of the wave field of the stand with the turbine is nonlinear in time. The structure of such processes does not fit into the conditions of linear resonant interactions of the elements and units of the stand. This is especially typical during transient conditions after the stand is switched on and the turbine accelerates to the flight modes of its operation.

Problem setting

As part of this assignment, we developed a mathematical model and an automated computational algorithm of studying the dynamic behavior of the element turbine as part of the element base of the stand during the turbine testing, taking into account the wave interactions of its structural elements and units and changes in modes during the operation of the turbine at the stand. Based on the analysis of the dynamic behavior with a change in the load of real structures of the stand element base, a range of initial and boundary conditions was selected for the process of mathematical modeling of the dynamic change in the turbine power during its operation, taking into account the interaction with the stand element base in the frequency domain.

The general objective of the research is reduced to determining the modal frequencies of the test bench element base, their change under loads (power load, temperature load) within the range of measured power and changes in the temperature of the gaseous medium.

The generalization of the design scheme is the introduction of elastic-dissipative bonds between the non-adjacent masses of the chain [4, 5].

To determine the natural frequencies of vibrations of the stand elements with a turbine, as well as the natural frequency of the system itself, it is necessary to obtain matrix forms for the following parameters: generalized coordinates of displacements q , inertial forces $F_o(q)$ with an inertial parameter A , and elastic forces with a quasi-elastic coefficient C without taking into account dissipative forces, which allows obtaining modal frequencies of structural elements.

The kinetic and potential energies of the system will be given as follows:

$$T = \frac{1}{2} A \dot{q}^2$$

$$U = \frac{1}{2} Cq^2$$

The differential equation of free vibrations in the matrix form will have this form:

$$\mathbf{A}\ddot{\mathbf{q}} + \mathbf{C}\mathbf{q} = \mathbf{0},$$

where \mathbf{A} is the matrix of the inertial coefficients; \mathbf{C} is the matrix of quasi-elastic coefficients, $\mathbf{q} = (\xi, \eta, \zeta, \alpha, \beta, \gamma)$ is the vector characterizing the motion of the body during oscillations.

The modal frequency will be determined as:

$$\omega = \left(\frac{c}{a}\right)^{1/2} = \frac{1}{(af)^{1/2}},$$

where $f = c^{-1}$ is a single admittance corresponding to the quasi-elastic coefficient c .

The general solution of the equation of free vibrations with natural frequency ω_a and natural form v_a will have the form:

$$q(t) = \sum_{a=1}^n v_a (C_a \cos \omega_a t + D_a \sin \omega_a t)$$

The solution to the differential equation of free oscillations will be:

$$\mathbf{q}(\mathbf{t}) = \mathbf{v} \sin(\omega t + \chi)$$

where \mathbf{v} is the vector (column-matrix), which characterizes the relationship between the generalized coordinates, these are also natural vibration modes; χ is the phase angle that forms the displacement conditions in the wave interaction.

ω and \mathbf{v} satisfy the matrix relation:

$$(\mathbf{C} - \omega^2 \mathbf{A})\mathbf{v} = \mathbf{0}.$$

For the solution, an algorithm was made to find the natural frequencies of the stand elements using the analysis of four subsystems in the *MatCad* software package.

Research results

The results of the frequency analysis of the modal characteristics of the stand were verified according to the results of the modal analysis performed at the stand.

Comparison of the results of the modal analysis of the unloaded stand, carried out on its element base and adjusting the above algorithm according to the experimental frequencies, made it possible to refine matrix \mathbf{C} of quasi-elastic coefficients at zero load, which made it possible to predict the change in the matrix of the quasi-elastic elements depending on the load implemented on the loading device of the stand directly on the measuring spring used as the turbine power sensor.

To construct the transfer function of the test bench base elements, the conditions of the frequency realization and the pulse excitation of oscillations sequentially from one measurement point on the bench element to the turbine were con-

sidered. Both direct and inverse transfer functions were built (direct: the change in amplitude-frequency characteristics from the turbine to the frame and foundation; reverse: from the loading element to the same point of attachment of the frame to the foundation).

As an example, Fig. 1 demonstrates the obtained results of tuning the partial frequencies at the point of attachment of the spacer to the frame.

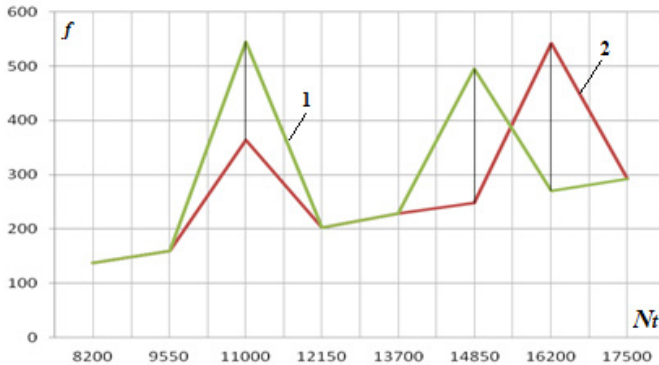


Fig. 1. Changing the partial frequency of the spacer depending on the turbine speed: f is frequency (Hz), N_t is the turbine rotation frequency (rpm); 1 is frequency in the axial direction; 2 is frequency in the vertical direction.

Experimental studies of the change in the root-mean-square value (RMS) of the vibration velocity were carried out depending on the turbine speed from the side of the loading device with a multiplier, from the side of the turbine, at the point of attachment of the spacer to the frame.

The presented results of studying the dynamic behavior and restructuring of the frequency characteristics of the component base of the test bench make it possible to explain the non-stationary changes not only in the oscillatory modes, but also in the oscillation energy during the transient modes of studying the turbine operation.

Conclusion. The mathematical apparatus is developed based on point masses for the stand to test the performance of turbines of various powers, which allows constructing the transfer function, when the turbine speed changes, and assessing the possible level of influence of each of the stand elements. By using the procedure of studying the modal characteristics of the bench equipment, we obtained the transfer functions of the frequency transformations by the element base of the bench.

The results of the stand dynamic behavior when changing the turbine rotation speed are obtained, taking into account the restructuring of the natural (modal) frequencies calculated using the mathematical algorithm.

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分析將飛機與伸縮式捕集阱結合在一起以創建視覺訓練模型的視覺控制系統的組成和工作原理

ANALYSIS OF THE COMPOSITION AND PRINCIPLE OF WORK OF THE SYSTEMS OF VISUAL CONTROL OF JOINING THE AIRCRAFT WITH A TELESCOPIC TRAP FOR THE CREATION OF A VISUAL TRAINING MODEL

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抽象的。 本文分析了飛機停車定位系統的當前結構，並分析了這些系統的設計。 作者認為這項工作是創建可視化系統原理的軟件培訓模型的分析步驟。

關鍵字：民航，定位系統，PAPA，AGNIS，VDGS，A-VDGS，Safedock，ADB SAFEGATE，激光傳感器，SafeControl管理系統，停機坪，培訓模型。

Abstract. *This article analyzes the current structure of aircraft parking positioning systems, and also analyzes the design of these systems. The authors consider this work as an analytical step for creating a software training model for visualizing the principles of the system.*

Keywords: *civil aviation, positioning systems, PAPA, AGNIS, VDGS, A-VDGS, Safedock, ADB SAFEGATE, laser sensors, SafeControl Management System, apron, training model.*

Introduction

An increase in the intensity of flights is observed annually in the transport industry and, in particular, in civil aviation. From year to year, airports serve more and more aircraft, and in order to keep up with the huge passenger traffic, it is necessary to use modern methods to accelerate the process of unloading and loading passengers. One of these means is a telescopic ladder, which allows you not to

waste time on the delivery of passengers to the plane by apron buses and ladders. It allows passengers to be loaded onto the plane directly from the terminal building via a covered walkway. But the use of this tool imposes increased requirements for the parking accuracy of the aircraft, otherwise there is a risk of damage to the aircraft during docking. To simplify this process, Airplane Positioning Assist Systems have been developed to assist pilots in accurately taxiing into the stands, thereby maximizing the speed of aircraft handling at the airport.

At the beginning of their existence, these systems were quite difficult for pilots to perceive, since the pilots had to distribute their attention to several instruments located nearby. Another factor that determined the development of these systems was the lack of accuracy of the first developments. Currently, such systems are bright LED monitors, on which a user-friendly interface helps pilots to perform very accurate parking.

