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SECTION 1

SOCIO-ECOLOGICAL, ETHICAL AND PEDAGOGICAL PROBLEMS OF OUR TIME

ACADEMIC INTEGRITY AS ONE OF THE IMPORTANT FACTORS OF PROFESSIONAL BEHAVIOR OF TEACHERS AND MEDICAL STUDENTS IN A PANDEMIC

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In a pandemic, the education sector underwent special changes, as it led to the closure of universities and the transition to distance learning with widespread introduction of the latest information and communication technologies (ICT), which serve as a platform for learning and monitoring learning outcomes. At the same time, the academic responsibility of both teachers and students has acquired a special status not only in Ukraine but throughout the world. After all, unprofessional behavior during the student years can manifest itself later in the professional career of a doctor and negatively affect the initiative, the ability to take responsibility and the desire for self-improvement.

Keywords: academic integrity, teacher, student, current and semester control.

Academic integrity is a complex concept that incorporates many fundamental values, such as scientific honesty, originality, accountability, responsibility, respect, trust, fairness, and recognition of the ideas of others. Academic integrity and scientific honesty are the foundation of the quality of education and research. The International Center for Academic Integrity (ICAI) argues that academic integrity itself is the fundamental basis for preparing students for both personal and professional success (Younis J., 2019). Medical education, like other areas, is susceptible to unprofessional behavior of students and teachers. In the context of a pandemic and the transition to distance learning, the principle of integrity, such as independent work, the implementation of tasks of current and final control, analysis of learning outcomes and their evaluation has become particularly relevant.

The spread of the COVID-19 virus worldwide has led to a global pandemic and the introduction of social distancing in everyday life (O'Byrne, 2020). The education sector has undergone special changes, as it has led to the closure of schools, universities and the transition to distance learning with the widespread introduction of the latest information and communication technologies (ICT) in the educational process (Grivko, 2020). ICTs are used not only for lectures and workshops, but also as a platform for monitoring learning outcomes. In TNMU, remote communication of participants in the educational process was carried out using the Moodle system, which contains all the training materials and test tasks for both current and final control and the oral part of the exam. The Ministry of Education and Science of Ukraine has developed recommendations for the organization of current, semester control and certification of students using distance technologies (Letter of the Ministry of Education and Science № 1 / 9-249 dated 14.05.20).

However, in the conditions of distance learning the problems of control over the results of independent performance of tasks by students at home in the absence of control by the teacher are exacerbated, so there is a need to rely on the academic responsibility of students. However, to reduce the possibility of unprofessional behavior of students, it became necessary to improve the quality and variety of test tasks, use the function of randomization and limit the time spent on each task or test in general. Tests should be varied at different levels of difficulty - as an open form - without specifying answer options; to a closed form, which provides: - the choice of one or more correct answers - the choice of an alternative answer; - establishing compliance; - establishing the correct sequence. But to meet certain pedagogical requirements: the necessary and sufficient level of complexity; objectivity and reliability; stability; representativeness and others (Bodnenko, 2012).

Academic integrity in the digital age is a problem that students face not only in their professional activities (Keener, 2019, Gagnon, 2015). A well-known example of Thai students using glasses with built-in cameras

during the exam is striking (Melvin, 2016). As for homework, students have unlimited opportunities to use a variety of additional tools, which can distort the system of assessment of their knowledge, calling into question the professionalism and honesty of both teacher and student. The only protection against this may be the teacher's awareness of responsibility to his students and students' understanding of the prospects of their own low professional efficiency in the future (Bertram et al., 2006).

Therefor in the new conditions, the existing principles of academic integrity act not only as the main means of monitoring learning outcomes, but becomes the basis for awareness of their own responsibility for the learning process of a medical student. For medical students, the principle of academic integrity can be correlated with the effectiveness of professional activities in the future.

ANALYSIS OF MEDICAL AND DEMOGRAPHIC INDICATORS IN RUSSIA AND IN THE REPUBLIC OF TATARTAN

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In this article, the author examines the medical and demographic indicators of the Russian Federation (hereinafter - RF) and the Republic of Tatarstan (hereinafter - RT). The author analyzed such indicators as fertility, mortality and causes of death in the territory of the Russian Federation and the Republic of Tajikistan. Summing up the results of this article, the author concludes that it is necessary to improve the system of early diagnosis of diseases of the circulatory system, neoplasms, and injuries.

Keywords: medical and demographic indicators, sanitary and epidemiological situation, ecology.

The health status of the population is one of the important indicators of the well-being of the region. The high level of air pollution, the state of drinking water, the presence of green zones in the region certainly affects the psychological and physical health of the population. Accordingly, the ecological situation in the region and the health of the population are directly related to each other. One of the objective indicators of population health are such medical and demographic indicators as fertility, mortality, and natural population growth, which also give us the opportunity to assess the sanitary and epidemiological situation in the region. The dynamics of birth rates in the Republic of Tatarstan and the Russian Federation (in people per 1000 population) showed that in 2019 the value of the indicators became equal and amounted to 11 [3]. In general, according to the dynamics of the birth rate, a decrease in the indicator can be noted since 2016. A positive point is the fact that in 2019 the Republic of Tatarstan was able to maintain the highest natural population growth among the regions of the Volga Federal District (hereinafter referred to as the Volga Federal District) and one of the lowest in the Volga Federal District in terms of overall mortality and mortality from external causes. Despite this, diseases of the circulatory system prevail in the structure of mortality (48.9%), neoplasms (16.7%) occupy the second place in the structure of mortality in 2019, then injuries, poisoning and other consequences of external causes (6.1 %) [1]. Mortality rates from diseases of the circulatory system in the Republic of Tajikistan are higher than in the Russian Federation (RT - 52.3%, RF - 47.3%). We also examined the causes of death in various countries and the Russian Federation. For foreign countries, to a greater extent, in comparison with Russia, mortality from neoplasms is relevant. Thus, the mortality rate from neoplasms in France is 32.7%, in the UK - 30.8%, in Spain - 31.3%, in Germany - 27.8%, in the Russian Federation - 16.1%, in the Republic of Tajikistan - 16 ,7%.

Today the policy of Russia and its regions is aimed not only at the treatment of diseases, but also at their prevention. In addition to the already widespread measures for the prevention of tobacco smoking and alcoholism, the Republic of Tatarstan is actively involved in promoting early diagnosis of diseases and maintaining a healthy lifestyle. In order to popularize a healthy lifestyle in the territory of the Republic of Tatarstan, improvement of parks and squares is also carried out, not only in the capital, but also in remote areas of the region, where free exercise equipment and bike paths are installed.

As we can see, despite the positive dynamics of natural population growth, high mortality rates from diseases of the circulatory system, neoplasms and injuries remain an urgent problem. Considering the above, in our opinion, it is necessary to improve the system of early diagnosis of the above diseases among the population.

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ASSESMENT THE LEVEL OF COMPETENCIES OF STUDENTS-ECOLOGISTS

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Assessment the level of environmental competencies is a necessary component in acquiring the knowledge and skills of future specialists. Assessment of the level of environmental competencies can improve the efficiency of the educational process.

Keywords: environmental competencies, competency building approach, environmental competence.

Modern tendencies in education and environmental problems lead to the necessity to move to a higher level of professional development of ecologists. A competitive specialist have to be self-organize and self-development, to create an individual educational trajectory and a strategy for successful professional activity. The development of these qualities is possible with a competency building approach. Its main goal is to become a specialist with social and professional mobility, a high level of competence in solving environmental problems [1].

The assessment of the level of environmental competencies among environmental students was carried out using a survey of 1st and 5th year students of the specialty «Medical and Biological Science». The survey contained 16 questions aimed at identifying the environmental competence of students who have a qualification field related to teaching. The greatest number of positive answers among 1st and 5th year students received the following questions: «To what extent do you consider the ecological training of a 21st century specialist to be significant?» (92-70%), «Are you able to get and apply environmental knowledge from personal experience and literary sources? (54% and 80%, respectively), «Do you think that environmental degradation is negatively affecting your health?» (94-82%), “Does environmental competence matter in your future professional career? (86-66%). In general, first-year students estimated their environmental competencies as high. The main group of students (78%) estimated their level of environmental competence as an average of 3 to 3.9 points. Only 2% of students estimated their level on average from 4 to 4.9 points. The survey among 5th year students showed that the largest percentage of students (62%) also gave an assessment from 3 to 3.9 points. 14% of students gave themselves an assessment from 4 to 4.9 points.

Consequently, it was revealed that the level of environmental competence among 5th year students is higher than that of 1st year students, but by very small values (3.27–3.29 points, respectively).

The creation of an education system for sustainable development involves the transition from traditional education to an environmentally oriented model. Currently, the violation of environmental laws can be prevented by increasing the level of environmental culture, which can be done through education and particularly the process of forming environmental competencies.

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ASSESSMENT OF THE IMPACT OF WIND POWER PLANTS ON HUMAN HEALTH DURING ENERGY PRODUCTION

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Annotation: in this paper, negative impact of wind turbines on human health in energy production.

Keywords: wind energy, people, health, ecology.

The use of renewable energy sources is an important area for reducing greenhouse gas emissions. Alternative energy sources help reduce pollution, ensure energy security and increase the country's energy independence. Wind power is an affordable, inexhaustible, clean and sustainable, and also the safest way to generate electricity. The use of wind turbines (wind power plants) does not pose a threat of radioactive contamination of the area in an accident. However, there are negative environmental impacts associated with the manufacture and operation of wind turbines: 1. aerodynamic sound generated by wind turbines; 2. mechanical sound generated by the turbine itself; 3. soil erosion; 4. emissions associated with the production of turbines, their transportation, construction, operation, maintenance and dismantling works; 5. the formation of powerful sound vibrations that affect the operation of navigation systems, 6. visual impact on human health [1].

The use of sound-insulating and sound-absorbing materials in modern designs of wind turbines, as well as special coatings, protective casings, reflectors and other protective devices does not help to completely eliminate the noise level, the sources of which are wind wheels, bearings, elements of mechanical gearboxes, an electric generator. The placement of wind turbines remotely from settlements leads to a loss of energy and an increase in the cost of the structure (it is necessary to build a power line). Aerodynamic noise can be reduced by appropriate profiling of the blades, selection of the speed of rotation of the wind wheel and the mechanism of its orientation to the wind. A person who is under the influence of constant vibrations and noise has a tendency to fatigue, disruption of the body's circadian rhythms, and increased nervousness. Prolonged exposure to vibration and noise leads to a deterioration in the general mental and physiological health of a person, in particular, to migraines, pressure in the ears, tachycardia, nausea and other symptoms of a number of diseases.

In places where a large number of large-sized wind turbines are located, a negative visual effect occurs due to the rotation of the wind turbines. The negative perception is amplified due to movement at different speeds. Residents of settlements living near the location of a large number of large-sized wind turbines, with regular and prolonged exposure to vision, may experience headaches and nausea. It is known that rotational motion with a frequency of 15-100 m – 1 has a negative impact on human life and health [2].

Another problem of wind turbines is the shading of residential buildings. Due to the rotating blades, shadows are created that cause flickering in rooms, which leads to disruption of the vestibular apparatus, deterioration of vision and other problems in the person who is in it (room). Flickering of the shadow from the rotation of the wind turbine, in people with mental disorders, can lead to an epileptic seizure, and in diseases of the cardiovascular system, an exacerbation of diseases is possible. People often complain of lack of sleep, indigestion. A number of researchers believe that the reason is the coincidence of the frequency of an external visual stimulus with the frequencies of the brain, pulse or respiration, that is, there is a resonance of a biological nature. The use of wind turbines with wind flow concentrators does not fundamentally solve the problem; installations with wind flow concentrators are too voluminous [2].

For example, wind turbines built in Germany have led to a number of problems. Due to the lack of clear rules governing the location of wind turbines near residential buildings, people are forced to find themselves (live) in conditions that negatively affect their health. Currently in Germany, about 1000 initiative groups are fighting against the construction of wind farms near their homes [2].

At the same time, it should be noted that wind turbines do not pollute the environment during operation, do not deplete natural resources. Wind power is one of the most promising ways to generate energy created by using the kinetic energy of the wind. In order for this to be justified, it is worth solving the problems that arise during the operation of wind turbines that affect human health [3]. It is necessary to investigate the impact of wind turbines on humans, to look for solutions using the experience of other countries that have encountered human health problems due to the negative impact of wind turbines.

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BELARUSIAN FOLK TRADITIONS OF RECUPERATION AS THE BASIS FOR IMPLEMENTING INNOVATIVE FORMS OF HEALTH TOURISM

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Annotation: The article discusses the features and trends of health tourism development in modern society. The analysis of indicators of health-improving potential of the Republic of Belarus is carried out, and also problems of use of natural and health-improving resources are revealed. Possible ways of forming authentic tourist health prod-ucts are determined. A list of innovative methods based on existing traditional ones that allow creating an authentic Wellness product is considered.

Keywords: health tourism, Wellness, folk methods of health improvement.

Belarusian folk traditions of recuperation the basis for implementing innovative forms of health tourism.

Trends in the development of modern society in developed countries, expressed in the aging of a significant part of the world's population, an increasing share of the urban population, and a constant increase in the intensity of the pace of life, lead to a greater awareness of the importance of maintaining health over the years. Therefore, the concept of «health» is being transformed. Today, society is striving not only for the absence of diseases as such, but more attention is paid to the health improvement. A new health phenomenon is being formed, the integral com-ponents of which are «body - mind - spirit». In the field of health tourism, it is not about providing services aimed at reducing the consequences of diseases, but about improving health, about «improved health». «Improved health is something more than health free from diseases, it offers a high level of physical strength, endurance, clarity of mind, as well as physical beauty and maximum efficiency of life (emotional, interpersonal, professional)», - Ko-zlyakovskaya N. O formulates this concept. Then the idea of «improved health «evolves into «perfect health». Well-ness is becoming more and more popular. According to M. Cowan: Wellness is a multidimensional state of well - being, when there is a harmony of the external and internal world of a person: increased activity of mind, which allows you to achieve maximum concentration anytime and respond to any situation in full accordance with your own internal world.

The health tourism industry strives to realize the public's request for the formation and development of the following areas: Spa tourism, Thalasso tourism, holistic tourism, spiritual tourism, professional Wellness.

The nature of Belarus has a huge health - improving potential- natural landscapes, climate resources, min-eral waters - analogues of world brands, unique sapropel and peat mud. Their use for health purposes in Belarusian medical organizations allowed to improve the health of 869.4 thousand people annually in 2019. Of these, 627.6 thousand are citizens of Belarus and 241.8 thousand are citizens of other countries (27%). The largest share of for-eign tourists is made up of CIS citizens - 24.7% of the total number of tourists. The share of tourists from abroad is only 3.1 %. At the same time, there is a positive trend. In 2015, their share was 1%. Most often, citizens of Russia (57% of the total number of foreign citizens), Lithuania (16%), Poland (13%) stay in Belarusian health organiza-tions. The centrality and transit of the geographical position of Belarus determines the possibility of attracting more solvent citizens of Western Europe to the resorts of Belarus. The question arises, how to realize the natural and health potential of Belarus effectively? The purpose of our work is to search for opportunities to create authentic Turkish health products for further presentation on the market of health services. To do this, we have studied the natural potential of health tourism, the tourist product provided by

Belarusian health organizations, and Belarusian folk methods of health improvement. We assume that in Belarus there are conditions for the formation of a new competitive tourist product that allows implementing a new health phenomenon, the integral components of which are «body - mind - spirit». In our opinion, the main factor for creating this product, along with natural resources, is a combination of innovative methods and folk traditions of health improvement. Exactly the introduction of innova-tive methods based on traditional methods of healing makes it possible to create an authentic Wellness product.

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COMBINED APPLICATION OF METOTREXATE AND CLADRIBIN IN THE TREATMENT OF RHEUMATOID ARTHRITIS

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The aim of this work is to study the clinical efficacy of the combined use of basic anti-inflammatory drugs in patients with rheumatoid arthritis. In the modern world, the problem of joint diseases of inflammatory etiology, namely arthritis, is very acute. This issue is worthy of attention, because every 6 people suffering from arthritis becomes disabled. Moreover, millions of people suffer from arthritis, both in developed countries, such as the United States, and in developing countries, such as Brazil, India, Indonesia, China, and so on.

Keywords: rheumatoid arthritis, combination therapy, methotrexate, cladribine.

Arthritis is a collective designation of diseases (lesions) of the joints of inflammatory etiology. May be an underlying disease or a manifestation of another disease (eg rheumatism). It proceeds in acute and chronic forms with damage to one or more (polyarthritis) joints.

Rheumatoid arthritis belongs to an independent nosological form and is a serious infectious-allergic disease characterized by damage to the tissues of the joints, sometimes spreading to internal organs. With rheumatoid arthritis, chronic inflammation of the limbs of the joints occurs, and if this is not given proper attention, the patient may have difficulty moving. Risk group - people of middle and older years.

The cause of the development of the inflammatory process in the joint may be a local or general infection, allergy, autoallergy, local trauma, etc. However, the etiology of some severe inflammatory joint diseases is still not clear enough. The factors contributing to the development of arthritis are hypothermia, physical overload of the joint.

Rheumatoid arthritis usually begins gradually, often beginning with general and articular symptoms. Common manifestations include morning stiffness in the affected joints, general fatigue and malaise, loss of appetite, general weakness and, in some cases, subfebrile body temperature. Joint symptoms include pain, swelling, and stiffness. Sometimes the disease begins suddenly, mimicking an acute viral syndrome. The disease progresses most rapidly during the first 6 years, especially in the 1st year; in 80% of patients, irreversible joint changes develop within 10 years. The course of the disease in individual patients is unpredictable. This type of arthritis reduces life expectancy by 3-7 years.

Several groups of drugs are used for the treatment of RA: basic anti-inflammatory drugs (DMARDs), genetically engineered biological drugs (GIBP), glucocorticoids (GC), non-steroidal anti-inflammatory drugs (NSAIDs). DMARD therapy remains the pathogenetic basis of RA treatment.

The aim of therapy is to reduce inflammation as a preventive measure to prevent the development of erosion, the progression of deformities and loss of joint function. Basic anti-inflammatory drugs are given early, often in combination.

The study included patients with a reliable diagnosis of rheumatoid arthritis (mean age 45 years, mean disease duration 3 years). All patients (n = 22) maintained a moderate or high degree of disease activity on the background of long-term administration of methotrexate (more than 3 months) at a dose of 10–15 mg / week. The drug «Leikladin» (cladribine) produced by RUE «Belmedpreparaty» was prescribed to patients at a dose of 0.075 mg / kg / day. in the form of a two-hour intravenous infusion for 7 days while taking methotrexate at the same dose.

In patients of the study group, against the background of combined cytostatic therapy (methotrexate, cladribine), a decrease in the severity of joint pain was revealed after 3 and 6 months. observations with a significant decrease after 3 months. In addition, this therapy led to a decrease in the duration of morning stiffness and a positive dynamics of the «patient's overall health assessment» indicator. The dynamics of these indicators was reliable after three months of observation.

Thus, in patients with rheumatoid arthritis who have not reached the state of remission or minimal disease activity, additional administration of cladribine leads to an increase in the therapeutic effect, which is accompanied by a positive dynamics of clinical and laboratory parameters reflecting the disease activity. According to the DAS28 index, this combination therapy was effective in 11 out of 20 patients with rheumatoid arthritis.

CONCEPT OF AN «ECOLOGICAL HOUR» AS A FACTOR OF THE DEVELOPMENT OF PERSONAL ENVIRONMENTAL CONSCIOUSNESS

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This work attempts to understand the importance of ecological worldview formation in children and adolescents.

Keywords: environmental education, environmental knowledge.

Currently, human environmental responsibility is becoming a set expression, and attempts to solve environmental problems are being made at all levels: global, regional, and local. Environmental problems are common for all countries, including the Republic of Belarus.

Environmental problems and the need to overcome them have given rise to a new direction in education – environmental education: everyone needs to understand how humans are connected with nature and how they depend on it, what patterns exist in nature and why humanity has no right to ignore them. That is why it is so important to teach children this discipline from an early age.

The purpose of environmental education is to form a new type of person with a new ecological thinking, able to realise the consequences of his actions in relation to the environment and able to live in relative harmony with nature. Then at an older age, children effortlessly learn a set of environmental knowledge if it is presented in an accessible, exciting way and if a child's interest in natural phenomena is taken into account.

School education lays the foundation for a child's personal culture, its basis, corresponding to universal moral values. The basis of personal culture includes the orientation of the child in four main areas of reality - nature, objects created by human hands, phenomena of social life, and self-activity. At school age, mastering the basics of environmental knowledge is the most promising, because it is the very age when a child perceives nature very emotionally, pays attention to such features of nature that an adult does not notice. He perceives animals as equal, sympathises with them, empathises with them. It is the very opportunity that should be used as fully as possible for environmental education. Therefore, the introduction of the basics of ecology into secondary education is very important.

We conducted a social survey, which resulted in the following:

- 18% of the respondents are unaware of all environmental problems;
- 48% of the respondents learned about waste sorting only after the age of 15, that is, at a more conscious age;
- 40% of the respondents learned about global warming also after the age of 15;

However, the most important thing that has been discovered is that only 23.7% of the respondents consider themselves ecologically educated people, but what is more important, the remaining 73% show a desire to learn new things and become educated citizens.

"Ecological hour" lesson plan.

- Choosing a topic (core environmental problems)
- Watching an educational video
- Discussion on the topic
- Summarising (making a common solution to the problem)
- Keeping an environmental diary (in which a child should write how s/he helps nature each day).

Thus, there is a progressive development of an environmentally responsible person from an early age, when an action for the benefit of the environment is not a feat, but natural behaviour.

CONTRIBUTION OF NEOFUNCTIONALISTS TO THE FORMATION OF ENVIROMENTAL ANTHROPOLOGY

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The school of neofunctionalism, as a direction in ecological anthropology, arose as an opposition to neo-evolutionist views, demonstrating certain weaknesses in the works of L. White and D. Steward.

Keywords: environmentalism, ecoanthropology, bioecology, neofunctionalism.

The term «neoevolutionism» in ecological anthropology is used for the reason that the followers of this approach viewed the culture and social organization of specific populations as functional adaptations, «which allow populations to successfully exploit the environment without exceeding their capabilities». The neofunctionalist approach is fundamentally different from functionalist approaches in other socio-humanitarian sciences in that the supported unit is a population, not a social order. It also differs from the approach to adaptation in bioecology in that it considers populations rather than specific individuals who adapt to the environment. In general, neofunctionalists explain some aspects of culture and social system in terms of the functions they perform to adapt to the environment.

The birth of neo-evolutionism in ecological anthropology is associated with the work of the American anthropologist Roy A. Rappaport (1926-1997) and Andrew Waida. In his works, R. Rappaport introduced the distinction between the cognized environment and the operational environment, that is, between how people understand the consequences of their actions in the world, and how a specialist in the field of ecoanthropology interprets the environment through analysis. He made the main emphasis on demonstrating the direct relationship between cultural and economic activities with the exceptionally priority position of the ritual.

One of the most famous publications of R. Rappaport, Pigs for Ancestors: A Ritual in the Ecology of the People of New Guinea (1968), is the most influential and cited work in the field of neofunctional ecological anthropology (2004). The work was first published in 1968, later, in 1984, it was republished with practical additions. R. Rappaport's research is based on experimental field research in the acephalous society of Tsembaga (one of about thirty politically autonomous maring groups living at the edge of the highlands in central Papua New Guinea) in 1967 [1].

Pigs for Ancestors: A Ritual in the Ecology of the People of New Guinea is a classic example of the study of the human impact on the environment (human-ecology relationship) in tribal society. And it is precisely the response of the population to the environment that is the main distinguishing feature of the works of neofunctionalists from the works of neo-evolutionists. In the latter case, the environment is viewed as a passive background, in a certain way, shaping culture, but not under its direct influence. On the basis of research by neofunctionalists (mainly of an applied nature), a new direction in the field of ecoanthropology has emerged: the anthropology of environmental problems. This direction was relatively isolated at the beginning of the 21st century, in particular in the works of E. Moran, P. Townsend, M. Sutton and Y. Anderson [2]. Within the framework of the anthropology of environmental problems, some lines of research of classical ecoanthropology continued: the study of tribes with small populations with certain cultural foundations. However, the objects of study were changed to urbanized communities with a highly fragmented culture, thereby enriching the methods of sociology, political science and socio-economic geography. In addition, the emphasis was shifted to finding ways to solve various problems of economic and political formats. In the title of her book, Patricia Townsend plays with the title of R. Rappaport's monograph, introducing the subtitle «From Pigs to Politics», thereby emphasizing the elements of a gap in goals with «ecological anthropology» itself [3].

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DEPENDENCE OF FOOD LOSSES IN THE FOOD SUPPLY CHAIN ON CONSUMER BEHAVIOR

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The chain of creating food products includes the following stages: growing food raw materials; storage; processing; transportation; sale and consumption of finished food products in households and public catering organizations. Developing countries suffer from food waste (44%) at the production stage, while developed countries have the highest food waste (56%) at the consumption stage. In this article, we will look at the formation of responsible consumption to reduce food loss and waste generation.

Keywords: food losses, supply chain, waste, food, responsible consumption, consumer behaviour.

In developed countries, food is thrown away mainly at the stages of retail and consumption. In retail, the primary driver of food waste is customer satisfaction. At the consumption stage, the main reason is the excessive amount of purchased food and the inability to handle it. The relevance of the topic is confirmed by the UN Sustainable Development Goals No. 2 and No. 12 and the UNEP program. Responsible consumption and production, ending hunger and tackling food waste are important goals we pursue.

According to the estimation (FAO) one person living in Europe or North America generates an average of 95-115 kg of waste at the consumption stage per year. British supermarket chain Tesco is trying to cut food waste, but confirmed about 50 million kilograms of food to be thrown away in one financial year. Producers and retailers aren't the only ones responsible for food losses. Consumers buy a lot of unnecessary products that will eventually go to the trash can. The main causes of food waste are: poor planning of purchases and improper handling of food when preparing food; the inflated aesthetic and quality standards; improper storage; leftovers being tossed away as the result of preparing new food before the previous one is eaten. In addition, products are often thrown away due to strict adherence to the expiration dates indicated on the label. Very often the date «best before» is perceived as the date of good quality of food, but often this date is associated only with the period when the product shows its best taste.

In practice, today the concept of food loss prevention at the stage of food consumption can be equated with the concept of consumer awareness. Constant informing of the population is the most important condition for encouraging people to rational consumption behavior and solving the global food problem. Formation of rational, responsible food consumption will require educational work with the population on sustainable consumption. The following key areas can be identified: information campaigns to raise consumer awareness of the problem of food waste, financial losses from wasteful spontaneous purchases; advice on shopping planning, food storage and cooking; informing about the meaning of «best before»; encouraging the purchase of "unsightly" goods; food processing; transferring excess food to food banks.

The use of simple measures to shape responsible consumption will result in significant reduction of food losses at the last stage of the food chain, economic benefits can be obtained and food security enhanced.

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ENVIROMENTAL AWARENESS OF STUDENTS IN THE MANAGEMENT OF MSW

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Today, the problem of recycling production and use wastes is extremely relevant for most countries, as their increasing volumes continue to grow the load on the environment.

Keywords: individual collection of secondary material resources, ecology, ecological responsibility.

In many countries of Europe, Asia, and the United States, waste sorting is common, which allows you to give trash a so-called «second life». The legislation of many countries obliges their residents to sort waste in different containers, which have their own color and label. This process is well established in Belarus. In the Republic of Belarus at the moment, the system for collecting secondary material waste (as of January 1, 2020) includes 446 organizations of housing and communal services, consumer cooperatives, organizations of JSC «Belresursy», individual business owners. According to the report of the state institution «operator of secondary material resources» for 2019, the country collected 765 thousand tons of secondary material resources, including paper and carton waste - 381.8 thousand tons, glass waste - 188.1 thousand tons, plastic waste - 97.2 thousand tons, worn tires - 54.2 thousand tons, used automobile oils - 18.2 thousand tons, waste of electronic and electrical rigs (old household devices) - 25.51 thousand tons. Despite the success achieved, there are still places of illegal dumps in the country, and not only owners of private homes, but also employees of organizations are guilty of this. [1]

The aim of the study was to study students ‘ opinions on waste control matters. The research was conducted among second-and third-year students of ISEI of A.D. Sakharov. Of the BSU, 162 people took part in the survey. The results of the survey showed that the most students are aware of the urgency of the problem of waste recycling in Belarus. Out of 162 people, 81.5% are engaged in waste sorting to some extent. The most relevant type of sorting was sorting used batteries – 67.9% of respondents noted that they throw batteries in a separate container. More than half of them dispose of waste paper, plastic and PET bottles in individual containers. 40.7% of respondents noted that they dispose of unusable energy-saving lamps in the places provided for this purpose. Recycling of glass was not so relevant – less than 40% throw it in specialized containers. Most students believe that it is necessary to install automatic containers in stores or near them, which will increase the popularity of separate waste collection. Mobile and stationary container collection points could also have a positive effect.

The survey results allow us to make the following conclusions:

- Ecological awareness of our University students is much higher than in the Republic as a whole;
- The level of secondary waste collection depends on the level of awareness of the problem. 3rd year students are more concerned with solving this problem than second year students;
- Water saving and separate collection of trash in containers are the most popular ways to protect the environment;
- The collection and recycling of glass will contribute to an increase in the cost of glass containers for delivery at reception points.

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ENVIRONMENTAL VOLUNTEER GROUPS AT SCHOOL

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It is told about the work of environmental volunteer groups in school 66 of Penza named after Viktor Stukalov. Fragments of the animation video, created to advertise the environmental volunteer movement, are given.

Keywords: environmental volunteer groups, schoolchildren, social advertising, animation video.

In school 66 of Penza named after Viktor Stukalov, environmental volunteer detachments were created [1].

In the wasteland near the school pupils planted several dozen linden and spruce trees. Every month the action «Make the world cleaner» is held. Schoolchildren make and hang bird feeders in winter and bird houses in spring. The school holds campaigns to collect waste paper; this allows you to save the life of trees.

We have developed social advertising videos. The animation videos talk about environmental volunteer groups, information on planned activities is also provided. Animation videos were created in Scratch [2]. See Fig. 1 a), b) for footage of the animation video.

a) b)

Fig. 1. – Frames of the animation video: a) «Creating an ecological volunteer group», b) «Garbage collection in the park»

Promotional animated videos are shown on school television. They can also be shown on placards that are placed on the streets of the city and in city transport. This will attract many people to environmental volunteer groups.

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EPIGENETIC TRAITS OF SKULL IN PALEOANTHROPOLOGY

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Epigenetic traits are non-metric, qualitative traits which are determined according to the principle of «presence – absence». They reflect diverse structural features of the human skeleton and can be a good source of data about individual and group variability. The article indicates the classification of this group of traits on the skull and the advantages of studying it.

Keywords: epigenetic traits, non-metric traits, craniology, paleoanthropology.

Nowadays, along with the well-known metric methods of studying paleoanthropological material, there is a so-called method of studying discrete-varying trait that reflects the diverse features of the structure of the human skeleton and can serve as a good source of data about individual and group variability. In other words, discretely varied (or non-metric) traits are variations in the anatomical structure of the skeleton, which may appear in the form of additional holes, bones or bone processes [3; 5].

The phenomenon of discrete variability is associated with clearly expressed differences in the manifestation of genetic differences at the phenotypic level. The expression of one or two genes or gene complexes is responsible for the manifestation of such traits in the human body. Such traits are either «there» or «not», and their appearance is associated with the presence of specific mutations in the locus responsible for the regulation of development [2; 4]. Hence appeared another name for these traits - epigenetic, i.e. which directly determine the manifestation of the features of the genotype in the phenotype. However, it should be noted that the development of such traits isn't complete without the control of some environmental factors [2].

In some sources, such traits are also called «anomalies», which is also correct, because they are quite rare [4]. Thus, the first major work related to the study of epigenetic characters was written by the Russian anthropologist D. Anuchin in 1880 and was called "About some anomalies of the human skull and mainly about their distribution on races" [2].Then, non-metrical traits on the bones were paid much attention in the studies of bone remains of ancient populations, and programs and methods for studying epigenetic traits of the skull appeared (under the authorship of such Russian and foreign anthropologists as A. Movsesyan, N. Mamonova and Yu. Rychkov, A. Kozintsev, G. Chesnis, A. Berry, R. Berry, N. Ossenberg, R. Corruccini, R. McWilliams, M. Finnegan et al [1; 3].

The variability of non-metric traits of the skull has been determined at different levels of organization (from the level of races to the level of individual small populations), which makes it possible to use this kind of craniological data to study the problems of general race, ethnic anthropology, population genetics and human phylogeny [1;3]. The advantages of this group of traits are: being numerous on the skull, these features do not correlate with each other, thereby providing more freedom in statistical analysis; unlike craniometric features, non-metrical traits are more genetically determined, which is much easier to use for studying the problems related to ethnogenesis and population genetics; the definition of these features is very simple, which makes it possible to carry out such studies even in the field and on fragmented anthropological material [3].

Morphologically non-metric traits of the skull can be divided into several groups: abnormal craniosynostosis (premature obliteration of one or more sutures); craniostenosis (skull deformations caused by craniosynostosis); inconstant foramen (their formation is associated with various options for the passage of blood vessels and nerves or with ossification of the ligaments, dura mater cords and partitions between the components of the neurovascular bundles); accessory processes and outgrowths (formed with the development of inconstant centers of ossification of any anatomical formations); additional, or inconstant sutures (sutures dividing bone formations in the skull of a human fetus, which persist after the period of their overgrowth); accessory bones (formed from isolated centers of ossification) [4; 5].

To study epigenetic traits in craniological research is a possibility to be more accurate in determining the kinship of individuals, evaluating the degree of panmixia and inbreeding, and determining the genetic affinity of separate ancient populations.

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EXPORT OF MEDICAL SERVICES IN BELARUS: PROBLEMS AND PROSPECTS OF DEVELOPMENT

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The article analyzes the current situation in the Republic with the export of medical services. The study concluded that this type of service is promising in Belarus and it is necessary to promote Belarusian suppliers to the world market.

Keywords: medical services, tourism.

The development of global health is becoming more and more widespread in the world today. According to the International medical tourism Association, about 11 million tourists travel for medical purposes annually. The sector of commercial medical services will reach a turnover of $3 trillion in the next 6 years. The largest exporters in this sector are the United States, Great Britain, Turkey, Thailand, Singapore, Korea, and India.

The growth of medical tourism is caused by the following reasons:

- dissatisfaction with the quality of medical care in the country of residence;
- bad functioning of the country's health system;
- high cost of medical services;
- high cost of health insurance policies;
- long queues for high-tech procedures even if you have an insurance policy.

State policy aimed at developing the export of medical services has a positive impact on health care and the country's economy as a whole. The development of exports of medical services leads to the creation of new jobs in many sectors of the national economy, infrastructure is being improved, and the quality of care for both foreign and national patients is improving. Foreign patients are the engine of the hotel business in the country: they need accommodation in hotels, patients bring with them relatives who rent apartments during treatment and rehabilitation. It is estimated that for every dollar spent by a foreign patient in the host country, there are $2 other expenses (travel, food, accommodation, recreation, entertainment).

The provision of medical services is one of the most perspective areas of the service sector in the Republic of Belarus. In our country the health care system is financed by the state and state health expenditure is growing, so there is a need to increase the export of medical services as an additional source of funding for the national health system. In 2019 the export of medical services exceeded $46 million. The largest part in the export of services provided to foreign patients on the territory of the Republic of Belarus was accounted for by the following organizations: RSPC of Oncology - 29%; RSPC of children's Oncology - 23 %; Republican hospital for speleotherapy - 13%; RSPC «Cardiology» - 12%; RSPC of radiation medicine - 8 %. These organizations account for about 80% of all exports of medical services provided by organizations of the Ministry of health of the Republic of Belarus. Citizens of 128 countries used the services of Belarusian centers and doctors. In the analysis of the geographic structure of export of health services it was found that most of the export of medical services falls on CIS countries - 90 % (50 % - citizens of the Russian Federation), on other countries - China, Libya, USA, Japan, Germany, etc. - account for less than 10 %. In terms of export the most popular technologies are in the field of oncology, cardiology, and transplantology. Foreign patients are attracted by highly qualified doctors, the availability of modern medical centers, and the use of the latest technologies. The introduction of a visa-free regime for citizens of 80 countries in Belarus has also had a positive impact on the growth of medical services export.

In our opinion a further increase in the export of medical services in the Republic is possible provided solving the following tasks:

- overcoming language barriers, in particular those related to receiving services in a foreign language and training medical personnel;
- providing financial assistance to exporters of medical services, including cost recovery for international accreditation and certification;
- digitalization of the medical sector related to the digitization of medical records, the use of big data, as well as the development of telemedicine;
- promotion of Belarusian medical service providers and their products abroad.

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FEATURES OF ADP-INDUCED PLATE AGGREGATION IN PREGNANT WOMEN WITH PREECLAMPSY

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Study of features of ADP-induced platelet aggregation in pregnant women with moderate preeclampsia. In this document presents and discusses the molecular characteristics of the platelet response of pregnant women with moderate preeclampsia to ADP.

Keywords: preeclampsia; platelets; ADP; aggregation.

Preeclampsia remains one of the most frequent and formidable complications of pregnancy and childbirth and has been a major cause of maternal and perinatal morbidity and mortality for many years. It accounts for up to 25% of maternal deaths. The incidence of preterm birth reaches 20-30%, perinatal morbidity is 56%, and perinatal mortality is 3-4 times higher than the population one, reaching 12% [1].

Thrombocytes are particularly affected by changes in the late form of pre-eclampsia, when the number of platelets decreases gradually with sustained high aggregation capacity. Changes in platelet function as well as in the balance between coagulation and anticoagulation may be the main cause of impaired regulation of uterine and placental blood flow and organ perfusion in pregnant women with preeclampsia. [2].

ADP plays an important role in hemostasis, platelet activation, and thrombus formation. ADP plays an important part in hemostasis, platelet activation and thrombosis formation. ADP is a relatively weak thrombocyte aggregation agonist, causing reversible platelet formation and weak transit aggregation. It is a necessary cofactor for normal activation of blood platelets by stronger agonists such as thrombin, collagen or A2 thromboxane.

To study the aggregation capacity of platelets in pregnant women with physiological pregnancy and pregnant women with PE, ADP was used at the final concentration: 2.5 10-5 M, 2.5 10-6 M, 7.5 10-7 M, 2.5 10-7 M

When using an ADP concentration (2.5-10-5 M), platelets of women in all the groups surveyed reacted similarly. However, the degree and rate of aggregation did not have statistically reliable differences. The degree of aggregation in physiological pregnancy was 52.23±6.90% and did not differ statistically from that in preeclampsia 53.50±7.85%. Aggregation rates in physiological pregnancy were 3.36±3.46%/min and 5.72±3.18%/min in pre-eclampsia ($P>0.05$).

With a decrease in ADP concentration to 2.5-10-6 M, the degree of aggregation in physiological pregnancy was 31.30±4.63% and did not differ statistically from that in preeclampsia 33.42±4.32%. The rate of aggregation in physiological pregnancy was 18.86±3.67%/min and 23.15±8.53%/min in pre-eclampsia ($P>0.05$).

With a further decrease in ADP concentration to 2.5-10-7 M, platelet aggregation appears only in pregnant women with pre-eclampsia. Aggregation rates in physiological pregnancy were 1.29±0.78% and 5.59±1.63% in pre-eclampsia, with statistically significant differences ($P<0.05$); aggregation rates in physiological pregnancy were 2.35±1.94%/min and 6.51±7.23%/min in pre-eclampsia ($P<0.05$). Available statistically significant differences in the groups studied ($P<0.05$) provide an opportunity to use this criterion for diagnostic purposes.