But since the positioning systems, on the one hand, are rather complicated and expensive, and on the other hand, they have a large number of modifications, it makes sense to use a software training model in the educational process to familiarize cadets with the principle of operation of such systems. Analysis, preparation of technical specifications, development of the complex and its implementation is the main goal of this project.

1. Composition of the visual control system for docking with a telescopic gangway

A *Visual Docking Guidance System with a telescopic gangway* (VDGS) is used to inform pilots when taxiing into a parking lot and to provide guidance where accurate positioning of aircraft is required. Such systems, for example, allow aircraft to park so that there are no obstacles in the area of the passenger doors, and the telescopic ladder can be guaranteed to dock with the aircraft. The main VDGS subsystems providing this process and requiring a description are mirrors, AGNIS, PAPA.

The simplest technical means of positioning is the base system, which is one or two mirrors that allow pilots to see the ground markers of the desired stopping zone, relative to the aircraft nose strut. A pair of mirrors mounted at different angles are used to match different aircraft heights. This solution is paired with AGNIS for small aircraft stands.

The system, which consists of two green and red light strips located next to each other, is called the Azimuth Guidance for Nose-in Stands (AGNIS). This system assists the pilot in positioning the bow strut along a previously defined line. The principle of operation of the system is to check the deviation of the nose strut from the center line, in this case one of the stripes will appear red to the pilot and in order to correct the situation it is necessary to turn towards the green stripe. When the nose pillar is steered exactly on the centerline, both stripes will appear green to it (figure 1).

The system is intended for use from the left pilot's seat only and is located approximately at the height of the flight deck. AGNIS itself allows only azimuth control, the system does not tell pilots when to stop, so AGNIS is used in conjunction with the PAPA system.

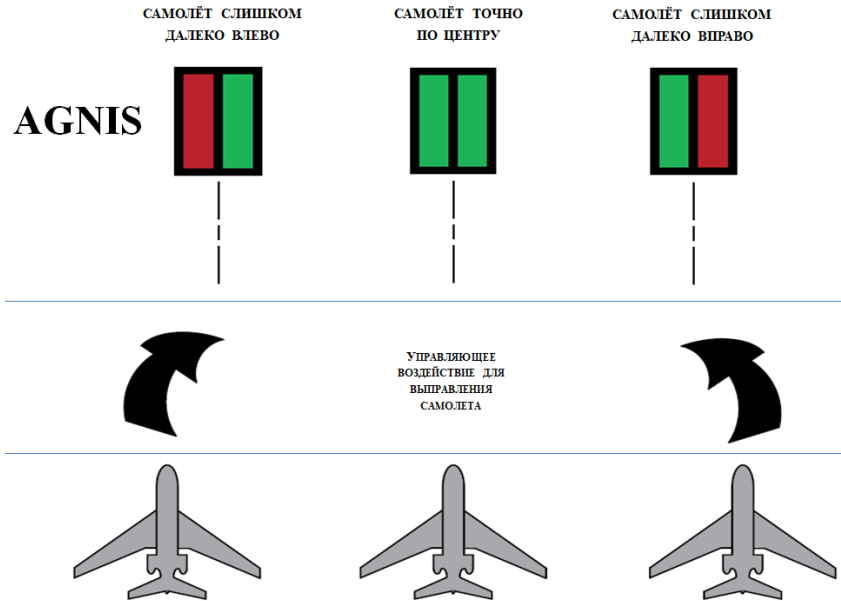


Fig. 1. The principle of operation with the system of azimuth tracking of the bow strut

The subsystem for informing the crew about the moment of stopping is called the Parallax Aircraft Parking Aid (PAPA), which is combined with the AGNIS system. The assistant device has no electronics or moving parts, and consists of a gray body (usually with one or more missing sides) with a large rectangular slot cut out in the front. Inside the box, towards the back, there is a white mark or light source that visually "moves" from one side of the cutout to the other when the viewer approaches, although it is actually stationary and the effect is simply due to the perspective. Above and / or below this cutout, white or yellow markings are applied to indicate where the different types of aircraft should stop (calibration based on aircraft length). Working with the system is shown in figure 2.

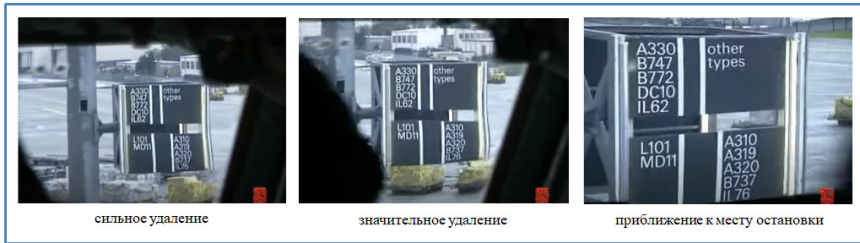


Fig. 2. Working principle with parallax aircraft setup assistant

As we can see in this illustration, as the aircraft approaches the stop point, the white mark in the slot moves from the right edge to the left, and when it coincides with the mark of the desired aircraft type, it is necessary to make a stop.

Since this system relies on the position of the viewer, it will not provide accurate information on the distance to aircraft that deviate significantly from the center line. Therefore, this system works in tandem with the AGNIS system, which controls the guidance of the bow strut along the center line.

2. Second generation of visual docking control systems with telescopic gangway

All the devices described above can be attributed to the first generation of aircraft positioning systems, they are quite simple in composition and reliable, but have insufficient accuracy and high complexity of operation. The development of positioning systems has led to the development of more modern, accurate and easy for pilots aircraft positioning systems when taxiing into a parking lot - A-VDGS. A distinctive feature of the Advanced Visual Docking Guidance Systems (A-VDGS) is the electronic displays that perform AGNIS / PAPA functions with greater accuracy through the use of high-precision sensors.

Further, the principle of operation of modern aircraft positioning systems in a parking lot is considered on the basis of the Safedock A-VDGS type 1 system from ADB SAFEGATE, which is one of the leaders in this field.

The characteristics of Safedock A-VDGS Type 1 presented by the manufacturer and translated into Russian are presented in table 1.

Table 1. Safedock A-VDGS Type 1 System Features

№	Name	Value
1	Sensor technology	Infrared laser with patented 3D scan
2	Stop position accuracy	10 cm / 3.9 in
3	Stop position distance:	2-65 m/6.56-213 ft

№	Name	Value
4	Azimuth accuracy	10 cm / 3.9 inches
5	Horizontal scanning angle:	±30°
6	Maximum separation between centerlines:	30°
7	Display type:	High intensity LED
8	LED configuration:	42 LED modules
9	LED resolution:	16x16 diodes per module
10	LED color:	All modules 2 color (yellow and red)
11	Visibility angle:	170°
12	Readability distance:	180 m/540 ft
13	Data interface:	Ethernet
14	Power supply:	115/230VAC, +10%, 50/60HZ
15	Laser classification:	Class 1 eye safe / digital
16	Operational temperature:	-25°C - +50°C / -13°F - +122°F
17	Wind load:	Up to 44 m
18	Snow load:	Up to 1000 N/m2

Technically, the system consists of a high-intensity LED screen (6×7 modules, each with 16×16 elements, a total of 10752 superbright two-color LEDs) and a laser sensor unit (figure 3).



Fig. 3. Appearance of the Safedock A-VDGS Type 1 system at the site of operation

Based on the information received from laser sensors, Safedock displays information on the LED display and helps pilots to correctly position the aircraft in the parking lot. To do this, the system displays information about the longitudinal guidance of the bow strut and the distance to the stop zone, thereby prompting the pilots when to stop.

Working with the Safedock A-VDGS system is to follow the recommendations provided by the system: the red arrows on the right and left indicate in which direction you need to correct the direction (figure 4 a, b), the yellow bar in the center decreases proportionally as you approach the stopping point (figure 4 c, d), as well as the display shows the exact distance to the place of stopping and at the end of positioning the system with a large inscription STOP (figure 4 e) notifies that the plane is in the right place and it is necessary to stop.

Safedock A-VDGS

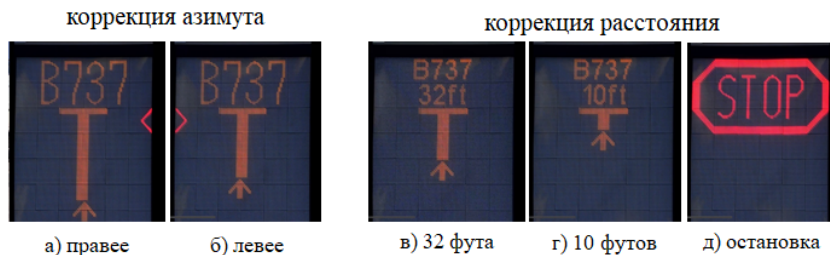


Fig. 4. Indication of the Safedock A-VDGS Type 1 system

Next, the Safedock system checks the correct position of the aircraft in the parking lot and then sends information to the flight bridge that the aircraft is ready for docking; before and after docking, the monitor displays useful information for pilots and ground personnel. It should be noted that the use of modern laser sensors as part of the system makes it possible to work in a normal schedule at night and in difficult weather conditions (fog, rain, snow).

Conclusion

Over the past decade, the niche of aerodrome equipment associated with the positioning of aircraft at the aerodrome has made a huge leap forward, thereby allowing again to increase the speed of servicing aircraft at airports, and therefore to increase passenger traffic. To this day, even more advanced systems are being developed, which in the future will be able to further accelerate the process of taxiing the aircraft into the parking lot.

The material collected at the stage of analyzing the subject area is sufficient for the subsequent development of a program that demonstrates work with such systems.

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在奧倫堡市一級地方的街道和道路交叉口的交通組織

**ORGANIZATION OF TRAFFIC AT INTERSECTIONS OF STREETS
AND ROADS IN ONE PLACE LEVEL OF THE CITY OF ORENBURG**

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抽象的。當前，城市街道上的車輛數量明顯增加。車輛的數量正在增加，並且已經超過了道路網絡的發展速度。本文討論了奧倫堡市道路網的實際路段上交通組織的改進。主要任務是為正在考慮的區域組織道路網絡的解決方案開發和證實其選擇。

關鍵字：道路網絡，車輛，道路事故，道路交通，交通組織。

Abstract. *Currently, the number of vehicles on the streets of the city is noticeably increasing. The number of vehicles is increasing and is outstripping the pace of development of the road network. This article discusses the improvement of the organization of traffic on a real section of the road network of the city of Orenburg. The main task is to develop and substantiate options for solutions for organizing the road network in the area under consideration.*

Keywords: *road network, vehicle, road accident, road traffic, traffic organization.*

We choose the section Gagarina Avenue - Mira Street, since at this intersection there is a high intensity of traffic and pedestrian flows. This intersection of Gagarin Avenue - Mira Street is located in the city of Orenburg in the Leninsky District. The intersection is T-shaped. The main street is Gagarin Avenue. Check-in can be done from Chkalov Street, Zagorodny and Nezhinsky Highways. The geographic coordinates of this intersection for the GPS or GLONASS navigator must be entered: latitude 51.775194, longitude 55.169459.

For a detailed study of the analysis and subsequent improvement, we will take 100 m from the boundaries of the intersection in each direction.

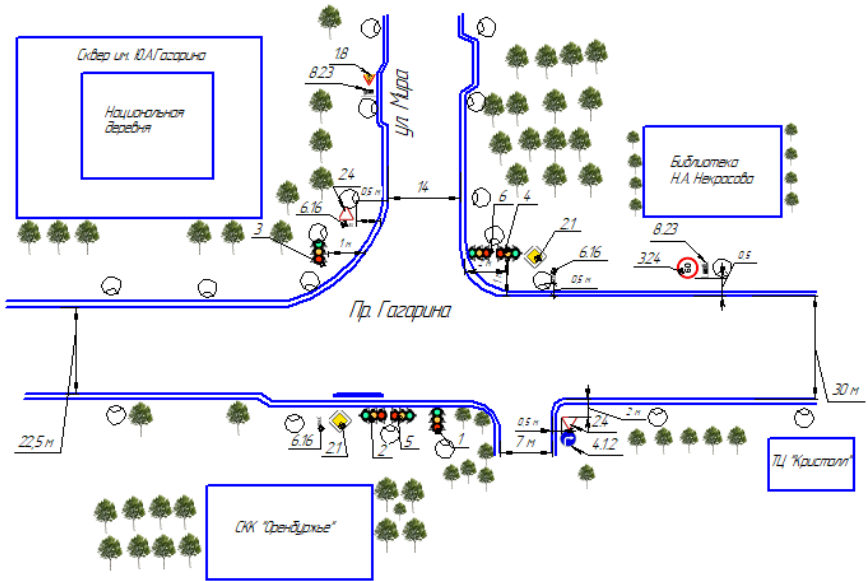


Figure 1 – Diagram of an existing intersection before reorganization

The main problem of this intersection is congestion, the absence of pedestrian barriers and markings, a large number of conflict points.

Traffic channeling in the intersection zone is intended to reduce the number and risk of conflict points by directing automobile and pedestrian flows along the most favorable and safe trajectory. Traffic canalization facilitates orientation and increases the clarity of the interaction of drivers at intersections with complex configurations and in those places of the roadway, where an excessive area creates the prerequisites for chaotic movement, the spread of zones of conflict points.

This method of organizing traffic must be carried out for passing directions in order to avoid congestion at left and right turns. You can also separate opposite directions of movement with a dividing strip.

The main activities, the method of sewerage, to improve the organization of traffic are:

- marking in accordance with GOST R 52289-2004;
- adding road signs in accordance with GOST R 52289-2004;
- installation of limiting pedestrian fences on Mira street for the safety of pedestrians (GOST R 52289-2004), paragraph 8.1.27.

Table 1 - Measures to improve the existing traffic management scheme

№	Name of the event	Expected effect
1	Installation of road signs	Informing drivers about the presence of lanes for traffic and permitted directions of traffic
2	Road markings	Separation of traffic flows in opposite directions, marking of the boundaries of the traffic lane
3	Installation of limiting pedestrian fences	Ensuring the safety of health and life of people

Table 2 – Dimensions of signs in accordance with GOST R 52289-2004

№	Sign according to GOST R 52289–2004	Standard size	U	L	r
1	5.15.1	700	700	1400	45
2	5.15.2	700	700	–	

Based on GOST R 52289-2004 section 5.1 clause 5.1.8:

Sign 5.15.1 "Direction of traffic by lanes" is installed at a distance of 150 meters to the intersection on the side of the carriageway. The height of the sign installation from the lower edge of the sign to the road surface is 2 meters.

Sign 5.15.2 "Direction of traffic along the lane" is installed at a distance of 100 meters to the intersection, located above the middle of the lane. The height of the sign installation from the lower edge of the sign to the road surface is 6 meters. We take the maximum height so that the signs are visible in advance, and also so that tall cars do not catch the signs when driving.

Signs 5.15.1 and 5.15.2 are installed on lighting poles at the intersection. The length of the lighting poles in accordance with GOST 32947–2014 is 11.5 meters.

Marking in accordance with GOST R 52289-2004:

- Gagarin street update the existing markup,
- Mira street, we change the existing markings in accordance with GOST.

We build a diagram in accordance with GOSTs in a graphic editor.

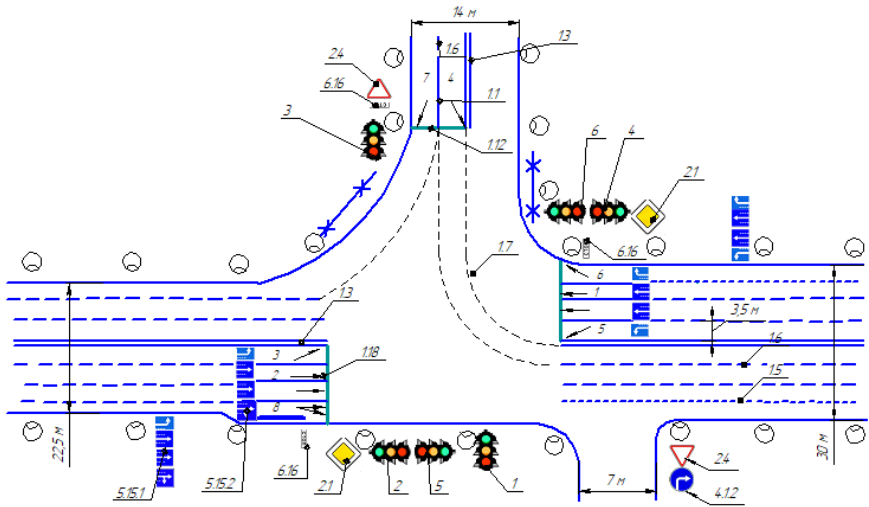


Figure 2 – Scheme of the section Gagarina Avenue - Mira Street after reorganization

Table 3 – List of installed road signs on the sections of the road network Gagarina Avenue - Mira Street

№	GOST R 52289–2004	Purpose
Gagarin Avenue		
1	Clause 5.6.16	signs 5.15.1 "Directions of traffic along the lanes" and 5.15.2 "Directions of traffic along the lane" are used to indicate the permitted directions of traffic in each of the lanes at the intersection.