Increasing the ADP concentration to 7.5-10-7 M made it possible to cause platelet aggregation, in women with physiological pregnancy and in pregnant women with preeclampsia. The degree of aggregation in physiological pregnancy was 15.46±4.08%, while in preeclampsia it was 18.72±2.23%. Available statistical differences in the degree of aggregation between the norm and pathology are statistically significant ($P<0.05$), which will make it possible to use this physiologically similar concentration of ADP for research purposes.

The experiment revealed that pregnant women with preeclampsia had a significant increase in platelet aggregation in response to low concentrations of ADP (2.5-10-7 M and 7.5-10-7 M) compared to physiologically occurring pregnancies.

There are two distinct P2Y receptors on platelets that bind ADP: the P2Y1 receptor, which is involved in platelet activation, and the P2Y12 receptor, which makes platelets more susceptible and sensitive to activation by platelet agonists.

Binding of ADP to the P2Y1 receptor activates phospholipase C. This leads to an increase in the intracellular Ca2+ concentration and activation of protein kinase C, together inducing platelet shape change, the release of granule contents, and aggregation. Binding of ADP to the P2Y12 receptor activates two major biochemical pathways: inhibition of cAMP production and activation of phosphoinositide 3-kinase, which phosphorylates various target proteins. Particularly, the decrease in the concentration of cytosolic cAMP is essential because high concentrations of cytosolic cAMP prevent platelet activation. By decreasing the concentration of cAMP, platelets become more sensitive to activation by any platelet agonist.

Expanded monitoring and early detection of increased platelet aggregation capacity in pregnant women with preeclampsia can significantly contribute to the timely diagnosis, prevention, and treatment of this complication of pregnancy.

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FROM PRINTED LIST TO DATA CELL: THE EVOLUTION OF TEXTBOOK

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Annotation: The article discusses the features and trends in the development of information technologies in the field of education, their impact on the environment in modern society. The analysis of the indicators of book publishing for a certain period of time in the Republic of Belarus is carried out, the history of the polygraphic industry is considered, as well as the problems of using printed carriers of information. Possible advantages of electronic information carriers are determined. A list of innovative technologies and methods based on electronic information carriers is considered, allowing to create more effective and environmentally friendly sources of information.

Nowadays we observe great successes of information technologies, which are gradually introduced into our daily life, and an inconspicuous process of digitalization of the society is happening. In the same time, human activity worsens ecological situation on the planet and modern digital technologies can help us to improve it. The key to a successful solution to this problem may be implementation of digital technologies into manufacturing and different spheres of human activity. Namely– education.

The idea of using electronic training aids is not new. In fact, electronic textbook is, to a certain degree, an interactive copy of printed original. The essence of interactive textbook is that process of the explanation of the new material and the knowledge control process must take place simultaneously. Electronic textbook of such type can be used via gadget of any type student has. Refusal to use paper information carriers has its virtues such as: mobility, availability, diversity of forms and types of educational activities. Furthermore, they are environmentally friendly.

Meanwhile, polygraphy is considered to be one of the most developed industries, which is characterized by a high degree of concentration in settlements, which makes its impact on the environment more noticeable. Moreover, in CIS countries, this problem is especially acute. It may seem strange to typographers, but it is widely believed that the polygraphic industry emits relatively small amounts of harmful substances into the environment. However, considering that pollutions entering the atmosphere with wastewater entering the soil and groundwater are very dangerous for people, the animal and plant world (aerosols of lead oxides, tin, antimony,

chromic anhydride vapor, toluene vapor, gasoline, and others), as well as the fact that most polygraphic enterprises are located within the city, in residential areas and there are virtually no sanitary protection zones in them, environmental protection at these enterprises is vital.

Thereby, our goal is to analyze the influence of polygraphic industry on life of mankind and to find out the advantages and disadvantages of transition from traditional printed information carriers to environmentally friendly data.

For finding out the answer we have set such tasks: to explore the history of polygraphic industry concerning its impact on ecology; to find out the pros and cons of transmitting to environmentally friendly data storages in the sphere of education.

Thus, paper carriers of information, particularly in the field of education, are the dominant type of knowledge acquisition. At the same time, over an interval of 10 years, some books can be reprinted 3 times or more in huge print runs, which increases the volume of production - the logging process, the use of energy for production, subsequent disposal problems and the corresponding costs. Textbooks, teaching aids, other educational literature occupies a significant place in the book production of Belarus. So, if in 2012 educational literature occupied up to 50% of the total volume of book publishing, then by the end of 2017 it was 51% by titles, 76% by circulation. According to the results of the first half of this year, the volume of educational literature amounted to 46% of the total by titles and 72% of the total circulation. Therefore, with an increase in production volumes, costs also increase, which in the context of the polygraphic industry negatively affects the ecology and the environment.

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GREENWASHING FROM THE PERSPECTIVE OF ENVIRONMENTAL MEDICINE

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In the modern world, the number of chronic conditions and diseases is increasing, as well as environmental constantly dependent syndromes and diseases that are the result of human activities. Along with this, a huge number of companies are fighting for organic products.

Keywords: Greenwashing, environmental medicine, marketing, environmental friendliness.

The modern world is characterized by chronic diseases, as well as environmentally dependent syndromes and diseases that are the result of human activities. There are environmental syndromes and diseases that are induced by society as a result of:

- environmental pollution;
- soil depletion;
- application of modern technologies of plant food.

Along with xenobiotics, one of the most important factors in the development of environmental diseases is nutritional status.

Thus, one should treat with particular care the choice of food.

In the modern world, in most countries, the issue of the shortage of such products is not acute. The supply is in great demand. The latest so-called “green” products, guaranteeing the high quality of the product itself and the absence of chemicals in the growing process.

However, along with the enthusiasm for “green” products, the concept of greenwashing has emerged – one of the pressing problems that exist in the field of environmental entrepreneurship.

Greenwashing is a marketing strategy aimed at creating an environmentally positive image for companies that are not. Thus, the company shows the consumer that it is environmentally friendly, but at the same time it does not introduce any real eco-innovations into its production to reduce its damage to the environment [1].

Over the decades, there has been a steady rise in recent phenomena: between 2007 and 2009, the use of green camouflage increased by 79%.

The growth of greenwashing as a phenomenon is causing an explosion of information stress due to the abundance of markers and indications that the product conforms to the concept of "ecofriendly", not supported by high-quality special certification, as well as the actual lack of nutrients that are often used as an element of green-washing to attract the attention of the masses, but are not contained in product in reality.

If we honestly use the concepts of "Eco-friendliness" and "Eco-friendly products", instead of the resulting spread of the phenomenon of greenwashing from the standpoint of environmental medicine, it would be possible to reduce the number of diseases associated with the alimentary factor. Since this reduces the intake of xenobiotics used by food, all nutrients are replenished, used products, and gentle technology used.

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GREENWASHING: DUVIOUS ENVIRONMENTAL PRESERVATION

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This paper analyzes the phenomenon of greenwashing and its negative impact on the environment, as well as the awareness of the consumption of the planet's resources by society.

Keywords: greenwashing, ecology, marketing, ecopsychology.

«Greenwashing» is a type of eco-marketing that uses «green» PR and methods, the meaning of which is to mislead the consumer about the goals of an organization or manufacturer in the environmental friendliness of a product or service, to present them in a convenient light. The term «greenwashing» was coined by the American ecologist Jay Westerveld in 1986. Greenwashing is being used by questionable manufacturers to build their green company image and boost sales. Recently, there has been an increase in this type of fraud: between 2007 and 2009, the use of greenwashing increased by 79%.

In 2007, in an effort to describe, understand and quantify the growth in sustainability, TerraChoice developed and launched a project to study the environmental requirements for products and services displayed in certain categories in store windows. Based on the results of initial and subsequent research, The Seven Sins of Sustainability were developed to help identify products that contain misleading environmental claims. The so-called sins are: Sin of the hidden trade-off, Sin of no proof, Sin of vagueness, Sin of worshiping false labels, Sin of irrelevance, Sin of lesser of two evils, Sin of fibbing.

In fact, greenwashing is found in almost many directions: starting with building materials ("eco-paint" or "eco-market" made of natural materials, where the manufacturer is the origin, receipt and component components of the product) and ending with products labeled "bio" without any certificates. «Eco», «natural» inserts, marketing gimmicks with «natural ingredients» and other manufacturer claims do not guarantee anything.

In the international environment, there is an «organic production» standard, endorsed by the International Federation of Organic Agriculture, and an ISO 14024 standard, which fully evaluates the existence of a product in terms of how it affects the environment. There are many organic certification organizations around the world targeting these installations.

In Belarus, as such, the apparatus for controlling the «honesty» of organizations and enterprises engaged in the production of speculative products does not exist, but there are organizations indirectly involved in monitoring and minimizing the consequences of the activities of such organizations. They are the «Operator of secondary material resources», the Belarusian Society for the Conservation of Nature, the Center for Environmental Solutions, the State Institution «Operator of secondary material resources», etc.

The growth of consumer awareness and the impact of external environmental factors leads to the formation of a new outlook on a person's lifestyle and his psychological profile; Thus, analyzing from the point of view of ecopsychology, we can conclude that the existence of the practice of greenwashing causes the formation of a «healthy» distrust of the existing norms of production and perception of the world, which in turn changes the attitude of society towards the environment, its preservation and exploitation.

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HUMANITARIAN IMPORTANCE OF PHYSICAL CULTURE

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In accordance with the State Educational Standard of Higher Professional Education, physical culture has been declared a compulsory discipline of the humanitarian educational cycle since 1994.

In educational institutions, taking into account local conditions and interests, students independently determine the forms of classes, physical education, means of physical education, sports and physical activity, methods and duration of physical education based on state educational standards and standards of physical education.

Keywords: physical culture, culture, education, health.

Being in essence a humanistic discipline, physical culture is aimed at the development of an integral personality, harmonization of its spiritual and physical strength, activation of the readiness to fully realize their vital forces in a healthy and productive lifestyle, professional activity, in self-construction, the necessary socio-cultural comfortable environment, which is an integral element of the educational space at the university. Humanization of education in the field of physical culture means, promotion of the student's personality as the main value of the pedagogical process.

Humanitarian knowledge makes it possible to overcome the technocratic and narrowly professional thinking of a future specialist, to bring up a spiritually rich person with a developed sense of social, professional and moral responsibility. Systemic and purposeful humanitarian training and the student's personal culture formed in its process determine the properties of his adaptability, self-learning, independence and initiative as a future specialist, thereby laying the foundations for his high professionalism.

Physical culture directly and indirectly encompasses such properties and orientations of a person that allow it to develop in unity with the culture of society, to achieve harmony of knowledge and creative actions, feelings and communication, physical and spiritual, to resolve the contradictions between nature and production, work and rest, physical and spiritual. Achieving such harmony by a person ensures social stability, productive involvement in life and work, and creates mental comfort for her.

Physical culture acts as a socio-cultural layer of practice, aimed at mastering the natural forces of students and mediated by their cultural attitude to their physical capabilities. The development of the physical capabilities of a student is considered within the framework of the educational process as the development of cultural elements, special personal qualities. Humanitarianization of the educational process emphasizes the huge role of personality education, its intrinsic value. Self-development, self-education, self-improvement, self-government, self-determination reflect the most effective and long-term results of physical education.

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INFLUENCE OF SOCIAL ISOLATION DURING THE PANDEMIC OF THE CORONAVIRUS ON THE PSYCHOLOGICAL STATE OF HUMAN BEING

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The problem of social loneliness due to the coronavirus pandemic is very acute today. The general impact of social isolation on the physical and psychological state of a person, as well as on the post-traumatic effects of lack of communication and changes in the usual way of life, daily routine.

Keywords: social loneliness, social isolation, stress, coronavirus, communication, monotony.

Today, social loneliness is one of the most pressing problems in the social, spiritual and cultural life of society [1]. The brain of a person who has been isolated from contact with other people can undergo strange metamorphoses in terms of consciousness, especially in conditions of forced or forced isolation.

Social isolation is characterized by a lack of social ties, and as a result, weak social support, which gives us the necessary resource of communication and sensation [2].

Amid the coronavirus pandemic, more and more countries are resorting to drastic measures such as curfews or a ban on leaving home for people at high risk. Chronic, prolonged social isolation has a profound effect on behavior and emotional well-being. To demonstrate a causal relationship, in 2018 they conducted a behavioral experiment on mice, isolating them individually for 24 hours and for 2 weeks. After 2 weeks, the mice became more aggressive, experienced increased anxiety and hypersensitivity to threatening stimuli.

There is a connection between the experience of social isolation and disruption of the endocrine system. Lack of certainty leads to an increase in tension, an increase in anxiety, and the loss of the usual rhythm of life leads to a failure in productivity. People also feel very tired, not related to the volume of training or workload. This fatigue arises from anxiety and stress, and the monotony experienced is one of the key factors. According to some reports, complete functional adaptation to this state occurs within 3 months, and the critical period occurs three weeks after the beginning of the isolation period. During this period, there is a steady drop in mood, motivation, and general apathy. Overcoming, smoothing out this psychological state occurs through the formation of a strict daily routine, the fight against monotony and uncertainty.

Loneliness is a manifestation of weak adaptability of the personality, and the reason for it is the inconsistency of a person's ideas about his own «I» [3].

Few would argue that isolation is physically harmful to humans. It is known that single people are more likely to suffer from high blood pressure, they are more vulnerable to viral infections, in addition, they have an increased risk of developing Alzheimer's syndrome and dementia.

Today in modern society there are methods for overcoming social loneliness. The success of rehabilitation largely depends on the mood of the individual, its orientation towards overcoming the painful state, its interest in the result and the activity of the position [1].

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INTERHEMISPHERIC BRAIN ASYMMETRY RESEARCH IN STUDENTS

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The article presents the results of the study of the interhemispheric asymmetry profile in students. To assess the asymmetry, two approaches were used: a survey (Edinburgh test) and the method of active detection of motor and sensory asymmetry by N.N. Bragina and T.A. Dobrokhotova. The study involved 52 students. The study revealed that the dominance of the left hemisphere of the brain was found most often in young men and women, the dominance of the right hemisphere was revealed to a lesser extent, the proportion of dominance in women was 5.9%, in men - 16.7%.

It was also found that the left hemisphere is more often dominant in women than in men, while the percentage of ambidextrous among men was significantly higher.

Keywords: functional interhemispheric asymmetry, sex differences, brain.

In recent years, attention to the problem of interhemispheric asymmetry of the brain has increased significantly. Over the past years, the idea of distinguishing between motor, sensory, and mental asymmetries of a person has become obvious, as well as the identification of an individual asymmetry profile, which is understood as a certain combination of functional asymmetries inherent in each given subject.. The functions of paired organs are not always identical in their structural and functional organization, and this is clearly manifested in the differences in the functions of the right and left hemispheres of the human brain [1].

At present two approaches to assess interhemispheric differences are used: the method of assessment and analyses of handedness by means of a survey (Edinburgh test), and the method of active detection of motor and sensory asymmetry by N.N. Bragina and T.A. Dobrokhotova. The tests for determining the leading limbs and the leading eye were used to assess the effect of brain lateralization on intelligence and mathematical abilities, in the study of the adaptive capabilities and physical development of young men and women, as well as the formation of the body's stress resistance.

The study involved students of the ISEI BSU, aged 18 to 21, 52 students, including 34 women and 16 men. The study was conducted online through Google Forms. The research was conducted on a voluntary basis and included several stages.

The first stage is organizational. It included the selection and analysis of scientific and methodological literature, choosing a research topic, defining goals and objectives, formulating the title of the work. The second stage is a questionnaire. At this stage, the students did a test to identify the leading hand, eye and functional asymmetry of the brain. The third stage is processing the collected data, determination and formulation of the findings and conclusion.

The results of the study using the Bragina and Dobrokhotova method are the following:

- Prevalence of students with dominance of the left hemisphere – 84,5%;
- The ratio of right-handed students in general: men - 77.8%, women – 91,2%;
- The ratio of left-handed students in general: men – 16,7%, women – 5,9%;
- The percentage of ambidextrous among men was significantly higher – 5,5%, versus 2,9% among women.
- In the test for determining visual asymmetry, the following results were obtained: right eye – 57,7%, left eye – 42,3%, which indicates the dominance of the right hemisphere more often than the left in general.

Thus, summarizing the results of experiments aimed at revealing the functional asymmetry of the brain, we can draw several conclusions. In the course of the work, it was revealed that the dominance of the left hemisphere of the brain was found most often in young men and women, and also in women the left hemisphere was more often dominant than in men, at the same time the percentage of ambidextrous among men was significantly higher. The results obtained probably indicate a low information content of isolated tests aimed at determining interhemispheric asymmetry, and the presence of an extremely small number of true right-handers and left-handers in the population. This study needs further research, as it is of clinical interest for science and society.

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IS ENVIRONMENTAL SITUATION A RESPONSIBILITY OF AN INDIVIDUAL OR SOCIETY?

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Who is responsible for the environmental situation in the world, in the country, on your street? Is it hard for a person to take responsibility?

Keywords: ecology, society, psychological state.

In today's technological world, a lot of attention is paid to environmental issues. Environmental concerns have become so serious that environmental movements are emerging to address environmental issues.

Ecology also affects the world as a whole, the development of states and industry, as well as on each individual. Today, any technological production in our country must meet environmental standards.

But where is the line between personal and social responsibility for the world around us? First, I propose to deal with what each of us can do to solve environmental problems. So, everyone today can make a conscious decision, and start sorting garbage, give up personal transport, minimize the use of plastic. On the other hand, the public can take this responsibility and introduce mandatory sorting of garbage (providing conditions for this), introduce taxes on the use of machines not on electric energy.

Collective and personal responsibility is a special kind of consciousness associated with self-restraint. It is a willingness to voluntarily and consciously assume obligations towards other members of society.

Psychologically, it is easier for a person to accept responsibility being in a team of people with similar interests than alone.

The person makes his own choice based on personal experiences. Usually the transition to, for example, conscious consumption occurs after studying information about it, the emotions of the person force him to reconsider his attitude to a certain issue. Thus, each person sets his own personal requirements and boundaries for their daily life. However, it is human nature to believe that only his actions are not enough, because it is difficult to save the planet, when your neighbors or friends still throw away plastic along with the paper. Then, we begin to look for or form whole public associations in order to popularize an informed attitude to ecology. And now our idea becomes not only our responsibility. Thus, there are many initiatives in the world that, even at the legislative level, encourage people to observe self-discipline and environmental safety principles. Now that it's becoming a public responsibility, can we say that there's less of it on every single person? In my opinion, no. After all, now it is not only your personal responsibility, now a whole group of people is pushing the planet away from environmental disaster. So what's the conclusion?

Responsibility for the environment rests with every person, and as soon as each of us understands it, it becomes a public responsibility. The more we talk about environmental issues, the more people take responsibility for their actions, and it is easier for a group of people to move the idea.

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PHYSICAL CULTURE - PART OF GENERAL HUMAN CULTURE

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Culture is a concept that has a large number of meanings in various areas of human life. Basically, culture is understood as human activity in its various manifestations, including all forms and methods of human self-expression and self-knowledge, the accumulation of skills and abilities by a person and society as a whole.

The concept of «culture» can be defined as the degree of disclosure of the potential of a person in various fields of activity. Culture is the spiritual and material activities of a person.

Keywords: physical culture, sports, culture, health.

Physical culture is an organic part of general human culture, its special independent area.

Physical culture is an integral part of the culture of society, which is a set of values and knowledge created and used for the purpose of physical and intellectual development of human abilities. It is one of the methods of improving his physical activity and the formation of a healthy lifestyle, social adaptation through physical education, physical training and physical development.

Physical education in educational organizations that implement basic general educational programs is a universal means of forming a versatile and harmoniously developed personality, capable of actively using the values of physical culture to strengthen and maintain their own health for a long time, optimize work activity and organize active recreation.

At the level of preschool and primary general education, students should ensure the formation of cognitive interests in physical education. It is necessary to talk about the positive aspects of sport, about its impact on human life and health. It is also important to establish healthy lifestyle skills as the foundation of physical education. The priorities in training are: acquiring knowledge and skills in performing basic exercises by means of gymnastics for the correct formation of the musculoskeletal system, the development of flexibility, coordination, motor skills which will significantly affect the health and future of the child.

Physical culture affects the vital aspects of a person, received in the form of inclinations or abilities that are transmitted genetically and develop in the process of life under the influence of parenting, the sphere of activity, the environment, the ecology of the area in which the person lives. Physical culture satisfies social needs in communication, play, entertainment, in some forms of personal self-expression through socially active useful activities. Sport is an active part of a person's life, which implies the contact of two or more people. Physical culture and sports have emerged as a special social institution that determines government activities in the education of the younger generation. This institute coordinates a network of amateur and commercial physical culture and sports institutions.

The result of activity in physical culture is the degree of perfection of motor skills and abilities, physical fitness of a person, his «sportiness», skill, high level of development of vitality, sports achievements, aesthetic, moral, intellectual development.

Mass media widely disseminate and advertise activities in the field of physical culture and sports. The concept of being athletic and healthy is "fashionable" is laid in human consciousness. A «fashion» is being formed to engage in various types of physical culture. Everyone can find something to their liking, since the range of sports games is great. A system of professional and special physical culture and sports education has developed in our country.

So, physical culture should be considered as a special kind of cultural activity, the results of which are useful for society and the individual. In social life in the system of education, upbringing, and the sphere of labor organization, everyday life, healthy recreation, physical culture shows its educational, health-improving, economic and general cultural significance, contributes to the emergence of such a social trend as physical culture movement, i.e. joint activities of people to use, disseminate and enhance the values of physical culture.

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PHYSICAL EDUCATION IN THE STRUCTURE OF PROFESSIONAL EDUCATION

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Physical culture is the basis of a person's socio-cultural life, a fundamental modification of his general and professional culture. It manifests itself as a holistic result of upbringing and professional training of a person in relation to his health, physical capabilities and abilities. It is also an example of lifestyle and professional activities. Physical culture acts in the unity of knowledge, beliefs, value orientations and in their practical implementation.

Keywords: physical culture, health, education.

Physical culture is an indicator of the professional culture of a future specialist, an inalienable personality trait and the goal of self-development and self-improvement.

An important direction in the development of physical culture and sports is their social universalization, which consists in the desire of society to attract all strata of the population to physical culture and sports. At the beginning of the twentieth century, physical culture and sports in some countries became a mass phenomenon. Currently, there is a tendency to familiarize the general population with physical culture and sports, which is due to the general course of development of socio-economic relations.

The share of physical labor in production is decreasing, everyday life becomes more comfortable, without requiring significant physical efforts from a person. This determines the growing need of society for special classes for its physical improvement.

A person's worldview in the field of physical culture is determined by knowledge. This knowledge is divided into three groups: theoretical, methodological and practical.

Theoretical knowledge covers the history of the development of physical culture, the regularities of the human body's work during motor activity and the fulfillment of motor actions, physical self-education and self-improvement. This knowledge is necessary for explanation and is related to the question «why?»

Methodological knowledge makes it possible to get an answer to the question: «How to apply theoretical knowledge in practice, how to engage in self-study, self-development, self-improvement in the field of physical culture?»

Practical knowledge characterizes the answer to the question: «How to effectively perform an exercise, a motor action?»

Physical culture and sports have developed as a special social institution that determines the activities of the state in the upbringing of the younger generation. This institute coordinates a network of amateur and commercial sports and medical institutions.

Mass media widely propagandize and advertise activities in the field of physical culture and sports, form a «fashion» for practicing certain types of physical culture and sports.

The country has a system of professional and special physical culture and sports education.

Knowledge is necessary for self-knowledge of a person in the process of physical culture and sports activity. First of all, this refers to self-awareness, that is, awareness of oneself as a person, awareness of one's interests, aspirations, experiences. The experience of various emotions accompanying self-knowledge forms an attitude towards oneself and forms a person's self-esteem. The student sets himself certain difficulties, i.e. has a certain level of claims, which must be adequate to its real capabilities. If the level of aspiration is underestimated, it can hinder initiative and activity in physical improvement; an overestimated level can lead to disappointment in the classroom, loss of faith in yourself.

Thus, in the process of physical education, the impact is carried out not only on the biological basis of the personality, but also on its biosocial integrity. Therefore, it is impossible to judge the physical culture of a person, relying only on the development of her physical capabilities, without taking into account her thoughts, feelings, value orientations, orientation and the degree of development of interests and forces.

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PROBLEMS OF COLLECTION, DISPOSAL AND USE OF MSW

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The article examines the current situation with MSW in the republic. The experience of foreign countries in the prevention and minimization of waste and the possibility of its application in the republic is analyzed.

Keywords: separate collection of secondary material resources, environment, environmental responsibility.

The last decade has seen a steady increase in the amount of MSW generated in the territory of the Republic of Belarus. The amount of garbage per capita during this period increased from 0.485 kg to 0.877 kg per day. This means that this indicator has almost doubled and approached the EU indicator (0.85-1.7 kg per capita per day). Every year about 100 square kilometers of usable land is alienated for landfills for solid waste disposal in Belarus not counting land contaminated by numerous unauthorized dumps. Nevertheless, according to experts the share of secondary material resources in MSW which are potential raw materials for industrial use reaches 60%. But at the moment the processing of MSW allows you to get no more than 20% of secondary materials which is 2 - 2.5 times lower than in developed Western countries. The potential volume of energy contained in MSW generated on the territory of the republic is equivalent to 470 tons of fuel per year.

Disposal of MSW by placing them in landfills is a very ineffective process since a huge amount of valuable resources that could be used in industry or agriculture are lost. Unlike us the efforts of foreign countries are primarily aimed at preventing and minimizing waste generation, and then at their recycling, reuse and development of effective methods for final processing, neutralization and final disposal, and only disposal of waste that does not pollute the environment. It is more efficient and expedient to prevent the generation of waste from the stage of mining to the consumption of finished products. Developed countries are trying to achieve this by introducing a circular economy. The principles of a circular economy were approved by the European Commission in 2014. This led to the adoption of national strategic plans in 2017 in France, Finland, Slovenia, the Netherlands, and Germany. In China the circular economy began to be introduced back in 2010. In Belarus there is still no large-scale introduction of the circular economy, although there is a need for this [2]. It would create a window of opportunity and reduce dependence on import of resources. Calculations show that the introduction of the principles of a circular economy in the republic can provide GDP growth by 12-15%. And if developed countries have already learned how to deal with this problem, then the best options for solving it must be considered and implemented in our country. Over the past few years efforts have been made in the republic to form an effective waste management system. If in 2005-2006 less than 50% of the population was covered by separate waste collection, today more than 92% of the republic's residents have the opportunity to carry out separate waste collection. However, this is not enough for the full functioning of the circular economy. The National Strategy states that by 2035 Belarus should extract at least 50% of waste from its entire volume [1]. The environmental awareness of the population is also constantly growing. If the level of extraction of secondary material resources in 2018 is 18.8% (714 thousand tons) with a total formation of MSW of 3.7 thousand tons, then in 2019 it was 22.6% (765 thousand tons) of the volume of formation MSW (3.4 thousand tons). At the same time, waste recycling remains a very urgent problem. If the state actively set the circular vector of development, the results in this direction would be much more significant. But we can complain about the state for a long time without looking after ourselves. Landfills in the forest after picnics and unreasonable consumption of goods exacerbate the already deplorable state of waste disposal in the country. Only after raising the consciousness of the population changes at the state level will make sense.

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PROBLEMS OF ECOLOGICAL HEALTH

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The article analyses interconection and interdependence of human health and the ecological conditions of his living.

Keywords: health, population, ecology, ecological culture, scientific and technological progress.

During the second half of the 20th century, people began to talk about a serious danger threatening human life and health due to the fact that the main reason for the progressive deterioration of human health was the widespread deterioration of the ecological situation, and, first of all, technogenic pollution of the environment. The interconection and interdependence of human health and the ecological conditions of his living against a background of intensively developing scientific and technological progress constantly remain the object of research by various scientists [1].

The aim of the technogenic way of development of civilization is to improve the life of the population, create comfortable living conditions, but at the same time the quality of life of people is constantly decreasing. Human is an integral part of nature, but often opposes himself to it through his rash activities. Numerous environmental factors, including infectious organisms, pollutants (chemical, biological waste), lack of food and nutrients - all this leads to a deterioration in living conditions and, as a result, leads to the formation of many diseases. In addition, air, water or soil pollution or other stresses affecting humans and other species in the ecosystem complicate matters. The dinamics of diseases is complicated by an increase in population density, as high density contributes to the increase and spread of infectious organisms among humans. Rapid growth of population and widespread environmental degradation are contributing to an increase in the world's problems associated with disease [3].

The ecology of increased disease is exceedingly complex because of the diversity of infectious organisms and the effects of environmental degra- dation on the prevalence of disease. The rapid expansion of human popu- lations is a major factor in the rise of human diseases: Humans living in crowded, urban areas are in an eco- system that is ideal for the resur- gence and rapid spread of old diseases.

The modern ecological crisis, which can develop into an ecological catastrophe, is caused by the development of productive forces, which occurs thanks to science and technology. In accordance with this a way out of the crisis must be sought in the latest scientific and technical achievements, but even the most perfect technology, inevitably damages the environment, and, therefore, harms human health, if it conflicts with the laws of self-reproduction of nature. When a human oppresses nature, he oppresses himself, the so-called «boomerang effect» works [2].

Ecological culture is an integral part of the development of global culture and is considered as the study of the interaction between living beings and their environment, includes human perception of the environment, as well as our unconscious impact on the environment and the environment on us. The main goal of environmental education is the formation of an ecologically cultural personality.

The greening of education and science is not only a process of enrichment with environmental knowledge, but also an act that is aimed at revealing in a person the need for self-development, which cannot be carried out in isolation from nature. Thus, we can conclude that a person, influencing the environment, affects your health, therefore, the environment as well as other factors determines human health.

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PROBLEMS OF IMPLEMENTATION OF THE CIRCULAR ECONOMY IN THE REPUBLIC OF BELARUS

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The article examines the relevance and principles of circular economy. The experience of its implementation in other countries is cited. As a result of the study, it was concluded that it was necessary and possible to im-plement it in Belarus.

Keywords: circular economy, development and implementation.

The «take, make, waste» economic model has prevailed since the beginning of the Industrial Revolution. However, the growing scarcity of all resources and the need for sustainable development has led to the search for a replacement model. The concept of circular economy is based on the «take, make, reuse» algorithm. It is defined by three basic principles: recycle waste and garbage; do not throw products and materials out of the production pro-cess; regenerate the natural environment. The circular economy not only eliminates the negative impact of a linear economy, but is itself a viable and sustainable closed-loop economy. It creates a new economic model for profit. At its core, the circular economy organizes a socio-economic environment on the principles of natural ecosystems of resource efficiency and wastelessness. In the future, the EU plans to switch only to a circular model of the econo-my. And it should be cost-effective. Experts estimate that a shift to a circular economy could generate $500 million, provide 10,000 new jobs and avoid 100 million tons of garbage.

Today, Belarus generates about 1.4 thousand types of waste, the total mass of which at storage facilities is more than 1270.4 million tons. Therefore, the problem of waste management is also relevant for Belarus, and the circular economy is identified as one of the priority areas in the National Strategy for Sustainable Development for the period up to 2035. [2]. It should be noted that forestry and agriculture were key sectors in the transition to a low-carbon economy. At the same time, the modern agricultural system is wasteful: in Europe, for example, about 700 million tons of agricultural and food waste are produced annually, and with an increase in agricultural production, their number will increase. The share of waste of plant and animal origin in the republic accounts for about 35%, therefore, the introduction of circular agriculture or the «zero waste» system is so relevant. All products that are pro-duced in agriculture will have to be used either as final products of consumption or as raw materials for other pro-duction. Belarus has adopted a number of state and government programs in the field of ecology and sustainable development, but all of them are disparate, the common vector that ensures the introduction of the circular econo-my is not traceable. Calculations show that the introduction of the principles of the circular economy can provide GDP growth of 12-15%. A closed-loop economy can change certain sectors, create new jobs, attract investment. Today, only 0.5 percent of the labor force is employed in the field of recycling of secondary resources in the coun-try. And the development of the closed-loop economy will increase employment in this industry to 3-4 percent. The country has technical, digital, organizational opportunities for the development of the circular economy. You need to set a strategic vector and move on it, to develop in this direction education, science, and production.

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PSYCHOLOGY AND GLOBALIZATION

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Today, more and more regions around the world are exposed to environmental pollution from waste and garbage. The Republic of Belarus is no exception. This is an important problem for all cities, because garbage attracts garbage. The amount of garbage is constantly growing, which adversely affects the ecology of the planet. However, by learning the true reasons why people litter, you can not only prevent further growth of garbage, but also reduce its amount.

Keywords: garbage, ecology, culture, «garbage blindness», «garbage infrastructure», social norms, human behavior.

What is the basis of what people litter, and how to prevent it? The answer to this question was sought by people in research in the 2000s. They consisted of observing people's behavior, conducting surveys, and photographing clean and polluted public places. When asked «is It OK to throw garbage on the floor next to an overflowing urn?» someone said that there are workers who receive money for cleaning garbage, others said that this is unacceptable and unacceptable due to their upbringing.

What parameters affect where we litter? 5 factors were identified: attitude to the place of residence; personal responsibility; understanding the cause of punishment or praise; individual factors and accidents. And another factor is «disgust» so as not to contact the garbage. Another specificity of people's behavior is «garbage blindness.» People try not to pay attention to garbage, and do everything possible for this. For example, turn away from him or look in the opposite direction all the time. At this moment, people are experiencing a strong internal conflict and remorse.

What is needed to reduce the amount of contaminated area? A set of measures is required. First of all, you should clean up the garbage. Cleaning squares and parks by volunteers develops a sense of self-responsibility. In addition to cleaning, it is necessary to demonstrate to everyone that this area was and will be clean. It is important to create conditions for people, in Australia this is called «garbage infrastructure». All trash baskets are available, are in the visibility zone, are highlighted in color and signs, and are permanently cleaned. If you adhere to all these conditions, then the behavior of a person will begin to change. At the same time, social norms will change, and people for the most part do not violate them publicly. If the norms are ignored, then citizens can force them to comply.

Today, there are many ways to reuse waste. For example, Rothy's brand makes shoes from recycled plastic bottles. Colorful washable ballet shoes are especially popular. Brazilian company Muzzicycles produces bicycles, the frames of which are made of recycled plastic bottles, which, in turn, makes them cheaper and more practical. Turkish company Pugedon produces machines for collecting plastic and glass bottles. Such a machine works on solar energy and instead of garbage will give dog or cat food.

People need to see the results of their work and its prospects. To do this in Australia, and now in the city of Vladivostok, you can see banners with the image of places «before» cleaning (with a pile of garbage), and «after». This helps people think about «what this place will look like in the future.»

Guided by the measures listed above, each of us can reduce the amount of contaminated territory and thus protect nature from its premature destruction.

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SOCIAL (NON)TRUST AS THE BASIS OF THE ENVIRONMENTAL CRISIS IN MODERN RUSSIA

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The author addresses the problem of the environmental crisis in modern Russia, presents the results of a sec-ondary analysis of public opinion polls and concludes that the ongoing deterioration of the environment is associat-ed with low social trust among Russians.

Keywords: environmental crisis, environmental consciousness, social trust, Russia.

Despite the current policy of environmental protection and restoration, the environmental crisis in modern Russia continues to deepen. The results achieved in the course of harvesting, planting and other activities lose their significance in the conditions of incessant anthropogenic pressure. The latter is determined by the low involvement of Russians in environmentally oriented practices of everyday behavior.

The nature of human interactions with the environment comes from the dominant value attitude in society and is described by the category of environmental consciousness. Environmental consciousness is a social structure that is reproduced in a variety of individual actions based on the results of consumption of available information about the state of the environment and the consistent formation of environmental awareness, environmental con-cerns, and environmentally oriented behavior [1]. The practical implementation of these guidelines among Rus-sians, however, contradicts the described scheme: despite the fact that more than half of the FOM 2017 respond-ents are concerned about the deterioration of the environmental situation in the country, only a few of them prac-tice at least some labor-intensive methods of nature conservation [4].

This contradiction points to the need to take into account in the theoretical scheme of reproduction of environmental consciousness the mechanism of refraction of installations of environmentally oriented behavior. Such a mechanism is social trust, which includes knowledge of the prescribed behavioral norm (which in the context of the topic under consideration is reduced to environmental consciousness) and the expectation of its compliance by sur-rounding people and their associations [1]. As the results of sociological research show, the expectations of Russians from the actions of their fellow citizens in 2019 are low – the absolute majority of them believe that people around them should be treated with caution. The same applies to expectations from the actions of the authorities: for most Russians, it is obvious that the interests of the state and society do not coincide, as well as the former's failure to fulfill its obligations to the population, its alienation and closeness. A drop in expectations on the part of Russians was also noted by the activities of the media, which provide information, including on the environmentally oriented behavior of Russian citizens and the ongoing environmental policy [2].

A low level of expectations constrains the implementation of installations based on high environmental con-cerns, complementing them with installations of the most common behavior. The discrepancy between the existing and practiced behaviors determines the situation of low social trust in the sphere of interaction with the environ-ment, which is characterized by "incorrect" reproduction of environmental consciousness. Thus, the Russians sur-veyed in 2019 tend to downplay the importance of their voice when discussing socially significant issues, as well as shift responsibility for solving environmental problems from themselves to the authorities [2, 3]. Accordingly, the low involvement of the population in environmentally oriented practices only encourages the development of the environmental crisis in the country.

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TENOFOVIR AS A POTENTIAL INHIBITOR FOR 2019-nCoV CORONAVIRUS M PTOTEASE

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In order to find candidate drugs for 2019-nCoV, we have carried out a computational study to screen for effective available drug tenofovir which may work as a strong inhibitor for the Mpro of 2019-nCoV.

The interaction of the tenofovir with the Coronavirus 2019-nCoV were performed by molecular docking studies.

Keywords: tenofovir, molecular docking, coronavirus 2019-nCoV.

The molecular docking analysis is an important tool for drug design and molecular structural biology. The aim of molecular docking analysis is to predict the preferred binding location, affinity and activity of drug molecules and their protein targets.

In the present work, the molecular docking studies of the tenofovir molecule was performed against Coronavirus 2019-nCoV using HyperChem Professional 08, Molegro Molecular Viewer software programs. Molecular basis of interactions between Coronavirus 2019-nCoV molecule and the tenofovir can be understood with the help of docking analysis and interactions as observed in Fig. 1.

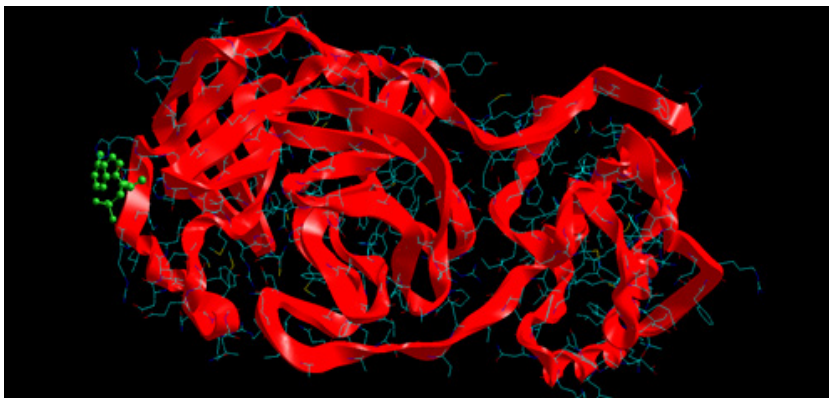

Fig. 1. – Interaction of the Tenofovir with Coronavirus 2019-nCoV

We found 6 positions in which there is a strong interaction between the drug molecule tenofovir and the Coronavirus 2019-nCoV that leads to the destruction of the protein structure. The best position is presented here. The binding energy for Coronavirus 2019-nCoV and tenofovir is -77.63 kcal/mol in which shows good binding affinity between the tenofovir and 2019-nCoV. Also, Ser 62, His 64, Asn 63 are contact with negatively and positively charged in the tenofovir binding environment. It was found that the ligand tenofovir shows the best affinity towards of the 2019-nCoV compared to other known antiviral drugs: Colistin, Valrubicin, Icatibant, Bepotastine, Epirubicin, Epoprostenol, Vapreotide, Aprepitant in which the binding energy for Coronavirus 2019-nCoV and them is -11.206, -10.934, -9.607, -10.273, -9.091, 10.582, -9.892 and -11.376 kcal/mol that shows weak binding affinity between them and 2019-nCoV.