Table 4 – List of applied road markings on the sections of the road network Gagarina Avenue - Mira Street

№	GOST R 52289–2004	Purpose
Gagarin Avenue		
1	Clause 6.2.9	Marking 1.7, used to mark the boundaries of traffic lanes within an intersection.
2	Clause 6.2.21	Marking 1.18 - indicates the directions of traffic on the lanes allowed at the intersection.
3	Clause 6.2.5	Marking 1.3 - Separates traffic flows in opposite directions on roads with four lanes or more

№	GOST R 52289–2004	Purpose
4	Clause 6.2.7	Marking 1.5 - Separates traffic flows in opposite directions on roads with two or three lanes; denotes the boundaries of traffic lanes in the presence of two or more lanes intended for traffic in the same direction.
5	Clause 6.2.8	Marking 1.6 - Warns of approaching markings 1.1 or 1.11, which separates traffic flows in opposite or following directions
6	Clause 6.2.14	Marking 1.12 - Indicates the place where the driver should stop if there is a sign 2.5 (according to GOST R 52290) or when the traffic signal of the traffic controller prohibits)
7	Clause 6.2.3	Marking 1.1 - Separates traffic flows in opposite directions and marks the boundaries of lanes in dangerous places on the roads
Mira street		
8	Clause 6.2.3	Marking 1.1 - separates traffic flows in opposite directions and denotes the boundaries of traffic lanes in dangerous places on the roads; denotes the boundaries of the carriageway to which entry is prohibited; denotes the boundaries of parking spaces for vehicles
9	Clause 6.2.8	Marking 1.6 - warns of approaching markings 1.1 or 1.11, which separates traffic flows in opposite or adjacent directions
10	Clause 6.2.5	Marking 1.3 is used to separate TP of opposite directions (center line) on road sections with four or more lanes in both directions
11	Clause 6.2.14	Marking 1.12 - indicates the directions of traffic on the lanes allowed at the intersection.

When considering the sewerage method, a set of measures was applied to improve safety at the intersection of Gagarina Avenue - Mira Street, namely: road markings in accordance with GOST R 52289-2004; installation of pedestrian barriers; installation of road signs belonging to the group of signs of special instructions that introduce or cancel certain traffic modes, the road orientation of drivers within this intersection has been increased.

We evaluate the measures taken by indicators.

- the intensity of the traffic flow does not change, since we do not remove any flows;

- the average speed of a car in a stream increases due to rearrangement of cars in advance, and not at the entrance to an intersection. The average speed of the car in the stream is 35 km/h.

- traffic delays are calculated by the formula:

$$t_{Ap} = 0,9 \cdot \left[\frac{T_u \cdot (1 - \lambda)^2}{2 \cdot (1 - \lambda \cdot x)} + \frac{x^2}{2 \cdot N_i \cdot (1 - x)} \right], \quad (10)$$

where λ – the ratio of the duration of the enabling signal to the cycle,
 x – the degree of saturation of the direction of movement,
 T_u – cycle time,
 N_i – traffic intensity.

The ratio of the duration of the enabling signal to the cycle is determined by the formula:

$$\lambda = \frac{t_i}{T_u}, \quad (11)$$

where t_i – duration of enable signal burning.

The degree of saturation of the direction of motion is determined by the formula:

$$x_i = \frac{N_i \cdot T}{M \cdot t_i}, \quad (12)$$

where M – saturation flux.

Table 5 – Protocol for measuring the duration of vehicle delays during a set of measures

	λ	X_i	t_{Ap}	N_i	M	t_i
1	0,4	5,07	29	3494	1970	42
2	0,5	2,43	36	2156	1970	54
3	0,5	0,76	20	572	1672	54
4	0,2	2,42	47	690	1713	20
5	0,4	0,21	24	120	1643	42
6	0,4	1,21	29	726	1713	42
7	0,2	1,28	42	365	1713	20
Amount	2,3	13,4	227	8123	12394	274

The total vehicle-seconds of vehicle delays at the intersection are calculated using the formula 2:

$$AT = (29+36+20+47+24+29+42) \cdot 15 = 3402,3$$

The average delay of one stopped car is calculated using formula 3:

$$t_3 = \frac{3402,3}{227} = 15 \text{ seconds}$$

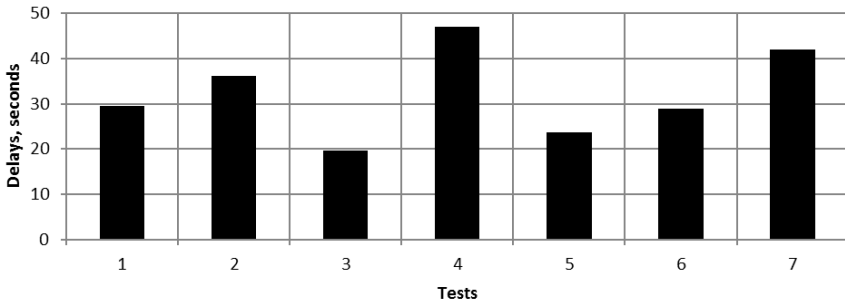


Figure 3 – Intersection delay schedule after reorganization

Thus, we see that when applying a set of measures for the intersection of Gagarin Avenue - Mira Street, the average delay is reduced by 3 seconds.

- the phase-by-phase siding of vehicles does not change, since the existing phases have not changed.
- conflict points at the intersection are calculated according to the formula 5

$$m1 = 1 + 3 \cdot 3 + 5 \cdot 5 = 35$$

$$m2 = 1 + 3 \cdot 1 + 5 \cdot 0 = 4$$

It turns out that taking into account the use of a set of measures, the complexity of the intersection in the first phase decreased by 12 points.

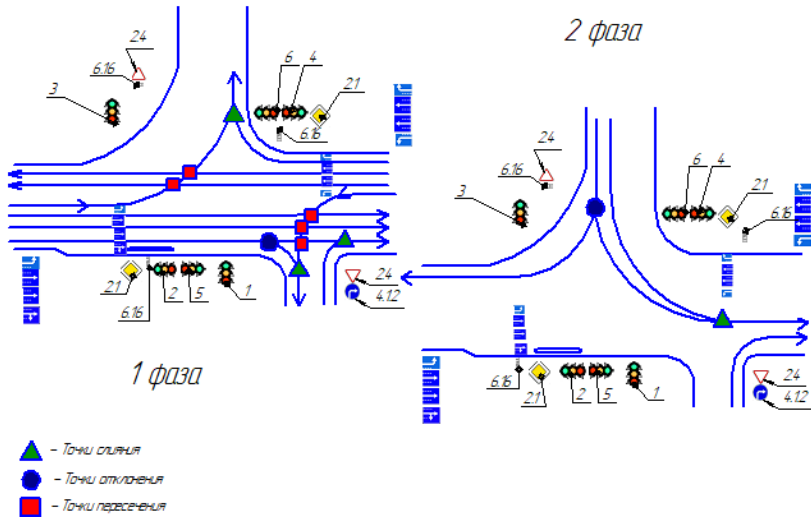


Figure 4 – Conflicting points at the selected intersection after reorganization

- traffic light regulation does not change, since they did not change the existing operating mode;
- the accident rate does not change, since the parameters specified in Appendix P – 1.1 and P – 1.4 of ODM 218–4–005–2010 do not change;
- the safety factor decreases in sections 1, 2, 3.

$$K_{\sigma_1} = \frac{50}{45} = 1,11$$

$$K_{\sigma_2} = \frac{50}{45} = 1,11$$

$$K_{\sigma_3} = \frac{50}{40} = 1,25$$

The main problem of the intersection was solved by allocating lanes for traffic in directions, thereby increasing the average flow speed by 5 km / h and reducing the average vehicle delays by 3 seconds.

These measures had an impact not only on this intersection, but also on neighboring sections: the direction of traffic flows was streamlined, delays decreased, and pedestrian collisions were prevented when crossing the carriageway in the wrong place along Mira Street. However, if the average flow rate increases by 5 km/h, vehicles will arrive at a neighboring intersection faster, which will contribute to the formation of congestion at the intersection.