The binding energy for 2019-nCoV coronavirus and tenofovir is -77.63 kcal/mol, which shows good binding affinity between tenofovir and 2019-nCoV. Based on our research, tenofovir may act as a potent inhibitor of Mpro 2019-nCoV.

THE IMPACT OF THE GLOBAL WARMING ON THE PSYCHO-EMOTIONAL STATE OF A PERSON

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The article analyses the influence of the global climate change on the psycho-emotional state of the individual and society and their reaction.

Keywords: climate change, abnormally high temperatures, psycho-emotional state, suicides.

The topic of weather is the most universal topic for starting any small talk, which today is hardly possible without focusing on the problem of global warming. It is illusory not to notice climate change, not to feel its impact on well-being and on the state of the planet as a whole.

The rise in temperature of water and air has a detrimental effect on flora, fauna and economy, which is a consequence of climate change. This fact ultimately leads to the emergence of the so-called «climate refugees». However, the ambient temperature has a great influence on the psycho-emotional state of every person.

Cardiovascular diseases, diabetes mellitus, chronic obstructive pulmonary disease (COPD) — this is not the whole list of diseases, which may be caused by the factors of global climate change. When the ambient temperature rises, the body is exposed to stress. A complex cascade of reactions takes place for maintaining a normal temperature range in the internal organs, which contribute to the release of excess heat [3].

In 2018, a study was carried out to prove that air emissions can actually cause various diseases. Air pollution with particles of less than 2.5 micrometer (the so-called PM2.5 class) reduces the average life for one year [1].

Abnormally high temperatures affect not only the body, but also the mental health. Unfortunately, today we do not have enough information about the impact of climate change on human mental health. Nevertheless, the interrelation between these two aspects becomes one of the most topical issues.

Not so long ago, one study was carried out. The purpose of it was to study the interrelation between indicators of an increase in average monthly temperature and the number of suicides. The results were published by the Stanford scientist Marshall Burke and colleagues. The study was based on the work with indicators of the average monthly and daytime air temperature in different USA districts, starting from 1968 to 2004 and a number of Mexican municipalities from 1990 to 2010. The findings were compared with the number of suicides in a particular region. It was concluded that the number of suicide rates increased by 0.7% in the United States and by 2.1% in Mexico [2]. It should be noted that the effect did not depend on the geographical location of the area and the level of income. However, this study raises a number of controversies regarding unaccounted for factors and methods of the study. Therefore, it will be possible to speak confidently about the influence of temperature changes on the psycho-emotional state of a person only after a series of other studies that considers the main mental indicators, for example, the level of a number of hormones. This question remains open, but the indirect effect of climate change on the mental state of a person, does not raise doubts among researchers. Climatologists argue that abnormal temperature rises to create conditions that provoke global catastrophes, which, in turn, already have disastrous consequences for our psycho-emotional state.

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THE INFLUENCE OF GEOPHYSICAL FIELDS ON HUMAN MENTAL AND NERVOUS ACTIVITY

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This article analyses how geophysical fields affect human health.

Keywords: geophysical pulsations, electromagnetic field, nervous system, human psyche.

The geoecological function of the lithosphere is the properties of geophysical fields of the lithosphere of natural and anthropogenic origin to influence the state of the biosphere including humans. Biosystems at any level of the organization are highly sensitive to mechanical vibrations and jolt. The spectrum of seismic vibrations ranges from hundredths of a second to several hours and modulated by long-period vibrations [1]. Therefore the low - frequency range contains not only mechanical but also acoustic (ultrasound and infrasound), electrical, electromagnetic and geomagnetic vibrations.

At the time when humanity discovered electromagnetic radiation it was considered that people like other living organisms did not have sense organs that perceived an external electromagnetic field [3].

A magnetic field is a stimulus that is very different from other irritants. It is not as intensive as light or ionizing radiation, but it acts directly on neurons. The magnetic field near a human head is registered by the alpha waves which are perfectly trace in a person when he closes or opens his eyelids. The Earth magnetic field tends to have periodic natural fluctuations - geophysical pulsations.

In the course of studies of these fields data appear that indicate the influence of electromagnetic waves of various frequencies on the mental and nervous activity of a person. A statistical relationship established between the numbers of patients admitted to a health care facility with mental illnesses and various geophysical anomalies, which were registered three days before the patient was admitted to the hospital [2]. This phenomenon is explained by the fact that the cells of the nervous system are electrically polarized and that neurons communicate with each other by transmitting electrical impulses. Changing the direction of these currents or polarization potentials to the opposite and reducing the current strength to zero puts the nerve in an excited state. There is an intensive influence of magnetic fields on the human nervous system in summer and spring. The value of the magnetic induction of the magnetic field in which a person is located should not exceed 50 μT.

This effect of electromagnetic fields is exerted through the strengthening of the biochemical reactions of a living organism in response to the action of these fields. Many earth chemical elements (except argon and thorium) have isotopes that have a magnetic moment [3]. When the nuclei of magnetic isotopes are exposed to an electromagnetic field, the resonant absorption of the field energy occurs. In the case of mind control, the determining elements are those whose nuclear magnetic resonance frequencies lie in the frequency range of the human encephalogram (0.35-70 Hz).

There is a connection between the electric charge of a person which changes episodically and the biorhythms of the human body. There is a very strong charge fluctuation in people with mental illness. The electric charge of a person's body can vary greatly with amnesia or hypnosis. Therefore, any state of illness of the human body affects the electric charge of the body.

This phenomenon is used to treat mental illnesses, to regenerate tissues and to analyze an altered state of consciousness.

In conclusion, we can say that the human brain can be compared to a radio receiver that is tuned to the frequency of electromagnetic vibrations in the atmosphere which has a strong effect on the human psyche.

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THE POSITION OF THE CONCEPT OF NEOEVOLUTIONISM IN CONTEMPORARY ECOLOGICAL ANTHROPOLOGY

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Attempts to determine the similarities and differences between Julian Steward and Lesley White begin the second stage in the development of environmental anthropology. One of the main directions of this period is neo-evolutionism.

Keywords: environmentalism, ecoanthropology, neoevolutionism.

Celebrating the centenary of the publication of Charles Darwin's The Origin of Species by Natural Selection on November 24, 1959, evolutionists pioneered a new trend in ecological anthropology: neo-evolutionism. The fundamental difference between the school of evolutionism and the attempt to separate the works of the latter from the early works of evolutionists (in particular L.G. Morgan and E. Taylor).

Elman Rogers Service dedicated his work Primitive Social Organization: An Evolutionary Approach to two prominent anthropologists of the period: Lesley Alvin White (1900-1975) and Julian Hines Steward (1902-1972). Environmental anthropology as an intellectual activity is attributed specifically to L. White and D. Steward, who received strong Boasian training from Fay Cooper Cole and Edward Sapir, Alfred Kroeber and Robert Lowy, respectively.

L. White expounded the ideas of neo-evolutionism in three fundamental works: The Science of Culture (1949), The Evolution of Culture (1959), and The Concept of Cultural Systems: The Key to Understanding Tribes and Nations (1975). L. White's concept is based on his approach to the study of sociocultural processes (and, as a consequence, three methods of their integration): historical, functional and evolutionary. The first approach explores unique processes (temporal processes), the second approach studies the functional and structural aspects of cultural development (formal processes). These approaches should be studied in historical analysis, functional analysis and method analysis, respectively. Based on the evolutionary ideas of G. Spencer, L. White formulated the «Basic Law of Evolution», which is based on the proposition that «culture progressively develops as the amount of harnessed energy per capita increases, or as increased efficiency or economy in energy controls, or «both happen together» [3]. Based on this, L. White saw the meaning of all cultural evolution in improving human adaptation to the environment.

D. Steward outlined the ideas of neo-evolutionism in his fundamental work The Theory of Cultural Change (1955), thereby indicating another direction in the development of ecoanthropology: the theory of multilinear evolution. In his work, D. Steward singles out each individual culture as a special system, the evolution of which determines the characteristics of the adaptation of each culture to specific environmental conditions. The phenomenon of «parallel evolution» that he considered is explained by the fact that societies under similar environmental conditions evolve in a similar way. Thus, D. Steward substantiated his concept of multilinear evolution, and, as a consequence, the theory of cultures of change.

One of the most influential exponents of neo-evolutionism, Marvin Harris (1927-2001), in his work Cultural Materialism (1979), presented a consolidation of White and Steward's ideas: similarities are culturally explained by meeting human needs with technologies that correspond to environmental conditions at a given time.

Thus, the theory of neo-evolutionism is based on the ideas of classical evolutionism, the general principles of functionalism and diffusionism. At the same time, neoevolutionists study directly irreversible socio-cultural changes caused by human interaction with the environment.

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THE PROBLEM OF GLOBALIZATION IN PROCESSUAL ENVIRONMENTAL ANTHROPOLOGY

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In the face of national and international incentives for exploitation and degradation, ethnological systems that, some time ago, managed to maintain local and regional environmental exclusivity, turn out to be irrelevant in the framework of ecoanthropological research.

Keywords: globalization, ecoanthropology, environmental anthropology.

Globalization is one of the manifestations of the processes of differentiation and integration in human society. For example, M. Waters understands globalization as "a social process in the course of which the dependence of social and cultural development on the geographical factor decreases, and this is increasingly recognized by people".

Theories of globalization of culture are conditionally divided in two directions, two opposite tendencies - convergence and confrontation of the subjects of the world community: apologetic and critical. In the first case, globalization is viewed as an extremely positive process of involving culture in its general flow, the formation of a single culture (when viewed from the position of culturalization). In the second case, globalization is seen as a force that threatens stability and the possibility of cultural development (in particular, local culture).

One of the directions of procedural environmental anthropology is determined by research related to the study of the impact of globalization on local cultures. Systematizing the spectrum of influence of globalization on the individual within the framework of local culture, one can note: demoralization, antisocial behavior, deviance (as a negative impact); marginalization (as an indifferent influence); activation of communication skills, increasing the educational level of development (as a positive impact).

Considering the negative impact on society as a whole, within the framework of local culture, we note the extensiveness of the development of nature in the form of industrialization, an intensive transition to market relations. On the other hand, there is a significant contribution of globalization to the development of the local culture society (for example, the introduction of nature-saving technologies, the widespread use of waste-free management and other scientific and technical achievements).

To maintain the culture of indigenous peoples and its natural development, it is necessary to solve problems at the socium and individual levels. American anthropologist Konrad Phillip Kottak argues that at this stage of development there is such an approach to solving the problem of globalization in research on ecological anthropology, which is based on consideration of certain aspects of human nature that lead to environmental degradation. K. Kottak refers to such aspects as «the desire for technological innovation, the desire for a higher social status and a bias toward social justice.» Another approach to solving the problem is the elementary practical application of knowledge in the field of environmentalism.

Despite the controversial nature of globalization, modern ecological anthropology is faced with the problem of lack of research objects.

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THE PROBLEM OF HYPERCONSUMPTION IN MODERN SOCIETY

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The problem of hyperconsumption is due to its global destructive manifestation, both in the socio-psychological and environmental terms.

Keywords: hyperconsumption, society, economy, ecology, psychology, human.

Hyperconsumerism - irrational and non-functional consumption of goods, as well as the associated pressure of modern capitalist society on the consumer, since these goods identify a person in the environment. Frenchie Lunning, a popular culture researcher, sums it up as «consumerism for the sake of consumption» [2].

As can be seen from the definition itself, the roots of this problem lie not only in the modern economic system, this is facilitated by the socio-cultural and political environment.

Hyperconsumption is fueled by various brands, as people often have strong attachments to product brands, which affects their personality and forces them to buy and consume goods in irrational quantities [3]. Another characteristic of hyperconsumption is the constant drive for novelty, encouraging consumers to buy new and abandon old, especially in fashion, where the product life cycle can be very short, sometimes measured in weeks.

The problem of hyperconsumption is more relevant than ever in modern society, today it is not only the purchase of a huge amount of things, cosmetics, equipment, but also food waste. According to statistics provided by the UN in 2020, a third of all food produced in the world is thrown away by humans.

Hyper-consumption harms not only your wallet, but also your mental state and the planet, because all thrown away things and products in most cases end up in a landfill, since the percentage of recycled waste is still low, especially for non-European countries. And landfills pollute the environment, occupy huge areas that could be used for the benefit of mankind or animals, substances emitted into the atmosphere poison the air, as a result of rotting and precipitation, chemicals and various harmful bacteria get into groundwater and soil, which leads to drinking water, reservoirs and soil corrosion.

From the point of view of psychology, hyper-consumption significantly harms our psyche. The accumulation of a large number of things «puts pressure» on our emotional state, and the process of shopping and accumulation of things is addictive. Materialism or syllogomania is a mental disorder manifested by the purchase and collection of things in large quantities, sometimes completely unnecessary. All this is explained by several factors: goods are often symbols of status, since individuals buy them not so much for use as for showing to others, transmitting messages (for example, about personal wealth or belonging to a particular group [1]. However, according to other theorists, this From a biological point of view, everything is quite easy to explain. When you are buying a new thing, the hormone of «happiness» - dopamine is produced. We receive it as if as a «reward» for the performed action: we feel a surge of strength, pleasure from what was done. Therefore, this hormone is associated with motivation, the urge to action. It pushes you to new and unnecessary purchases just for the sake of sensations, although in fact these things are not necessary, but only clutter up your space.

How do you solve this problem? Firstly, you should rationally think about new purchases, if the person himself does not cope, you should ask for help from specialists: from a budget planning and shopping assistant to a psychiatrist, in especially difficult cases. Secondly, hand over old things for recycling, make donations to the poor. In terms of food, the UN has launched a global campaign to combat food loss that is already benefiting the planet, each of us can do our part. Next time, carefully plan a trip to the grocery, make a shopping list, before that, make sure that you have in stock, take less goods in the store, because you know which products are thrown away by you and your family more often. Even such seemingly insignificant actions will help save both your money and our planet.

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THE PSYCHOLOGY OF CONSUMPTION

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The problem and the psychology of consumption is analyzed in the article.

Keywords: consumption, hyperuse, pollution, demand.

In today's fast-moving world, people don't notice the problem of consumption. Each individual is in an insistent desire for better life, better conditions. People always have a great desire to increase their income in order to provide themselves with the best products and services, i.e. for constant consumption. In modern society, people are more willing to surround themselves with various material goods than good friends and communication with people. However, individuals do not always really need what they acquire. Against this background, the problem of consumption is arising. So what moves their desire to consume?

The main task of a business is to create demand and meet the needs of society with its own products and services. Marketers use various methods of influencing the human subconscious in order to maximize the level of consumption. With the help of various triggers of psychological impact, a desire to acquire new goods and services is artificially formed in society, an idea is created about the need for constant renewal of existing products. So, for example, rapidly changing fashion trends motivate society to acquire exactly new and branded goods, regardless of whether it is really necessary for individuals. In addition, over the past decades, there has been a widespread tendency towards the production of low-quality quick-wear goods, which makes them periodically renewed.

Fashion and advertising call for an irrational buy-throw-buy cycle. As a result, excess production increases, which creates goods that are not necessary to satisfy normal human needs, but goods needed to satisfy fictitious (imposed by fashion and advertising) needs. In this regard, the amount of raw materials is constantly increasing. As a result of such production, two large-scale problems arise - hyper-use of resources and an increase in the volume of various types of garbage (pollution of the atmosphere, water, soil, etc.) [2].

Clothes production causes great damage to the environment. The textile industry, in terms of CO2 emissions into the atmosphere, is on the second place after aviation — it counts about 10% of such emissions, which is more than 1.7 billion tons of CO2 per year. According to scientists, clothes production consumes 1.5 trillion tons of water and generates more than 92 million tons of waste annually.

Many companies are forced to produce more goods than they can sell because of shareholders who demand constant business growth and increased expansion. However, many brands would rather destroy their products than sell them at a lower price or give them away for free. So in 2017 unsold H&M clothes were used instead of coal in power plants in Sweden. For three years according to the law about the sanctioned products, the Rosselkhoznadzor destroyed about 26 thousand tons of food — this would be enough to provide all homeless people in Moscow with food three times a day for a year. And the British brand Burberry burns unsold clothes and perfumes every year an average of $ 23 million to prevent goods from steeling or selling at lower prices. Burberry claims that they care about the environment and use the energy obtained during combustion in production. But whether this is true we do not know [1].

In this way, in modern society, the category of "happiness" is linked to material factors, and envy becomes a mechanism that motivates modern man to the eternal race to constant consumption. To solve this problem it is necessary to change social habits and principles and form the culture of consumption.

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SECTION 2

MEDICAL ECOLOGY

ADSORPTION TYRPHOSTIN AG528 ANTICANCER DRUG UPON THE CNT(6,6-6) NANOTUBE

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The theoretical information concerning the molecules Tyrphostin AG528. The physicochemical properties of the Tyrphostin AG528 molecule and CNT(6,6-6) nanotube have been studied. Quantum-chemical modeling of the Tyrphostin AG528 has been carried by the semi-empirical RPM6 method.

Keywords: quantum-chemical modeling, tyrphostin AG528, CNT nanotube.

CNT is the best drug delivery systems for anticancer drugs to mark-cells. The molecules of the drug bind covalently or non-covalently to the surface of the CNT and then enter the necessary cells. There are suggestions that the cause of cancer is impaired protein kinase function. Tyrphostin AG 528 is an inhibitor of this enzyme. As a result of experiments and studies, it was found that the most stable complex with this drug is its combination with the OSUNT configuration D (6; 6-6).

To calculate the starting geometry of the Tyrphostin AG528 molecule the molecular mechanics method (MM+) of the HyperChem 08 software package was chosen. This method was chosen because it was developed for organic molecules takes into account the potential fields formed by all atoms of the calculated system and allows flexible modification of various calculation parameters depending on the task.

The optimization of the tyrphostin molecule was also carried out using the RPM6 semi empirical method of the Gaussian 09W software package. The result was visualized using the Gauss View 06 program.

To perform quantum-chemical modeling based on the structural formulas of compounds a special algorithm was developed that includes the following steps: 1) transformation of each structural formula into a three-dimensional structure; 2) optimization of the geometry of the molecule.

Using the MM+ method dipole moment of the molecule is 4.31. Molecular orbitals involved in the formation of the absorption spectrum of tyrphostin: LUMO [- 2.26 eV]; HOMO [-5.86 eV].

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AGE AND GENDER DISTINCTIONS IN THE PSYCHOLOGICAL STATE WHILE WORKING ON THE COMPUTER ACCORDING TO SUBJECTIVE SCORING

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Analysis of the survey data about the subjective scoring of the respondents' psychological state. The distinctions between age and gender groups are inspected.

Keywords: psychological state, age groups, gender groups, subjective scoring.

The computer is an objective reality of our world. The level of interaction with computers and other technical devices is increasing. This fact enables people to use large capacity of the machine effectively. Such technological changes not only substantively transform the human environment but also affect the people themselves [1].

Computer work introduces several specific stress factors into our life.

Let's state the main of them:

- data loss – undoubtedly occupies the first place amongst computer stressors (if not according to frequency, then according to stress power);
- unstable operation, failures and freezes of computer, even not leading to data loss, are still the serious stress factors;
- information overload. Computers, programming, the internet are the most dynamically developing areas of people's activity. The need for constant and intensive renewal of one's knowledge and skills, to be on top of the vast majority of everyday emerging inventions becomes an overwhelming task;
- spam (unapproved mailout). The need to constantly deal with spam, the risk to miss indeed important and crucial mails is a very serious stressor [2].

So, the goal of the current job is to compare age and gender distinctions of respondents' subjective scorings of their psychological state.

The psychological state scoring has been conducted using the survey method as the most reasonable for polling ones who work on computers.

It is logical to assume that age and gender distinctions will become evident in the subjective scoring of psychological state.

The following average values were gained according to 10-grade scale: at the beginning of a working day – 6.17 for men and 4.50 for women, at the end of a working day – 6.28 for men and 5 for women, at the end of a working week for different age groups: 16> – 5.60; 16-20 – 7.31; 20-25 – 6.59; 26-35 – 6.42; 36-50 – 7.07.

Men subjectively score their state better than women at the beginning and the end of a working day (6.17 > 4.50 and

6.28 > 5 respectively).

According to age groups breakdown, the highest grade (7.31) falls into the 16-20 years group, the lowest (5.60) belongs to people younger than 16. In age groups 20-25 and 26-35 the grades are as follows: 6.59 and 6.42 respectively.

According to the scale from 1 to 10 the average value is 5, so that leads to the conclusion, that all respondents score their state higher than the average (5>).

When interpreting gained data estimator should consider the subjectivity of respondents' scoring of their psychological state, because in some cases the heightened self-esteem is observed. It also seems appropriate to consider the relevance of data, indicating the negative influence of computer work on the human psychological state. In connection with computer technical progress, increasing computer time and depending on one's work experience the mental steadiness can be worked out.

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ANALYSIS AND INTERPRETATION OF ONCOMARKERS PRESENCE IN BLOOD SERUM

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The study of tumor markers is of particular relevance in the context of an increase in the number of oncological diseases. But taking into account the sufficient novelty in the application of the definition of tumor markers as a diagnostic procedure, there are significant problems with the analysis and interpretation of the results of such a study. Determination of the level of tumor markers for the early diagnosis of tumors of various localization is of greater importance.

Keywords: tumor markers, prostate specific antigen, prostate gland, chronic prostatitis, prostate adenoma.

Diseases of the prostate gland, which include chronic prostatitis, prostate adenoma, prostate cancer, are diseases that are widespread in men from middle age and beyond. According to various sources, it is observed in 60-80% of sexually mature men. According to official medical statistics, over 30% of young people of reproductive age suffer from chronic prostatitis. In about a third of cases, it occurs in men over 20 and under 40. According to the WHO, urologists diagnose chronic prostatitis in every tenth patient [1].

The use of prostate-specific antigen in clinical practice significantly improves the diagnosis of prostate diseases. PSA is a continuous parameter, i.e. the higher the value, the greater the likelihood of chronic prostatitis and prostate adenoma.

In the group of healthy men, there was no significant correlation between PSA level and height and age (correlation coefficients 0,028 and 0,29). In diseases of the prostate gland, these connections are manifested at a reliable level: in chronic prostatitis there is a pronounced positive relationship between PSA and growth (correlation coefficient 0,84), and less noticeable - with age (correlation coefficient 0,67). Analyzing this observation, it should be said that the correlation coefficients of the indicator (in this case, the PSA level) with age and height in adults are independent of each other - growth stops at the age of 19-21, and then it acquires the value of status homeostatic indicator. Adenoma of the prostate is also accompanied by a significant correlation between these indicators, but less pronounced than in chronic prostatitis (0,63 and 0,74, respectively).

PSA is a continuous parameter, i.e. the higher the value, the greater the likelihood of chronic prostatitis and prostate adenoma. This means that there is no generally accepted threshold or boundary value for this indicator [2].

It is this feature that manifested itself in our study: in the group of healthy individuals, the correlation coefficient between the PSA level and age is lower than in the case of prostate diseases. This means the appearance of the effects of influencing factors on the level of PSA in chronic prostatitis and prostate adenoma.

Differences in Spearman's correlation coefficients in the studied conditions mean differences in regulatory effects on the prostate. Thus, the development of the diseases under consideration initially occurs according to various pathogenetic scenarios.

Thus, the PSA level in the examined individuals (both clinically healthy and those suffering from chronic prostatitis and prostate adenoma) depends on individual characteristics, which is manifested by a wide variation in the PSA level in the blood serum; and the appearance of a disease of the prostate gland (chronic prostatitis and adenoma) is accompanied by the establishment of correlations between PSA and age, PSA and male growth, which is not observed in the normal state of the prostate gland.

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ANALYSIS OF ACCESSED APLASTIC ANEMIA INCIDENCE AMONG CHILDREN IN THE REPUBLIC OF BELARUS (2000 – 2018)

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The purpose of this work is to analyze the dynamics of the morbidity rate of acquired aplastic anemia among children in the Republic of Belarus for the period from 2000 to 2018. Acquired aplastic anemia is a disease in when the producing enough of all the main types of blood cells is stopped by patient's bone marrow - white blood cells, red blood cells, and platelets. The disease occurs rarely, but has a severe course and requires the earliest diagnosis. 80% of cases of the disease are due to the acquired form of pathology, and the remaining 20%

are caused by genetic factors. The vast majority of acquired aplastic anemia cases do not lend themselves to etiological identification and are classified as idiopathic.

Keywords: acquired aplastic anemia, pancytopenia, immunosuppressive therapy, allogeneic stem cell transplantation, morbidity, mortality.

The analysis of statistical data was carried out on the basis of graphs and diagrams built in the work. The indicators were considered for the period from 2000 to 2018 for the analysis; the age range of patients was 0-17 years. The total number of registered cases of AAA is 93 people. The number of cases among boys is 59; among girls - 34 people; the number of deaths - 15 people. It is based on such important concepts as morbidity and mortality. The calculation was carried out both for the entire Republic as a whole and for each of the regions separately.

In the process of calculations it was found that boys get sick 1.8 times more than girls. Two peaks were found where the disease occurred more often: at 11 and 16 years.

The rough intensive rate of AAA morbidity in children 0-17 years old for the period from 2000 to 2018 was 0.26 cases per 100 thousand of the child population. The highest average incidence rate was noted in the Minsk region and the lowest in the Grodno and Gomel regions.

Analysis of the mortality rate from AAA among children 0-17 years old showed that the average value was 0.044 cases per 100 thousand of the child population. The maximum average mortality rate was recorded in the Brest region, the minimum in the Grodno region.

No dependence of the morbidity and mortality rate on the level of radioactive contamination after the accident at the Chernobyl nuclear power plant was found. There are two explanations for this: probably, such dose values do not lead to the occurrence of this disease, or it has a stochastic nature, which requires taking into account the incidence over a much longer period of time; the analysis should be carried out in more details, taking into account the distribution of indicators by districts, and not regions. It should be noted that cases of aplasia of hematopoiesis, as a manifestation of radiation sickness, are recommended to be considered separately.

The causes of acquired aplastic anemia are diverse (viruses, ionizing radiation, chemicals, heredity, medications, etc.) but often the etiology cannot be established.

Treatment for severe and supersevere AA should be started immediately after diagnosis, as the condition of severe all-cell deficiency is life-threatening. There are highly effective methods of treating this disease today. The most common and effective treatment for children is hematopoietic stem cell transplantation from a related fully matched donor, which is successful in 90% of cases. Due to the fact that the patient often does not have a related donor, some difficulties may arise. In this case immunosuppressive therapy is performed in first-line therapy. The response to this therapy is usually slow: if successful, the bone marrow will gradually regenerate several weeks or months after the drug is administered and begin to produce healthy cells.

Due to the fact that the disease is very serious it is necessary to study more details of the issue. It will allow reducing the level of morbidity and mortality and diagnosing the disease at early stage.

ANALYSIS OF BIOCHEMICAL INDICES OF PERIPHERAL BLOOD OF PATIENTS WITH METABOLIC SYNDROME IN COGNITIVE DYSFUNCTION

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The comparison of biochemical indicators (uric acid, bilirubin, creatinine, a lipidic profile) in patients with cognitive dysfunction against the background of a metabolic syndrome and without the expressed metabolic violations is carried out in the work.

Keywords: cognitive dysfunction, metabolic syndrome, biochemical indices, uric acid, creatinine, HDL, LDL, bilirubin.

The study included 60 patients treated at the State Institution «P.M.Masherov Republican Clinical Hospital for the Disabled of the Great Patriotic War». Cognitive disorders in relation to the state of the emotional sphere represent both a medical and social problem, being one of the reasons for the restriction of working capacity in patients with metabolic syndrome. The prevalence of cognitive impairment in different populations is not the

same. In addition, the statistical analysis provides information on the number of patients with both moderate and mild cognitive impairment in various age groups, including persons of working age. [1] The assessment of the patient's cognitive functions is an integral part of the clinical study of neurological status. The quantitative and qualitative features of the detected cognitive impairment play an important role in the syndromic, topical, nosological, differential diagnosis of diseases of the nervous system. Analysis of data from the current world literature showed that cardiovascular pathology and individual components of metabolic syndrome are associated with cognitive disorders and dementia. However, until now, the pathogenesis of the formation of cognitive dysfunctions in these categories of patients remains completely unexplored.

The study included 60 patients treated at the State Institution «P.M.Masherov Republican Clinical Hospital for the Disabled of the Great Patriotic War.» The average age of patients was 65.01 ± 12.25 years. During the work, all patients were divided into 3 groups of 20 people: 1st group - control, persons without cognitive dysfunctions, 2nd group - persons with mild cognitive dysfunction without metabolic disorders, 3rd group - persons with cognitive disorders and with clinically established metabolic syndrome. The test parameters were determined on an automatic biochemical analyzer BA-400 (Spain) using Biosystems, (Spain) reagent kits.

The study included 60 patients treated at the State Institution. During the work, the content of uric acid was studied. It was established that in the control group (1st group) this parameter was 336.98 ± 63.91 μmol/l, in the 2nd group - 321.8 ± 47.7 μmol/l, in patients of the 3rd group the uric acid index was 411.96 ± 94.5 μmol/l. Statistical analysis of the obtained data revealed that this indicator in the 3rd group of patients is significantly higher than in the 1st group by 1.2 times (p(Manna-Whitney) = 0,0032) and higher than in the second group by 1.3 times (p(Manna-Whitney) = 0,0007). When studying the blood creatinine content in the study groups of patients, it was revealed that in the 1st group this indicator was 85 ± 22.5 μmol/l, in the 2nd group - 79.95 ± 12.6 μmol/l, in the 3rd group - 101.53 ± 26.9 μmol/l. Analysis of the data showed that creatinine content in those with cognitive disorders and metabolic syndrome was 1.3 times higher than in those without pronounced metabolic syndrome (p(Manna-Whitney) = 0.008) and 1.2 times higher compared to the control group (p (Manna-Whitney) = 0.042). Changes in blood lipid scores are directly associated with metabolic syndrome and correlate with patients' cognitive dysfunction. [2] The high density lipoprotein (HDL) cholesterol content in the 1st group of patients was 1.81 ± 0.44 mmol/l, in the 2nd group - 1.29 ± 0.25 mmol/l, in the 3rd group - 1.59 ± 0.25 mmol/l, which is characterized by a statistically significant decrease of this indicator in the 2nd group by 1.4 times (p(Manna-Whitney) = 0.0003) and The content of low density lipoprotein cholesterol (LDL) in the 1st group of patients was 2.57 ± 0.65 mmol/l, in the 2nd group - 2.07 ± 0.44 mmol/l, in the 3rd group - 3.6 ± 0.69 mmol/l. Individual analysis of the data showed that in the 3rd group of patients, LDL content is 1.73 times higher than in the 2nd group (p(Manna-Whitney) = 0,0001) and 1.4 times higher than in the 1st group of patients (p(Manna-Whitney) = 0,0413). Analysis of peripheral blood bilirubin in these patient groups showed no statistically significant differences.

Thus, according to preliminary data, it can be concluded that metabolic syndrome against the background of cognitive disorders is characterized by significant changes in biochemical indicators: an increase in uric acid and creatinine by 1.2 times, LDL by 1.73 times and a decrease in HDL by 1.4 times, which must be taken into account to predict the course of the disease and select treatment tactics in the optimal volume.

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ANALYSIS OF CARDIOLOGICAL PATIENTS INCIDENCE ON THE ULTRASOUND «GANTSEVICHI CRH» IN THE BREST REGION

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In modern conditions, the amount of patients with cardiovascular system diseases that applied for medical care at the Gantsevichi CRH in the cardiology department in 2016 was about 367,1 people per 1000 population of the district, in 2017 – 378,9. According to nosology, in the first place among the diseases of the cardiovascular system are arterial hypertension, coronary heart disease with arterial hypertension, cerebrovascular disease.

Keywords: cardiovascular diseases, cardiovascular system, environmental and social factors.

Heart diseases, along with cancer and diabetes, firmly hold the lead among the most common and dangerous diseases of the 21st century [1]. WHO experts predict a further increase in morbidity and mortality, both in developed and developing countries, due, first of all, to the peculiarities of the lifestyle [2].

In modern conditions, the incidence rate of cardiovascular diseases in the health care institution «Gantsevichy CRH» in 2016 was about 367,1 people per 1000 population of the district, in 2017 – 378,9. If we compare 2016-2017, then changes are observed towards an increase in the considering indicator. According to nosology, in the first place among diseases of the cardiovascular system are arterial hypertension, ischemic heart disease on the background of arterial hypertension, cerebrovascular diseases (table 1), which also finds confirmation in many scientific studies [1, 2].

Table 1

The structure of the incidence of heart disease according to the data of the Healthcare Institution «Gantsevichi CRH» for 2016-2017

Distribution by category (Line code according to ICD-10)	Number of patients (people)	Specific gravity (%)	Number of patients (people)	Specific gravity (%)
	2016 year		2017 year	
	10229	100	10443	100
Arrhythmias (10.3)	3376	34,7	3145	30,8
Coronary artery disease (10.4)	3843	39,5	4315	42,3
Cerebrovascular diseases (10.8)	1967	20,2	2182	21,4
Vascular disease (10.9-10.10)	338	3,6	330	3,1
Other diseases	402	3,9	471	4,5

Of the total number of patients with heart disease, there are much more men than women (the differences are significant, P <0.05) (Table 2).

Table 2

Gender structure of patients with CVD according to the data of the Healthcare Institution «Gantsevichi CRH» for 2016-2017

Группы	Number of patients (people)	Specific gravity (%)	Number of patients (people)	Specific gravity (%)
	2016 year		2017 year	
Men	6260	61,2	5712	54,7
Women	3969	38,8	4731	45,3
M±m	5114,5±1145,5	-	5221,5±490,5	-

Note: P <0.05 (significant differences)

Pensioners are much more likely to seek help (the differences are significant, P <0.05). The relationship between the number of cardiac patients and the season has not been established (P> 0.05).

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ANALYSIS OF MORTALITY OF THE POPULATION OF VITEBSK REGION FROM CARDIOVASCULAR DISEASES FOR THE PERIOD 2008-2019

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Abstract: the paper analyzes the dynamics of mortality from CVD against the background of other causes of mortality and identifies its main trends in the Vitebsk region in 2008-2019.Relative indicators (intensive and extensive) were calculated, regression analysis was performed to determine trends, and growth rates were calculated for individual time intervals.

Keywords: cardiovascular diseases, dynamics, mortality, neoplasm, diseases of the nervous system.

The relevance of the problem covered in this paper is very high and is justified by the high prevalence of CVD. It is important to study risk factors, disease clinics, diagnostic and treatment methods, as well as to improve prevention and awareness of the population, increase people's motivation to follow a healthy lifestyle and treat arterial hypertension, which can cause such serious complications as heart attacks and strokes.

When analyzing the long-term dynamics (2008-2019) of mortality in the Vitebsk region from cardiovascular diseases, a slight upward trend in mortality from this cause was noted.

At the same time, the analysis of the annual growth rate of mortality in the Vitebsk region from cardiovascular diseases showed significant changes in this indicator in the period from 2008 to 2019.

Thus, according to the results of this work, when analyzing the long-term dynamics of the death rate of the population of the Vitebsk region from cardiovascular diseases, there was a pronounced tendency to reduce the number of deaths during 2008-2015 from 760.9 to 636.0 per 100,000 people, which was 16.4%. At the same time, during 2015-2019, the analysis revealed a steady trend towards an increase in mortality from 636.0 to 814.2 per 100,000 population, which caused an increase of 178.2 people per 100,000 population, or 28 %.

Analysis of the dynamics of mortality for other classes of causes of death for the same period – 2008 – 2019 showed the following results:

- mortality due to neoplasms increased slightly by 2.1 % – from 13.5% to 15.6% of the total number of deaths;
- mortality due to diseases of the nervous system has shown a steady upward trend. It increased 21.3 times from 0.6% in 2008 to 12.9% in 2018 of the total number of deaths from all causes;
- mortality from external causes steadily decreased almost twice – from 11.8% in 2008 to 6.9% in 2018.

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ANALYSIS OF SENSITIVITY OF *PROTEUS MIRABILIS* TO ANTIBACTERIAL DRUGS *IN VITRO*

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Enterobacteriaceae are one of the most common families of microorganisms. Proteus mirabilis is a prominent representative. Its strains are widely distributed in the environment and can be found in soil, gastrointestinal tract, water sources and sewage [1]. Because bacteria of this type are opportunistic, they often cause various forms of infections in humans. One way to combat foodborne diseases and purulent-inflammatory processes caused by bacteria of the genus Proteus is antibiotics. The use of various broad-spectrum antibiotics makes it possible to identify the most effective antibiotic to combat this opportunistic pathogen [2].

Keywords: Proteus, Proteus mirabilis, sensitivity, antibiotics, resistance, cooked pasteurized sausages, food toxicoinfections, pyoinflammatory diseases.

During the study, the following research methods were used: methods for obtaining pure bacterial cultures of *Proteus mirabilis* using the Mossel differential diagnostic medium (MYP-agar); disk diffusion method; microscopic methods: Gram stain, Burri-Gins method. The material for the research was pure bacterial cultures of *Proteus mirabilis*, which was isolated and identified from expiring cooked pasteurized sausages and antibiotics of various groups: penicillins, cephalosporins, some broad-spectrum antibiotics.

Based on the analysis carried out to study the sensitivity of *Proteus mirabilis t*o antibacterial drugs *in vitro*, it was shown that ticarcillin (10 μg, the zone of growth retardation (ZGR) – 23 ± 0.46 mm) and cefotaxime (30 μg, ZGR – 12 ± 0.24 mm) were more effective in the groups of penicillins and cephalosporins – 12 ± 0.24 mm). Based on the data obtained, it can be assumed that they could be used for therapeutic purposes to treat infectious diseases caused by bacteria of the genus *Proteus*. The least sensitive are amoxicillin (20 μg, ZGR – 6 ± 0.12 mm) and ampicillin (10 μg, ZGR – 6 ± 0.12 mm). It is possible that the effect of amoxicillin and ampicillin at the concentration used by us, is not sufficient to suppress the growth of bacteria of the genus Proteus. Carbenicillin (100 μg, ZGR – 2 ± 0.04 mm) and cephalothin (30 μg, ZGR – 2 ± 0.04 mm) were practically inactive antibiotics in relation to suppressing the growth of *Proteus mirabilis*. Therefore, considering the sensitivity of *Proteus mirabilis* to antibiotics of the penicillin and cephalosporin groups, it can be said that most of them did not show resistance against suppressing the growth of *Proteus mirabilis*.

The sensitivity of pure bacterial cultures of *Proteus mirabilis* in relation to some broad-spectrum antibiotics was studied. It was found that the *Proteus mirabilis* strains are most sensitive to ketoconazole (20 μg, ZGR – 20 ± 0.4 mm), ciprofloxacin (5 μg, ZGR – 16 ± 0.32 mm), furadonin (300 μg, ZGR – 12 ± 0.24 mm) and vancomycin (100 μg, ZGR – 10 ± 0.2 mm). Antibiotics from the tetracyclines group were revealed not to affect the suppression of the growth of bacterial cultures and cannot be used in medical treatment. According to the results of the study, it can be stated that the proteas are resistant to most of the studied drugs. Bacterial cultures of *Proteus mirabilis* proved to be resistant to streptomycin, neomycin, clarithromycin, erythromycin, tetracycline, doxycycline, norfloxacin, clotrimazole, and chloramphenicol.