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使用“Era-glonass”系統確定車輛的穩態減速度
**USING THE "ERA-GLONASS" SYSTEM TO DETERMINE THE
STEADY-STATE DECELERATION OF A VEHICLE**

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抽象的。 研究的目的和目的。 分析計算運動參數時使用速度讀數的問題。

研究的相關性。 該研究的相關性取決於與交通事故相關的複雜情況的存在以及計算運動速度的特殊性。

研究方法。 在專業汽車技術研究中使用的一般科學方法，其特徵，原理和任務。

主要結果。 據透露，在使用“時代-加洛納斯”系統時，消除了確定特定道路情況下阻礙確定運輸實際減速的主要限制。

關鍵字：公路運輸，立法，汽車技術研究，穩態車輛減速。

Abstract. *Goals and objectives of the study. Analyze the problem of using speed readings when calculating motion parameters.*

The relevance of research. *The relevance of the study is determined by the presence of a complex situation associated with traffic accidents and the peculiarities of calculating the speed of movement.*

Research methods. *General scientific methods, their features, principles and tasks of their use in expert autotechnical research.*

Main results. *It was revealed that when using the "Era-Glonass" system, the main restrictions that hindered the determination of the actual slowdown of the transport in a specific road situation are removed.*

Keywords: *Road transport, legislation, autotechnical research, steady-state vehicle deceleration.*

Over the past decade, the equipping of vehicles with electronic systems has increased significantly. The development of microprocessor technology has made

it possible to increase the safety, efficiency, and reliability of cars, while the cost of its implementation only becomes lower over time. In the standard equipment of serial cars, depending on the configuration, there may be systems that control and so complement the process of movement. Thus, we can say with confidence that today electronic assistants are an integral part of the vehicle and the further development of the industry can proceed only along the path of greater integration and fusion of these components.

Modern transport has a large complex of electronic devices that record the parameters of a car's movement. In most cases, melon records were recorded on the vehicle itself, in special blocks, the so-called "black boxes". An example of such devices is tachographs that record the parameters of the vehicle movement, the driver's work and rest regime.

However, this method of storing information cannot be characterized as reliable, since free access and attachment to the machine are vulnerabilities in the system. An example in this case is the actions of drivers to bypass the control and safety systems of tachographs using various methods of circumventing restrictions.

To solve this problem, in many countries, telematics devices are installed on cars during production, which provide two-way communication and data recording on the operator's server. This method of storing information is more reliable, since it can prevent the application of a direct impact on data packets during storage. It is also possible to speak with confidence about improving the quality of control over the vehicle fleet. An example of such devices is the implementation of the Glonass system in vehicle fleets.

Within the framework of the Customs Union, an initiative was put forward for the widespread introduction and installation of "Era-Glonass" on new transport systems. Starting from February 2018, all produced or newly imported vehicles on the territory of the Russian Federation should be equipped with this system. This system provides registration of the main parameters of the vehicle movement.

Steady-state vehicle deceleration ($j \text{ m/s}^2$) - is the average value of vehicle deceleration in the braking area from the moment of the end of its increase, until the start of releasing or stopping the vehicle.

The deceleration of a vehicle is one of the main quantities that allow an expert to create a mathematical model of a road traffic accident and analyze various versions of the investigator and the court, and give substantiated answers to the questions posed to him. The amount of deceleration depends on many objective factors, including the road and weather conditions at the scene at the time of the accident, the technical condition and design features of the vehicle.

The amount of deceleration of a particular vehicle is established by conducting an investigative experiment in the road conditions of the scene of the accident or

similar. If conducting an investigative experiment is impossible, it can be determined by calculation using formulas known in expert practice, or by reference data.

In the general case, the vehicle speed at the time of the start of braking is calculated by the formula:

$$Va = 1.8 * T3 * J + \sqrt{25.92 * S * J};$$

where,

J - steady deceleration of a technically sound vehicle during braking, m/(s*s)

T3 - the rise time of the vehicle deceleration, s;

S - the length of the vehicle braking track, m;

Application of processing the results to obtain the value of vehicle deceleration, using the value of the speed of its movement before braking and the value of braking traces, obtained during the test drive, was permissible.

The formula is a solution to the quadratic equation obtained by substituting all values (except for the desired deceleration value) into the formula for determining the vehicle speed along the tracks of its deceleration.

The inadmissibility of this approach was determined by the following reasons. First, the result obtained largely depended on the vehicle speed before braking. This value had to be actual, measured with an accuracy of units. This condition, using the "Era-Glonass" system, is feasible, since the actual speed value is determined with high precision.

Secondly, the braking process must necessarily correspond to wheel locking. If the blocking occurred not at the end of the deceleration rise time, but somewhat later (which happens, for example, with wet brakes), then the result of calculating the deceleration value may differ significantly from the actual one. This condition, using the "Era-Glonass" system, is feasible, since the actual time is determined with high precision.

Thirdly, in the formula it is necessary to substitute the value of the deceleration rise time, the numerical value of which is the same actual and may differ from the value taken in accordance with the reference data. This value can be obtained by direct examination of the vehicle.

Thus, when using the "Era-Glonass" system, the main restrictions that hindered the determination of the actual slowdown of the vehicle in a specific road situation are removed.

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氣候變化對俄羅斯聯邦沃羅涅日州水資源狀況的反映

**REFLECTION OF CLIMATE CHANGES ON THE STATE OF WATER
RESOURCES OF THE VORONEZH OBLAST OF THE RUSSIAN
FEDERATION**

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抽象的。氣候變化問題中最重要任務是預測水資源狀況以及河流、湖泊和水庫的水文特徵。由於水資源的變化會影響環境狀況和人們的生活條件，以及該地區許多經濟部門的運作，包括水利工業，如航運，養魚，公用事業等，因此必須特別注意這一預測。了解即將到來的水文特徵變化，就不可能預測國家對水的管理和適應性預防措施的發展。關鍵詞：氣候，水資源，環境，經濟，區域，預測，活動。

Abstract. *The most important task in the problem of climate change is to forecast the state of water resources and hydrological characteristics of rivers, lakes and reservoirs. Special attention is paid to this forecast, since changes in water resources affect the state of the environment and living conditions of people, the functioning of many sectors of the region's economy, including the water industry - shipping, fish farming, utilities, etc. Without knowledge of the upcoming changes in hydrological characteristics, it is impossible to predict the state water management and development of adaptive preventive measures.*

Keywords: *climate, water resources, environment, economy, region, forecast, activities.*

The paper analyzes climate changes in the territory of the Voronezh Oblast of the Russian Federation, according to the data of the Voronezh meteorological station, which is the reference for the region. Due to the loss of observations in certain years (for example, during the Great Patriotic War) and for a better under-

standing of the factors affecting the water content of rivers, the climatic analysis was carried out over 100 years in the context of decades, and the last decade by years, which are presented in tables 1 - 4 and figures 1 - 4.

Table 1
Average annual precipitation at the "Voronezh" meteorological station by decades

Analyzed decade, years	1921-1930	1931-1940	1941-1950	1951-1960	1961-1970
Average annual precipitation, mm	480	450	527	516	557
Analyzed decade, years	1971-1980	1981-1990	1991-2000	2001-2010	2011-2020
Average annual precipitation, mm	571	620	546	586	581

Table 2
Average annual precipitation at the "Voronezh" meteorological station in the last ten years

Years analyzed	2011	2012	2013	2014	2015
Average annual precipitation, mm	461	829	591	419	527
Years analyzed	2016	2017	2018	2019	2020
Average annual precipitation, mm	766	644	612	520	446

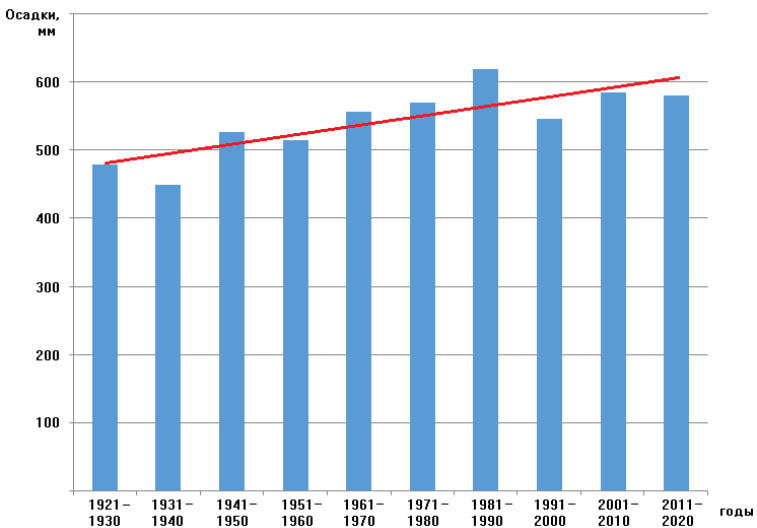


Fig. 1 – A histogram for a visual representation of the precipitation trend over the past 100 years using the example of the "Voronezh" weather station

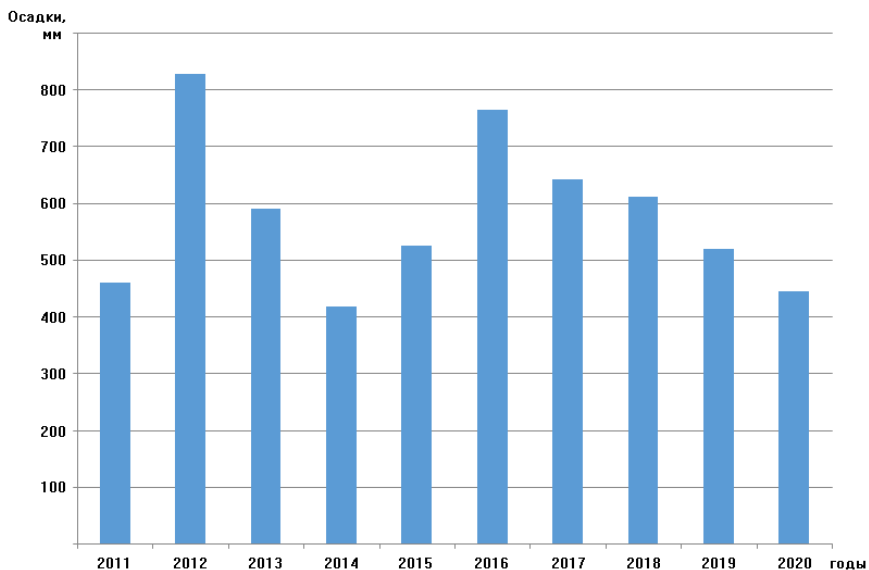


Fig. 2 – A histogram for a visual representation of significant differences in precipitation in different years using the example of the "Voronezh" weather station.

Table 3
Average annual temperature at the "Voronezh" meteorological station by decades

Analyzed decade, years	1921-1930	1931-1940	1941-1950	1951-1960	1961-1970
Average annual temperature in a year, °C	5.3	5.8	5.6	5.6	5.8
Analyzed decade, years	1971-1980	1981-1990	1991-2000	2001-2010	2011-2020
Average annual temperature in a year, °C	6.0	6.4	6.7	7.6	8.2

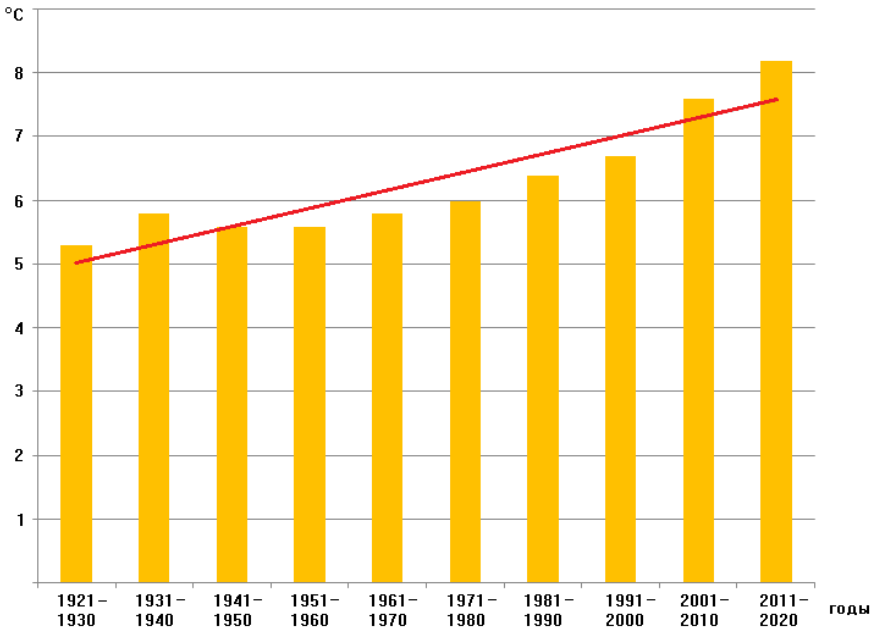


Fig. 3 – A histogram for a visual representation of the tendency of temperature changes over the past 100 years using the example of the "Voronezh" weather station

Table 4
Average annual precipitation at the "Voronezh" meteorological station in the last ten years

Years analyzed	2011	2012	2013	2014	2015
Average annual temperature per year, °C	7.1	7.7	8.4	8.0	8.7
Years analyzed	2016	2017	2018	2019	2020
Average annual temperature in a year, °C	8.1	8.1	7.6	8.9	9.5

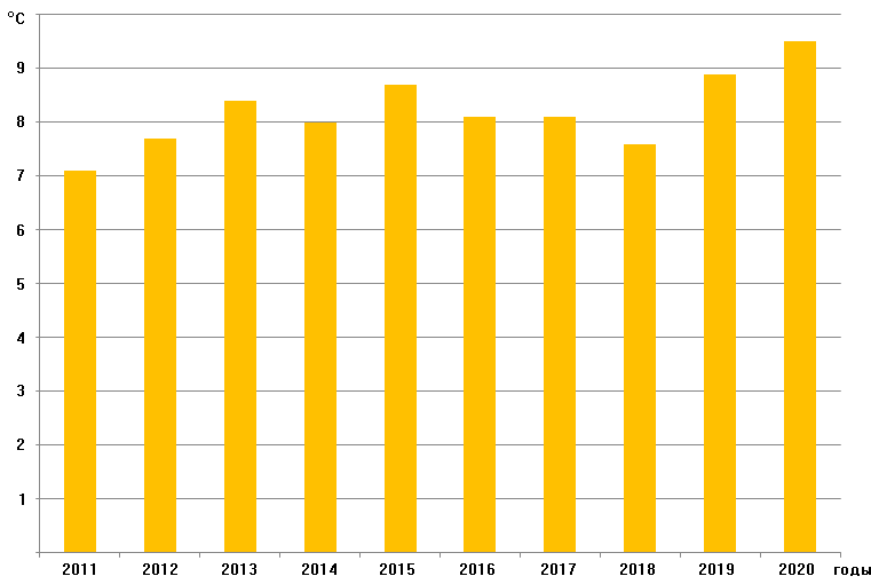


Fig. 4 – A histogram for a visual representation of significant average annual temperature differences in different years using the example of the Voronezh weather station.

The analysis shows that over the past 100 years, the average annual temperature in the Voronezh area has increased by 46% (by 2.6° according to the linear trend), and precipitation has increased by 26% (the increase was 130 mm according to the linear trend). In the context of the last decade, over the years, one can easily detect significant changes in climatic indicators, which indicates the instability of the climate in recent years, not only from year to year, but also within the season, for example, winter 2020-2021.

Studies by many specialists of the runoff of large rivers (as an integral indicator of changes in water resources over large areas) using special models and paleo-analog data and under different scenarios of increasing air temperatures showed a wide scatter of data. However, most researchers predict an increase in the flow of the main rivers of the world [1].

Domestic scientists-hydrologists of our country and a number of foreign countries in recent decades have carried out research on changes in water resources and hydrological characteristics have identified the following basic patterns.

Almost everywhere, the runoff characteristics are already becoming more variable throughout the year and in the long-term series, more and more abnormal

indicators are observed, floods and droughts occur simultaneously, and the intra-annual runoff distribution changes. Thus, according to the State Hydrological Institute (St. Petersburg), the winter runoff on Russian rivers increases, the spring runoff noticeably decreases as a result of the shift, probably, of the snow melting period from spring to the end of winter as the air rises. In fact, under the scenario of climate warming by 2 degrees, the formation of two hydrological seasons is predicted - winter (November-April) and summer (May-October), characterized by high runoff and low, stable low-water season, respectively.