According to the general results of the study, an increased sensitivity of bacteria of the genus *Proteus* was observed, mainly to ticarcillin, ciprofloxacin, ketoconazole. To achieve the fastest possible therapeutic effect against Proteus infection, it is recommended to use 2-3 types of antibiotics in the complex treatment.

The results obtained may indicate a different degree of resistance of *Proteus mirabilis* bacteria to broad spectrum antibiotics. The results can be taken into account when giving recommendations on the choice of antibiotic drugs aimed at reducing the development of foodborne toxicoinfections and pyoinflammatory processes.

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ANALYSIS OF THE INCIDENCE OF RESPIRATORY SYSTEM PATHOLOGY OF THE POPULATION OF MINSK AND THE MINSK REGION

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Analysis of the presented data showed that the incidence of respiratory pathologies in the city of Minsk is higher than in the Minsk region over the studied period of time. Over the past years, a dynamic increase has been seen in the number of patients of childhood and a decrease in the proportion of adults in the city of Minsk. In the Minsk region, the proportion of patients of childhood is increasing, and the proportion of adult patients is decreasing.

Keywords: respiratory diseases, morbidity, population of Minsk and Minsk region.

Respiratory organs are the system responsible for supplying the body with oxygen and excreting life products like carbon dioxide.

The increase in morbidity and mortality from diseases of the respiratory system in Belarus is due to some objective and subjective factors. The main share of newly detected diseases (71.65%) is respiratory diseases caused by non-professional factors.

Respiratory diseases remain the leading cause of premature death and disability in the European region.

Therefore, the aim of the study was to provide a comparative analysis of the incidence of the population of Minsk and the Minsk region with respiratory system pathologies.

The assessment of respiratory morbidity in Minsk and Minsk region was carried out by statistical methods.

It was established that the incidence in the city of Minsk increased by 11761 people over the period from 2015 to 2020, there was a significant increase in the incidence of respiratory pathologies, from 2015 to 58871 cases by 100 thousand, to 2020 years 70632 cases per 100 thousand population.

In half of the large cities of the Minsk region (Borisov, Dzerzhinsk, Soligorsk), there has been a significant increase in the total incidence of respiratory pathologies in recent years among the population.

The incidence in the Minsk region increased by 4489 people from 2015 to 2020, there is an increase in the incidence of respiratory pathologies from 40,876 cases per 100 thousand population in 2015 to 45,366 cases per 100 thousand population in 2020.

In such cities of the Minsk region as Molodechno and Slutsk, there is a slight increase in the incidence of this group of pathologies.

Thus, in recent years, respiratory diseases (47%) have taken the leading position among all diseases in the Republic of Belarus. According to WHO, respiratory diseases also occupy a leading position in the world (52%).

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ANALYSIS OF THE MECHANISMS OF INTRACELLULAR CALCIUM HOMEOSTASIS IN LYMPHOCYTES

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The paper analyzes the literature data revealing the role of individual mechanisms in maintaining intracellular calcium homeostasis in peripheral blood lymphocytes.

It has been shown that intracellular calcium functions as a universal secondary messenger in eukaryotic cells, including cells of the immune system. In lymphocytes, calcium signals induce various immune responses, from tolerance processes to activation of inflammation, and also mediate apoptosis of these cells.

Keywords: biological membranes, calcium channels, lymphocyte activation, calcium-binding proteins.

Calcium ions play an important role in the process of cell division, differentiation and apoptosis. They are necessary for the implementation of a number of vital processes in organisms - muscle contraction, transmission of nerve impulses, secretion of hormones, blood clotting, skeletal building and metabolic reactions. The slightest change in calcium homeostasis leads to significant changes in the functioning of cellular systems, such as storage and implementation of genetic information - the structure of DNA and RNA, mechanisms of replication, transcription and translation [2].

Biological membranes play an important role in maintaining intracellular calcium homeostasis. Due to the selective action of the cell membrane, the concentration of Ca2+ inside the cell is much higher than outside it. Con-versely, the concentration of calcium inside the cell is hundreds of thousands of times less than outside. An increase in the concentration of Ca2+ in the intracellular solution triggers a number of biochemical and physiological process-es - contraction of muscle fibers, transmission of nerve impulses from one neuron to another, blood clotting and hormone release. The increase in the concentration of Ca2+ in cells is short-term [2].

Based on the above, the paper analyzes the literature data concerning the disclosure of the mechanisms of regulation of intracellular calcium homeostasis in peripheral blood lymphocytes.

Significant Ca2+ current into the cell is carried out through the channels of the plasma membrane of lymphocytes. Calcium channels provide calcium entry into the cell. They are a family of channels that are selectively per-meable to Ca2+. There are 28 channels (TPR) in mammals. They provide taste transmission, pain sensitivity, ther-mal sensitivity, maintenance of osmoregulation and calcium homeostasis in the body.

Organelles such as mitochondria play an equally important role in maintaining calcium homeostasis. Ca2+ homeostasis in mitochondria is an important component of the calcium-mediated cellular response to extracellular stimuli, since it controls key mitochondrial functions [1]. Mitochondria regulate the level of Ca2+, acting as buffers, activating or limiting the action of calcium signals in the cell, namely, regulating the level of Ca2+ in the cytosol and cytoplasmic microdomains, changing the frequency of oscillations of calcium signals and decreasing the amplitude of propagating waves.

The ability of mitochondria to absorb Ca2+ influences the formation of calcium signals and their distribution. During the activation of lymphocytes, mitochondria localized near the immunological synapse, form a com-plex structural complex connecting the membranes of the endoplasmic reticulum with the membranes of mito-chondria and the plasma membrane. By absorbing ions from the intracellular environment, these organelles accu-mulate them in the mitochondrial matrix and release an excess amount into the cytosol [1].

In the blood, calcium is in a protein-bound form. Ca2+ is one of the universal regulators of numerous processes occurring in the cell [2].

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ANALYSIS OF THE PREVALENCE OF BONE-MUSCULAR SYSTEM AND CONNECTIVE TISSUE DISEASES AMONG THE POPULATION OF GOMEL REGION IN 2013-2018

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This work is devoted to the problem of the prevalence of diseases of the musculoskeletal system and connective tissue. The subject of the study is the prevalence of the diseases of musculoskeletal system and connective tissue. The purpose of the work is to analyze the prevalence of diseases of the musculoskeletal system and connective tissue among the population of Gomel region in 2013-2018. Great attention to the problem of diseases of the musculoskeletal system and connective tissue is due to its socio-economic importance. This class of diseases occupies one of the leading places in the structure of primary and general morbidity in the world's population. Diseases of the musculoskeletal system and connective tissue include over 100 diseases and

syndromes. This type of diseases are the most common cause of long-term pain and disability, affecting hundreds of millions of people worldwide.

Keywords: diseases of the musculoskeletal system and connective tissue, morbidity, disability, mortality, socio-economic significance.

Diseases of the musculoskeletal system are pathological changes in the structures of the skeletal system, tendons, joints and skeletal muscles, which cause dysfunctions of the body.

There are 150 types of musculoskeletal diseases. They range widely, from acute and short-term events - fractures, sprains and dislocations - to lifelong disabilities associated with chronic pain and disability.

Diseases of this group affect people of all age groups in all regions of the world. Although the prevalence of these diseases increases with age, they also affect younger people. Women suffer more often than men. The highest incidence rate falls on the working age of 30-50 years.

Diseases of the musculoskeletal system and connective tissue are usually characterized by pain and decreased mobility, motor skills and functionality, which limits a person's ability to work and perform social functions, thereby having a negative impact on mental well-being and the well-being of the general population. Treatment of these diseases is associated with significant economic costs.

According to a study by the World Health Organization, diseases of the musculoskeletal system rank second among the factors of disability in the world (they accounted for 16% of all years lived with disability). Diseases of the musculoskeletal system rank third among the causes of disability in Belarus - 8.6% among other diseases. At the same time, 42.7% in the structure of diseases of the musculoskeletal system is the pathology of the spine, 25.5% - arthrosis of large joints (knee, hip).

Diseases of the musculoskeletal system has been a slight increase in these diseases, primarily due to improved diagnostics, and not due to an increase in the number of pathologies over the past 10 years.

Every ninth inhabitant of the Republic of Belarus suffers from diseases of the musculoskeletal system. More than 90% of patients who work at industrial enterprises in recent years have annually been temporarily disabled, create a significant precedent of disability, which entails significant economic and social losses. Treatment requires large economic costs for both the state and individual patients.

The overall dynamics of the incidence rate of this group of diseases of the population is assessed as stable in the Gomel region. The nosological structure of the overall morbidity has not changed for several years: diseases of the musculoskeletal system and connective tissue remain in fourth place among all diseases of the population of the Gomel region, occupy one of the leading positions among the causes of disability in the population and are second among diseases with temporary disability. The mortality rate due to diseases of the musculoskeletal system and connective tissue is quite low. There is no infant mortality from diseases of this group.

ANALYSIS OF THE QUALITY OF TREATMENT OF CERVICAL CANCER BY COMBINED RADIOTHERAPY

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We analyzed the results of treatment of cervical cancer depending on the diagnosed stage of disease, presence of complications at the end of the course of brachytherapy, the complication, delivered doses in the State in-stitution «N. N. Alexandrov national cancer centre of Belarus».

Keywords: cervical cancer, radiotherapy, brachytherapy, radiation damage, radionuclide sources.

The effectiveness of radiation in oncology largely depends on the choice of the optimal method of lu-cha therapy. In order to determine the quality of cervical cancer treatment by the contact radiation tera-fdi method, a statistical analysis of two-year treatment results of 183 patients was carried out at the State institution «N. N. Ale-xandrov national cancer centre of Belarus» in Minsk depending on the diagnosed stage of the disease, the presence of complications at the end of the course of bra-chitherapy, the type of complications delivered dose. For the anal-ysis of results of treatment the dose brought in the clinical volume of a target of EQD_2 D90 CTV HR (D90) in which existence of not visualized microscopic invasion of a malignant new growth is possible is chosen. For each patient, this dose is different.

According to international recommendations [1], the dose per clinical volume of a high rice tumor per course of radiation treatment should be more than 80 Gy or 85-90 for large (more than 4 cm) volumes of the target or in

the absence of a response after remote radiation therapy. Combined brachytherapy is used at the N.N. Alexandrov Republican Scientific and Practical Center for Oncology and Medical Radiology with the placement of additional intra-tissue needles in the cervix. The use of additional needles in the conduct of brachytherapy allows not only to increase the coverage and the delivered dose to the target with not exceeding tolerant doses to critical organs, but also to increase the dose concentration at the edges of the cervix, which leads to improved local control of the dis-ease [2, 3].

Studies have shown that the number of complications per critical organ is 5% of the total number of pa-tients. Table 1 shows the results of analysis of patient distribution based on treatment results.

Table 1

Proportion of patients by treatment results

Patient category	Number of patients	Proportion of total patients
Full regression	96	63,58%
Partial regression	38	25,17%
Process stabilization	3	1,99%
Primary incuracy	12	7,95%
Tumor progression	2	1,32%

The findings suggest that the largest number of patients (63.58% of the total) experienced complete regression of the tumor process. The smallest number of patients showed tumor process stabilization and tumor progression. It was established that in patients with disease progression, the average dose delivered to the tumor was D90 lower than 80 Gy, and in patients with complete regression - more than 85 Gy.

The established possibility of assessing the dose for critical organs allows optimizing the dose distribution for the target. The results obtained can be used in selecting treatment plans. Based on the study, a list of recommenda-tions for choosing an op-optimal radiation plan for patients with cervical cancer receiving brachytic rapia treatment was developed.

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ANALYSIS OF TOOTH MORBIDITY IN THE POPULATION OF GOMEL AND GOMEL REGION

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The analysis of the presented data showed that there is an increase in tooth morbility from 407,516 cases per 100 thousand people in 2015 to 408,240 cases per 100 thousand people in 2019 in Gomel. In such towns of Gomel region as Zhlobin, Mozyr an increase in dental morbility was observed and in Rechitsa and Khoiniki - a slight decline.

Keywords: dental diseases, clinical picture, classification, symptoms, morbidity.

In the Republic of Belarus uncomplicated cavity is found with the highest frequency among the population (92.2%), periodontitis (24.6%) and pulpitis (31.1%) are much less common.

In Rechitsa the level of total dental morbidity in 2015 was 59517 cases per 100 thousand, in 2016 - 59632 cases per 100 thousand, in 2017 - 60366 cases per 100 thousand, in 2018 - 59621 cases per 100 thousand, in 2019 - 60,200 cases per 100 thousand.

In Gomel there was an increase in dental morbility from 407,516 cases per 100 thousand people in 2015 to 408,240 cases per 100 thousand people in 2019.

In Zhlobin the analysis of the dynamics of the overall incidence of teeth showed: in 2015 - 60,722 cases per 100 thousand, in 2016 - 60,825 cases per 100 thousand, in 2017 - 62,051 cases per 100 thousand, in 2018 - 68120 cases per 100 thousand, in 2019 - 65 766 cases per 100 thousand. In the period from 2015 to 2019 inclusive, the number of total morbidity in Zhlobin increased by 5044 people.

Analysis of the overall morbidity of the population of Mozyr with dental pathologies showed: from 2015 - 97966 cases per 100 thousand, in 2016 - 98862 cases per 100 thousand, in 2017 - 98478 cases per 100 thousand, in 2018 - 98563 cases per 100 thousand, in 2019 - 100 204 cases per 100 thousand people.

It should be noted that the incidence of teeth in the city of Zhlobin and Mozyr is predominantly higher than in the Gomel region for the period under study. This may be due to the high population density, malnutrition, which is typical for large cities, as well as the difficult environmental situation.

The analysis of the dynamics of the incidence of tooth morbility of the population in Khoiniki over the past years showed a decline in the incidence of teeth, from 2015 - 9961 per 10 thousand, in 2016 - 9801 per 10 thousand, in 2017 - 9720 per 10 thousand, in 2018 - 9605 per 10 thousand, in 2019 - 9510 per 10 thousand people. This dynamics can be explained by the actions of the town health care aimed at improving work and measures to prevent morbidity.

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ANTAGONISTIC ACTIVITY OF *BACILLUS* THURINGIENSIS BACTERIA IN RELATION TO SOME SANITARY-INDICATIVE MICROORGANISMS

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The main task of research and development of biotechnology is to search and reception of means of struggle against pathogens which are safe for humans and the environment. Currently the creation of new biologics based on bacterial antagonists, especially bacterial strains of *Bacillus thuringiensis (Bt)*, is becoming more and more relevant. Antagonistic activity of Bt bacteria in relation to some sanitary-indicative bacteria was found. All strains of the studied bacteria of the genus *Bacillus* were found to have a bactericidal or bacteriostatic effect in relation to the test objects under study.

Keywords: antagonistic activity, bacteria of the genus *Bacillus, Bacillus thuringiensis*, strains.

To study this issue the following research methods were used: isolation and cultivation of antagonist strains and test cultures were carried out using differential diagnostic nutrient media; microscopic, biochemical, and cultural methods. The analysis of *Bt* antagonistic activity in relation to sanitary-indicative bacteria was carried out by the agar block method. The study material was natural strains of *Bt* spore-forming bacteria that were independently isolated from soil and identified using differential diagnostic media. Antagonism of bacteria of the genus *Bacillus* was determined by the zone of growth retardation (ZGR) of opportunistic microorganisms during joint cultivation of bacteria under conditions optimal for the growth of test cultures.

During the study of antagonistic activity in relation to sanitary-indicative microorganisms of soil and water it was found that *Bt* exhibit a high level of antagonistic activity in relation to the strains of Escherichia coli ATCC

25922 (ZGR 8 ± 0.16 mm), *Escherichia coli* B (ZGR 6 ± 0.21 mm), *Escherichia coli* M-17 (ZGR 6 ± 0.19 mm). After analyzing the data the bactericidal and bacteriostatic effects of natural strains of Bt bacteria were revealed.

However, when studying the antagonistic activity of sanitary-indicative air microorganisms, it was found that Bt bacteria did not show antagonistic activity against *Staphylococcus aureus* and *Staphylococcus epidermidis*. Based on this we can conclude that respectively probiotic and antibacterial drugs based on Bt can not be used to suppress the growth and development of *Staphylococcus aureus* and *Staphylococcus epidermidis.*

Therefore, after analyzing the data obtained we can say that the use of the studied strains of bacteria of the genus *Bacillus* is promising. Given all their advantages namely the ubiquity of this genus, development cycle, unusual resistance of their spores to chemical and physical agents and pathogens and the release of biologically active substances which cause a high bactericidal and bacteriostatic activity of these bacterial strains against the pathogenic microorganisms it is possible to evaluate selected strains as promising objects in the creation of biological preparations [1].

Thus the antagonistic activity of the studied spore-forming bacteria justifies the possibility of expanding the scope of practical use of *Bt* bacteria. The effectiveness of antagonistic activity can be used for test systems that allow assessing the sanitary condition of soil, water and air.

This study allows us to identify new areas of possible application of the antagonistic properties of Bt bacteria in relation to the main contaminants of the human environment.

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ANTIBIOTIC RESISTANCE STUDY OF THE MAIN REPRESENTATIVES OF THE ENTEROBACTERIACEAE FAMILY

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The most active microorganisms populate the gastrointestinal tract due to the abundance and diversity of nutrients in it. The nature of the relationship of these microorganisms with the host may be different. Recently, the understanding of the importance of *Enterobacteriaceae* bacteria in human life has expanded. Representatives of this family are widely distributed in nature and most of them are normal microflora of the gastrointestinal tract. However, among these microorganisms there are pathogenic variants that can cause both independent diseases and various inflammatory processes.

Keywords: Enterobacteriaceae, microflora, *Escherichia coli, Klebsiella, Enterococcus*, pathology, antibacterial drug, sensitivity, resistance.

The formation of resistance in microorganisms is a recognized threat to patient safety, as it significantly reduces the effectiveness of the treatment process, contributes to the development of serious complications and mortality, lengthens the time and increases the cost of treatment. The administration of antimicrobial drugs, without sufficient information about the infectious agent that caused the disease, as well as about the spectrum and degree of resistance/sensitivity, leads to widespread consumption of ineffective drugs, increases the selective pressure of antibiotics on microbial populations, and contributes to the emergence and spread of multiple-resistant strains. Treatment of a number of infectious diseases is becoming more complex, there are microorganisms with multidrug resistance, against which even the most modern means are ineffective [1, 2].

The analysis of the resistance of bacteria, the main representatives of *Enterobacteriaceae* to antibacterial drugs in health care institutions of Rechitsa district was carried out. Antibiotic therapy and the correct strategy of the medical institution in choosing antibiotics provide significant assistance in solving this problem [3]. The analysis of the antibiotic resistance of the main representatives of the most frequently detected microorganisms was also carried out, and the following conclusions can be drawn:

1. *E. coli* is part of the normal microflora in humans, but it is also the most common cause of infection of the gastrointestinal tract, bloodstream and urinary tract. For therapeutic treatment, it is advisable to use antibacterial

drugs of the carbapenem group (resistance to this group of the drug is 0%), as well as aminoglycosides and drugs of combined action. The greatest resistance of this pathogen is shown to penicillins, cephalosporins and fluoroquinolones;

2. Most infections caused by K. *pneumoniae* often affect the respiratory tract, the bloodstream. The results of a study of the resistance of this microorganism have shown that this pathogen is the least resistant to antibiotics of the carbapenem group;

3. The vast majority of gastrointestinal infections in humans are caused by *Enterococcus bacteria* (*E. faecalis* and *E. faecium*). The results of the antibiotic resistance study showed an increase in the resistance of these bacteria to gentamicin. Vancomecin, in turn, shows stability of effective therapeutic action (the resistance of microorganisms is extremely low), so when conducting treatment, you should pay attention to this particular drug.

Thus, the traditional approach (treatment with broad-spectrum antibacterial drugs) is gradually disappearing from practice, due to the spread of highly resistant strains. In addition, treatment with a non-specific antibiotic leads to the fact that the normal microflora of the body suffers greatly, and the pathogenic flora adapts to antibiotics. Currently, the results of determining the degree of resistance of microorganisms can serve as a good guide for clinicians to choose and correct antibacterial therapy.

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ANTI-CHLAMYDIA ANTIBODIES: DIAGNOSTIC AND PATHOGENETIC SIGNIFICANCE OF CLASS AFFILIATION

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As a result of the studies carried out, the diagnostic and pathogenetic significance of anti-Chlamydial immunoglobulins of different classes was analyzed. It was found that the titer level of anti-chlamydia antibodies of different classes depends on the immunoreactivity of the body, and on the rate of their elimination, which is manifested by a wide variation of antibody titers in the blood serum.

Keywords: Chlamydia, anti-chlamydia antibodies, immunoglobulin, forms of chlamydia infection, chlamydia life cycle, ways of transmission of chlamydial infection.

Introduction: Chlamydia infection is widespread nowadays; it affects human reproductive function. Chlamydial infection is often latent, which does not allow the modern start of therapy. Since it often takes on a chronic course, the immune status is especially important for this condition. It is composed by various mechanisms, among which antibodies occupy a particularly active position.

The presence of anti-chlamydia antibodies in the body is determined using the ELISA method. ELISA is based on the detection of genus-specific LPS of chlamydia. Chlamydia antigens have low immunogenicity, so that the production and accumulation of antibodies in the body occur in small quantities.

Specific anti-chlamydia antibodies of various classes (IgM, IgG, IgA) are detected in the blood serum. An increase in the IgA titer occurs in the acute form of the infectious process, exacerbation of chronic chlamydia. They can be found in 10-14 days after infection, in children, the indicators are usually always a little higher than normal. The values increase within 2-3 months after infection. If the treatment is chosen correctly, the number of type A antibodies begins to decrease and reaches the norm by the end of the 16th week of the disease. IgA exists in serum and secretory forms. IgM – positive value indicates active growth of pathogenic bacteria, acute phase of pathology. IgM antibodies are detected as early as 5 days after the onset of the disease. IgG – appear in the blood 15-20 days after infection after an infection, IgG can be detected in a low titer for many years.

Materials and methods: the object of the study was the peripheral blood of patients with different titers of anti-chlamydia antibodies. To determine the antibodies to Chlamydia trachomatis, the method of enzyme immunoassay was used.

Research results: in the groups of examined individuals, the level of antibody titer of different classes varied within quite noticeable limits, which can be provided by individual programs for the formation of indicators. In the diagnosis of chlamydia infection, it is important to determine IgA antibodies since they are a marker of both acute and chronic forms of infection. The presence of IgA indicates the activation of chlamydia infection. The first protective reaction of the body is the induction of secretory IgA at the sites of infection. Initially, this class of antibodies can be detected in seminal and vaginal fluids, but there is no correlation with the content of serum IgA. IgG affinity for antigenic determinants of chlamydia increases as the immune response develops. Their presence reflects a more General picture of a positive immune response in cases of current, chronic, or past infection. The increase in the concentration of IgG antibodies indicates progression of the disease, reduction of IgG level indicative of the effectiveness of treatment, after treatment, IgG may persist for up to 1 year or more IgM antibodies in the serum of patients are early markers of infection appear the first immunological response of the macroorganism infected with the chlamydia.

In the groups of examined individuals, the titer of antibodies to chlamydia in patients with chlamydia, whose antibody spectrum does not contain antigen-specific IgM, varied within quite noticeable limits, which can be provided by individual programs for the formation of indicators. The absence of IgM in the anti-chlamydia antibody sector may indicate a chronic form of infection. IgM peaks in week 1-2. Then there is a decrease in antibody titer. These antibodies are present only in the acute phase of the disease and are not detected during reinfection.

The titer level of anti-chlamydia antibodies of different classes depends on the immunoreactivity of the body, as well as on the rate of their elimination, which is manifested by a wide variation of antibody titers in the blood serum. The studied protitvochlamydial antibodies of different classes differ in the level of the immunoglobulin titer, which is accompanied by a slight correlation with gender.

ANTIOXIDANT ACTIVITY OF MILFOIL FLOWERS AND LEAVES EXTRACTS (ACHILLEA)

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A comparative study of the antioxidant activity of extracts of 10 species of flowers and leaves of yarrow was carried out. The dependences of the fluorescence intensity of fluorescein on the logarithm of the concentration of yarrow flower extracts were obtained, where the IC50 values were graphically determined. Yarrow flower extracts restored fluorescein fluorescence to 76-88% at a sample concentration of 0.1-1%, leaf extracts up to 71-85%. IC50 values were in the range of 0.47 -15.1 · 10-3 % for flowers, 0.53-2.63 · 10-2% for leaves.

Keywords: antioxidant activity, extracts of milfoil flowers, fluorescein.

The genus Yarrow (Achillea) includes more than 100 species, which are mainly distributed in the northern hemisphere. They are widely used in traditional European medicine to treat fevers, hypertension, gastrointestinal disorders, and to stop bleeding and heal wounds. Previous studies have shown that various types of yarrow have antioxidant and antiproliferative activity [1-4].

A comparative study of the antioxidant activity (AOA) of extracts of 10 species of yarrow flowers was carried out. The method for determining AOA in relation to activated forms of oxygen (ROS) is based on measuring the intensity of fluorescence of the oxidized compound and its decrease under the influence of ROS. In this work, for the detection of free radicals, fluorescein was used, which has a high extinction coefficient and a quantum yield of fluorescence close to 1. The generation of free radicals was carried out using the Fenton system, in which hydroxyl radicals are formed upon the interaction of an iron complex (Fe2 +) with ethylenediaminetetraacetic acid (EDTA) and hydrogen peroxide [5]. When fluorescein interacts with free radicals, its fluorescence is quenched, which can be restored by adding substances exhibiting antioxidant properties to the system.

Fluorescence measurements were carried out on an RF-5301 PC fluorimeter (Shimadzu, Japan). The fluorescence intensity was recorded at a wavelength of 514 nm. The excitation wavelength is 490 nm.

For all samples, the dependences of the fluorescence intensity of fluorescein on the logarithm of the concentration of extracts of flowers and leaves of yarrow were obtained. The studies were carried out in a wide range of concentrations 10-4 - 5%. Samples of yarrow extracts began to show AOA at a concentration of 10-4%. With a subsequent increase in the concentration of extracts, an increase in the suppression of the action of free radicals is observed and an increase in fluorescein fluorescence up to 81-83% at a sample concentration of 0.1%, which corresponds to a 1000-fold dilution of the original extract. The dependences are almost similar, which may indicate the same composition of substances antioxidant properties, differing in quantitative composition.

IC50 values are graphically determined - the concentration of yarrow flower extracts at which 50% inhibition of free radicals is achieved. The minimum IC50 (0.47 · 10-3 %) was obtained for a sample of Asian yarrow flowers (Kemerovo) and for a sample of the leaves of small-flowered and noble yarrow (IC50 = 0.53·10-2%), which indicates their maximum antioxidant activity

The data obtained show that each species of yarrow contains an individual set of substances responsible for antioxidant activity. The place where the yarrow grows also affects the qualitative and quantitative composition of antioxidant substances.

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APPLICATION OF ELISA IN DIAGNOSTICS OF INFECTIOUS DISEASES

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Currently, enzyme-linked immunosorbent assay (ELISA) is effectively used for laboratory diagnostics of a relatively large range of infectious diseases. At the same time, using various modifications of the method, it is pos-sible to simultaneously detect antigens and antibodies, which significantly increases the effectiveness of the study. However, the expanded opportunities for obtaining information create the requirement for the optimal integration of research areas, which creates a specialized platform for the relevance of scientific research.

Keywords: ELISA, antigen, antibody, chlamydial infection, chronic hepatitis C virus.

In the present study, it was planned to analyze a complex of indicators of humoral immunity, pro-inflammatory factors and data of an antigen-specific immune response, which makes it possible to compile a pic-ture of the features of the course of an infectious disease in an individual patient and at the level of a group of pa-tients as a whole.

A comparison of the parameters of humoral immunity in chlamydial infection and chronic hepatitis C virus (CHCV) was carried out. To do this, we calculated the median and percentiles for the indicators of both diseases and compared them using the Mann-Whitney test.

As a result, the analysis of the data obtained makes it possible to reveal significant differences in the profile of the humoral factors of immunity in chlamydial infection and CHCV. If the level of IgG, IgA, IgM, the patients of both groups actually does not differ, then the levels of IgE, CRP, RF and β-2-microglobulin are significantly higher in patients with CHCV (Table 1).

The revealed differences in the profile of humoral immunity factors can be provided by a number of factors. First, differences in the biological and antigenic organization of pathogens, and, as a consequence, differences in the formation of the immune response and immune-mediated inflammation. Secondly, individual differences in the immune system of different organisms.

Table 1

Indicators of humoral immunity in persons with chlamydial infection and CHCV
(Presented median (25th; 75th percentile))

Indicators	Groups of surveyed persons (number of persons surveyed)					
	Chlamydial infection (n=14)			CHCV (n=25)		
	Median	Percentile 25%	Percentile 75%	Median	Percentile 25%	Percentile 75%
IgG, g/l	13,05	10,8	15,1	14,6	9,1	17
IgA, g/l	3,25	2,2	4	3,64	3,24	3,95
IgM, g/l	1,32	1,1	2,1	3,2	1,24	3,65
IgE, IU/ml	10,5*	0	65	90	75	650
CRP, mg/ml	0,03*	0	0,1	3,3	2	9,1
RF, IU/ml	0,75*	0	5	0	0	0
β-2-microglobulim, mg/ml	1,46*	0,95	2,2	2,6	2,4	2,8

*Note: * - Differences between groups are significant at p <0.05 according to Mann-Whitney U-test*

Thus, the conducted research allows us to draw conclusions:

1) ELISA allows you to effectively determine antigen-specific markers of the investigated infections, which is used in the etiological diagnosis of these diseases;

2) pathogenetically investigated infectious diseases differ in their developmental mechanisms, which can be traced by differences in the profile of IgE, CRP, RF and β2-microglobulin;

3) the investigated infectious diseases (chlamydial infection and CHCV) have common features of the immunoglobulin profile, which reflects the same trends in the involvement of immunoglobulins M, G, A in the response of the body.

ASSESSMENT OF BREAST CANCER AGGRESSIVE POTENTIAL BY HER-2 / NEU AND KI-67 EXPRESSION LEVELS

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In the work, the aggressive potential of breast cancer was assessed by the levels of expression of human epidermal growth factor type 2 (Her-2 / neu) and the marker of proliferative activity (Ki-67) in 45 patients using the immunohistochemical method, as well as a statistical analysis of the relationship between the obtained results.

Keywords: breast cancer, aggressive potential, Ki-67, Her-2 / neu, tissue markers.

Breast cancer (BC) is the most common cancer in women and is a pressing health problem worldwide. In 2017, 51,080 new cases of malignant neoplasms were registered in the Republic of Belarus. The average age of the cases was 53.5 years. Among malignant diseases in the female population, breast cancer accounts for 22.2% and still occupies a leading position, while tumors expressing the human epidermal growth factor 2 type Her-2 / neu receptor are found in 25–30% of cases. Stimulation of this receptor in tumor cells is one of the main intracellular signals that trigger various cellular processes, such as proliferation and differentiation [1]. Protein Ki-67 is a reliable marker of cell proliferative activity, which is expressed starting from the late G1 phase of the cell cycle, in S, G2, and M phases and, thus, allows the entire proliferative pool of the tumor to be detected [2].

The expression of the Her-2/neu protein was assessed according to the generally accepted visual scale with the diagnosis of overexpression (3+) in the presence of continuous membrane staining in more than 10% of tumor cells in the invasive component. Proliferation was assessed by the relative number of tumor cells with an average and intense nuclear reaction to Ki-67 with dividing the results into 4 groups: no expression – up to 10% Ki-67-positive cells, low level of proliferative activity – from 10 to 30%, moderate – from 30% to 50% and a high level of proliferative activity – > 50% Ki67-positive cells.

The object of the study was the clinical data and tumor tissue of 45 patients suffering from breast cancer and receiving special treatment at the State Institution of the Republican Scientific and Practical Center for Oncology and Medical Radiology named after V.I. N.N. Alexandrova. The average age of the patients was 53.5 ± 13.8 years. The material for the study was samples of tumor tissue from patients, enclosed in paraffin blocks. Determination of the expression levels of tissue antigens (Her-2 / neu, Ki-67) in patients with breast cancer was carried out by immunohistochemical method using DAKO kits (Denmark), with an imaging system (EnVision +). Statistical data processing was carried out using the computer programs of the statistical package STATISTICA (version 10.0, «StatSoft»). The measure of the relationship between the analyzed indicators was determined by the value of the Spearman correlation coefficients (Rs) at $p \leq 0.05$.

Analysis of the data obtained on the expression level of Her-2/neu showed the absence of expression of this indicator in 36% of cases, in 24% of cases there was a low level of expression (score 1+), in 16% - a moderate level of expression (score 2+), in 24 % of cases, overexpression (score 3+) was detected in tumor cells of patients. According to the literature, overexpression of Her-2/neu indicates a poor prognosis of the course of the disease. During the study, overexpression (score2 + and score3 +) was detected in 40% of patients with breast cancer. In this regard, the detection of Her-2/neu can serve as an independent marker of a poor prognosis [3].

In the course of the study, the absence of expression of tissue antigen Ki-67 was 13% of cases (0-10%), 40% of patients had a low level of expression (10-30%), 22% (30-50%) – moderate and 24% (> 50%) overexpression of the Ki-67 antigen in tumor tissues of patients with breast cancer was found. Overexpression of the proliferative antigen Ki-67 (> 50% of cells) is associated with an aggressive course of the disease and the risk of predicting early metastasis.

The comparative correlation analysis showed that there is a moderate inverse relationship between the overexpression of tissue antigens Ki-67 (> 50%) and Her-2 / neu (score 3+) (Rs = - 0.47).

Thus, the study of molecular biological markers helps in predicting the course of the disease and is necessary for the individualization of treatment tactics.

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ASSESSMENT OF HODGKIN'S LYMPHOMA INCIDENCE AMONG THE POPULATION OF THE CITY OF MINSK

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The assessment of the spread of Hodgkin's lymphoma among the residents of the city of Minsk is given. The largest part of the incidence is registered among young people.

Keywords: lymphoproliferative disease, Hodgkin's lymphoma, prevalence.

Hodgkin's lymphoma accounts for approximately 10% of all lymphoproliferative diseases. It is characterized by a bimodal age distribution with a predominance at a young age [2]. In the WHO classification, two nosological types of Hodgkin's lymphoma are distinguished: Hodgkin's lymphoma, a nodular type of lymphoid predominance, and clas-sical Hodgkin's lymphoma, which differ in clinical, immunohistochemical and molecular genetic characteristics [1].

We analyzed the spread of Hodgkin's lymphoma disease among residents of the city of Minsk (2015-2019). The collection of material and its analysis was carried out on the basis of the Healthcare Institution "City Clinical Pathological Bureau" in Minsk. As a material for the study, we used paraffin blocks of patients with lymphoprolifera-tive diseases in Minsk with clinical and histological diagnosis.

The following methods were used in the study: histological examination (staining with hematoxylin-eosin), im-munohistochemical study (CD3, CD15, CD20, CD30, CD45, CD79a, Ki-67, Pax 5), cytogenetic analysis (CISH (Zyto Vision: EBV Probe)).

As a result of the studies, 1343 patients with a diagnosis of lymphoma were identified, 196 patients of them were diagnosed with Hodgkin's lymphoma earlier (14.59%).

Hodgkin's lymphoma was recorded during 2015-2019 research. The incidence of this disease varied from the minimum value in 2015 (10.9%) to the maximum value in 2019 (17.8%). The increase in the number of cases among the population of the city of Minsk confirms the general trend of the spread of this disease among the residents of Bela-rus.

The spread of diseases of various etiologies is determined by a number of factors, one of which is the patient's age. The age of the patients who participated in this study ranged from 17 to 89 years. For patients with a confirmed diagnosis of Hodgkin's lymphoma, the dominant group is patients at a young age from 21 to 40 years old, which is 55.6% of the entire sample of patients.

The incidence of Hodgkin's lymphoma tends to increase among the general population and especially in cities where the influence of unfavorable factors is especially significant on the condition of residents of different age groups.

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ASSESSMENT OF THE BODY'S REACTIVITY BY CELLULAR INDICATORS OF PERIPHERAL BLOOD IN PATIENTS SUFFERING FROM TUBERCULOSIS DURING THERAPY

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The work evaluated the dynamics of cellular reactivity of homeostasis in terms of peripheral blood parameters in 14 patients with tuberculosis during the therapy. As a result of the study, we found that during the treatment performed in patients suffering from tuberculosis, a statistically significant ($p\ (_{Wilcoxon}) < 0.05$) increase in the total content of erythrocytes by 6.35 times and the relative number of eosinophils by 1.35 times was revealed.

Keywords: tuberculosis, indicators of peripheral blood, cellular reactivity.

Tuberculosis is an acute infectious disease caused by Mycobacterium Tuberculosis. The main route of transmission is the aerogenic (inhalation) route of infection. Treatment of tuberculosis is a complex process that requires time and an integrated approach. The development of tuberculosis is accompanied by an immune imbalance in the cellular link [2]. The disease is often accompanied by intoxication syndrome. The success in antituberculosis therapy is largely due to the ability of the body's immune system to restructure and an adequate immune response. Evaluation of endogenous intoxication by indicators of peripheral blood allows you to assess the patient's condition according to the data of the general clinical blood test [1].

The object of the research is the clinical data of patients suffering from tuberculosis. The analysis of hematological parameters of peripheral blood in the course of treatment was carried out: platelets, eosinophils, leukocytes, lymphocytes, neutrophils, monocytes, ESR. Hematological examination was carried out using a Hemacomp 10 analyzer (Italy). The study included 14 patients with tuberculosis aged 38–59 years. The average age of patients included in the study was 49.3 ± 8.9 years.

In the course of the work, the reactivity of the organism of patients with tuberculosis was assessed according to the cellular parameters of the peripheral blood. Thus, it was found that when studying the content of erythrocytes,

this indicator during treatment statistically significantly (p (Wilcoxon) = 0.038) increased 6.35 times from 3.82 ± 0.7x1012 / l to 24.28 ± 58.4x1012 / l. Also, four patients have anisocytosis and poikolocytosis of erythrocytes, which indicates an inflammatory process. Analysis of the total platelet count (216.50 ± 55.1x109 / l) before treatment was within the normal range, followed by a slight increase in the values of this parameter (217.75 ± 42.1x109 / l) after treatment by 1.01 times (p> 0,05). The analysis of the total number of leukocytes before the start of treatment was 9.05 ± 2.9x109 / l. After treatment, this indicator was 9.73 ± 4.24x109 / l, which exceeded the norm and increased 1.07 times (p> 0.05). During the analysis of the dynamics of eosinophils, a statistically significant (p (Wilcoxon) = 0.047) increase of 1.35 times was found (before the start of treatment – 1.80 ± 1.03 %, after – 2.43 ± 1.2%). The relative number of neutrophils before and after treatment did not change significantly and, accordingly, was (64.0 ± 8.09% and 66.14 ± 11.6%), which is within the normal range. But in four patients, toxic granularity of neutrophils was revealed, which is observed in pathological processes. The relative content of lymphocytes before the start of therapy was 31.7 ± 8.04%, which was within the normal range. After treatment, this indicator (27.86 ± 11.4%) decreased 1.13 times (p> 0.05) and was also within the normal range. During therapy, the content of monocytes did not change statistically significantly (p> 0.05) and amounted to before and after treatment, respectively (3.00 ± 2.9% and 3.00 ± 1.7%). Before the start of treatment, the ESR indicator in patients with tuberculosis was (17.8 ± 22.1 mm / h). After treatment, the index (18.43 ± 23.7 mm / h) tended to return to normal and decreased 1.03 times (p> 0.05).

Thus, according to our preliminary data, we can conclude that such blood parameters as the total content of erythrocytes and the relative number of eosinophils most significantly respond to changes in the body that occur as a result of chemotherapy. However, it is necessary to monitor the dynamics of all blood cells studied by us before and after treatment for a comprehensive assessment of the body's cellular reactivity to therapy, reflecting the degree of disturbances in the homeostasis of patients with tuberculosis and the prognosis of the course of disease.

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ASSESSMENT OF THE PSYCHOLOGICAL STATE OF SCHOOL CHILDREN OF DIFFERENT AGE GROUPS

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The problem of anxiety is one of the most pressing problems in modern psychology. Anxiety occupies a special place among negative experiences, it often leads to a decrease in working capacity, productivity of activity, and difficulties in communication. The paper deals with the problem of assessing the psychological state of schoolchildren of different age groups. It was found that the level of anxiety in children of primary school age is within the normal range, while in schoolchildren of secondary school age this indicator is slightly increased. There were no differences in the level of anxiety of children depending on gender. This problem is relevant at school age, since a sharp change in the social situation of development and the leading activity of the child requires the mobilization of his cognitive and personal resources, which the child cannot always cope with without the proper support of the teacher and parents, and under an unfavorable combination of circumstances, this leads to an increased level of anxiety.

Keywords: psychological state, methods of psychological research, testing, anxiety.

A psychological state is an integral characteristic of mental activity for a certain period of time, showing the originality of the course of psychological processes depending on the reflected objects and phenomena of reality, the previous state and mental properties of the individual [1]. Psychological conditions characterize the state of the psyche as a whole. They have their own dynamics, which is characterized by duration, focus, intensity

and stability. Psychological conditions affect the course of psychological processes and can oppress them or, on the contrary, contribute to their activity. Examples of psychological states are such phenomena as stress, despondency, joy, anxiety, etc.

Anxiety is an experience of emotional distress associated with a premonition of danger or failure. It is subjectively felt as tension, anxiety, anxiety and is associated with feelings of helplessness, uncertainty. At the physiological level, anxiety reactions are manifested in increased respiration and heart rate, increased blood pressure, and increased general excitability.

School anxiety is a specific type of anxiety that is characteristic of situations of child interaction with various components of the school educational environment. It is expressed in anxiety, increased anxiety in educational situations, in the classroom, negative assessment from teachers, in anticipation of a bad attitude towards oneself.

Therefore, the aim of the work was to give a comparative analysis of the level of anxiety in children of primary and secondary school age.

We used the Phillips questionnaire to assess school anxiety. Phillips' school anxiety questionnaire refers to standardized psychodiagnostic methods and allows one to assess not only the general level of school anxiety, but also the qualitative originality of the experience of anxiety associated with various areas of school life [2].

The data obtained show that the level of anxiety in children of primary school age is within the normal range, in subjects of secondary school age this indicator is slightly increased. The level of anxiety in middle-aged schoolchildren exceeds the level of anxiety in younger schoolchildren. An increase in the level of anxiety in adolescence may be associated with the formation of character and the need for a stable satisfactory attitude towards oneself. The source of increased anxiety in adolescents is an internal conflict caused by external and internal factors. External ones include the desire to meet the requirements and expectations of people who are significant to the adolescent. To the inner ones - his personal characteristics. Both boys and girls are prone to anxiety. There were no statistically significant differences in the level of school anxiety of children depending on gender.

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BIOACTIVE PROPERTIES OF LUPINE (*Lupinus albus L.*) SEEDS AND ITS IMPORTANCE IN HUMAN NUTRITION

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As well as being used in human and animal nutrition for many years, lupen also plays a role in disease prevention and treatment due to its bioactive components. In addition to its high protein content, lupine flour is an important additive for grain products due to its high water and oil retention capacity and a good emulsifying agent. It is used in products such as lupine, bread, biscuit, cake, pasta, confectionery, soy sauce, in the production of high-quality vegetable oil with high antioxidant content, as gluten-free flour, emulsifier, alternative products to milk and cookies. Lupen is particularly useful for human health against conditions known as metabolic syndrome, which includes a number of factors such as obesity, high blood pressure, insulin resistance, high cholesterol in the blood.

Keywords: Lupine, bioactive properties, antioxidant activity, polyphenols, use in foods, nutrition.

Lupine (Lupinus albus L.) is an annual herbaceous plant that contains about 300 species of the Legumineceae family, including the Lupinus species. The lupine seeds contain about 36-52 % protein, 2-20 % fat and 30-40 % fiber. The fatty acid composition of the lupin oil consists mainly of oleic and linoleic acid. The mineral contents of

the lupine seds and in addition to this rich content, it is in a position that can compete with soy (about 40 %) with its high protein content and it has been found that it has the potential to meet a significant portion of the mineral substances that should be taken daily. Dietary fiber makes up 40 % of the grain weight of the sweet lupine and is at a higher level than other legumes. The antioxidant activity of the lupin varieties does not depend on the color or polyphenol content of the seeds. Lupen flour is an ideal food component because it has a high content of protein, dietary fiber and bioactive compound and low lipid and starch content.

In this study, the bioactive properties of loupes and loupes and their importance in human nutrition will be explained. In addition to its high protein content, lupine flour is an important additive for grain products due to its high water and oil retention capacity and a good emulsifying agent. It has become an alternative raw material for gluten-free products because it does not contain gluten and gluten-like proteins and has a high nutritional value for the diets of celiac patients. Lupen can be used as a supplement in existing products or as a source of protein or fiber in new products. Protein extracts obtained from lupine are used as food additives in the USA in the range of 1-10 % in many food products, especially bakery products, dairy products, frozen milk desserts, jams, puddings and meat products. Lupine is especially beneficial for human health in cases known as metabolic syndrome, which includes a number of factors such as obesity, high blood pressure, insulin resistance, high cholesterol in the blood. It gives fullness (appetite suppression) and provides energy balance. It affects glycemic control. It regulates blood lipids, hypertension, intestinal health.

A minor component of the lupine lipid fraction lupeol is a triterpene alcohol that promotes differentiation as well as promoting dilution of epidermal cells and inhibits the growth of melanoma cells. Lupine usually contains 36-52 % protein, 5-20 % fat and 30-40 % fiber. The composition varies depending on genetic and environmental conditions. Sodium and calcium are low compared to lupine other legumes. Caroteonids and zeaxanthin are high and give bright yellow color. While other legumes contain as much as 50 % starch, the rate of starch in lupene is low (2.3 %). The lupen protein contains high levels of lysine amino acid and low levels of methionine and cystine amino acid. Lupine is a potential source of bioactive plant components with antioxidant activity due to the chemical composition of its seeds. Seeds of low alkoloid lupen varieties are a valuable source of protein. As a valuable component of functional food, interest in lupine is growing. Lupine cotyledon is the source of antioxidant components. As in other oil plants, alpha-(85.5 %) and gamma-tocopherol (86.1 %) are dominant in lupen species. The loupe's vitamin E content is similar to soy, but its rate is lower than that of sunflower or rapeseed oil. The tannin content of lupen flour is several times higher than the tannin content in seeds. The antioxidant activity of the lupen varieties does not depend on the color or polyphenol content of the seeds. A lupine flour protected by irradiation can be considered a functional food additive to prevent negative oxidative changes during storage. The antioxidant effect of tocopherol depends on the temperature and the amount of tocopherols lost in competitive reactions with phenolics. Vitamin E prevents oxidation of cholesterol and cholesterol carrier proteins and prevents damage to the vessel wall, which leads to the development of atherosclerosis in the future.

Conclusion. It is able to compete with soy with its mineral content and high protein content in addition to this rich content, and it has been shown that it has the potential to meet a significant portion of the mineral substances that should be taken daily. This case demonstrates the importance of the work for recovering the development and dissemination of planting and breeding in the region via Turkey. Lupene seeds can be a potential source of nutritious cellulose for dietary food production. Since it contains minimal starch, its glutemic index is very low. It is extremely nutritious and easy to digest. The loupe's essential amino acids are high, cholesterol-free, contain trypsin inhibitors in an insignificant amount, saponins and lectins known as stomach irritants are very low, no chemical or heat treatment is required before consumption.

BIOCHEMICAL DISORDERS OF HOMEOSTASIS IN DEVELOPMENT OF A SYSTEMIC INFLAMMATORY PROCESS CAUSED BY CORONAVIRUS INFECTION

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COVID-19 was first detected in late December 2019 in Wuhan, China. In December 2019, the Chinese authorities informed WHO about the outbreak of unknown pneumonia. As of 12.03.2020, 126,672 cases of COVID-19 were recorded, of which 68,305 people recovered, and 4,641 people died. The outbreak of the novel coronavirus was declared a public health emergency of international concern at a meeting of the WHO Emergencies Committee on 30 January 2020.

Keywords: Morbidity, homeostasis, coronavirus, biochemical parameters, complications.

The aim of the study was to detect the biochemical changes in the homeostasis of patients with COVID-19. The study of biochemical parameters of homeostasis was carried out using an automatic biochemical analyzer BA400 (Spain) with the use of reagent kits from the manufacturer Biosystems (Spain). Statistical data processing was performed using the Microsoft Office Excel software package.

A retrospective analysis of the biochemical parameters of homeostasis in patients with the development of a systemic inflammatory process caused by coronavirus was performed. The study was conducted at the «Republican Clinical Hospital for Disabled Great Patriotic War Veterans named after P. M. Masherov». The patients were divided into three groups. The study group included patients with confirmed coronavirus who received the necessary treatment. The control group included clinically healthy people, and the comparison group included patients who were treated before the pandemic.

The results of the study revealed that the biochemical parameters of patients in the study group significantly exceed those in the other two groups. The average value of aspartate aminotransferase (ASAT) in the study group of patients was 55.23 U/l, which exceeded similar indicators in the comparison groups by 2.7 times, and the upper threshold of the norm (40 U/l) – by 1.4 times. The content of alanine aminotransferase (Alat) in the control group was 19.8 U/l, and in the comparison group – 24.55 U/l. In both cases, the results did not exceed the limits of the established norm and were 2.1 and 1.7 times lower than the indicators of the study group, respectively. Comparative analysis of creatine phosphokinase (CC) and cardiac fraction of creatine phosphokinase (CC-MV) did not reveal significant differences in the studied groups of patients. The concentration of ferritin in patients of the study group significantly exceeded the norm (485.5 mcg/l and 45.4 mcg/l, respectively) by 10.7 times. The content of highly sensitive C-reactive protein in the study group of patients revealed its high level (35.27 mg/l at normal – up to 5 mg/l) – 7.0 times higher than normal values. In the control and comparison groups, the C-reactive protein was within the normal range (1.54 and 0.59 mg/l, respectively). The results of the performed studies haven't detected any significant differences in the content of transferrin in all the study groups.

Thus, clinical and laboratory diagnostics of a new COVID-19 and the effectiveness of disease therapy are associated with the development and implementation of diagnostically significant indicators that characterize the severity of the patient's condition and the choice of an adequate amount of pathogenetically justified therapy. Informative criteria for assessing the severity of the disease will allow predicting the course of the disease, its outcome, and the amount of treatment required.

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BIOELECTRICAL IMPEDANCE DETERMINING BODY COMPOSITION AND HARDWARE-SOFTWARE RECORDING OF HEART RATE VARIABILITY DURING AN OBJECTIVE STRUCTURED CLINICAL EXAMINATION AS A DIAGNOSTIC TOOL

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Annotation: The purpose of the publication is to determine the clinical diagnostic potential and the appropriateness of applying the computerized methodology for a short record of heart rate variability and the body impedance measurement technique as an instrumental Objective Structured Clinical Examination.

Keywords: Bioelectrical impedance determining body composition, Hardware-software recording of heart rate variability, Non-communicable diseases, Objective Structured Clinical Examination.

This research work is a fragment of the initiative research project "Development of algorithms and technology for introducing a healthy lifestyle in patients with non-communicable diseases based on the study of psycho-emotional status" (State registration No. 0116U007798, UDC 613:616-052:159.942:616-03).

The aim is to determine the clinical diagnostic potential and the feasibility of Objective Structured Clinical Examination (OSCE) patients of assessing heart rate variability (HRV)-short recording of and of Bioelectrical Impedance method (BIM) determining body composition as a tool procedure in functionally healthy individuals. Materials and methods. The results of an open, non-randomized, controlled study of 82 functionally healthy people (group n1=60 athletes, average age – 20.5±4.7 years, men – 100%; control group n2=23, average age – 24.8±2.0 years, men – 78%) were taken. The formula of the methodology included the following methods of multiparameter diagnostics: 1) testing according to an adapted questionnaire with the determination of the psychological type of attitude towards a healthy lifestyle with the identification of predictors of the occurrence of NCDs; 2) BIM determining body composition was performed on a Body Composition Monitor (model HBF-500-E, Omron Healthcare, Japan); 3) HRV-short recording (background recording - 5 minutes and Orthostatic test - 3 minutes) was assessed using a complex (model Poly-Spectr, Neurosoft Company, Ivanovo, Russia).

Review. The averaged anthropometric data for the groups are given in Table1 and significant differences in the power of spectral characteristics for all indicators of the frequency spectrum were established by us (Table 2).

Table 1

General Characteristics of the body composition

	Group n1=60	Group n2=23
Weight (kg)	73.54±9.22	74.48±12.07
Height (cm)	182±6.7	176.6±7.8
Body Mass Index (BMI)	22.76±2.92	23.98±2.48
Skeletal Muscle Percentage (SMP, norm 42-54 %)	41.54±5.88	37.37±5.72*
Body Fat Percentage (BFP, norm 8-19,9%)	15.87±3.74	22.65±7.27*
Visceral Fat Level (VFL, norm 1-9 level)	4.27±1.10	6±2.42
Resting Metabolism (RM, kcal)	1742±67	1671±207

*Note * - the difference is reliable at p<0,05 between the characteristics Group n1, Group n2.*

Table 2

General indicators of Spectral Characteristics of the Heart Rate Variability

	Group n1=60		Group n2=23	
	Background recording	Orthostatic test	Background recording	Orthostatic test
TP (мс²)	24173±71872	7333±11772	2918±2042*	2614±1955**
VLF (мс²)	8442±32908	3269±8946	935.5±858.2*	880,4±818,3**
LF (мс²)	7369±29211	2918±3429	1080±808,7*	1413±1218**
HF (мс²)	8362±14530	1146±2326	902.4±759.2*	320±251.7**
LF/HF ratio	1.024±1.071	6.656±5.078	1.433±0.925	6.003±5.591

*Note * - the difference is reliable at p<0,0001 between the indicators Background recording, ** the difference is reliable at p<0,0001 between the indicators Orthostatic test.*

Conclusions: Indicators of spectral analysis of HRV and body composition (BFP, SMP) differ significantly at different levels of physical activity. This confirms the clinical value and objectivity of methods in examining the human body as screening markers of health and metabolic/energy status.

BORON NEUTRON THERAPY − BORON-10 DELIVERY TO THE TUMOR TISSUES

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Boron neutron capture therapy is a promising application for the treatment of cancer. The benefits of BNCT are the ability to destroy cancer cells without causing damage to normal tissues. Boron neutron capture therapy is carried out using special drugs and boron delivery vehicles.

Keywords: Boron neutron capture therapy, Boron-10, Peptide transporter-1, Boron phenylalanine

Neutron radiation, a type of corpuscular radiation, is a stream of neutrons with relative biological efficiency with values from 1 to 10. Neutron radiation has a small dose of absorption and is an inductor of DNA chain rupture. The appearance of ruptures is caused by the influence of activated radicals formed by the interaction of atoms. Neutron radiation has a high linear transmission of energy and is capable of disrupting basic nuclear interactions. Therefore, the probability of recovery of the damage to the tumor cell is extremely small. [1]

Of particular importance is the neutron-capture therapy based on nuclear particle capture and fission reactions when the boron is exposed to neutrons with the formation of an alpha particle and lithium nucleus.

The first stage is the introduction of a drug containing non-radioactive boron-10, which is localized in the tumor. It captures slow neutrons with energy of less than 0.1 keV, then the cell saturation occurs. Neutrons begin to lose their energy and penetrate into the tissues where the boron-10 is absorbed. The second stage is nuclear capture and fission reactions with the formation of high-energy alpha particles. Their effects are devastating to cancer cells. [2]

The medication is a boron containing agent. It consists of complexes that have an increased affinity for tumor growth factors. Boron is bonded by hydrolytic bonds. Additional components are high molecular weight and low molecular weight agents. [2] The high molecular weight agents are mainly monoclonal and bispecific antibodies, their fragments, lipid bilayer vesicles and lipoproteins. The low molecular weight agents are phosphates, pyrophosphates, amines, amino acids containing boron, sugar, DNA binding elements and porophines having low toxicity and uniform distribution in the tumor cell. Biochemical and molecular differences between tumor and healthy cells play a large role in creating a certain composition of the drug, which served the development of computer modeling technology for the corresponding drugs. [3]

Delivery of boron agents is carried out by intravenous injection of the medication into the artery that feeds the tumor cells. However, the path is currently being improved to enhance the delivery of agents. Various artificial transporters can be used to deliver Boron-10, but the issue of their effectiveness and further implementation into clinical practice remains open. The assessment was carried out according to their preclinical models. Such transporters are disodium mercaptoclose-undecahydrododecaborate ([B12H11SH]2-2Na+) and boron phenylalanine. PepT-1 oligopeptide transporter is activated in cancer and participates in the transfer of boron associated with dipetids of borono-1-phenylalaene, which accumulates in tumors, and tyrosine. With the introduction of BPA, there was an increase in the expression of PEPT-1 in the cancer cells of the pancreas of the mouse and the accumulation of boron in the tumors. Thus, the mechanism of delivery of the boron to the tumor by MEANS PEPT-1 is established. It is concluded that the number of transporters not only glucose and amino acids, but also oligopeptides is increasing in the conditions of metabolic need. Accordingly, the task is to use the cancer mechanism of regulation of various transport molecules in order to deliver boron compounds to the tumor. In addition, the transport of the drug can be strengthened by acidification of the extracellular environment of tumor cells by metabolic products. H-related transport facilitates the delivery of the drug. [1]

Traditionally, BNCT has been used to treat gliomas, and head and neck tumors, but it is currently actively used in the treatment of genital cancer and melanomas. Despite the fact that BNCT is in the experimental phase, the safety of boron neutron capture therapy compared to standard radiotherapy has been proven. The advantages of therapy are biological and physical orientation, the ability to destroy tumor cells without affecting healthy tissues, a relatively small dose of radiation along with high efficiency. Methods are being developed to use controlled nanoparticles that focus the drug's effect on the tumor. These particles are transported with phagocytes. Exposure to the magnetic field localizes the toxic effect of therapy, so the effectiveness and safety of BNCT will increase. Improving the delivery mechanisms and combination of boron agents can improve the effectiveness of boron neutron capture therapy.

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CALCIUM EXCHANGE MODIFICATIONS IN RAT PLATELETS DURING THE POST-RADIATION PERIOD

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This work presents the results of a study using platelets from irradiated and non-irradiated rats (dose 1 Gr). The studies were carried out on the 3rd, 10th, 30th, 90th day after irradiation. On the third day, there was an increase in ADP-induced platelet aggregation; however, Ap4A was able to reduce the increased content of calcium ions in platelets in rats.

Keywords: platelet, calcium metabolism in platelets, ionizing radiation, Ca2 + channel.

Fresh platelet transfusion is included in the list of therapeutic agents in many recommendations for the treatment of radiation sickness in humans, since it leads to an increase in the resistance of the vascular walls, a decrease in bleeding, an increase in blood clotting, the consumption of prothrombin during blood clotting and blood clot retraction.

Along with quantitative, morphological changes in platelets in acute radiation sickness, violations of their functional properties occur: adhesive exchange decreases and aggregation properties weaken, the rate of the aggregation process slows down, the degree of aggregation decreases, and disaggregation of platelet aggregates increases.

In rats, exposure to low doses of radiation resulted in thrombocytosis and exposure to large doses resulted in thrombocytopenia. Thrombocytopenia in acute radiation sickness is caused by impaired proliferation of megakaryocytes in the bone marrow and inhibition of thrombocytopoiesis. A decrease in the content of cells of the megakaryocytic lineage of the bone marrow and thrombocytopenia are permanent and characteristic signs of acute radiation sickness. The degree of their reduction depends on the type of ionizing radiation, its dose and power, as well as the type of animals

After irradiation of animals at a dose of 1 Gr, the number of platelets in the blood did not change (3, 10, 30); therefore, this factor is not critical for any changes in platelet-endothelial relationships during the rehabilitation period. However, on the 3rd, 30th day in animals there is an increased aggregation activity of platelets, which increases the risk of platelet aggregates formation in the vascular bed and ischemic organ damage. After irradiation of platelets, a violation of the receptor-dependent regulation of the level of calcium ions in the cytoplasm of cells occurs. Thus, the ADP-stimulated intake of calcium ions into the cytoplasm of platelets in irradiated animals increased 2.3 times on day 3, and 1.5 times on day 10 due to an increase in the transmembrane intake of these ions from the outside. On the 30th day after irradiation, no significant changes in the concentration of calcium ions in the platelets of the irradiated rats were found in response to the ADP action as compared to the control group.

It was revealed that acute irradiation at a dose of one gray did not affect the number of platelets in the peripheral blood of rats, but on the 3rd and 30th days after irradiation, an increase in the degree of ADP-induced platelet aggregation was found in some individuals as compared to the control. Experiments have shown that in the short term after irradiation, the content of cytoplasmic calcium in rat platelets increased both without calcium and in a calcium-containing medium, which indicates a dysfunction of the molecular systems located in the plasma membrane and intracellular deposit structures that regulate the influx into the cytoplasm and outflow from her calcium ions. ADP-stimulated intake of calcium ions into the cytoplasm of platelets of irradiated animals on the third day increased two, three times. Ap4A was able to reduce ADP-induced increase in the content of calcium ions in the cytoplasm of platelets in control and trained animals in vitro experiments. On the third day of the post-radiation period 50% inhibition was achieved, on the 10th day inhibition ran up to 80%.

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CALCULATION OF THE ANNUAL EFFECTIVE DOSE OF THE INTERNAL IRRADIATION OF THE POPULATION DUE TO CONSUMING HONEY PRODUCED ON THE TERRITORY OF THE POLESSKY STATE RADIOECOLOGICAL RESERVE

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In 2017 and 2019 studies of honey obtained in an apiary located in the village of Babchin were conducted. This settlement is located on the territory of the Polessky State Radiation Ecological Reserve (Belarusian part of the Chernobyl Exclusion Zone). The specific soil activity for Cs-137 ranged from 780 Bq/kg to 2044 Bq/kg and for Sr-90 from 78 to 108 Bq/kg.

Among the studied honey in 2017 the most polluted was acacia - 168 Bq/kg, and the least polluted canola (46 Bq/kg). This fact indicates a significant role in the migration of radiocaesium-137 into honey.

Keywords: honey, caesium-137, strontium-90, specific activity, accumulation coefficient, annual effective dose.

The process of migration of radionuclides along the soil chain - plant - honey plant , honey plant, honey-animal body, is determined by the physical and chemical properties of the soil, weather conditions, plant species, biological properties of the bee, features of the technology of the process of receiving honey.

According to the table 1 we can see that the accumulation rate for cesium is an order of magnitude lower than for strontium. The 1.9-fold increase in the accumulation rate of S-137 in acacia honey per buckwheat indicates that the species characteristics of honey plants play a significant role in the migration of radiocesium-137 into the main product of beekeeping.

Table 1

Accumulation rate (AR) of Chernobyl radionuclide of different types of honey

Kind of honey	Accumulation ratio	
	Cesium	Strontium
Rapes	0,059	0,11
Acacia	0,082	0,03
Buckwheat	0,043	0,02

At the same time rapeseed honey which was characterized by the least specific activity on cesium-137 and strontium-90 had the highest accumulation rate of strontium-90.

In recent years there have been reports of the possibility of bioindication of bee ecosystems and their products as a method of bioindication. The Belarusian Polesya traditionally has a well-developed beekeeping industry.

Rape honey which was characterized by the least specific activity in cesium-137 and strontium-90 had the highest accumulation rate of strontium-90. This fact indicates a certain role of physical and chemical properties and forms of finding nuclides in the soil on the process of their migration through biological chains.

According to the calculations the annual effective dose of internal exposure to the population by honey produced in 2017 on the territory of the Babchin settlement did not exceed 0.02 mSv and in 2019 - 0.0016 mSv. These differences are probably due to uneven weather conditions, biological characteristics of bee colonies, as well as differences in the species composition of honey plants.

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CHANGES IN THE HEALTH OF RUSSIANS IN THE CONTEXT OF ENVIRONMENTAL THREATS

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The author addresses the problem of changes in public health, presents the results of the analysis of official statistics and secondary analysis of public opinion polls, and concludes that the environmental factor plays a signif-icant role in the deterioration of the health of Russians.

Keywords: environmental threats, atmospheric air, drinking water, health, Russia.

In the context of a consistent deterioration of the Russian environment, environmental threats come to the fore among the factors that change the health of its population. Thus, according to the self-assessments of the par-ticipants in the VCIOM survey in 2019 and 2020, the environmental disadvantage of their place of residence cre-ates more conditions for the development of certain diseases than a low-activity lifestyle and bad habits. As a re-sult, most of them assess their health only as "satisfactory", although they adhere to the principles of proper nutri-tion, refrain from Smoking and drinking alcoholic beverages, and also engage in physical culture or sports [2, 4].

The link between negative trends in changes in environmental and public health indicators in Russia is also confirmed by expert assessments and official statistics. First of all, air pollution is of high importance, which re-mains high and very high in 1/5 of all Russian cities in 2018 and threatens the health of 1/10 of the country's urban population. Excess levels of nitrogen and carbon oxides, formaldehyde, hydroxybenzene derivatives, chlorine compounds, suspended solids, and other substances increase the risk of stroke, heart disease, chronic respiratory diseases, and cancer. In particular, in 2018, they were associated with about 2% of deaths of Russians (in the total number) from respiratory diseases and malignant neoplasms [1]. They are also associated with the deterioration of the population's reproductive health – an increase in the proportion of married couples who fail to conceive a child [3, 5, 6].

The reproductive health of Russians, as well as the functioning of the digestive, genitourinary and endocrine systems and the condition of the skin are also threatened by contamination of tap water with compounds of sodi-um, magnesium, manganese, boron, lithium, chlorine and chloroform. Exceeding the standards for sanitary and epidemiological indicators in 2018 is shown by 1/7 of all water supply systems in the country that produce insuffi-cient treatment of water supplied to the population. Unsatisfactory quality of the latter, in turn, is associated with 1.5% of cases of diseases among Russians. In addition, soil contamination and physical factors have a fixed im-pact on the population's morbidity [1].

Thus, Russia's environmental problems are specifically reflected in the health indicators of its citizens. They provoke an increase in morbidity and mortality for a number of reasons, which, in a situation of increasing envi-ronmental threats, should be the basis for reviewing the priorities of the country's health policy.

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COMPUTER MODELING OF OLIGOPEPTIDES THAT BIND S1 SARS-COV-2 PROTEIN

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S1 protein is a superantigen. Elimination of this protein will reduce organ and tissue damage by the activated immune system. Analysis of the ACE2-S1 Sars-CoV-2 (PDB: 6M0J) complex will allow the deter-mination of oligopeptides, which are ligands for binding of the S1 protein. In addition, they will be able to remove from the body viral particles located in the extracellular space.

Keywords: Computer simulation, S1 Sars-CoV-2 protein, Angiotensin-converting enzyme 2 (ACE2).

Clinical manifestations of coronavirus infection are diverse and are not limited to damage to the respirato-ry system [1]. Many researchers suggest that this may be due to the action of the surface protein as a superantigen. The superantigen leads to clonal proliferation of lymphocytes and excessive production of proinflammatory cyto-kines, which mediate the development of the so-called «cytokine storm» [2]. Therefore, the development of oligo-peptides capable of binding and removing viruses and products of viral virions from the microvasculature will be a breakthrough in the therapy of SARS-CoV-2 infection.

The aim of this work is: to study the binding site of ACE2 and S1 Sars-CoV-2 protein, as well as computer modeling and selection of oligopeptides most suitable for the sorption of S1 Sars-CoV-2 protein.

A PIC (Protein Interactions Calculator) server was used to analyze the binding site. Based on the data obtained, promising amino acids with a long bond of up to 3 A were selected. Modeling and docking of oligopeptides was carried out using the UCSF Chimera and PyMOL programs. The results of the study are presented in table 1.

Table 1

Free energy of oligopeptides binding to S1 protein

Oligopeptides	Average value of Free binding energy, -kcal / mol	Root mean square deviation	Confidence interval
GLN 24.A ALA 25.A LYS 26.A THR 27.A PHE 28.A	-4,86	0,144	0,08925
PHE 28.A LEU 29.A ASP 30.A LYS 31.A	-5,29	0,329	0,203913
ASP 30.A LYS 31.A PHE 32.A ASN 33.A HIS 34.A	-5,63	0,121	0,074995
ASP 30.A LYS 31.A PHE 32.A ASN 33.A HIS 34.A GLU 35.A	-4,7	0,08	0,049584
GLU 35.A ALA 36.A GLU 37.A ASP 38.A	-5,22	0,396	0,245439
ASP 38.A LEU 39.A PHE 40.A TYR A.41	-6,1	0,46	0,285106
PHE A.40 TYR A.41 GLN A.42	-6,27	0,521	0,322913
LEU A.79 ALA A.80 GLN A.81 MET A.82 TYR A.83	-5,76	0,364	0,225605
LYS A.353 GLY A.354 ASP A.355	-3,91	0,349	0,216308
GLN A.24 LYS A.31 ASP A.38 TYR A.41	-5,38	0,136	0,084292
GLN A.24 ALA A.25 LYS A.26 THR A.27 LEU A.29 ASP A.30 LYS A.31	-5,48	0,296	0,183459
GLN A.24 ASP A.30 ASP A.38 TYR A.41 GLN A.42	-5,59	0,729	0,451831

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CONGENITAL DISEASES PREVENTION

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The aim of this work was to study the methods of congenital diseases prevention and to analyze data from the Belarusian register of congenital malformations.

Keywords: monitoring systems, prenatal diagnostics, congenital malformations.

The problem of congenital and hereditary pathology is relevant at the present time. Over the past decade, it has acquired a status of serious social and medical importance. In the health care system of many countries, including Belarus, the creation and improvement of methods for the prevention of congenital malformations, based on modern achievements of medical genetics, obstetrics and perinatology, are taking a priority direction [2].

According to studies based on long-term data on the control of cases of congenital malformations in European countries, the introduction of preventive programs can prevent up to 50% of malformations [1].

Due to the unfavorable environmental situation (environment with increased mutagenic activity, polluted air, food containing genotoxic components, etc.), the role of active prevention of the development of congenital malformations is now more than ever great [2].

There are main ways to reduce the incidence of congenital malformations in newborns:

1. Study of the etiology of malformations and the development of measures aimed at minimizing the impact of risk factors.
2. Conducting preventive measures through medical genetic counseling.
3. Improvement of methods for prenatal diagnosis of fetal anomalies. The use of modern methods of diagnosing malformations allows in the case of incurable pathology to prevent the birth of a sick child.

In many countries of the world, to study the dynamics of the occurrence of congenital malformations, specialized monitoring registers have been created, which are systems for monitoring the frequency of developmental anomalies in the population and are effective tools for monitoring congenital malformations and their prevention. Currently, at the international level, the monitoring registers of birth defects are represented by two systems: EUROCAT and the International Clearinghouse Birth Defects Monitoring System (ICBDMS) [4]. The main tasks of international registers are: providing the necessary information on the epidemiology of congenital malformations in European countries, timely detection and prevention of new teratogenic effects, assessing the effectiveness of the primary prevention of congenital malformations programs and stimulating the creation of new registers in European countries [3].

In Belarus, monitoring of congenital malformations is carried out within the framework of the Belarusian register of congenital malformations, created in 1979 at the Research Institute of Hereditary and Congenital Diseases (Republican Scientific and Practical Center «Mother and Child») [1]. This is a unique database that allows you to monitor the dynamics of the frequencies of congenital malformations in the regions and the republic as a whole and creates the necessary conditions for studying many aspects of impaired embryonic development.

According to the register data, over the past 20 years in the Republic of Belarus, there has been a stable increase in the population frequencies of most forms of congenital malformations with a tendency to slowdown in its rates in recent years, due to the introduction of new prenatal examination methods and an improvement in the quality of diagnostics [2].

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CONTENTS OF SEPARATE RADIONUCLIDES IN VARIOUS TYPES OF FISH OF RESERVOIRS OF THE PINA REGION OF THE BREST REGION

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The studies were carried out on the basis of the 5th city clinical hospital in Minsk. During the period from 2015-2019, 8600 people were hospitalized in the cardiology department with diagnoses of violations of the cardiovascular system, 8827 people were discharged, 177 people were transferred to other hospitals in the city of Minsk, 139 people died.

Keywords: cardiovascular diseases, cardiovascular system, environmental and social factors.

Diseases of the cardiovascular system are the leading cause of death in Belarus. One of the first places among them is ischemic heart disease (IHD) - a group of diseases that are combined by the presence of acute or chronic myocardial ischemia [1,2]. IHD occupies one of the leading places not only in our country, but all over the world, 80% of IHD cases are registered in developed countries. More than one million Belarusians die annually from cardiovascular diseases, of which more than 20% from myocardial infarction. Myocardial infarction is one of the most formidable manifestations of coronary heart disease, which is accompanied by high mortality and disability. Of the total number of deaths from myocardial infarction, 30-40% of patients die in the first 15 minutes after the onset of the disease and about the same in the next 2 hours. The increase in the incidence of coronary heart disease, including acute and repeated myocardial infarction, in recent decades, combined with a severe outcome of the disease and disability, indicates the great social significance of this pathology.

Table 1

Basic diagnoses of patients admitted to the cardiology department in 2015-2019

	2015	**2016**	**2017**	**2018**	**2019**	**Total**
AMI newly diagnosed	31	17	10	6	6	**70**
Ischemic heart disease	1676	1511	1405	1363	1365	**7320**
Arterial hypertension	1618	1486	1388	1354	1356	**7202**
Acute myocardial infarction	53	36	23	12	11	**135**
Recurrent myocardial infarction	21	9	6	5	3	**44**
Transmural myocardial infarction	6	5	2	2	3	**18**

Of the total number of patients suffering from heart disease, there are far more women than men.

Table 2

Structure of the incidence of cardiovascular diseases by gender

	2015	**2016**	**2017**	**2018**	**2019**	**Total**
Men	993	813	810	738	697	**4051**
Women	1215	1010	1030	909	945	**5109**

Of the total number of patients suffering from heart disease, patients over the age of 50 prevail, but at present there is a tendency for the development of cardiovascular pathology in patients at a younger age, namely from 18 to 30 years.

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CREATION OF BACTERIAL STRAIN-PRODUCER OF XANTHOSINE PHOSPHORYLASE

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As a result of this work, the Escherichia coli strain pET42a-xapA was constructed. This strain is capable to overproduce the homologous xanthosine phosphorylase. In further work, this enzyme is planned to be purified and tested for enzymatic activity.

Keywords: xanthosine phosphorylase, nicotinamide riboside, Escherichia coli, genetic engineering.

NAD^+ is one of the most important cofactors for numerous enzymes involved in cellular energy metabolism. NAD^+ level is known to decrease with aging, while the reduced activity of enzymes consuming NAD^+ contributes to a wide range of senile diseases [1].

There are several ways of synthesizing this cofactor, but one of the most important is the salvage pathway. On this route, NAD^+ is produced from its precursors, such as nicotinamide, nicotinamide riboside, nicotinamide mononucleotide [1]. It is possible to promote the level of the precursors to compensate NAD^+ losses during aging of the body [2]. Studies of foreign authors have shown that nicotinamide riboside is the most effective precursor of this cofactor. Biochemical and genetic investigations confirmed that xanthosine phosphorylase was capable to synthesize nicotinamide from nicotinamide riboside [3].

Therefore, the aim of this work was to obtain a strain producer of protein xanthosine phosphorylase, which is capable to catalyze the process of synthesis nicotinamide riboside, acting as the main intermediate of the most important coenzyme NAD^+.

In our study, we used the *xapA* gene consisting of 834 nucleotides and coding for the protein xanthosine phosphorylase of *E. coli.* The gene was isolated from the genomic DNA of the E. *coli K-12* bacteria strain by polymerase chain reaction (PCR) [4]. The *xapA* gene was cloned into the linearized plasmid pET42a (+) (Invitrogen, USA) using the continuous overlapping PCR method [5]. The resulting genetic construct, named by us as pET42a-xapA, was analyzed by agarose gel electrophoresis. The resulting genetic construct was used to transform competent *E. coli* BL21(DE3) cells (Invitrogen, USA). PCR screening for the presence of the *xapA* gene was performed to confirm the success of transformation *E. coli* cells. At the next stage of the work, bacteria with the xanthosine phosphorylase gene were subcultured into a liquid nutrient medium LB. We also performed induction of protein synthesis. After induction, the cells were grown for 6 hours. According to electrophoretic analysis in SDS-polyacrylamide gel, xanthosine phosphorylase has a size of 31.3 kDa. Its maximum accumulation in cells is observed at 4 hours of induction.

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CYTOTOXIC EFFECT OF MUSHROOM *PHALLUS IMPUDICUS* ETHANOL EXTRACTS ON TUMOR CELLS LINE

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The cytotoxicity of ethanol extract of *Phallus impudicus* in various dilutions was studied in relation to tumor cultures of the K562 cell line. The studied extract of *Phallus impudicus* has a strong dose-dependent inhibitory effect on the growth of K562 cells in cell culture.

Keywords: ethanol extracts of *Phallus impudicus*, tumor cultures, viability, dose-dependent effect.

The problem of cancer remains a priority for modern society. The incidence of malignant neoplasms in the Republic of Belarus has tripled over the past forty years. Every year, more than 43,000 residents of the Republic of Belarus are diagnosed with cancer, and the death rate is more than 17,000 per year. There is a steady increase in the incidence of an average of 3% per year. In modern conditions, biostimulants of plant and animal origin are used to increase the reserve forces of the macroorganism in the fight against the tumor. These are medicinal mushrooms that synthesize a unique complex of biologically active substances. Currently, we are studying species that were previously not even considered as possible producers for the production of medicines. These types of mushroom include a representative of gastromycetes – *Phallus impudicus*. In therapy, the entire mushroom is used, but the most useful is the mucus that is in the mushroom egg.

Modern scientific literature contains information about studies that have confirmed the immunomodulatory and antitumor properties of the fungus. Obviously, there is no consensus on the mechanisms of antitumor action through physiologically active components of fungal origin. At the same time, basidial medicinal mushrooms have long been used in folk medicine. Functional products of therapeutic and preventive action based on mushrooms that have official registration in the form of biologically active additives, powders, extracts and infusions are popular and widely presented in the pharmacy chain of Belarus.

The aim is to study the ability of ethanol extracts of the mushroom *Phallus impudicus* to have a cytotoxic effect on K562 tumor cells.

Research materials and methods. The object of the study was ethanol extracts of the mushroom *Phallus impudicus.* Initial 40% alcohol extracts of *Phallus impudicus* were subjected to diafiltration with 0.877% sodium chloride solution («Sigma», USA) on the unit Vivaflow 50/50R/200 («Sartorius», Germany) with a cell containing a membrane with an exclusive coefficient of 10000 MWCO PES. The final alcohol concentration in the extracts is 0.08%.