For example, in 2018, outstanding floods were observed in Voronezh Oblast on the Bitug, Podgornaya, Voronezh, Usmanka rivers, and already in 2020 there was no flood at all, the drought period in August-October 2020 dehydrated ponds and reservoirs, which were practically half-empty in spring.

Not only the quantitative indicators of water resources are changing, but also their qualitative state. Due to an increase in the solubility of many pollutants with an increase in temperature, changes in the dilution capacity of rivers and water bodies occur, and their ability to self-purify changes.

An increase in the water temperature of lakes and reservoirs leads to the development of microorganisms and algae, for example, the flowering of the Voronezh reservoir, which is located inside the metropolis.

All this causes a deterioration in the quality of surface water, complicates the operation of treatment facilities, while stench is increasingly spreading throughout the millionth city. Surface water becomes unsuitable even for technical needs without preliminary purification. Already at present, the region needs to revise the volumes of polluted water discharged into rivers. In the projects, there are already estimates of additional discharge of water from the Voronezh reservoir during the summer low-water period to ensure sanitary flow in the Don River - the project for the construction of the 6th and 7th units of NVNPP. [3]

As a result of the ongoing changes in the regime of rivers, their coastal erosion increases (the Don river - the Shchuchye village of the Liskinsky district, Pavlovsk, the Vorona river - the village of Bolshiye Alabukhi, Borisoglebsk), the channel itself is eroded, as a result, the turbidity of river flows increases, sediments on the rifts, which worsens navigation on the Don river. Currently, there is no through navigation on the Don River in the region.

As a result of climatic changes, the area of snow cover decreases, especially in the south of Oblast, the duration of the frost-free period increases, the timing of opening and freezing of rivers, artificial and natural reservoirs changes, the thickness of the freeze-up changes. For example, in winter 2020, for the first time during the period of meteorological observations, the ice cover was not formed on the rivers of the Voronezh Oblast.

The ongoing changes in water resources, their water regimes are reflected in

the use of water bodies, the navigation situation on the Don and its tributaries, complicate the operation of hydraulic structures (dams, dams of ponds and reservoirs), pontoon crossings on the Don, fishery facilities (in Voronezh Oblast there is a developed fish pond economy). In the urban economy, due to changes in runoff, the reliability of drainage, stormwater and sewerage systems decreases.

The significant variability of groundwater under climate change is reflected in the solution of a number of practical problems: the establishment of zones of flooding of cities and agricultural lands (the established zones do not actually reflect them), analysis and forecasting of the activation of geodynamic and geological processes (karst, landslides, subsidence, etc.). The latter is most clearly expressed on the right bank of the Don, the highest exogenous geological risks are in the Podgorensk region [2].

Increased natural disasters and increased frequency of extreme situations destabilize the ecological situation and the economy of the region, creates a threat of degradation and even destruction of water bodies. What is only the winter fish kill on the Usmanka River near the Voronezh Reserve in 2021!

Climate change affects the size, structure and nature of water consumption and water use in the region, with which the problems of water resources management, economic and environmental consequences are closely related. The authors were "lucky" to participate in the analysis of the conflict situation between neighboring villages in the Kalacheyevsky region over the use of the water resource - the water of the Manino River (a tributary of the Podgornaya River). The residents of the upstream village of Manino wanted to restore the dam destroyed during the flood, while the residents of the downstream village of Podgornoye were categorically opposed.

Changes in climate and water resources directly affect the operation of thermal and nuclear power plants in the region, since they are vulnerable to contamination of the incoming water into the water intakes of the cooling systems of the plants.

In the context of climate warming, the problem has already arisen of the lack of a dispatcher's schedule of drawdowns and releases produced by the Matyrsky and Voronezh hydroelectric complexes on the Voronezh River, which complicates the trouble-free passage of flood waters and aggravates hydroecological problems.

Conclusions:

- climatic changes significantly affect the water resources of the Voronezh Oblast - the Don River and its tributaries, lakes, reservoirs and ponds.

- it is currently possible to identify such an impact in a timely manner, and even more so to predict, at present it is possible only in general terms, since in fact water bodies are managed hydrological natural-technical systems (HNTC), the control centers of such HNTC, in fact, and unfortunately, are not united into a single whole and are not subject to a single control action.

- related to the above is the justification of the regional economic management bodies that the impact on water resources is determined by many multidirectional processes and their outcome is almost impossible to predict.

- there are many assessments of the impact of global climate changes on hydrological situations, but the conclusions obtained are very contradictory due to the differences in the forecast methods used, different scenarios of climatic changes, the different directions of the processes affecting water resources, their different knowledge, etc.

In conclusion, I would like to quote the words of Leonardo da Vinci: "When you set out the science of the movements of water, do not forget to cite its practical provisions under each provision, so that your science does not remain useless."

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鑽井廢料處理產生的建築材料
**CONSTRUCTION MATERIAL AS A RESULT OF DRILLING
WASTE DISPOSAL**

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抽象的。提出了一種用於處置鑽井廢料的技術，該技術提供了一種廉價的，環境友好的建築材料，該材料可滿足所需的物理和機械特性，並具有防電離輻射的防護性能。給出了確定複合材料物理和機械性能的研究結果。對原料混合物中鑽井泥漿的不同含量進行了研究。結果表明，當骨料中的鑽井污泥含量為50%時，樣品的抗壓強度最高。這些結果與電離輻射劑量率衰減係數值的數據相關，這使得可以將砂：鑽進污泥的比率= 50:50視為具有增強的機械強度和能力的複合材料的最佳成分。以減弱電離輻射劑量率。研究結果表明，所提出的複合材料組合物能夠承受長期的輻射暴露，而不會顯著降低結構和技術性能。所提出的處置鑽探廢物的方法增強了環境保護，改善了環境狀況，同時允許使用便宜的組件來獲得用於電離輻射源襯裡房間的建築材料，用於建設低放射性廢物的存儲設施。

關鍵字：鑽井污泥，建築材料，環境保護，電離輻射。

Abstract. *A technology for the disposal of drilling waste is proposed that provides an inexpensive, environmentally friendly construction material that meets the required physical and mechanical characteristics and has protective properties against ionizing radiation. The results of research on determining the physical and mechanical properties of composite materials are presented. Studies were carried out for different contents of drilling sludge in the raw material mixture. It is shown that when the content of drilling sludge in the aggregate is 50%, the highest values of the compressive strength of samples are provided. These results correlate with data on the value of the attenuation coefficient of the ionizing radiation dose rate, which makes it possible to consider the ratio sand:*

drilling sludge = 50: 50 as the optimal composition of a composite material with increased mechanical strength and the ability to attenuate the ionizing radiation dose rate. The results of the study showed that the proposed compositions of composite materials are able to withstand long-term radiation exposure without significant deterioration of construction and technical properties. The proposed method of disposal of drilling waste increases environmental protection, improves the environmental situation and at the same time allows using cheap components to obtain building material for lining rooms with sources of ionizing radiation, for the construction of storage facilities for low-level radioactive waste.

Keywords: *Drilling Sludge, Construction Materials, Environmental Protection, Ionizing Radiation.*

Rational use of mineral resources, minimization of negative impacts and preservation of the productive natural environment is one of the main tasks of environmental research. Production activities of oil and gas companies inevitably lead to technogenic impact on the environment, which is expressed in the contamination of the earth's geosphere shells – the atmosphere, hydrosphere, and lithosphere [1-3]. During the construction of oil and gas wells, a significant amount of drilled rock, or drilling sludge, is extracted from the earth's crust interior from various geological formations. One of the most important tasks is to protect the natural environment from liquid and solid drilling waste generated during the operation of drilling equipment. They consist of drilling waste water, spent drilling solution and drilling sludge, in some cases mixed in mud barns. The main factors affecting the impact of drilling waste on the surrounding elements of the biocenosis are determined by the composition and oil products and mineralized waters entering it from the bottom hole.