To determine the cytotoxic activity, the studied substances were cultured together with K562 tumor cells in DMEM medium («Lonza», Belgium) containing 10% fetal serum («HyClone», Great Britain), 2mM glutamine (Sigma, USA), 1% antibiotic (Sigma, USA), cultured for 24 hours at 37°C and 5% CO2. At the end of incubation, the number of live tumor cells was evaluated by staining with 0.02% trypan blue solution. The estimation of % suppression of K562 cell growth under the influence of the studied substances was calculated by the formula:

$$N\% = \left(1 - \frac{N\ experience}{N\ control}\right) \times 100\%,$$

N% - degree of cell growth suppression, %; Ncontrol – cell concentration in the control, cells/ml; $N_{experience}$ - concentration of cells in the experiment, cells/ml.

Research results. Introduction of the test substance in dilutions (1:1; 1:2; 1:5; 1:10) to cell culture, K562 resulted in a statistically significant decrease in the number of live cells, while this trend was observed in all dilutions of the studied substance. Cell viability in the control group was 76.7 (68,9÷83,2) % and statistically significantly ($p<0.05$) differed from similar indicators in the presence of extract in dilutions of 1:1- 0%, 1:2 – 0%, 1:5 – 20,91 (18,73÷24,32)%, 1:10 – 61,13 (56,41÷65, 46)%. When calculating the % suppression of K562 cell growth under the influence of *Ph.impudicus* extract, 100% inhibitory activity on the growth of K562 tumor cells is observed when the substance is diluted 1:2 and is 100%.

Conclusion. The study of antitumor activity showed that the effect of *Ph.impudicus* extract in a 1:2 dilution on the growth of K562 cells is manifested in an inhibitory activity reaching 100%. This extract has a strong dose-dependent effect on the growth of cells of this line.

DEVELOPMENT OF OSTEOPENIA IN PATIENTS WITH PRIMARY OSTEOARTHRITIS IN COMORBIDITY WITH EXOCRINE INSUFFICIENCY OF THE PANCREAS

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Introduction. Primary osteoarthritis is characterized by degeneration of articular cartilage with subsequent changes in subchondral bone and the development of marginal osteophytes and is often accompanied by reactive synovitis. The study of bone tissue state is very topical in the case of a combination of osteoarthritis and osteoporosis [1-4].

Keywords: osteoarthritis; exocrine pancreatic insufficiency; mineral density of bone tissue.

The goal of research. Make a complex study of bone density in patients with primary osteoarthritis and exocrine pancreatic insufficiency and patients with primary osteoarthritis without exocrine pancreatic insufficiency.

Methods. There were examined 67 ambulatory patients with primary osteoarthritis (1-st group) and 73 patients with osteoarthritis in the comorbidity with exocrine pancreatic insufficiency (2-nd group).

Diagnosis of osteoarthritis was based on diagnostic X-Ray criteria - according to J.H. Kellgren and J.S. Lawrence. The level of exocrine pancreatic insufficiency was based on the result of the Elisa test. The state of mineral bone density was examined by using dual-photon densitometry.

Results. To sum up the results of research, we can talk about the negative influence of exocrine pancreatic insufficiency on bone mass.

Densitogram in 1-st group patients shows the tendency of patients with primary osteoarthritis to increase the mineral density of bone tissue. The results were statistically significantly higher in relation to the referent base Lunar ($p<0,05$) but were within the age range.

Patients in the 2-nd group, with primary osteoarthritis with gastrointestinal disorders, the densitogram rates were statistically significantly lower than in patients 1-st group, and lower in relation to the reference base of Lunar and were at the 2 st level of osteopenia. ($p<0.05$). Completed correlation and regression analysis established a significant correlation between bone mineral density and fecal elastase value and also has proved the importance of the functional state of the pancreas in trophic insufficiency development and osteopenia for patients with osteoarthritis

Conclusions. The changes in bone tissue can be explained by the formation of trophological insufficiency as a result of exocrine pancreatic insufficiency. One of the symptoms of trophic failure is bone and mineral changes, in particular, the decrease of bone density.

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ECOLOGICAL FACTORS IN THE DEVELOPMENT OF DISEASES OF THE CARDIOVASCULAR SYSTEM

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The goal of effective prevention is to reduce morbidity, mortality, and disability of the population from diseases of the circulatory system, which increases the quality and availability of medical care for patients. The state program provides for a complex of preventive, organizational, methodological, educational, scientific, medical and diagnostic measures aimed at preventing BSC, forming the population's need for a healthy lifestyle, taking care of their own health, improving the quality and availability of cardiac care for the population, introducing the most promising treatment technologies patients with cardiac arrhythmias, acute coronary syndrome, acute cerebrovascular accident.

Keywords: diseases of the circulatory system, arterial hypertension, cardiovascular diseases.

One of the most pressing problems of scientific medicine and practical health care at the beginning of the XXI century is diseases of the circulatory system (BCS). These diseases are among the leading causes of death in most of the economically developed countries of the world. In our country, diseases of the circulatory system are the main cause of disability.

As established by numerous epidemiological studies, cardiovascular disease results from various risk factors. And if some of them (heredity, age) are not amenable to change, other factors can be avoided by changing habits and lifestyle.

According to WHO experts, 1/3 of the reduction in mortality from cardiovascular diseases can be achieved through the development of drug therapy and clinical interventions, while 2/3 of the reduction in mortality will provide changes in lifestyle habits, including proper nutrition, control over the course of hypertension, exercise and smoking cessation. WHO experts emphasize that for both economically developed and developing countries, the most practical and least expensive way of prevention is not medicine, but a healthy lifestyle.

The increase in morbidity and mortality from CSD in the republic is due to objective and subjective factors: demographic aging of the population, the financial and economic situation negatively affecting all aspects of the population's life, the growth of psycho-emotional stress, urbanization of the population, changes in the nature of nutrition, living conditions, work, the presence of a significant some of the residents of many risk factors for the development of CDS, primarily the widespread prevalence of smoking, alcohol consumption, sedentary lifestyle, overweight, lack of motivation among residents of the republic to take care of their own health, to maintain a healthy lifestyle.

Among the main reasons for the increase in mortality at working age are the following:

- inadequate attitude of patients to their health, lack of motivation for treatment (58.0% of cases);
- social ill-being, in particular, alcohol abuse (up to 50.0%);
- untimely appeal for medical help (about 14%);
- the presence of concomitant pathology, aggravating the prognosis (10%), most often - type II diabetes mellitus and liver cirrhosis of alimentary-toxic genesis.

It should be especially noted that the population lacks responsibility for their own health, motivation for a healthy lifestyle, treatment of arterial hypertension (AH) and coronary heart disease (IHD).

According to WHO experts, a positive dynamics in the level of morbidity and mortality due to CDS can be achieved only under the condition of a complex impact on the factors affecting the state of public health. A decrease in morbidity and mortality from CSD can be achieved thanks to a population (mass) and individual prevention strategy, which consists in changing the lifestyle and environmental factors associated with diseases, as well as their social and economic consequences.

Prevention of BSK is a real way to improve the demographic situation in the country.

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ECOLOGICAL IMMUNOLOGY: A SCIENTOMETRIC STUDY BASED ON THE PUBMED DATABASE

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Over the past decade, new molecular and cellular knowledge and methods have become available, which formed the basis for the combination of immunology and ecology. A retrospective scientometric study of the PubMed database in the field of environmental immunology was presented.

Keywords: ecological immunology, scientometric study, PubMed database, review, clinical trial.

Research on the mechanisms of the immune system and immune function has been at the center of health and medicine for over a century. For a long time there was no understanding of immunity in the context of the environment, only in the mid-1990s the field of environmental immunology appeared. Currently, there are categories of environmental factors that affect the diversity and complexity of the immune system: interaction with parasites and other types of biotic as well as abiotic interactions, intraspecific selective restrictions and population genetic processes that affect the evolution of immune components [1, 2].

PubMed is a free full-text archive of biomedical and life sciences journal literature. This database has more than 30 million citations and abstracts

Methods. The design of the work provided for a scientometric retrospective study. The publication data on ecological immunologt has been retrieved by using PubMed database of the United States National Library of Med-icine (http://www.ncbi.nlm.nih.gov/PubMed). The search for the studies was carried out using an advanced search engine: the «AND» operator was used to combine the field names «Immunology», “Ecology” and the type of publi-cation. The following categories of publications were taken into account: «reviews», «clinical study». The PubMed database was analyzed for the period from 1990 to 2019.

Results. The contribution of ecology to the field of immunology has been reviewed in the last 20 years. Until this period, articles in PubMed containing the terms «ecology» and «immunology» together were rare. The first article related to the field of ecoimmunology is dated 1973 [3]. It was found that over a 20-year period (2000 - 2019) the PubMed electronic database included 5 154 scientific studies in the field of ecological immunology, of which 793 (15,4%) belong to the category of «reviews «. The results of clinical trials were published in 49 articles, which corre-sponds to only 1,0 % of all publications in the field of ecological immunology for the analyzed period. These clini-cal trials have mainly been devoted to interactions of microbiota with immune factors in a healthy state and with the development of pathologies.

According to the PubMed database, there is an increase in the number of publications in the field of environmental immunology. So, for the period 1990 - 1999, only 332 articles on this topic were published, for 200-2009 there are 909 publications. Over the last 10 years, the database contains 3913 publication.

Conclusion. Since about 1990, ecological immunology is a rapidly expanding field that examines the physiological or molecular basis of immune responses in the context of ecology and adaptation. The ideas and concepts at the base of ecological immunology allow to understand variability in immune responses between populations, to relate the outbreak of diseases to the evolutionary history and ecology of populations etc.

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ECOLOGICAL SYNTHESIS OF SILVER NANOPARTICLES USING BACTERIA

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Due to the potential use of nanomaterials, there is a need to investigate environmentally friendly technologies for the synthesis of nanoparticles. Traditionally, nanoparticles are synthesized by physical and chemical methods. However, these methods are characterized by the use of hazardous and aggressive substances, including sodium borohydride (NaBH4), Tollens reagent, N, N-dimethylformamide (DMF) and polyethylene glycol, which are harmful to the environment and cause serious health problems. It should be noted that the production of nanoparticles using microorganisms, in particular bacteria, is environmentally safe, since this method of synthesis does not require the use of toxic materials [1].

Iqtedar et al investigated the possibility of biogenic synthesis of silver nanoparticles (AgNPs) using a cell-free extract of Bacillus mojavensis BTCB15 cells. The bacterial culture was cultivated for 72 h at 37 °C and stirring at 120 rpm. Next, a cell-free extract was obtained, to which 1 mM AgNO3 was added in a 1:1 ratio, followed by incubation protected from light at 37 °C, 120 rpm/min for 168 hours. AgNP synthesis was monitored by changing the color of the solution from colorless to brown. Scientists also managed to optimize this process of synthesis of silver nanoparticles. Thus, at pH 7, the size of the nanoparticles decreased by 147%. In the presence of Tween 20, it was possible to reduce the incubation time from 5 days to 24 h, and also to reduce the size of the resulting nanoparticles. Also in the presence of K2SO4, the size of AgNP decreased by 104% and the incubation time was reduced. In the current study, the antibacterial activity of the obtained silver nanoparticles against such pathogenic bacteria as Escherichia coli, Staphylococcus aureus, Klebsiella pneumonia and Pseudomonas aeruginosa was established. The inhibitory concentration ranged from 0.05 mg/ml to 0.27 mg/ml [1].

Other authors synthesized silver nanoparticles using the supernatant Acinetobacter sp. The culture was grown on LB medium for 24 h at 30 °C and stirring at 150 rpm. After culturing, 1 mM AgNO3 was added to the cell-free extract. AgNP synthesis could be observed visually by discoloration of the solution. The synthesis process was also optimized by determining the optimal incubation temperature (70 °C) of the mixture of supernatant and AgNO3 solution, the optimal concentration of AgNO3 salt (0.5 mm) and the optimal time for culturing bacterial culture (72 h). The obtained nanoparticles had a spherical shape and a size of 10-60 nm. The antifungal activity of the obtained silver nanoparticles against the mycosis pathogen Candida albicans was studied. The minimum inhibitory concentration was 4 mg/ml. It was found that the antifungal activity of AgNP is due to the violation of the integrity of the cell membrane, as well as the generation of reactive oxygen species (ROS). An increase in ROS led to the accumulation of hydroxyl radicals, which causes serious membrane damage, DNA fragmentation, and apoptosis of Candida albicans cells [2].

Ameen and co-workers have established the possibility of extracellular synthesis of Ag nanoparticles by the soil bacterium Cupriavidus sp. The bacteria culture was grown for 24 h at 37 ° C and constant stirring. Next, a solution of AgNO3 salt at a concentration of 1 mM was added to the cell-free extract. As a result, spherical nanoparticles with a size of 10-50 nm were obtained. The antibacterial action of the synthesized AgNPs in the concentration range of 25-100 mg/ml was established against such pathogens of human diseases as Stenotrophomonas pavanii, Aeromonas enteropelogenes, Proteus mirabilis

and Enterobacter xiangfangensis. There was a significant relationship between the concentrations of nanoparticles and the species of pathogens, indicating that different species reacted differently to different concentrations. At the lowest concentration, there was no significant difference between the species. At the highest concentration of AgNP, significantly higher zones of growth inhibition were observed for A. enteropelogenes and S. pavanii. At the same time, a slight growth retardation was observed for P. mirabilis and E. xiangfangensis [3].

Therefore, for the biosynthesis of silver nanoparticles it is possible to use cell-free bacterial extracts. This method of obtaining nanomaterials is environmentally friendly due to the lack of need for the use of toxic substances. The nanoparticles synthesized in this way can be used in medicine due to their antimicrobial and antifungal properties.

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EFFECT OF CRYOTHERAPY ON THE PROPERTIES OF BLOOD CELL MEMBRANES IN RHEUMATOID ARTHRITIS

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Annotation: The effect of cryotherapy on erythrocytes in patients with rheumatoid arthritis. Change in microviscosity parameters and polarity of annular lipid and polar bilayer. Decrease in the severity of pain after cryotherapy procedures.

Keywords: cell membranes, cryotherapy, rheumatoid arthritis, membrane microviscosity, membrane polarity.

Rheumatoid arthritis (RA) is common throughout the world and affects all ethnic groups. Prevalence is 0.5-1% (up to 5% in the elderly) in developed countries. From 5 to 50 people per 100,000 of the population fall ill every year [1]. In 2010, about 49 thousand people died from rheumatoid arthritis in the world [2]. The average age of onset of the disease is 40-50 years for women and slightly more for men. Women get sick 3-5 times more often than men do [2].

Widespread prevalence, steady progression and early disability determine the social significance of rheumatoid arthritis. Drug therapy for this disease often does not give the desired effect, and its high cost is an additional incentive for the development of new pathogenetically substantiated methods of therapy, characterized by sufficient antirheumatic activity, good tolerance and safety.

Most of the research conducted in the field of improving therapeutic tactics for rheumatoid arthritis is aimed at identifying damaging factors and studying the possibilities of reducing their formation.

In connection with the above, the aim of this work was to study the effect of cryotherapy on the structural state of erythrocyte membranes in patients with RA.

The study included a group of 15 people (12 men and 3 women) diagnosed with rheumatoid arthritis. Conditionally the control group consisted of 20 people, in the history of which there was no information about the disease of rheumatoid arthritis, and biochemical and general blood tests were within the physiological norm. Blood sampling for studies was performed on an empty stomach after a 12-hour fasting at the same time of day (in the morning) by puncture of the cubital vein.

After a general examination and in the absence of contraindications, patients were sent for a course of general gas cryotherapy in a cryocapsule «KRYOMED-20 / 150-01» (manufactured by the Russian Federation), which

consisted of 10 procedures. The temperature in the procedural cryocapsule during the cryotherapy procedure was being maintained at -130 oC.

The registration of fluorescence spectra was carried out on a spectrofluorimeter («Solar», Belarus) at excitation wavelengths of 337 and 286 nm. Based on the obtained spectra, the following indicators that characterize the structural state of membranes were calculated [3]:

Annular lipid polarity at λ_{ex} = 286 nm: I_{385} / I_{373}

The polarity of the lipid bilayer at λ_{ex} = 286 nm: I_{385} / I_{373}

The microviscosity of an annular lipid at λ_{ex} = 286 nm: I_{470} / I_{373}

Microviscosity of the lipid bilayer at λ_{ex} = 286 nm: I_{470} / I_{373}

During the study, it was found that the use of cryotherapy affects the properties of the plasma membrane of erythrocytes. At the same time, a decrease in the microviscosity and polarity of the annular lipid was noted, but an increase in the value of the microviscosity of the lipid bilayer after the procedure was observed. It should be noted that the group of patients suffering from RA, after cryotherapy procedures, felt a decrease in the severity of pain syndrome according to subjective sensations.

It is assumed that the observed effects can be interpreted by a decrease in the activity of enzyme systems in a more microviscous environment of the membrane [4].

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EFFECT OF HIGH CONCENTRATION GLUCOSE ON MULTIPOTENT MESENCHYMAL STROMAL BONE MARROW CELLS *IN VITRO*

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The effect of glucose in various concentrations on the morphology, viability and proliferative potential of rat bone marrow multipotent mesenchymal stromal cells was presented. When cultivating multipotent mesenchymal stromal cells under conditions of high glucose content (25 mM), no changes were observed in the viability, morphological features, and proliferative potential of cell cultures.

Keywords: bone marrow, multipotent mesenchymal stromal cells, cultivation, glucose.

Multipotent mesenchymal stromal cells (MMSCs) are multipotent cells with high proliferative activity and the ability to differentiate into mesenchymal cells (for example, osteocytes and chondrocytes). The wide range of biologically active action of MMSCs has made them a popular source for cell therapy of various diseases (for example, for the treatment of patients with diabetes). However, high glucose levels can negatively affect the function of MMSCs. Elevated glucose concentrations can damage cell function and cause apoptosis. Li et al. we evaluated the effect of high glucose concentrations on MMSC CM in vitro and proved that proliferation and osteogenic differentiation are stimulated by high glucose levels. Studied by Kim et al. we studied the effect of high glucose levels on stem cell proliferation and concluded that high glucose levels can increase the growth rate of stem cells.

Objective: to evaluate the effect of various glucose concentrations on the morphology, viability, and proliferative potential of bone marrow MMSC cultures in laboratory animals in vitro.

Materials and research methods. The object of the study was MMSC cultures isolated from the bone marrow of 3 mongrel sexually Mature laboratory rats with a body weight of 270 – 320 g. Bone marrow for

isolation of MMSCs was obtained from the tibia and femur bones by centrifugation on a Histopaque density gradient (p=1.077 g/cm3) (Sigma, Germany). The resulting bone marrow mononuclears were sown on Petri dishes coated for adhesive cultures and cultured in a complete DMEM culture medium (Gibco, USA) containing 10% fetal bovine serum, 2 mM

L-glutamine, an antibiotic – antimycotic mixture (100 Conv/ml benzylpenicillin sodium, 100 Conv/ml streptomycin sulfate, 100 Conv/ml neomycin sulfate, Lonza, USA). The cells were cultured at 37°C under 5% CO2 conditions. The first replacement of the complete culture medium was carried out 24 hours after sowing, and then the medium was replaced every 3 days. The viability of MMSCs after incubation with glucose was evaluated by the number of apoptotic cells using flow cytometry using the ANNEXIN V-FITC — PI kit according to the manufacturer's instructions. Cell cultures were monitored and growth dynamics were evaluated using an inverted BS-7000 fluorescence microscope (BestScope, China). Statistical data processing was performed using the STATISTICA 8.0 application software package.

Results. To assess the effect of glucose on the morphology and proliferation of MMSCs, the test substance was added to the cultures of 2 passages (2,7x105 cells/well of a 24 – well tablet) in final concentrations of 5 mM, 10 mM and 25 mM. On day 5 of cultivation in the presence of glucose, the morphology of MMSCs did not change. The cultures retained homogeneity and were represented by spindle-shaped fibroblast-like cells. The viability of MMSCs with an increase in glucose concentration did not change in comparison with the control and did not significantly differ from the same indicator in intact cell cultures (without glucose addition, 96% (91%÷97%). Regardless of the concentration of glucose for all cultures of MMSCs were able to self-maintenance and active growth. In the presence of 25 mM glucose, MMSCs were characterized by a more pronounced proliferative potential, as evidenced by the high number of cells generated in culture. Thus, the PPI of intact MMSC cultures was 3.4 (3.1÷3.7) conv. units. and it did not differ statistically significantly from the same indicator in cultures containing 25 mM (3.3 (3.0-3.6) conv. units), 10 mM (3.1 (2.8-3.4) conv. units) and 5 mM (2.7 (2.4 - 3.0) conv. units) of glucose.

Conclusion. In the presence of various glucose concentrations, MMSCs retained high viability (more than 90%), morphological homogeneity, adhesion ability, and proliferative potential.

EFFECTS OF MORİNGA *(Moringa oleifera L.)* PLANT ON BIOACTIVE PROPERTIES AND HUMAN HEALTH

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The problems of hunger and malnutrition have caused an increase in food demand and search in developing countries in the last few decades. Various plants were used in this sense. Moringa (*Moringa oleifera* Lam. Moringaceae) is a highly valuable plant that is mostly grown in tropical and subtropical regions. It is used for food, pharmaceutical and industrial purposes. Different parts of the MO tree have been identified as unique sources of unparalleled glucosinolates, flavonoids and phenolic acids, carotenoids, tocopherols, polyunsaturated fatty acids (PUFAs), highly bioavailable minerals and folate. *Moringa oleifera* is a versatile herb with exceptional medicinal and therapeutic values used to alleviate and manage a variety of disease states. The leaves of this plant can be used as food and oil can be extracted from the seeds as vegetable oil or biodiesel raw material. The strong antimicrobial and flocculant properties of proteins extracted from *M. oleifera* seeds are important in water treatment. In this review, the phytochemical composition of *Moringa oleifera*, its nutritional values, its effects on human health and its industrial uses are discussed.

Keywords: Moringa, *Moringa oleifera*, Antioxidant, biodiesel, extraction.

Since almost every part of the Moringa tree can be used for food, pharmaceutical and industrial purposes, it is considered one of the most useful trees in the world. This tree has the potential to improve nutrition, increase food security and improve rural development. It contains *M. oleifera*, vitamins A, C, E, carotenoids, alpha-carotene and specific plant pigments with strong antioxidative properties such as beta-carotene, kaempferol, quercetin, routine. The dried moringa leaf powder was recorded to contain 44.4 % carbohydrate, 28.7 % crude protein, 10.9 % ash, 7.1 % fat, 103.1 mg/100 g iron and 3.0 mg/100 g calcium. Similarly, the protein profile

showed 70.1 % insoluble proteins, 3.5 % glutelin, 3.1 % albumin, 2.2% prolamine and 0.3 % globulin. Seed oil is highly oleic (18: 1, 70-80 %), palmitoleic (16: 1, 6-10 %), stearic (18: 0, 4-10 %) and arachidonic acid (20: 0, 2-4 %) and contains lower oleic, linoleic and linolenic acid. Potassium (K), calcium (Ca) and magnesium (Mg) are the dominant minerals in *Moringa oleifera* tissues. The highest content of K is found in vegetable parts and immature seeds, while leaves and seeds are a rich source of Ca and Mg, respectively. In addition, Moringa's seeds and leaves contain high amounts of Ca, Mg, K, Mn, P, Zn, Na, Cu and Fe. Different parts of the Moringa oleifera tree containing roots, bark, leaves, flowers, fruits and seeds have traditionally been used in a variety of therapeutic applications, including abdominal tumors, hysteria (a psychological disorder), scurvy, stroke, helminthic bladder, prostate problems, wounds and other skin infections. Used. Stohs and Hartman described the physiological and pharmacological activities of the leaves, seeds, bark, roots, juices and flowers of *M. oleifera. M. oleifera* seeds have been found to be a good antioxidant that can reduce aging and cancer-related oxidative damage. Many of the bioactive compounds isolated from *M. oleifera* seeds have been found to be potential antitumor regulators. All parts of the Moringa tree are edible and have been consumed by humans for a long time. Moringa seed oil, also known as 'Ben oil' (30-40 % yield by weight), is a sweet, non-stick, non-drying oil resistant to rancidity. It has been used in salads, precision machine lubrication and in the manufacture of perfumes and hair care products. Moringa is one of the most important natural ingredients that can be used in purification of drinking water and low cost is also low risk for human health and the environment. Aruna and Srilatha reported the antibacterial effect of Moringa seed powder on water treatment and treatment of fish ponds. Egbuikwem and Sangodoyin observed that 90 % turbidity was removed by Moringa seed extract in well, river, water samples and they examined their effectiveness against *Escherichia coli* in river water. Moringa seeds are a potential alternative to some traditional synthetic chemical coagulants, such as alum, which can increase the risk of cancer, although not effective for removing turbidity, such as alum, and are considered to be natural, biodegradable, environmentally friendly and safer.

Conclusion. As can be understood from this information, *Moringa oleifera* plant has many positive effects on nutrition and health. In addition, it has various industrial uses. *Moringa oleifera* is a food that people can easily consume thanks to its fatty acids, proteins, minerals, vitamins and flavonoids. Moringa has medicinal and therapeutic effects on disease states thanks to its components. Different parts of the *Moringa oleifera* tree, including roots, bark, leaves, flowers, fruits and seeds, can be used for medicinal purposes. The rich antioxidant content and polyphenols of *Moringa oleifera* leaves are part of a healthy and balanced diet. *Moringa oleifera* has water treatment, biodiesel production and many more industrial uses. Moringa is one of the most cost-effective, low risk and natural ingredients in purifying drinking water.

EFFICIENCY OF THE NAVIGATION SYSTEM «DeclipseSPECT» IN TREATMENT OF BREAST CANCER

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The results of the «DeclipseSPECT» navigation system study for intraoperative imaging of signal lymph nodes in breast cancer patients at the Minsk Clinical Oncology Clinic were analyzed.

The work studied the use of intraoperative navigation system of declipseSPECT distribution in operations to remove breast cancer. Accuracy, sensitivity and specificity of method in treatment of malignant tumors of given localizations are established.

Keywords: breast cancer, malignant tumor, signal lymph node, «DeclipseSPECT» system.

The need to perform lymphadenectomy in the treatment of malignant tumors of various locations in the last two decades has undergone a significant revision. If earlier it was considered that in breast cancer, mastectomy with removal of axillary lymph nodes of 1-3 levels was considered mandatory, then according to the modern concept, in the absence of metastases in the axillary lymph nodes, lymphodissection cannot be performed [1]. The success of early metastasis in cancer patients was facilitated by the development of methods for detecting the sentinel lymph node, i.e. the first lymph node, which filters the lymph flowing from the tumor and collects malignant cells in a trap [2]. Its definition allows you to reasonably choose the appropriate amount of surgical intervention. Modern re-search shows that the «DeclipseSPECT» system, designed to visualize the distribution

of radionuclides in the human body using photon detection, effectively determines the spatial location of signal lymph nodes in malignant tumors of various localizations [3].

The principle of operation of the DeclipseSPECT navigation system is based on an isotope-associated detection method, which allows it to be used for intraoperative visualization of tumors and signal lymph nodes. In the isotope-associated method, a radioactive isotope is injected subcutaneously into the area of the tumor localization in the preoperative period. Then total lymphoscintigraphy is performed, during which the area with the highest gamma activity is detected on the patient's body, which is the projection of the signal lymph node. The operation of the DeclipseSPECT system consists in integrating radioactive scans of the study area with the usual video signal and infrared radiation from the antennas installed on the gamma probe and the patient's body, which allows you to achieve direct comparison of the 3D radiometer with the real anatomical picture and, consequently, achieve maxi-mum accuracy when removing tumor tissue and lymph nodes.

In order to determine the effectiveness of the DeclipseSPECT navigation system for intraoperative visualization of signal lymph nodes in patients with breast cancer, the results of treatment of patients from the Minsk clinical Oncology dispensary with various stages of development of malignant tumors were analyzed. All patients included in the study were examined according to the algorithms for the diagnosis and treatment of malignant neoplasms approved by the Ministry of health of the Republic of Belarus. Before the operation, they performed ultrasound examination of regional lymph nodes. Data for their metastatic lesion were not obtained in 100% of cases. The diagnosis of the primary tumor was verified cytologically in all cases. In this study, a lyophilized powder was used to obtain a solution of 99mts-SENTI-SCINT, the active substance of which is human albumin 100-600 nm. The isotope was administered to patients subcutaneously parareolarly or peritumorally also 2 hours before surgery. Scin-tigraphy was performed using SPECT/CT.

The signal lymph node was visualized using the «DeclipseSPECT» system in 100% of cases, which was con-firmed by scanning the remote lymph node in vitro, as well as scanning the bed of the remote node with a gamma probe. In nine patients with breast cancer, the signaling lymph nodes were subjected to urgent histological and cyto-logical examination. In 3 cases, urgent histological examination of the signal lymph node showed no signs of tumor growth. According to the results of the final histological examination, in 2 out of three cases, micrometastases were found in the signal lymph node, and in one case, macrometastases were found in both the signal and other lymph nodes of the remote collector. In 4 patients, metastases were not found in either the signal or other removed lym-phocollectors. In 2 patients, metastases were detected in the signal lymph nodes, while in 2 cases these metastases were the only ones. The following data on the accuracy, sensitivity and specificity of the method for breast cancer were obtained: accuracy – 83 %, specificity – 100 %, sensitivity – 57 %.

According to the results of the study, it can be concluded that the method used has high accuracy, specificity and sensitivity, which indicates the justification for using the «DeclipseSPECT» system in the treatment of malignant breast tumors. Based on the accumulation of a sufficient number of observations on breast cancer, it is advisable to study the possibility of refusing to perform radical axillary lymphodissection in intact signal lymph nodes.

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ENVIRONMENTAL ANALYSIS OF THE SVETLOGORSK REGION

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This work is devoted to the problems of the ecological state of the environment in Svetlogorsk. The subject of the study is the ecological state of the environment in Svetlogorsk. The purpose of the work is to analyze the features of the ecological situation in the Svetlogorsk region. The problems of pollution of atmospheric air, soil, natural waters and vegetation are urgent for the cities of Belarus. The impact of atmospheric air, water and soil pollution with harmful substances on the life of citizens varies from city to city and depends on its industrial specialization, the development of transport infrastructure and a number of climatic parameters.

Keywords: ecological status, air pollution, groundwater pollution, surface water pollution, soil pollution, vegetation condition.

There are 92 industrial enterprises with stationary sources of emissions into the atmosphere, natural waters and soil in the Svetlogorsk region. In terms of the amount of pollutant emissions into the environment emissions we register such large enterprises as OJSC «SvetlogorskKhimvolokno» (more than 40%), Svetlogorsk thermoelectric power station (30%), OJSC Svetlogorsk pulp and paper mill (about 20%).

Air pollution remains one of the most significant environmental problems in Svetlogorsk. Formaldehyde and carbon disulfide are the priority pollutants. In the residential area, the average annual concentration of formaldehyde exceeds the MPC by about two times, the excess of MPC for one-time concentrations reaches 3.5. Cases of exceeding the maximum one-time concentrations of carbon disulfide are observed. Emissions vary, but remain stable every year.

An important problem of the city is groundwater pollution. On the territory of the city and in the zone of its influence, nitrate, sulfate, chloride-sulfate, chloride-hydrocarbonate pollution of groundwater (mainly at the industrial site «SvetlogorskKhimvolokno») and an increase in Ph (in the zone of influence of the thermoelectric power station) are observed. Water pollution with nitrates can be found in the areas of individual development in the village of Neftyanikov, the village of Svetoch, Shatilki and the village of Yakimova Sloboda. In some areas of the city, there is an excess of iron content in groundwater used for water supply. Lead and cadmium are found among the most dangerous substances in the waters.

A significant amount of pollutants is discharged into the surface water bodies of the city. When discharging waste water from industrial enterprises, the greatest influence is exerted by suspended solids, phosphates, nitrates, chlorides, iron, copper, and oil products.

The problem of soil pollution in the Svetlogorsk is associated with the following groups of pollutants: heavy metals (primarily zinc) and water-soluble compounds (primarily sulfates). A high level of soil pollution is characteristic of garden plots, which is associated with their location in the immediate vicinity of the thermoelectric power station and «SvetlogorskKhimvolokno». The main pollutants are nickel and zinc. Increased copper concentrations are found in soils on the territory of individual enterprises, as well as in the oldest part of the city. In the soils of the city and the region as a whole, one can observe a slight increase in the content of individual metals and chemical compounds.

The basis of the city's green spaces are forest communities and parks, forest parks, sanitary protection zones formed on their basis, which are dominated by species that are not resistant to industrial emissions (primarily pine), which causes the deterioration and gradual degradation of plantations in the absence of proper care. In general, the city is characterized by a poor species composition of plantations.

EPIDEMIOLOGICAL ASSESSMENT OF INCIDENCE INDICATORS OF DIFFERENT FORMS OF THYROID CANCER IN THE POPULATION OF THE REPUBLIC OF BELARUS

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The analysis revealed an intensive increase in the incidence of papillary thyroid cancer in the population of the republic, with a decrease in mortality rates. For other forms of thyroid cancer, there was no change in the dynamics of morbidity and mortality.

Keywords: population of the Republic of Belarus, cancer of the thyroid gland, an accident at the Chernobyl nuklear power plannt, a gross intensive indicator, standardized indicator, aging indicator.

Introduction

One of the expected adverse medical consequences of the Chernobyl accident is an increase in cancer incidence in the affected population of our country [1].

The Republic of Belarus occupies one of the leading places in the world in terms of the incidence of thyroid cancer. The problem of thyroid cancer in Belarus became especially acute after the accident at the Chernobyl nuclear power plant, when the incidence increased several times, and in certain groups of the child population by 100 times. It is believed that papillary thyroid cancer is radiation-induced, but to date there has been no study of other forms of thyroid cancer [2,3].

Material and research methods

Research method: epidemiological analysis. The material for the study of various forms of thyroid cancer was the data of the Belarusian Cancer Registry for 2001-2017.

Purpose

Conducting an epidemiological analysis of the incidence of papillary thyroid cancer, follicular cancer, medullary cancer and anaplastic thyroid cancer.

Research results and their discussion

The analysis of rough intensive, standardized, age-specific indicators of morbidity and cumulative survival of various types of thyroid cancer in the Republic of Belarus has revealed a significant increase in the incidence of papillary thyroid cancer, starting from 2001.

In 2001-2017, 19,693 cases (16,195 in women and 3,498 in men) of thyroid cancer were registered in the Republic of Belarus. The ratio of the number of sick men and women during this time was 4.6 / 1.

In the structure of the incidence of thyroid cancer, the main share is occupied by papillary thyroid cancer (93%), follicular thyroid cancer (1.81%), medullary thyroid cancer (2.42%) and anaplastic thyroid cancer (0, 59%). At the same time, a pronounced increase is noted only for papillary thyroid cancer (the growth rate was ARC = 1.9 (1.51-2.3)% per year ($p > 0.05$)

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ESTIMATION OF THE CYTOTOXICITY OF CITARABIN AND CYCLOCYTIDINE•HCl IN COMBINATION WITH EMOXIPIN BY EXPRESSION CD107a

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The aim of the work was to evaluate the effects of cytarabine, cyclocytidine • HCl in combination with emoxipin on the cytotoxicity of lymphoid cells in co-culture with the human tumor cell line K562.

The expression of CD107a was assessed on NK cells and T lymphocytes (total and subpopulations of CD8 + T lymphocytes).

It was found that cytarabine and cyclocytidine•HCl in combination with emoxipin increased the expression of CD107a on T lymphocytes, but not on NK cells.

Keywords: cytotoxicity, cytarabine, cyclocytidine•HCl, emoxipin, CD107a.

An aspect limiting the use of cytostatic drugs is that these drugs have undesirable side effects due to possible effects on the genetic apparatus of the host cell. In this regard, it is attractive to search for substances or their combinations, the use of which will lead to a decrease in intoxication indicators in the body.

Thus, most authors point to the ability of antioxidants to improve the tolerance of chemotherapy, supporters of a different point of view believe that antioxidants inhibit the antitumor effect of chemotherapy. However, all these studies concern the use of nutraceuticals with a mild antioxidant effect (β-carotene; vitamins A, C, E; selenium; melatonin, cysteine; B vitamins; vitamin D3; vitamin K3; glutathione, coenzyme Q10).

CD107a is a marker for the degranulation of lymphocytes such as CD8 + and NK cells. and may also play a role in tumor cell differentiation and metastasis.

Evaluation of the effects of cytarabine, cyclocytidine • HCl on the cytotoxicity of lymphoid cells in co-culture with the human tumor cell line K562.

Cytotoxicity was assessed by the expression of CD107a (LAMP-1, English Lysosomal-associated membrane protein 1), a glycoprotein of the lysosomal membrane, on MIC in co-culture with K562. CD107a is detected on the surface of the cytoplasmic membrane during cell degranulation and characterizes the implementation of the effector function of cytotoxic cells. Expression of CD107a on effector cells (MIC or NK cells) was measured to assay lymphocyte degranulation. Lymphocytes were incubated with or without K562 cells. After 4 hours of culture, the cell mixture was stained with monoclonal antibodies against CD8-FITC, CD107a-PE, CD3-APC, and CD56-PC7 (R & DSystems, Beckman Coulter, USA). NK and T cells were gated as CD56 + and CD3 + cells, respectively, and cytotoxic T lymphocytes were additionally counted as CD3 + CD8 + cells. To determine the expression of CD107a cells, the positive rate of CD107a effector cells was analyzed.

In all cases, the expression of CD107a increases in all lymphoid populations with potential cytotoxicity in the presence of K562 (most shown on NK cells: 39.48 vs 1.35).

The addition of cytarabine enhances IL-2-stimulated expression of CD107a in all subpopulations, with the most represented effect in the population of NK cells, while in combination with emoxipin, expression is potentiated only on T-lymphocytes, but not on NK cells. Cyclocytidine has no represented effect, while in combination with emoxipin, there is a tendency to increase the expression of CD107a on T-lymphocytes.

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EVALUATION OF QUALITY OF LIFE INDICATORS OF PATIENTS WITH ISCHEMIC STROKE

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The purpose of the survey among patients was to assess the quality of life (QOL) of patients who had a stroke after a certain period of time: immediately after a stroke, at the beginning of rehabilitation and at the end of rehabilitation.

Keywords: ischemic stroke, depression, anxiety, rehabilitation.

Introduction

Stroke is the most common brain disease in adulthood and old age in the population. The incidence of strokes varies in different regions of the world from 1 to 4 cases per 1,000 population per year increasing significantly with age. In Belarus, the incidence of strokes is 2-2.5 times higher than in the countries of the European Union [1]. Stroke is the third leading cause of death and first among the causes of disability. In the acute stage of the disease, 25-30% of patients die, by the end of the first year of life - more than half. Among the survivors, up to 80% of patients, to one degree or another, need outside help due to paralysis, impaired coordination and speech. A significant proportion of patients after an ischemic stroke remain neurological deficits in the motor, sensory, emotional and mental spheres of the nervous system, which is reflected in the quality of life of these patients [2].

Material and research methods

The study was conducted on the basis of the Brest City Hospital No. 2. For these studies, 50 patients were selected who underwent ischemic stroke for the first time. The material was processed using the standard package of statistical and mathematical analysis of the Microsoft Excel 2012, Statistica software application.

Research results and discussion

In the course of our research, we obtained the following results. The first test was carried out by us according to the Zung method, according to which it is possible to determine depressive states in the studied patients (table1).

Table 1

The severity of the level of depression in patients identified according to the Zung method

Indicators	Number of patients		
	Immediately after a stroke	At the beginning of rehabilitation	At the end of rehabilitation
State without depression	2	4	23
Mild depression	34	37	25
Moderate depression	10	7	2
Severe depression	4	2	-

The data indicate that there was an improvement in depression scores during rehabilitation.

The initial state of the patients was mainly characterized by moderate and mild depression, and at the end of rehabilitation - by a state of mild depression and a state without depression.

The next test according to the Spielberg-Khanin method made it possible to assess the level of anxiety in patients (Table 2).

From the data obtained, it follows that after rehabilitation, moderate reactive anxiety is most common; at the beginning of rehabilitation, moderate anxiety also prevails, and after rehabilitation, patients note low and moderate reactive anxiety. The study of personal anxiety showed a predominance of low anxiety after rehabilitation. A high level of personal anxiety was observed only immediately after a stroke and at the beginning of rehabilitation.

Table 2

The severity of the level of depression in patients identified according to the Zung method

Anxiety levels	Number of patients		
	Immediately after a stroke	At the beginning of rehabilitation	At the end of rehabilitation
Reactive anxiety			
Low	-	-	16
Moderate	28	31	31
High	22	19	3
Personal anxiety			
Low	10	15	36
Moderate	35	33	14
High	5	2	-

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EXPRESSION OF microRNA let7 AND miR-140 IN SYNOVIAL LIQUID IN DEFORMING JOINT DISEASES UNDER HIGH ANTHROPOGENIC LOAD

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The work determined the expression levels of microRNA let-7e and miR-140 in the synovial fluid in patients with osteoarthritis. A statistically significant decrease in the expression of miR-140 in the synovial fluid was established in patients with gonarthrosis and coxarthrosis living in Minsk ($p < 0.05$, respectively). At the same time, the expression level of miR-140 decreases during the development of degenerative joint damage. MicroRNA let-7e cannot be a marker of osteoarthritis; however, it characterizes concomitant pathology and indicates the develop-ment of metabolic syndrome.

Keywords: microRNA, miR-140, let-7e, synovial fluid, osteoarthritis.

Osteoarthritis is a worldwide joint disease characterized by severe pain, limited mobility and inflammation of varying intensity. The participation of small non-coding RNAs (miRNAs) that perform regulatory functions in the formation and progression of pathological changes in the joints is discussed. MiR-140 deserves special attention as the main myrcoRNA involved in chondrogenesis and the development of cartilage tissue.

Purpose: to establish the features of the expression of circulating miRNA let-7e and miR-140 in synovial flu-id in patients with gonarthrosis and coxarthrosis living in Minsk.

The study group consisted of 24 patients, who gave the informed consent, with gonarthrosis and coxsarthrosis who underwent surgical treatment (arthroscopy or total arthroplasty). To determine the level of microRNA ex-pression in synovial fluid in patients with deforming joint diseases, we used a protocol of molecular genetic research adapted by us («miRNeasy Serum / Plasma Kit», Qiagen). The expression of microRNA was determined

in a two-step polymerase chain reaction (PCR): the reverse transcription stage (miRCURY LNA RT Kit, Qiagen), then - real-time PCR (miRCURY LNA miRNA SYBR Green PCR Kit, Qiagen). The hsa-miR-140-5p (MIMAT0000431) and hsa-let-7e-5p (MIMAT0000066) were studied. The obtained Ct values were normalized according to Ct of small nuclear RNA U6. To determine the expression of miRNAs, the 2-ΔΔCT method was used. Statistical analysis of the obtained results was carried out by nonparametric methods using the «Statistica 8.0» software.

A statistically significant decrease in the expression of miR-140 in synovial fluid was found in patients with gonarthrosis and coxarthrosis living in Minsk, compared with a similar indicator in the control group ($p < 0.05$). In addition, a statistically significant inverse correlation ($Rs = -0.65$, $p = 0.02$) was found between the level of miR-140 expression in the synovial fluid and the degree of osteoarthritis activity. There were no statistically significant dif-ferences in the level of let-7e expression in the synovial fluid compared with the control group ($p > 0.05$). However, a statistically significant moderate inverse correlation ($Rs = -0.53$, $p = 0.03$) was found between the level of let-7e expression in the synovial fluid and the degree of osteoarthritis activity. Probably, the increase in let-7e expression is associated with the components of the metabolic syndrome, which is quite common in patients with osteoarthritis [1].

Thus, miR-140 is the most promising biomarker for deforming joint disease. MicroRNA let-7e cannot be a marker of osteoarthritis, but it characterizes concomitant pathology and indicates the development of metabolic syndrome.

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EXPRESSIONAL ANALYSIS OF CIRCULATING microRNA FOR DIAGNOSTICS AND PREDICTION OF CELLULAR AGING AND DEVELOPMENT OF OSTEOARTHRITISPREDICTION OF CELLULAR AGING AND DEVELOPMENT OF OSTEOARTHRITIS

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A systematic review and meta-analysis of the data revealed potential microRNAs that are biomarkers of deforming joint diseases: miR-675, miR-146a, miR-195, miR-30b, miR-373, miR-140, miR-93, miR-132 and let-7e. MiR-27b, miR-199a, miR-185, let-7b, miR-141, miR-429, miR-146a are directly involved in the processes of cellular aging, which can lead to pathophysiological changes in the musculoskeletal system.

Keywords: osteoarthritis, cell aging, microRNA, biomarker.

Cell aging is assumed to be one of the factors involved in the development of joint diseases. Senescent cells are characterized by a stop of proliferation, which protects against negative changes. It is believed that such cells accumulate with age in tissues, leading to pathological age-related changes through the secretion of extracellular proteases, pro-inflammatory cytokines, chemokines and growth factors, which is called the “secretory phenotype associated with aging». Local elimination of senescent cells in a mouse model of post-traumatic osteoarthritis led to a decrease in pain syndrome and an increase in cartilage development. Also, recent data show that senescent cells can transmit limited aging phenotypes to neighboring cells, which is called secondary or paracrine senescence [1, 2].

Purpose of the work: determination of the risk of development and prognosis of the course of deforming joint disease on the basis of meta-analysis of data on the expression of circulating microRNAs and associated pro-cesses of cellular aging.

During the statistical analysis of scientific literature on the relationship of miRNAs with osteoarthritis, we identified 9 potential miRNA biomarkers: miR-675, miR-146a, miR-195, miR-30b, miR-373, miR-140, miR-93, miR- 132 and let-7e. A statistically significant increase in the expression of miR-146a in plasma was found in pa-tients with osteoarthritis compared with the same indicator in the control group ($p < 0.05$). It was revealed that

the most studied potential microRNA biomarker of cartilage inflammation isolated from plasma is miR-146a, and miR-140 is the most promising biomarker for deforming joint disease.

An experiment on mice showed that the composition of extracellular vesicles includes microRNAs responsible for the formation and progression of osteoarthritis (miR-27b, miR-199a, miR-185). Also, the group of microRNAs associated with the processes of cellular aging can include: let-7b, which causes a decrease in the prolifera-tion potential of muscle cells in mice and, as a consequence, insufficient regeneration of the aging muscle; miR-141, which reduces the level of ZMPSTE24 expression and post-translational proteolytic cleavage, leading to the accumulation of prelamin A, aging and dysfunction of mesenchymal stem cells, or by acting by another mecha-nism – by suppressing BMI proteins involved in stem cell self-renewal, thereby inhibiting cell proliferation; miR-429, which regulates apoptosis in human osteoblast cell lines by acting on the catalytic subunit of protein phosphatase 2A and indirectly activating AMP-activated protein kinase, thereby protecting human osteoblast cells from dexa-methasone-dependent oxidative stress; miR-146a, associated with inflammatory factors, such as IL-1β, IL-6, TNFα, IL-8, and does not affect the expression of extracellular matrix genes in articular chondrocytes in the ab-sence of inflammatory conditions, but the role of this miRNA in the pathogenesis of osteoarthritis is controversial: both a protective function and a destructive role in cartilage homeostasis are proposed [2].

Thus, potential biomarkers of osteoarthritis have been identified. It has been established that microRNAs are directly involved in the processes of cellular aging, which, in turn, can lead to pathophysiological changes in the musculoskeletal system.

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EXTRACORPORAL THERAPY AND ANTI-COAGULATION METHODS

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The aim of this work is to analyze anticoagulation methods during extracorporeal renal therapy. Despite great advances in dialysis therapy the mortality rate in acute renal failure remains high. With the increasing incidence of serious complications, severe bleeding has a significant risk. The problem of anticoagulation of the extracorporeal circuit during renal replacement therapy is a constant urgent problem.

Keywords: acute renal failure, extracorporeal therapy, anticoagulation, extracorporeal circuit, platelets, bleeding.

Inadequate anticoagulation leads to a decrease in the effectiveness of extracorporeal therapy, filter thrombosis and increased blood loss. An overdose of an anticoagulant can cause numerous hemorrhagic complications. The main risk factors for bleeding and coagulopathies during surgery are: thrombus formation through activation of the coagulation cascade, platelet structures can be damaged, suppression of fermentation activity, activation of arachidonic acid metabolism and deposition of hepatocytes in sinusoids, patient's blood contact with perfusater, development of fibrinolysis, decreased effectiveness of antithrombin III, hypoxia, impaired blood rheology.

A differentiated approach to the choice of anticoagulation method in patients with a risk of bleeding is determined by the degree of prolongation of activated partial thromboplastin time, aspartate aminotransferase, prothrombin time, hemodilution level, fibrinogenemia, deficiency of natural anticoagulant and plasminogen activity, thrombocytopenia, and the duration of the procedure.

In the case when the patient has severe hypocoagulation, thrombocytopenia, active bleeding, a high risk of hemorrhagic complications, it is recommended to carry out renal replacement therapy without the use of anticoagulants. The duration of the procedure should be no more than 6 hours.

The need for heparin corresponds to the number of platelets in the peripheral blood, and therefore most patients with thrombocytopenia do not need anticoagulation during renal replacement therapy.

It is noted that the technique of the extracorporeal contour is advisable to apply if it is necessary to carry out renal replacement therapy procedures lasting 8-12 hours. TECC is a thromboresistant, highly effective and safe method for RRT in patients at high risk of bleeding.

Anticoagulation of low molecular weight heparins is indicated in patients with decreased activity of natural anticoagulants.

In the course of the study, it was revealed that regional anticoagulation with heparin is indicated in patients without significant thrombocytopenia, with severe hemodilution and coagulopathy, fibrinogenemia, and preserved activity of AT-III and protein C, in the presence of fibrinolysis and a high risk of bleeding, with a procedure which lasts more than 8-10 hours and with relatively stable hemodynamics of patients.

Citrate: Citrate binds Ca ++ required for the coagulation cascade; does not have antiplatelet activity (recommended for thrombocytopenia); removed by dialysis (systemic effect decreases); it is neutralized when circulating in the blood.

Other methods of EKK anticoagulation can be: citrate; heparin with PG12 proglandin (up to 48 hours); recombinant monoclonal antibodies to platelet surface glycoprotein receptors; hirudin (thrombin inhibitor); serine proteases (aprotinin, naphomostat, maleate).

It is worth noting that these techniques are an integral part of the treatment of patients with acute renal failure, since it is adequate anticoagulation that helps to avoid complications during dialysis therapy.

FEATURES OF SENSITIZATION IN INCREASING EFFICACY OF RADIO-THERAPY

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One of the techniques used in the complex therapy of malignant neoplasms is applying ionizing radiation to increase the lethality of cells affected by a malignant tumor. The compound of lithium and oxyglycine will reduce the radiation dose necessary to achieve positive dynamics in the treatment of tumors and help to keep the cognitive functions of the central nervous system. The study drug was administered parenterally (intraperitoneally) to the animals of the experimental groups at doses of 120, 70, and 40 mg/kg. 25 days after irradiation, all animals in all three experimental groups died, and in the control group 7 animals were alive. The minimum of the tested doses of the drug (40 mg/kg of live weight) showed the maximum biological effect. Protecting cognitive functions and lower-ing the radiation dose, while still achieving a positive clinical effect, is a promising direction in radiobiology.

Keywords: radiosensitization, lithium oxyglycinate, cognitive functions, radiation therapy, radiation.

The use of ionizing radiation to induce the death of cells affected by a malignant tumor is one of the meth-ods applied in the complex therapy of malignant neoplasms. Therefore, in radiobiology, the development of drugs that help protect healthy cells surrounding the tissue affected by a cancerous tumor, and drugs that reduce the radi-osensitivity of affected tissues are widely discussed. The compound of lithium ang oxyglycine will reduce the radia-tion dose necessary to achieve positive dynamics in the treatment of tumors, and help to keep the cognitive func-tions of the central nervous system.

The aim of the research was to study the effect of ionizing radiation on the hematological parameters of Wistar rats with the introduction of various dosages of lithium oxyglycine.

The experiment was carried out on 150 Wistar rats at the age of 6-8 weeks. The animals were irradiated on a Luch gamma device; Co40 with an initial activity of 4000 Curie was used as a radiation source. The radiation dose was 7 Gy and 5 Gray. The animals were injected parenterally (intraperitoneally) with the studied drug at doses of 120, 70, 40 mg/kg of live weight, respectively, of the 1st, 2nd and 3rd experimental groups. The 4th group served as a control, and the 5th group was intact. The study determined the hematological parameters (Mindray BC-2800Vet), the phagoactivity of polynuclear cells, the content of phagocytic polynuclear cells (neutrophils, pseudo-eosinophils).

The number of dead animals in all three experimental groups in the first 5 days after irradiation was at the same level as in the control group. From the 10th day on, the number of dead animals in the experimental groups has begun to gradually exceed the mortality in the control group. By the 30th day, in the experimental groups, with the introduction of the drug in doses of 120, 70 and 40 mg/kg of body weight, respectively, not a single animal was alive. In the control group, 7 species or 46.6 % of species were alive, the rest of them died from the intestinal form of radiation sickness. The death of intact animals during the experiment (30 days) was not observed. Thus, the lowest of the tested doses of the drug (40 mg/kg of live weight) showed the maximum biological effect.

When the radiation dose is reduced to 5 Gy in the groups with lithium oxyglycinate (40 and 10 mg/kg of live weight), the death of animals is observed, which is characteristic of higher doses. With a decrease in the absorbed dose of gamma radiation in the control group (7 Gy), mortality accompanied by symptoms of radiation sickness has decreased by 20 % compared to the group receiving the half-lethal dose.

On the 15th day, the most characteristic erythropenia was observed in rats receiving a dose of 7 Gy. A similar situation was observed at a dosage of 5 Gy while using lithium oxyglycinate, which is a sign of sensitization. In animals that did not receive lithium salts at a dosage of 5 Gray, the revealed effect was significantly lower. On the 30th day, the significant differences were found in rats that received a dosage of 7 Gy in comparison to the control group.

Conclusion. Therefore, the specific radiosensitization properties cannot be considered to be a consequence of the toxicity of the drug, and its adverse effect on metabolic processes in the animal body. However, after studying the properties of the lithium salt of oxyglycine, it can be argued that the underlying mechanisms responsible for its ability to increase tissue radiosensitivity are still not clear. At the same time, the protection of cognitive functions and the reduction of the radiation dose, when a positive clinical effect is achieved, is a promising direction in radio-biology.

FEATURES OF THE POPULATION COMPOSITION OF LYMPHOCYTES IN INDIVIDUALS WITH EBV-INFECTION

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In recent years, the number of patients suffering from chronic recurrent herpes-viral infections has increased. Diagnosis and treatment of herpesvirus infections is one of the current problems of modern medicine. The Epstein-Barr virus is one of the most common viruses in the human population. The virus is much wider than can be expected.

Keywords: B-lymphocytes, infectious process, immune response, infection, infectious mononucleosis, antigen, herpesvirus, CD.

The herpes virus of a person type 4, or Epstein-Barr virus, causes three diseases in humans: infectious mononucleosis, nasopharyngal carcinoma and Burkitt lymphoma. The source of infection is a sick person, including patients with erased forms of the disease. The disease is a little contagious. The virus is ubiquitous and is present in all age groups.

The host's immune response to a viral infection includes CD8's positive T-lymphocytosis with cytotoxic functions, leading to atypical lymphocytosis in the peripheral blood. High mutability, allows it for a certain time to avoid exposure to specific specific immunoglobulins and cells of the host immune system.

Infectious mononucleosis is an acute infectious disease of viral nature mainly with air-drop mechanism of infection [1].

Recently, much attention has been paid to infectious mononucleosis as a disease of the immune system. The virus does not destroy infected cells (B-lymphocytes), but stimulates their reproduction; can stay in lymphocytes for a long time. To diagnose infectious mononucleosis most of all helps conducted in the laboratory, clinical blood test. Because the virus of infectious mononucleosis specifically affects blood cells. Therefore, in the laboratory study of blood doctors find special cells - atypical mononuclears, which in the absence of the virus mononucleosis should not be [2].

Twenty-seven children were included in the study. Of these, 17 boys, aged between 2 and 17. And 10 girls from 3 to 13 years old. The diagnosis of «infectious mononucleosis» was made on a set of clinical and laboratory

parameters, including a characteristic clinical picture. Clinical manifestations of diseases caused by VEB largely depend on the severity of the process. The presence of typical lymphocytes in the peripheral blood, the detection of antibodies to VEB in the blood.

Statistical processing of data revealed the high heterogeneity of the indicators studied. Due to the heterogeneity of the indicators, we assumed the presence of options for the body's response to VEB infection.

The study draws the following conclusions:

1) In children with infectious mononucleosis there are various changes in the population composition of peripheral blood lymphocytes, which corresponds to such features of infectious mononucleosis as «variability of the course of the disease and variability of the immune response»;

2) The main features of the population composition of lymphocytes peripheral blood of children with infectious mononucleosis are an increase or decrease in the representation of T-lymphocytes, a decrease in the representation of T-helpers, an increase in the representation of T-cytotoxic and NK-lymphocytes, as well as a predominant increase in the number of B-lymphocytes.

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FEATURES OF THROMBIN-INDUCED PLATELET ACTIVATION IN PREGNANT WOMEN WITH PREECLAMPSIA

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Preeclampsia (PE) is one of the most complex and important problems of scientific and practical obstetrics. In pregnant women with PE there was a significant increase in the degree and rate of platelet aggregation at a thrombin concentration of 0.05 mg/ml. The range of thrombin concentrations used is 0.01, 0.02, 0.05 mg/ml.

Keywords: Preeclampsia, arterial hypertension, platelets, thrombin, aggregation, PAR-receptors.

In PE it is the blood platelets that undergo particularly significant changes. At this time progressive thrombocytopenia is observed which is accompanied by increased intravascular platelet aggregation, the onset of which is believed to be a trigger for the development of this pregnancy complication [1].

Thrombin plays an important role in hemostasis, platelet activation and blood clot formation. Thrombin circulates in the bloodstream in an inactive state in the form of prothrombin which is converted to an active enzyme by splitting two peptide bonds in the molecule. It is one of the main activators of platelets and the main enzyme of the blood clotting system which catalyzes the main reaction of this system to convert fibrinogen into fibrin.

To study the platelet aggregation capacity in pregnant women with physiologically occurring pregnancy and pregnant women with PE thrombin was used in concentrations of 0.01, 0.02 and 0.05 mg / ml as the most powerful platelet activator.

In experiments it was found that when using thrombin at a concentration of 0.01 mg / ml the aggregation rate in physiological pregnancy (19.82±2.54%) did not have statistical differences from that in preeclampsia (22.35±3.73%), ($P>0.05$). At the same time the aggregation rate in physiological pregnancy (21.43±5.84%/min) differed from the corresponding indicator in PE (26.81±4.02%/min), ($P<0.05$).

With a thrombin concentration of 0.02 mg / ml, the aggregation rate in physiological pregnancy was 29.65±6.04%, and in PE -40.24±6.21%, which had statistically significant differences ($P<0.05$); the aggregation rate In physiological pregnancy was 44.86±6.14%/min and 42.5±7.79%/min in PE ($P>0.05$).

When using thrombin at a concentration of 0.05 mg / ml, the aggregation rate in physiological pregnancy was 48.36±4.79% and 55.09±5.41% in PE. This indicator had statistically significant differences ($P<0.05$); the aggregation rate in physiological pregnancy (53.23±5.51%/min) and PE (60.9±8.08%/min) also had statistically significant differences ($P<0.05$).

During the experiment a significant increase in the degree and rate of platelet activation was found in pregnant women with moderate PE in response to the action of thrombin (0.05 mg/ml) compared with physiologically occurring pregnancy.

The state of PE is presumably accompanied by an increase in the functional activity of PAR receptors mediating platelet activation, due to binding to thrombin. Signal transmission inside the cell via PAR-receptors is carried out by G-proteins (Gq, G12/12, Gi) that cause shape changes and enhance platelet shape changes and their activation. Signal transmission inside the cell via PAR-receptors is carried out by G-proteins (Gq, G12/13, Gi). Exposure to Gq protein leads to activation of phospholipase Cß (PLCβ), signaling to G12/13-protein activates RhoA (stimulates phosphorylation of myosin light chains) and Rho kinase (stimulates phosphorylation of myosin light chains), exposure to Gi-protein, leads to inhibition of adenylate cyclase and thereby a decrease in the level of cAMP in platelets.

Advanced monitoring and early detection of increased platelet aggregation in pregnant women with PE can significantly contribute to the timely diagnosis, prevention and treatment of this pregnancy complication.

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FREQUENCIES OF FCGR3A AND NKG2C GENE POLYMORPHISMS IN DONORS FOR ALLOGENEIC HEMATOPOETIC STEM CELL TRANSPLANTATION OF PATIENTS WITH LEUKEMIA

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The achievements of the last two decades in the field of oncoimmunology have revealed a significant potential for using the resources of the immune system in the treatment of malignant neoplasms. Natural killer (NK) cells are one of the key participants in the cellular component of antitumor immunity. The cytotoxic activity of NK cells is regulated, among other things, by a wide repertoire of activation and inhibitory receptors expressed on the surface of this group of lymphocytes. The receptors of NK cells are characterized by significant genetic polymorphism, which contributes to the regulation of functional activity.

Keywords: NK cells, inhibiting and activating receptors, immunotherapy.

Bone marrow transplantation is one of the options for anticancer therapy in the treatment of leukemia. An allogeneic transplant from an unrelated or haploidentical donor can exhibit cytotoxic activity towards residual tumor cells of the recipient, including due to the presence of alloreactive NK cell populations. The genetic status of the activation receptors of NK cells can be used as additional parameters when choosing an allogeneic donor. With the aim of further implementation of the above approach, we are developing a method for genetic analysis of CD16 (FCGR3A) and NKG2C gene polymorphisms.

CD16 is an activation receptor whose function is to regulate the antibody-dependent cytotoxic activity (ADCC) of NK cells. It is encoded by the FCGR3A gene. The studied polymorphism rs396991 at position chr 1: 161544752 (GRCh38.p13) determines the affinity of the receptor encoded by the CD16 gene for the constant domain of antibodies. The allele carrying the polymorphism under study encodes a high-affinity receptor variant. The wild type allele encodes a low affinity variant.

Another activation receptor is NKG2C, which is a type II transmembrane glycoprotein. It is encoded by the KLRC2 gene. The investigated deletion of the NKG2C locus (KLRC2) at position Chr 12: 10,426,854-10,442,300 (GRCh38: CM000674.2) is the reason for the absence of expression of the NKG2C receptor on the surface of NK- cells. The use of donor material with the investigated deletion can lead to reactivation of CMV infection in recipients.

At this stage of the research, we had the following goal: to develop a method for genetic analysis of the FCGR3A and KLRC2 gene polymorphisms.

Materials and methods: the study was carried out on a group of allogeneic bone marrow donors, the material of which was used for transplantation of patients with leukemia. All patients underwent treatment on the basis of the Belarusian Research Center for Pediatric Oncology, Hematology and Immunology.

Genetic analysis is carried out by PCR amplification of fragments of the FCGR3A and KLRC2 genes. For the KLRC2 gene, the presence of the studied polymorphism (deletion) is determined by the method of electrophoretic separation of PCR products in agarose gel. For the FCGR3A gene, the presence of the studied single nucleotide polymorphism was determined by the Sanger sequencing method.

Results: bone marrow samples from 50 donors were taken.

The results of determining the rs396991 (G> T) polymorphism of the CD16 gene (FCGR3A) are the following: allelic frequency of polymorphism – 61%. Distribution by genotype: homozygous for wild-type – 9,8%, heterozygous – 56,8%, homozygous for polymorphism – 33,4%.

The results of the study for the presence of the NKG2C locus (KLRC2) deletion: the allelic frequency of the deletion was 21,4%. Distribution by genotype: homozygous for wild type – 61,2%, heterozygous for – 34,7%, homozygous for deletion – 4,1%.

IFNγ PRODUCTION TO T-LYMPHOCYTES OF PATIENTS WITH NON-SPECIFIC INFLAMMATORY DISEASES OF THE INTESTINAL

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Nonspecific inflammatory bowel diseases, which include Crohn's disease and ulcerative colitis, are autoimmune inflammatory diseases with unknown etiology and insufficiently understood pathogenesis. The effector mechanisms arising from the symbiosis of genetic and external factors lead to the development of nonspecific transmural immune inflammation in the mucous membrane of the intestinal wall. Impaired immune response is primarily expressed in the selective activation of T-cell immunity, the balance between pro-inflammatory and anti-inflammatory cytokines is shifted towards the prevalence of the former (IL-1, IL-6, TNF, IFNγ) [1]. Saccharomycetes, poly- and oligosaccharides that are part of the cell wall can act as an initiating factor. Analysis of IFNγ production by T-lymphocytes of patients with IBD under conditions of specific and nonspecific stimulation can be used to search for biomarkers to assess the therapeutic efficacy of new drugs.

Keywords: interferon gamma, Crohn's disease, ulcerative colitis.

Aim of study: to assess the number of IFNγ-producing T-lymphocytes in patients with IBD under conditions of nonspecific and specific stimulation.

Patients and methods. Subject: 18 patients with IBD (12 men / 6 women, average age 30 years) and 18 healthy donors (10 men / 8 women, average age 34 years). The number of IFNγ-positive T-lymphocytes was assessed by flow cytometry (Cytoflex) by staining with anti-γ-interferon-Ab labeled with phycoerythrin (Beckman Coulter, France) and anti-CD3-P7 (Beckman Coulter, France). Pre-isolated on a Roti-Sep density gradient (Germany) peripheral blood mononuclear cells were cultured in the presence of a polyclonal mitogen phytohemagglutinin (PHA) or saccharomycete oligosaccharide mannan (MAN), which acts as an initiating factor in IBD, for 3 days at a final concentration of 2.5 μg / ml and 4 μg / ml, respectively. Data processing was carried out using the STATISTICA 8.0 program. using the Mann-Whitney test with a significance level of 0.05.

Results. In patients with IBD, in comparison with donors in an unstimulated culture of peripheral blood mononuclear cells, an increase in the number of CD3+γIFN+ lymphocytes (14.49 (9.53-23.18%) and 9.18 (5.2- 12.8)%, p = 0.013, respectively). Upon stimulation with the proliclonal nonspecific mitogen PHA, a decrease in the number of CD3+γIFN+ lymphocytes was found in the group of patients with IBD compared with the group of donors (14.17 (10.52 ÷ 29.57) and 22.615 (19.32 ÷ 26.2), p = 0.046, respectively). In mannan-stimulated culture, an increase in the number of CD3+γIFN+ lymphocytes was found in the group of patients with IBD compared with the group of donors (14.12 (10.22 ÷ 24.04) and 8.09 (7.44 ÷ 10.62) p = 0.01, respectively).

Conclusion. The results obtained indicate a pro-inflammatory orientation of T-lymphocytes in patients with IBD towards T-helpers 1, which is confirmed by a statistically significant increase in IFNγ-positive cells in mannan-stimulated culture. The number of CD3 + γIFN + cells can be used as biomarkers for evaluating the therapeutic efficacy of new drugs.

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IMMUNE STATUS OF PERSONS WITH IN-HOSPITAL INFECTION

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The increase in the number of nosocomial infections and the dominant position of opportunistic bacteria in their etiological structure is one of the important directions in the evolution of the modern period. Nosocomial infections enter, on the one hand, in human infectious pathology, on the other hand, in the problem of the safety of medical care. The immune status of patients plays an important role in characterizing the course of nosocomial infections.

Keywords: nosocomial infections, opportunistic microorganisms, pathogen transmission mechanism, T-lymphocytes, surgery, hernia, cholelithiasis.

Nosocomial infections are infectious diseases associated with stay, treatment, examination and seeking medical help at a medical institution. Joining the underlying disease, nosocomial infections worsen the course and prognosis of the disease. Sporadic morbidity (90-98%) is represented by purulent-inflammatory diseases of newborns, women in childbirth, post-injection abscesses, suppuration of postoperative wounds, sepsis, intestinal and aerosol infections, urinary tract infections, parenteral hepatitis. According to official data, surgical site infections (SSIs) make up about 13-30% of all nosocomial infections; the share of surgical hospitals accounts for about 60% of all nosocomial infections. Depending on the hospital profile and the type of surgical wound, SSIs can develop with a frequency of 4 to 100 cases per 100 operations (on average, 10 per 100). About 25% of these are not preventable. SSIs determine up to 40% of postoperative mortality. Endogenous infections account for up to 80%. Leading nosological forms: suppuration of postoperative wounds, pneumonia, peritonitis, abscess, endometritis [1].

All examined patients were routinely operated on for inguinal hernia and cholelithiasis. In the period 3-5 days, the examined persons developed purulent inflammation of the operating wound. The etiological agent was S. aureus resistant to beta-lactam antibiotics. There were no significant differences in the content of lymphocyte populations in the peripheral blood in individuals with different diagnoses.

In the group of examined patients, a purulent-inflammatory complication after planned operations for hernia and gallstone disease develops against the background of changes in the population composition of peripheral blood lymphocytes - a decrease in the number of T-helpers (observed in almost all examined individuals - 97.5%). Against the background of acute inflammatory surgical diseases, it changes the reaction of the leukocyte system to an operational injury with a decrease in the number of lymphocytes, which reflects the severity of necrobiotic processes and does not depend on the type of pathogen. With a surgical infection, the reactivity of the leukocyte system is activated, with its generalization, signs of a secondary immunodeficiency state, caused by intoxication, develop [2].

There is also an increase in T-cytotoxic lymphocytes (observed in 97% of the examined individuals). These indicators indicate a lack of immunity, a decrease in the hyperactivity of the immune system and is a sign of a complicated course of the postoperative period [1].

In a significant number of patients, a purulent-inflammatory complication after surgery proceeds against the background of a decrease in the functional potential of T-lymphocytes, determined by the CD28 molecule (78.5% of the examined individuals). From this position, this observation confirms the immunological nature of purulent complications after surgery in the examined individuals: in a number of patients, signs of functional T-lymphocyte insufficiency associated with a decrease in the number of T-lymphocytes expressing the co-stimulating molecule CD28 are recorded. In a number of examined individuals, the decrease in the potential of T-helpers proceeds with compensation by other populations of lymphocytes, including B-lymphocytes and NK-lymphocytes.

Thus, this study shows that in the development of nosocomial infection, the leading role was played not by a specific pathogen, features of the initial diagnosis, but by the load of the surgical operation and the immune status.

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INCIDENCE OF CIRCULATORY DISEASES AND ASSESSMENT OF EFFECTIVENESS OF CARDIOLOGICAL ASSISTANCE IN DIFFERENT GENDER AND AGE GROUPS

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Annotation: The analysis of the incidence of diseases of the circulatory system in the population of the 9th therapeutic site of 23rd city polyclinics of Minsk have showed that there has been an increase in both primary and general incidence of various forms of cardiovascular diseases from 2018 to 2019. For the period from 2018 to 2019 an increase in mortality from causes associated with pathology of the heart and blood vessel was recorded.

Keywords: coronary heart disease, cerebrovascular diseases, arterial hypertension, diseases of the circulatory system.

In Belarus, the pathology of the cardiovascular system is an extremely important problem since it determines more than half of the cases of disability and mortality of the adult population. The mortality rate of the working-age population from cardiovascular diseases in Belarus is currently 4.5 times higher than in the EU. The incidence of diseases of the circulatory system (CVD) is characterized by a high prevalence, disability, and mortality. Therefore, the need to intensify measures to improve the effectiveness of early detection and timely provision of medical care in full to such patients comes to the fore [1–2].

To analyze the incidence of cardiovascular diseases and assess the effectiveness of cardiac care at the outpatient stage, statistical data obtained during the implementation of an independent outpatient appointment, as well as the performance of primary home visits, active visits and patronage by an assistant doctor for outpatient care of the 9th therapeutic section of the 23rd city polyclinic of Minsk were taken.

Analysis of the prevalence of pathology of the heart and blood vessels (CVD) showed that the overall incidence of CDS in 2018 was 40.1%, in 2019 - 54.1%, the share of CDS in the structure of the total morbidity in the area increased from 48.2% in 2018 to 55.1% in 2019 year, and various forms of ischemic heart disease (CHD) took 30.5%, cerebrovascular diseases (CVD) - 16.3%, diseases occurring against the background of high blood pressure (primary and secondary hypertension, CHD with arterial hypertension (AH), CVD with AH) , gained 45.7% in total. The primary incidence of CVD, calculated per 1000 population, increased from 130.2 cases in 2018 to 148.2 cases in 2019; there was also an increase in the overall incidence - from 400.6 cases in 2018 to 541.4 cases in 2019

Among the patients from 18 to 40 years old, the leading form of CVD in 2018 was rubric diseases I10-I15 by ICD-10, whose contribution to the structure of CVD incidence was 61.9% with an increase by 2019 to 70.6%. Primary and secondary hypertension retained superiority among all forms of CVD and among the patients from 40 to 60 years old - the contribution to the structure of CVD in 2018 was 43.4%, with an increase of 2.7% by 2019 to 46.1%. Among patients over 60, the first place in the structure of the incidence of CVD is IHD, occurring against the background of arterial hypertension - in 2018 its contribution was 51.8%, in 2019 there was a decrease in the share in the structure of CVD by 4.4% to 47.4%.

The increase in mortality associated with CVD, was noted in the course of the study, whose indicator was 8.2 and 9.9 cases per 1000 population in 2018 and 2019, respectively. The rate of increase in mortality associated with CVD was 23.1%, including among men - 25%, among women - 22.2%. The contribution of the male population to the structure of the overall incidence of CVD was 28.8% in 2018 and 28.9% in 2019, while the female population - 71.1% and 71.2% in 2018 and 2019, respectively.

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INDICATORS OF HUMORAL IMMUNITY IN PATIENTS WITH IGA NEPHROPATHY

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IgA nephropathy is currently the most common form of glomerulonephritis in the world. The pathogenesis of the disease remains unclear. Morphological and clinical manifestations of IgA-nephropathy, course features, response to therapy, and prognosis are characterized by extreme variability. The clinical manifestations of the disease vary widely not only in different patients, but also in the same patient throughout the disease [1].

Keywords: immunoglobulin A (IgA), IgA receptors, IgA nephropathy, enzyme immunoassay.

Introduction. Modern medicine needs to identify prognostic signs that would allow us to determine the tactics of further treatment until the appearance of irreversible renal fibrotic damage. Recently, some progress has been made in understanding the pathogenesis of Idan, which will allow in the future to form a comprehensive therapeutic approach for this type of glomerulonephritis, which will be based not only on morphological and clinical data, but also on immunological indicators.

Material and research methods. The study of humoral parameters was performed on peripheral blood serum obtained from patients with various diseases affecting the kidneys: IgA-nephropathy, chronic glomerulonephritis, systemic lupus erythematosus.

In total, 36 patients were examined. The experimental group consisted of 18 male patients from 19 to 52 years old, with an average age of 32 years, and 16 female patients from 23 to 57 years old, with an average age of 34 years.

The concentration of immunoglobulins A, M, G and E in peripheral serum was determined by enzyme immunoassay, the results of which were evaluated spectrophotometrically using a calibration graph.

Results. In most patients with IgA nephropathy, serum concentrations of iimmunoglobulin, G and M are normal, but in some people they exceed normal values. An increase in the concentration of serum IgA indicates that the IID Independent immune response of the mucous membranes is suppressed and the antigenic load on the bone marrow increases. An increase in the concentration of IgM and IgG in the blood serum may indicate that an enhanced immune response occurs and the elimination of immune complexes is accelerated.

Correlation analysis of the relationship of clinical indicators with the levels of immunoglobulin concentrations showed a relationship between the level of IgG in the blood of patients with IgA-nephropathy and daily proteinuria (= -0.55), which indicates damage to the renal glomeruli and impaired protein filtration in IgA-nephropathy.

Conclusions. The concentration of IgG4 and its correlation with clinical and laboratory parameters can serve as a biomarker of kidney damage, prognosis of the course of the disease, and the effectiveness of therapy.

Despite the absence of statistically significant differences between the study groups, the concentration of serum IgE showed a trend (0.06), which draws attention to the fact that this type of immunoglobulin can affect the development of IgA nephropathy.

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INDICATORS OF NEUTROPHILS PHAGOCYTIC ACTIVITY IN PATIENTS WITH INFECTIOUS BOWEL DISEASE

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Currently, countries around the world face with an increase in opportunistic microorganisms. Acute intestinal infections are among the most common diseases caused by opportunistic organisms. Every year they claim about 13 million lives [1].

The aim of this research is to study the phagocytic activity of peripheral blood neutrophils in individuals with acute intestinal infections. To achieve this aim, the following tasks are set: to master the method for determining the phagocytic activity of peripheral blood neutrophils; to determine the phagocytosis completion index in individuals with acute intestinal infections.

Keywords: enterobacteria, Escherichia, microorganisms, intestinal infections, blood, neutrophils, antibiotics.

The research is based on the clinical data from 10 patients with acute intestinal infections. The research material for the study was peripheral blood of 10 adults (7 men and 3 women) aged 23-25 years with «acute intestinal infection». Phagocytic activity indicators were studied in the course of the study.

The method of isolation of mononuclear cells in density gradient was used to isolate neutrophils from peripheral blood. The result was evaluated after seeding neutrophils and bacterial suspension on the culture medium by comparing colony-forming units and the bactericidal index of neutrophils between the control sample of bacterial suspension and samples of bacteria mixed with neutrophils [2].

The results of the research are the following:

1) In clinically healthy donors, the bactericidal activity of neutrophil phagocytosis reduces the colony-forming unit of E. coli by 2lg (namely from 7.15 to 5.5 ± 0,07 lg CFU);

2) In individuals with acute intestinal infections, the bactericidal activity of neutrophil phagocytosis can reduce the CFU of E. coli insufficiently in comparison with the CFU of an intact sample (7,15 to 6,21 ± 0,63 lg CFU);

3) In individuals with acute intestinal infections, the neutrophil bactericidal index is significantly lower than in clinically healthy donors (0.87 ± 0.9 and 0.77 ± 0.01, respectively), which indicates a lack of phagocytosis as a mechanism of immune protection.

Since neutrophil phagocytosis in the examined individuals is not as active as in clinically healthy individuals, it is assumed as the result of the analysis of phagocytosis bactericidal indicators – lg CFU and the neutrophil bactericidal Index, that acute intestinal infections are associated with a lack of phagocytic activity. This mechanism within the framework of the immune response to an opportunistic microbe does not have the proper effect, which leads to the formation of an infection caused by opportunistic organisms.

Based on the results of the research carried out to assess the indicators of phagocytic activity of neutrophils in patients with infectious bowel disease, we can conclude that:

1) In individuals with intestinal infections of Escherichia etiology, the activity of neutrophil phagocytosis is reduced according to the index of neutrophil bactericidal activity in comparison with clinically healthy individuals;

2) A decrease in the phagocytic activity of neutrophils against E. coli in intestinal infections is a component of immunological insufficiency, which determines the possibility of developing an infectious disease caused by opportunistic organisms.