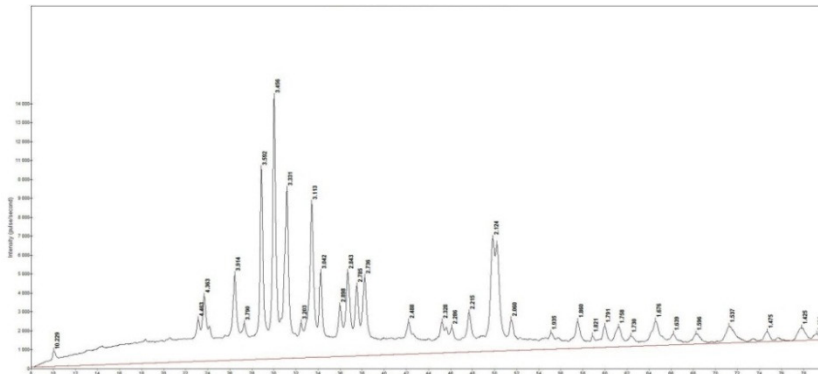
Drilling waste mostly consists of 30-45% of drilled rock (clay and sand particles), 30-45% – drilling fluids and 10-20% – possible technological discharges of underground water and oil: wash water, pickling solutions, waste electrolytes [4].

A promising method of utilization of drilling sludge is to use them as secondary raw materials for the manufacture of construction materials [5-7].

The paper considers a method for utilization of drilling sludge in an optimal way with minimization of economic costs in the production of building materials - concrete [8-11].

The object of research was drilling sludge formed during the drilling of exploration wells in the gas-bearing reservoir of the Yamburg oil and gas condensate field (YAOGCF) from a depth of 3400-3800 m.

Figure 1 shows an x-ray image of drilling sludge waste.



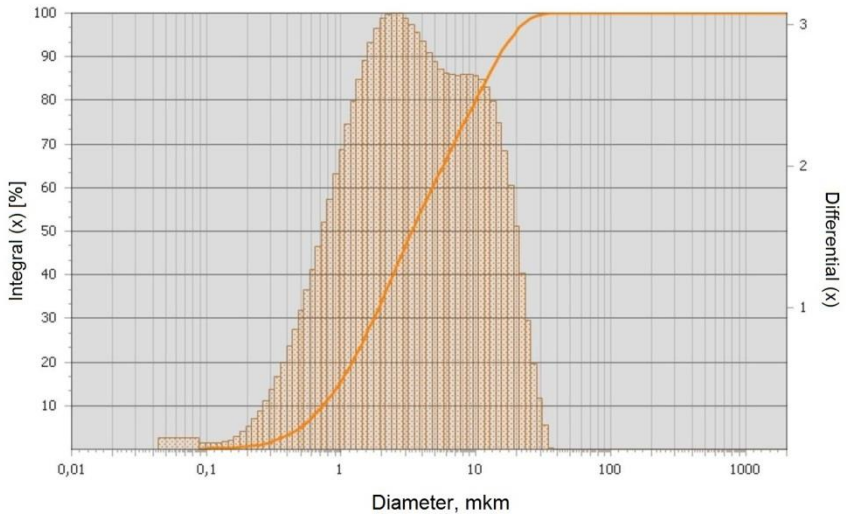


Fig. 2. Particle size distribution

The study of the particle size distribution using an optical microscope and laser radiation scattering showed that most of the studied samples of drilling sludge are characterized by a bidisperse composition, expressed in one way or another.

Raw mixture for manufacture of building materials samples were prepared by mixing Portland cement grade 400 and filler in the form of drilling sludge and quartz sand with grain size of 1.5–3 mm, at various mixing ratios with added water, based on the conditions necessary plasticity of the mixture and depending on the moisture content of drilling sludge.

The results of studies with different content of drilling sludge in the raw material mixture are shown in Fig. 3-6.

When the content of drilling sludge in the aggregate is 50% in terms of dry matter, the highest values of the compressive strength of the samples are provided (Fig. 3). These results correlate with data on the value of the coefficient of half attenuation of the ionizing radiation dose rate, which makes it possible to consider the ratio sand : drilling sludge = 50 : 50 as the optimal composition of a composite material with increased mechanical strength and the ability to attenuate the ionizing radiation dose rate (Fig.6).

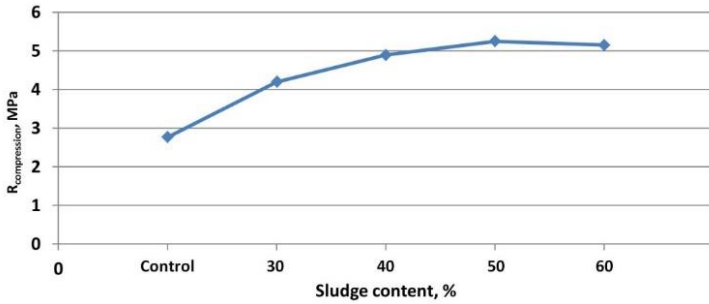


Fig. 3. Dependence of the compressive strength of samples on the mass fraction of drilling sludge in the composite.

The increase in sample density with an increase in the content of drilling sludge in the mixture is due to the high density of drilling sludge (2800 kg/m³).

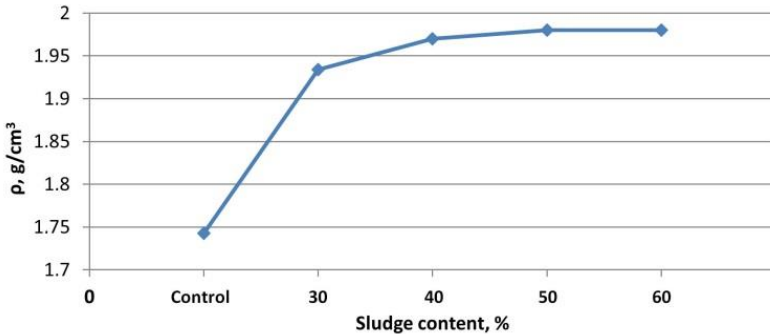


Fig. 4. Dependence of sample density on the mass fraction of drilling sludge in the composite.

The lowest water absorption is observed in samples with the ratio sand : drilling sludge = 50: 50.

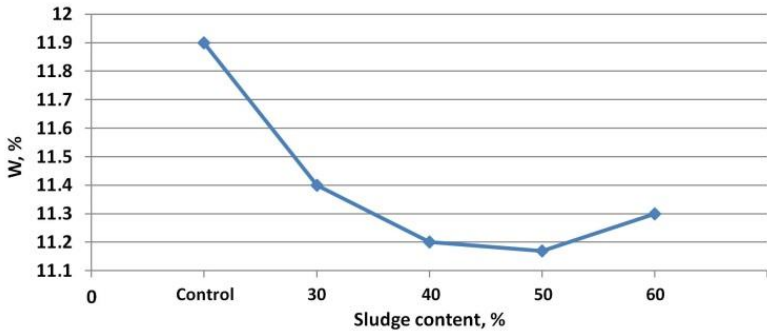


Fig. 5. Dependence of water absorption of samples on the mass fraction of drilling sludge in the composite.

The presence of sulfuric acid barite BaSO₄ in the drilling sludge allowed making an assumption about the possibility of using composite materials based on drilling sludge as materials for protection against ionizing radiation.

Using a dosimeter-radiometer DKS-96, the thickness of the attenuation layer of the equivalent dose of ionizing radiation and the mass attenuation coefficient were determined. The dependence of the ionizing radiation attenuation coefficient on the mass fraction of drilling sludge in the filler and the thickness of the samples is shown in Fig. 6.

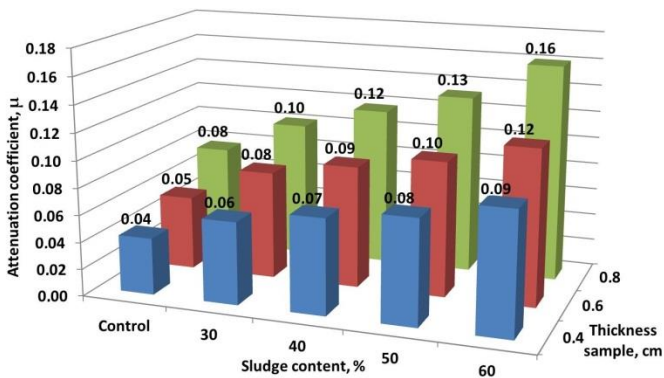


Fig. 6. Dependence of the attenuation coefficient on the mass fraction of drilling sludge in the composite.

The data presented in Fig. 6 allow concluding that when the content of drilling sludge in the filler is 50-60%, the maximum value of the ionizing radiation attenuation coefficient is provided for a sample thickness of 0.4-0.8 cm.

The proposed method of disposal of drilling waste increases environmental protection, improves the environmental situation and at the same time allows using cheap components to obtain building material for lining rooms with sources of ionizing radiation, for the construction of storage facilities for low-level radioactive waste.

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