Thus, we can conclude that such indicators as the colony-forming unit and the bactericidal index allow us to determine the changes in the body due to intestinal infection and help to correctly assess the phagocytic activity of neutrophils in human blood, which can serve as the basis for the proper treatment and prevention of escherichiosis.

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INFLUENCE OF LOW-MOLECULAR COMPOUNDS ON THE PROCESSES OF PROTEIN MOLECULES AGGREGATION

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The aim of this work is to develop a general understanding of the aggregation process and its role in human metabolism.

Keywords: aggregation, amyloid, fibrillation, folding, chaperones, proteins, neurodegenerative diseases, diabetes mellitus.

The theory that one polypeptide chain can only accept one unique spatial conformation is no longer relevant. The formation of different prion structures is convincing proof of this, showing how, through conformation changes, a single protein can form different structures, including amyloids and amyloid-like fibres. Improper protein formation leads to the development of many neurodegenerative diseases, such as type 2 diabetes, Alzheimer's and Parkinson's disease and others.

The aggregation process can be divided into the following stages: the transformation of soluble native proteins into aggregation-prone intermediations; nucleation, which precedes the growth of the aggregate and is characterized by a relatively slow stage of nucleus formation; and the growth of protein aggregates, which can occur according to two mechanisms - «monomer-cluster» aggregation and «cluster-cluster» aggregation [1].

Low-molecular compounds affecting aggregation: osmolites, pharmacological chaperones, polyelectrolytes, free amino acids and polyamines.

In response to stress, many living organisms accumulate high concentrations of osmolites, which have a protective function. They stabilise the three-dimensional structure of the protein, inhibit the unfolding of the protein under denaturing conditions and increase the yield of native protein during refold. The anti-aggregating activity of osmolites is manifested in the suppression of protein aggregation through interaction with hydrophobic sites on the surface of deployed protein molecules [2].

Pharmacological chapyrons are small molecules such as lobelin, glucosamine, tetrahydrobiopterin, pyridoxine and others intended for selective interaction with an incorrectly collapsed protein target. They stabilise the protein structure, preventing degradation and increasing biological activity. They can also be used to correct defects in protein holding [2].

Polyelectrolytes have an inhibitory effect on the thermal aggregation of oligomeric enzymes (glyceraldehyde-3-phosphate dehydrogenase, lactate dehydrogenase and aspartate amino transferase). The efficiency of inhibition of the aggregation process depended on the degree of polymerisation of the chain and the charge density of the lielectrolyte.

Free amino acids can be used to stabilise proteins without affecting their bio-logic functions. These additives affect the solubility of proteins, as well as the aggregation and re-folding processes.

Polyamines - polymers containing primary, secondary, tertiary or quaternary amino groups in a repetitive link of macromolecules. They are supposed to prevent aggregation by creating ionic pairs with local negative charged groups, increasing the total charge of protein, which leads to increased electrostatic repulsion and limiting intermolecular interaction [3].

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INFLUENCE OF STUDYNG STRESS FACTORS ON THE PSYCHOLOGICAL STATUS AND VEGETATIVE FUNCTIONS OF THE ORGANISM

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There are two forms of stress: eustress and distress.

Eustress or positive stress increases the body's adaptive capabilities, improving reactions and mental activity and manifests itself as a result of positive events in life.

Distress or destructive stress is caused by negative stimuli. Distress adversely affects both the mental and physical health of a person, in connection with which the body's ability to deal with external stimuli decreases [1].

Keywords: stress, testing, systemic reaction.

Stress is a non-specific (general) reaction of the body to an impact (physical or psychological) that violates its homeostasis, as well as the corresponding state of the nervous system of the body (or the body as a whole). Stress affects not only on the physiological functions of the body, but also on the psycho-emotional state of a person. A small portion of stress has a positive effect on a person, ensuring the normal functioning of the body. There are physiological and psychological, emotional and informational, and other types of stress. Both physical and psychological stress causes physiological reactions that occur in the autonomic nervous system. There are «mobile» methods for assessing the impact of stress factors, for example, analysis of heart rate variability or cross-correlation relations of various vegetative indicators, in particular, the correlation coefficient between heart rate and respiratory rate.

Psycho-emotional stress is characterized by a wide range of disorders of various physiological functions and is a widely branched systemic reaction of the body. A striking example is the sessional period for students. During the session, the average stress level becomes prevailing for students, expressed in the difficulty of controlling emotions, a feeling of physical malaise, lack of concentration at the time of the important task, and reduced adaptive abilities [2].

The study was attended by students of the Belarusian State University ISEI BSU, fourth-year students of the Faculty of Environmental Medicine, aged 20 to 23 years, only 42 students, including 38 girls and 4 boys. The study was conducted online, using Google forms.

The study was based on a number of existing tests:

1. Test for stress sensitivity Y.V.Cherbatych;
2. Sondi's test;
3. Life satisfaction index;
4. Self-assessment of mental states (according to Eysenck).

The relationship between the stress level of students and the period of study was evaluated by a testing method: 67.7% of students experience increased stress during the session, 25.8% of students experience high levels of stress throughout the training period, 3.2% of respondents experience increased stress during the pre-session period and the same number of students are under stress throughout the semester.

Thus, we can conclude that the correlation between the level of students' stress and the period of study is very significant, and the highest most students are experiencing increased stress directly during the session.

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INFLUENCE OF SUCCINIC ACID DERIVATIVES ON LIPID COMPONENTS OF LYMPHOCYTE MEMBRANES

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It was found that after the use of the preparation of succinic acid, a decrease in the polarity of the lipid bilayer was noted, but in the region of the annular lipid, no significant differences were found between similar indicators. At the same time, a significant decrease in the microviscosity of the annular lipid was noted, and the microviscosity of the lipid bilayer increased 2.7 times compared with the control value.

Keywords: nanotechnology, succinic acid, lymphocyte membranes, annular lipid, lipid bilayer, microviscosity of membranes, membrane polarity.

Also it was found that succinic acid preparations have high reactivity due to the influence of carboxylic groups. The acid itself participates in the process of cellular respiration. In medicine, this substance is used as a metabolic agent that improves the metabolism and energy supply of tissues, thereby reducing tissue hypoxia [3].

The purpose of work was to analyze the influence of succinic acid derivatives on physicochemical characteristics of membrane lipids of peripheral blood lymphocytes of donors.

A fluorescent pyrene probe (Enigma) was used to evaluate the influence of succinic acid derivatives on the physico-chemical characteristics of peripheral blood lymphocyte membrane lipids of donors. It is a hydrophobic fluorescent probe capable of embedding mainly in non-polar areas between fatty acid chains of biscuit membrane phospholipids [2]. In the excited state (after absorption of the photon) pyrene molecules collide with non-excited molecules, combining into long-lived complexes – excimers (dimers consisting of one excited and one non-excited molecule of the probe), the emission of quanta in which is shifted to a longer wavelength region in comparison with the monomer.

Implantation of the probe was carried out by pre-incubation of its alcohol solution (4 mmol/l) with cells (1·106 kl/ml) in phosphate buffer (pH 7,4) [1]. The final concentration of the probe in the incubation medium was 5 μmol/l. Fluorescence spectra were recorded at excitation wavelengths of 337 and 286 nm on spectrofluorimeter «CM 2203». (SOLAR, RB). The microviscosity of the pyrene lipid environment was estimated in relation to the intensities of excimer and monomer fluorescence (Je/Jm) at spectrofluorescence spectra registration («Solar», Belarus) at excitation wavelengths of 337 and 286 nm.

The analysis of influence of succinic acid derivatives on physical and chemical characteristics of lipids of peripheral blood lymphocyte membranes of donors showed that:

- polarity values of lipid bilayer significantly decreased (20% against control values), but no reliable differences were found between the polarity values of annular lipid.
- microviscosity of annular lipid after use of the drug decreased significantly. At the same time, the lipid microviscosity indices increased (2.7 times against the control values).

It's assumed that the detected decrease in microviscosity affects changes in lipid-protein interactions, which leads to a modification of the functional activity of membranes. The increase in microviscosity of lipid bilayer indicates the influence of a preparation based on succinic acid on lymphocyte metabolism.

Thus, the preparation based on succinic acid derivatives, taking into account the impact on microviscosity and polarity, can indeed be used as a means to accelerate the recovery of injuries in professional athletes, and have a positive effect in the treatment of a number of pathological processes.

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INFLUENCE OF THYROID PATHOLOGY ON REPRODUCTIVE HEALTH AND PREGNANCY

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The state of reproductive function and the nature of pregnancy in women with thyroid pathology were studied. It was found that the most pronounced disorders of reproductive function are observed in women with hypothyroidism.

Keywords: pregnancy, thyroid gland, hypothyroidism, reproductive health.

An urgent problem of modern perinatology is thyroid pathology (TG) in women of reproductive age, which is associated with a high risk of adverse effects on the fetus during pregnancy. Pregnancy complicates the course of thyroid disease and exacerbates reproductive disorders.

It was established that pregnancy against the background of impaired thyroid function leads to the development

of gestosis (54.5%), chronic intrauterine fetal hypoxia (22.7%), discoordance of birth activities (35.2%), preterm birth (18.2%) [1].

The most common endocrine pathology in women is diffuse non-toxic goiter (DNT) - diffuse thyroid enlargement, not accompanied by an increase in its functional activity. However, pronounced iodine deficiency can lead to the development of hypofunction of the thyroid gland of the mother and fetus. In goiter-endemic areas, the frequency of birth of children with congenital hypothyroidism is increased. In women suffering from toxic goiter, pregnancy has a complicated course. Thus, 46% of women show signs of threatening miscarriage or preterm birth. Pregnancy against the background of autoimmune thyroiditis (AIT) is accompanied by non-carrying and development of placental insufficiency [2].

Hypothyroidism prevails in the structure of thyroid diseases in women of reproductive age. Primary hypothyroidism, which developed as a result of the destruction of TG itself due to AIT, has the greatest clinical significance and distribution in women of reproductive age [3]. Hypothyroidism causes disorders of the female reproductive system, which manifests itself as a violation of the menstrual cycle. According to recent research, hypothyroidism is a significant factor in female infertility. When pregnancy occurs, hypothyroidism has negative effects on the mother and fetus in the form of a threat of termination of pregnancy; preeklampsiya; placental detachment; postpartum bleeding. Pregnancy in hypothyroidism can be complicated by hypertension, gestosis, eclampsia and fetal death. Subclinical forms of hypothyroidism are accompanied by miscarriage. Stillbirth rate in women suffering from hypothyroidism is 2 times higher than in healthy women [4]. The pathological significance of manifest and subclinical hypothyroidism is dangerous for the development of the fetal nervous system.

Thus, women with thyroid pathology have a high incidence of pregnancy complications, most pronounced in hypothyroidism, which requires careful monitoring of the health status of this risk group.

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INTRAEPITHELIAL LYMPHOCYTES PHENOTYPE IN COLON OF CROHN'S DISEASE PATIENT

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In patient with Crohn's disease the changes in phenotype of colon intraepithelial lymphocytes may be used as a hallmark of immune inflammation in the gut what makes intraepithelial lymphocytes as ideal candidate for targeting in further immunoregulation of mucosal adaptive immune response against autoantigens.

Keywords: Intraepithelial lymphocytes, Crohn's disease, autoimmune inflammation.

Crohn's disease (CD), one of the manifestations of human inflammatory bowel disease, is characterized by a chronic, relapsing–remitting inflammatory condition predominantly affecting the terminal ileum and colon and associated with delayed clearance of bacteria from the tissues, leading to local chronic granulomatous inflammation and compensatory adaptive immunological changes [1]. Intraepithelial lymphocytes (IEL), which are located between the epithelial cells of the intestinal mucosa close to the gut lumen, have been suggested to be the first lymphocytes to encounter luminal antigens and therefore play an important role in mucosal immunity

[2]. But the phenotype and functional characteristics of IEL in pathological conditions have remained an enigma and required further in investigation.

The aim of research was to investigate the number, aliveness and phenotype of IEL isolated from colon of CD patient and healthy donor.

Small samples of colon mucosa were obtained from CD patient (n=1) and healthy donor (n=1) during scheduled surgeries. CD diagnosis was confirmed by histological examination of the sample. IEL isolation was performed according to Trapecare et al. [3]. Cell viability was assessed using Annexin A5-FITC/7AAD Kit (Beckman Coulter, USA). For immunophenotyping, 2×105 IEL were stained with 10 µl of CYTO-STAT tetra CHROME monoclonal antibodies panels (CD45-FITC/CD4-RD1/CD8-ECD/CD3-PC5 or CD45-FITC/CD56-RD1/CD19-ECD/CD3-PC5) and incubated at 20–25°C for 15 minutes in the dark. The aliveness and the phenotype were measured on 10000 IEL using flow cytometer Cytoflex (Beckman Coulter, USA).

After isolation, IEL quantity from CD patient colon was lower (1.5×106/ml) than from healthy donor (14.4×106/ml) but cells number per tissue cm2 was not differed: 3.7×105/cm2 – in CD patient and 4.5×105/cm2 – in donor. The investigation of IEL viability after isolation in the both samples revealed that majority of cells was Annexin A5–7AAD– corresponding to alive cells (94.02% in CD patient and 94.82% in healthy donor). Meanwhile, the analysis of dead cells among IEL in CD patient showed the equal numbers of Annexin V+7AAD– primary apoptotic cells (2.35%) and Annexin V–7AAD+ necrotic cells (2.12%) while in healthy donor primary apoptotic cells (3.58%) were dominated compared to necrotic ones (1.84%). The percentage of Annexin V+7AAD+secondary apoptotic cells was insignificant and made 0.71% and 0.56%, respectively, in CD patient and healthy donor.

Four-color flow cytometry analysis of colon IEL showed that cells from CD patient were predominantly consisted of T-lymphocytes (CD3+–79.7%; CD19+–14.9%; CD3+–3.7%) while in healthy donor B-lymphocytes was prevailed subset (CD3+–31.4%; CD19+–66.1%; CD3+–9.5%). It was demonstrated the equal numbers of CD3+CD4+T-helper (54.7%) and CD3+CD8+cytotoxic T-lymphocytes (47.1%) with CD4+/CD8+ ratio=1.2 in CD patients but the increase of cytotoxic T-cells IEL (60.7%) compared to T-helper IEL (30.8%) with CD4+/CD8+ ratio=0.5 in healthy donor what corresponded to literature data. Cytofluorometric investigation of CD3+CD4-CD8-γδT-cells revealed their decrease in colon IEL of CD patient (2.8%) compared to healthy donor (12.3%).

Thus, the total number and aliveness of IEL isolated from CD patient colon are not differed from the same parameters in healthy donor while the changes in IEL phenotype are detected: the elevation of T-lymphocytes mainly due to T-helper subset along with γδT-cells decrease in CD patient may be used as a hallmark of autoimmune inflammation in the gut and make IEL as ideal candidate for targeting in further immunoregulation of mucosal adaptive immune response against autoantigens.

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INVESTIGATION OF THE ROLE OF C677T POLYMORPHIC LOCUS (rs1801133) OF THE MTHFR GENE IN THE DEVELOPMENT OF EXTRAPYRAMIDAL IMPAIRMENTS INDUCED BY NEUROLEPTICS

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Annotation: Comparative analysis of the frequencies of polymorphic loci MTHFR (C677T, rs1801133) and COMT (Val108Met, rs4680) outcomes showed significant differences for the combination of CT (MTHFR) and LL (COMT) genotypes with a general risk of motor complications and for a combination of genotypes TT

(MTHFR) + HL (COMT), CT (MTHFR) + LL (COMT) female patients with akathisia. It is assumed that these genes are involved in the epigenetic mechanisms of regulation in the development of antipsychotic-induced extrapyramidal complications during drug therapy of schizophrenia.

Keywords: coronary heart disease, cerebrovascular diseases, arterial hypertension, diseases of the circulatory system.

Introduction. The main problem that complicates the drug treatment of schizophrenia is the occurrence of undesirable drug reactions pathogenetically associated with the extrapyramidal system of the brain. The MTHFR gene product, methylenetetrahydrofolate reductase, is one of the possible gene which associated with schizophrenia [1]. The COMT gene is the main enzyme involved in the catabolism of dopamine and catechol substrates in general. Both genes (MTHFR and COMT) have part in genome methylation. The aim of this work is to evaluate the role of the MTHFR and the COMT genes in the formation of the risk of antipsychotic-induced motor impairments.

Materials and methods. In the research 272 people suffering from schizophrenia and taking antipsychotic therapy took part (with parkinsonism– 97 people, with akathisia - 99 people). Samples of the buccal epithelium and the appraisal of the degree of impairments according to the ESRS-A scale (Extrapyramidal Symptom Rating Scale; 2 points or more) were provided by the Republican Scientific and Practical Center for Mental Health.

Genotyping for the rs1801133 locus was done by RT-PCR. Statistical analysis of the data was carried out by using SPSS Statistics 19.0 software. The evidence of the study results was assessed on the Chi-squared test, the differences were considered significant at $p < 0.05$.

Results and Conclusions. Among the entire sample at the locus *rs1801133* with a dominant homozygote CC 135 people (49.6%) were identified, 111 people were identified with a dominant heterozygote CT (40.8%), and 26 people were identified with a recessive homozygote TT (9.6%).

Nevertheless, the frequency of occurrence dominant CC homozygote in patients with no parkinsonism control sample (48.0%) is lower than in the sample with lightweight parkinsonism (56.30%), and also lower than in the sample with severe parkinsonism (59.10 %). However, statistical processing of the data did not confirm the evidence of the relationship between the TT genotype and the risk of developing antipsychotic-induced parkinsonism ($\chi2 = 4.156$ $p = 0.843$). Also, our hypothesis about the relationship of the CC genotype with a reduced risk of developing antipsychotic-induced akathisia ($\chi2 = 7.344$, $p = 0.693$) was not confirmed.

We carried out further analysis for two polymorphic loci rs1801133 of the MTHFR gene and rs4680 of the COMT gene (catechol - O - methyltransferase), which we had studied earlier, depending on the sex of the patients.

Analysis of the distribution of frequencies in the total sample of women with schizophrenia with and without extrapyramidal impairments discovers a significant relationship between the combination of CT genotypes for the MTHFR gene and LL for the COMT gene with the overall risk of developing side drug reactions in the form of motor impairments ($\chi2 = 8.91$ $p = 0.012$).

In addition, the comparison of the frequency distribution in the groups of women with schizophrenia with and without akathisia detects a significant relationship between the combination of TT + HL ($\chi2 = 6.00$ $p = 0.05$) and CT + LL ($\chi2 = 6.11$ $p = 0.045$) genotypes with the risk of developing this impairment. According to the literature, the COMT gene may be one of the autosomal genetic factors associated with differences in the pathophysiology of schizophrenia between men and women. Our data confirm this hypothesis.

Consequently, we have established complex genotypes of the risk of developing antipsychotic-induced motor impairments and, in particular, akathisia, for female patients suffering from schizophrenia.

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ION-EXCHANGE RESIN AS A REAGENT IN THE SYNTHESIS OF SECO-INOSINE

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This paper presents the data on the synthesis of inosine dialdehyde (seco-inosine).

Inosine dialdehyde inhibits ribonucleotide reductase, resulting in decreased synthesis of DNA, RNA, and proteins, and G2/M-phase cell cycle arrest. This agent also forms stable covalent crosslinks in proteins, thereby inhibiting the activity of enzymes involved in nucleic acid synthesis.

Keywords: synthesis, inosine dialdehyde, antitumor activity.

Inosine dialdehyde (INOX), the periodate oxidation prod uct of inosine, inhibited the proliferation of various tumor cell (completely inhibited the proliferation of L1210 and P388 mouse leukemia cells) [1].

The prerequisite for the creation of inosine dialdehyde was its high biological activity and activity of some purine and pyrimidine nucleoside analogues.

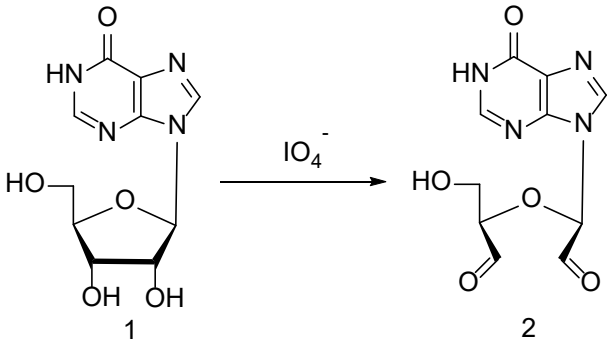

Fig. 1. – Scheme of the synthesis of inosine dialdehyde

In the course of the work, dry and distilled solvents were used. Control over the course of the reaction and the content of inosine dialdehyde was carried out using thin-layer chromatography on plates «Kieselgel 60 F254» from «Merck» (Germany) in the solvent system: chloroform / methanol (4: 1 v/v). Compounds were visualized on the plates by viewing them in ultraviolet light.

Dowex50Wx4 resin charged with IO4- ions was added to a solution of inosine 1 (1 g, 3.76 mmol), and stirred for one hour, after which the mixture is applied to a chromatographic column and eluted with water till absence of UV absorbance in eluate. The resulting solution was concentrated in vacuo at a temperature of ≤30 ° C to 10–20 ml using a rotary evaporator. The resulting mixture was left in the refrigerator to precipitate crystals. The precipitate of inosine dialdehyde 2 was filtered off and dried at room temperature.

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LYCORINE, PHYSICO-CHEMICAL PROPERTIES

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This publication represents theoretical calculations applied to lycorine that has been investigated using Density Functional Theory (DFT / RB3LYP / 6-31 ++ G *) in solvent water. The molecular HOMO-LUMO, excitation energies and oscillator strengths of investigated compound have also been calculated and presented.

Keywords: PM6, B3LYP, semi-empirical, theoretical calculations.

Licorin (narcissin, galantin) - an alkaloid contained in canadian goldenrod, enhances the secretion of bronchial glands, has analgesic, antipyretic, anti-inflammatory properties.

Lycorine has been seen to have promising biological and pharmacological activities it has displayed various inhibitory properties towards multiple cancer cell lines that include, lymphoma, carcinoma, multiple myeloma, melanoma, leukemia, human A549 non-small-cell lung cancer, human OE21 esophageal cancer and more.

The starting geometry of the molecule was additionally optimized in a dimethylformamide solvent by the semiempirical PM6 method of the Gaussian 16 software package until the global minimum of the total energy of the systems under study was reached. To find the global energy minimum and the most stable conformers, all stationary points on the potential energy surface of molecules are analyzed. Optimized geometric configurations, total molecular energy, electronic properties and enthalpy of formation of substances are found using the PM6 method.

Calculations using the DFT method for lycorin were carried out by RB3LYP methods in the 6-31 ++ G* basis. All quantum-chemical calculations were performed using the Gaussian 16 software package and the GaussView 06 results visualization program on a personal computer with an intel core i7 processor (2.21 GHz CPU) with the Ubuntu 18.04 operating system installed. The IEFPCM method is used to calculate the solvent effect. The integral equation formalism PCM is the most popular version of PCM. It uses a molecule-shaped cavity made of spheres centered on nuclei. The calculated geometric parameters, such as the bond length (Å) and bond angle (˚) of lycorin, were obtained by the RB3LYP method in the 6-31 ++ G * basis.

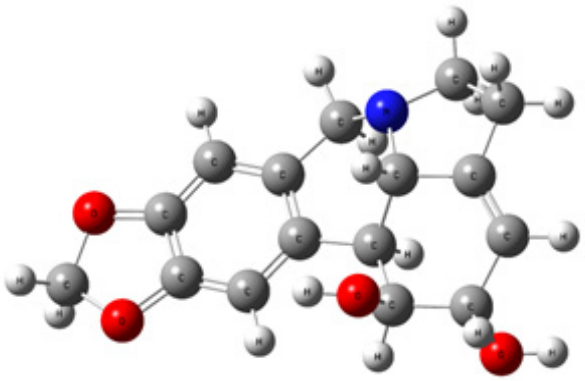

Fig. 1. – Optimized licorin molecule

1. Preliminary quantum-chemical calculations of azomethine compounds were carried out by the PM6 semiempirical method. The most stable conformers were found in terms of the total energy of the molecules. For a lycorin molecule, the energy is -3984.2898 kcal / mol.

2. Using the ab initio method of the density functional theory TD / RB3LYP / 6-31 ++ G *, the electronic spectra of a molecule in a solvent medium were calculated. For a lycorin molecule λmax = 266.37 nm at f = 0.18 S0→S4 (HOMO (-0.21023), LUMO (-0.02799).

3. Calculated physicochemical and antioxidant properties. The band gap for a lycorin molecule is 0.18224 eV.

4. The analysis of the molecular electrostatic potential has been carried out. It was found that the O20 and O21 atoms have the highest electron density in the lycorin molecule.

MECHANISM OF FORMATION OF AMYLOID FIBRILS ON THE EXAMPLE OF THE INSULIN PROTEIN

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This article analyzes the General picture of modern ideas about the structure, functions, and mechanism of amyloid formation of the hormone insulin.

Keywords: amyloid formation, insulin, type 2 diabetes mellitus, hormone structure, fibrillation, physiological effect.

The therapeutic importance of gaining in-depth knowledge of insulin fibrillation in relation to type II diabetes has led to six decades of research focused on its kinetics and structural characteristics. Insulin fibrils have characteristics common to amyloid fibrils, such as a transverse β-structure in which individual filaments in the β-folds run perpendicular to the long axis of the fibrils, an elongated morphology, a characteristic pattern of cross-beta diffraction, thioflavin T fluorescence, and birefringence in Congo-red.

Monomeric and dimeric forms of insulin are less stable than hexamine, and prone to the formation of amyloid aggregates fibrillating. Insulin aggregation mainly involves non-covalent interactions. During the process of fibrillation, several types of conformational changes occur in the structure of insulin. Insulin forms either an amyloid-like structure or amorphous aggregates at the stage preceding fibrillation. Amyloid fibrils are formed by a stepwise process through oligomerization, nucleation, and growth phase. The nucleation process is a slower stage, whereas the growth phase proceeds quickly, immediately after the nuclei are formed.It should be noted that to date, several experimental studies of insulin show that the N and C ends of the B-chain play a crucial role in the process of fibrillation. Analysis of the structure of the insulin solution under amyloidogenic conditions (pH = 2.4 and t = 60 ° C) using high-resolution NMR spectroscopy confirmed the hypothesis that partial unfolding of Monomeric insulin is an important prerequisite for the fibrillation of the molecule. Under these conditions, insulin exists in a partially collapsed state, where the N-terminal regions of both the A-and B-chains detach from the helical core and unfold, while the C-terminal segment of the B-chain undergoes noticeable disordering, but remains bound to this core. The unfolding of the N-terminal α-helix in the A-chain exposes a hydrophobic surface, which suggests that the separation and unfolding of the N-terminal segments play a crucial role in the formation of the amyloidogenic core. In particular, the α-β transition of human insulin appears to occur only when the fibrils are assembled, whereas the original aggregates retain the predominant helical structure.

Despite intensive research on insulin fibrillation, there is no generally accepted scheme for the formation of Mature fibrils. The main difficulties arise when interpreting the beginning of the fibrillation process. The polymerization of insulin begins with the transition of a Monomeric protein from the native state to a partially unfolded conformation, which may be amyloidogenic. The strong dependence of the polymerization reaction on various external parameters leads to the formation of insulin fibrils with different morphology, which makes it difficult to analyze the General scheme of fibrillation.

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MEDICAL AND BIOLOGICAL ASSESSMENT OF THE INFLUENCE OF NATURAL MINERAL HEALING MUD ON THE HUMAN BODY

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The assessment of the influence of therapeutic mineral mud and sapropel on the human body has been carried out.

Keywords: sapropel, mineral mud, natural resources, healthcare institutions.

Introduction. To identify a qualitative and quantitative assessment of the resources of peat raw materials in the Republic of Belarus, the receipt and use of therapeutic mud and sapropel in medical institutions, it is necessary to study the patterns of their distribution throughout the country. At present, numerous deposits of medicinal mud have been explored in Belarus, but some of them have not been studied in detail. The composition of peat, peat and sapropel therapeutic mud and their extraction is determined by the type and type of peat and

sapropel, as well as inorganic soluble compounds accompanying peat and sapropel. The pressing of high-moor peat species contains a large amount of water-soluble humic substances and low molecular weight carbohydrates in comparison with the pressing of highly decomposed lowland peat and sapropel species, which are depleted in organic components and saturated with inorganic salts [1].

Materials and research methods. For an objective assessment of the quality of medicinal peat and sapropels, for subsequent use in medicine, it is advisable to apply the method of thermal analysis.

Purpose of the study. To assess the degree of impact of natural healing mineral mud on the human body.

Research results and their discussion. Mineral mud in medical institutions is used both in the form of applications and in the form of balneotherapy. Thermophysical properties of sapropel mud depend on their moisture content, ash content and density [2]. The optimum moisture content in sapropel mud is 80 - 93%. Among peloids, therapeutic muds have a higher heat capacity, lower thermal conductivity, higher heat-retaining capacity, which indicates their best thermal properties from a balneological point of view. The healing properties of this substance are explained by the presence of effects on the human body, playing an important role in metabolic for example, such as lymph drainage. The useful microelements and biological active substances present in sapropel are absorbed by the skin cells and trigger or activate certain regenerative processes or enhance the body's defenses. The bacteria contained in the mud contribute to the decomposition into the simplest components and the assimilation of as many useful substances as possible, helping to cleanse the body of toxins. The antibacterial action of the mud is facilitated by organic compounds present in sapropel with sulfide groups in their composition, as well as inorganic ions of zinc and bromine. The quality of therapeutic mud must meet the requirements for their composition and comply with the sanitary and bacterial indicators.

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METABIOTICS AS A REMEDY OF RESTORING THE MICROBIAL ECOLOGY OF MACROORGANISM

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Recently, metabiotics have been increasingly used to restore the microbial ecology of the host organism.

Keywords: metabiotics, normobiota, microbiota, normal microflora.

Metabiotics are structural components of probiotic microorganisms and/ or their metabolites and/ or signaling molecules with a known chemical structure. Metabiotics can influence metabolic and signaling pathways of the microbiome and/ or host, optimizing the composition and function of the local microbiota and host-specific physiology, immunity, and neuro-hormone biology, as well as regulating metabolic and/ or behavioral responses associated with the activity of the host microbiota. Various probiotic strains can be a source of metabolic substances. Metabiotics are also known by various names such as metabolic probiotics, postbiotics, ghostprobiotic, heat-killed probiotic, biogenics, cell free supernatants, «biological preparations» or «pharmacobiotics».

Metabiotics have certain advantages over classical probiotics: - a certain chemical structure; - a certain dosage; - safety; - long shelf life.

In addition, metabiotics are superior in absorption, metabolism, distribution and excretion compared to classical probiotics based on live microorganisms. Metabiotics exhibit broad inhibitory activity against various types of pathogens. Metabiotic substances contain various metabolites and signaling molecules that exhibit a broad antibacterial spectrum and immunomodulatory effects.

Using of metabiotics makes it possible to create a controlled intestinal microbiocenosis. Metabiotics are characterized by high bioavailability, do not come into conflict with their own microbiota, start working as soon as they enter the gastrointestinal tract (GIT).

Characteristics of metabiotics: - modulation of physiology and metabolism; - local and systemic effect; -

regulation of metagenomic stability; - membrane permeability; - attachment to specific surface cell receptors; - epigenetic control; - are capable of diffusion into the body fluid.

Metabiotics include various low molecular weight molecules with a variety of chemical manifestations. The main types of metabiotics can be classified as follows: metabolic molecules; signaling molecules; molecules with a specific structure and function.

Technological advances based on «ohmic» technologies such as transcriptomics, metabolomics, proteomics and others have provided important information for the discovery of a more potential permanent strain for the production of metabiotics. Genome analysis of probiotics and its subsequent functional characterization, now referred to as probiogenomics, has provided exciting new opportunities for identifying metabiotic components that are responsible for influencing the physiology and immune function of their respective host. These approaches hold the promise of broadening metabiotic knowledge, providing opportunities for the development of therapeutic approaches.

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METHODS OF DETERMINING ANTICLEBSIELLOUS ANTIBODIES IN SERUM

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The purpose of this work is to study the titers of anticlebsiellous antibodies in persons with an acute intestinal infection caused by Klebsiella.

Keywords: Klebsiella, acute intestinal infections, passive hem agglutination reaction, anticlebsiellous antibodies.

The causative agents of acute intestinal infections are various opportunistic bacteria. And one of them is a bacterium of the genus Klebsiella. In this regard, modern approaches to the prevention and treatment of hospital infections caused by Klebsiella bacteria have been studied, as well as the use of healing technologies that reduce the incidence of disease. [1].

The object of the study is 15 people diagnosed with acute intestinal infection (8 men, 7 women aged 18 - 28 years). The material for the study is the serum of individuals with acute intestinal infection with confirmed bacteriologically isolated K. pneumoniae. The method for the study of the credits of anticlebsiellous antibodies was a reaction of passive hem agglutination.

Analysis of the results of the detection of anticlebsiellous antibodies in the blood of people with acute intestinal infection is shown in Table 1.

As can be seen from the presented data, in the group of individuals examined, the antibody titer to Klebsiella varies widely. These differences can be provided by different infection conditions of patients with acute intestinal infection, as well as individual differences in the immune system of each patient.

Statistical analysis of the results of the study allowed us to determine the average indicators reflecting the strength of the immune response in acute intestinal infection of Klebsiella etiology. As a result of the data presented, the level of antigen-specific immunity in the examined persons with acute intestinal infection is quite high. The average level of antibodies is 1: 128 or more by titer.

Table 1

Antibody titers	Number of persons with a given antibody titer	Of them:	
		Men	Women
1 : 16	3	1	2
1 : 32	3	1	2
1 : 64	3	3	0
1 : 128	3	1	2
1 : 256	1	1	0
1 : 512	2	1	1

Thus, the conducted study allows us to conclude that the level of activity of the humoral immune response in persons with acute intestinal infection of Klebsiella etiology is different, as well as in most of the examined individuals the titer of antibodies reaches a sufficient level of 1 : 128.

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MODELING NON-ALCOHOLIC FATTY LIVER DISEASE IN VITRO

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Non-alcoholic fatty liver disease (NAFLD) is now recognized worldwide as a common chronic liver disease, which can also be a component of other diseases such as metabolic syndrome, diabetes mellitus, and obesity. Studies on NAFLD are important because patients with this disease are at increased risk of developing cirrhosis and hepatocellular carcinoma. In recent years, there has been an increase in the incidence of NAFLD; therefore, it became necessary to clarify the exact mechanisms of the development of fatty liver disease, as well as to study the effectiveness of treatment methods. [1]

Keywords: non-alcoholic fatty liver disease (NAFLD), fatty acids (FA), HepG2.

The modern concept of NAFLD covers the spectrum of liver damage, including its three main forms: fatty hepatosis, non-alcoholic (metabolic) steatohepatitis and cirrhosis.

The cause of non-alcoholic fatty liver disease is the accumulation of triglycerides and cholesterol in the liver, which occurs due to the excessive formation and absorption of free fatty acids in the intestine and the excess intake of free fatty acids in the liver, as well as due to a decrease in the rate of b-oxidation of free fatty acids in the mitochondria of hepatocytes, increased synthesis of fatty acids in mitochondria, difficulty in removing fat from the liver due to a decrease in the synthesis or secretion of very low density lipoproteins and the removal of triglycerides in their composition.

In vitro modeling of non-alcoholic fatty liver disease is based on the effect of high concentrations of fatty acids on the HepG2 cell line, which leads to the formation of intraplasmic lipid droplets, since the main role in the pathogenesis of NAFLD belongs to fatty acids. [2]

Hepatocytes were passed into Petri dishes 10 cm in diameter for cells per dish. Cells were cultured in a CO_2 incubator at 37 ° C and 5% CO_2, in AlphaMem complete nutrient medium containing 10% bovine serum and 1% antibiotic mixture. When the HepG2 culture reached a confluence of 80-85%, the cells were removed from the culture plastic by enzymatic treatment with 0.5% trypsin / EDTA solution for 5 minutes at 37 °C. The action of trypsin was inactivated with a 10% bovine serum solution. Hepatocytes were subcultured in 12-well plates with a well diameter of 2 cm in the amount of 1x 105 cells per well, which amounted to about 40-50% of the coverage of the culture surface of each well. 24 hours after cell attachment, the complete AlphaMem culture medium was replaced with RPMI-1640, free of bovine serum and antibiotic mixture. In a serum-free medium,

hepatocytes were cultured for another 24 hours. For modeling, oleic and palmitic fatty acids were used (in a ratio of 2:1). Stock solutions of FAs were prepared in RPMI-1640 culture medium containing 1% bovine serum albumin. Complete dissolution of FA was carried out at 37 ° C. The final total concentration of fatty acids in the culture medium was 0.6 mM, 1.2 mM. Each concentration was reproduced in triplicate. As a control, we used hepatocytes incubated in a culture medium that did not contain FA. The cells were incubated in a CO2 incubator at 37 ° C and 5% CO2 for 72 hours.

This model system is specific for hepatocytes. This model of NAFLD will allow to study not only the mechanism of development of NAFLD, but also to determine effective methods of prevention and treatment.

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MODERN ASSESSMENT OF THE BIOLOGICAL ACTIVITY OF TOP PEAT IN MINSK REGION

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The article describes the current assessment of the biological activity of top peat. The subject of research is humic substances, the concentration of which in an aqueous solution increases significantly during electrohydraulic treatment of peat-water pulp. The purpose of this work is to determine the parameters of electrohydraulic treatment of peat and establish the effectiveness of such treatment to increase its biological activity. The organic substance of peat and the humic acids (HA) included in it largely determine the fertility of soils, being sources of physiologically active substances that increase the processes of vital activity of living organisms. However, these properties appear only after the corresponding processes of decomposition of organic peat and the transition of a number of its compounds to an available state for assimilation by plants. In this regard, the hypothesis was put forward to realize the effective and environmentally safe possibilities of the electrohydraulic effect of L.A. Yutkin for «activation» of natural peat, that is, to translate the useful organics contained in it into an easily accessible form for plants [4].

Keywords: top peat, electrohydraulic effect of Yutkin, water-peat mixture, growth-stimulating activity.

Peat – deposits of organic origin consisting of the remains of marsh plants (deciduous and coniferous trees, shrubs, grasses, mosses, etc.) that have undergone incomplete decomposition with insufficient air access [1].

According to the conditions of formation, peat is divided into top, lowland and transitional.

Humic acids are the product of natural biochemical modification of organic matter in the biosphere. They are the main part of the organic matter of the soil – humus. The mechanism of action of humic substances is to stimulate all biochemical processes in the plant's body not only at the initial stage of seed germination and root system formation, but also the further growth and development of the plant. They change the permeability of cell membranes, increase the activity of enzymes, the content of chlorophyll and the productivity of photosynthesis. As a result, cell division is accelerated, which means that the overall growth of the plant is improved [2].

To determine the biological activity of humic drugs in the Russian Federation, a method established by the standard GOST P 54221-2010 has been developed. The selection and preparation of analytical samples of solid GP (humic drugs) are carried out on GOST 10742. [3].

The essence of the method was to determine the increase in the germination of agricultural crops (cucumber and corn seeds), the length of stems and roots, as well as the weight of plants under the action of humic preparations in comparison with the control sample. The increase in these indicators reflects the biological activity of humic drugs [3].

Based on the conducted research on the use of the electrohydraulic method for activation of top peat, the following results were obtained:

1. A working chamber for electro-inskled water solutions has been manufactured and tested, samples of activated peat have been obtained at a ratio of water-peat mixture 3:1.

2. When using peat samples OJSC «Turshovka» (Minsk region) achieved an increase in the germination rate of cucumber seeds by 21.4%. Electrohydraulically activated samples provided an increase in the height of plants relative to the variant with a solution of inactivated peat by 17.5%, and the green mass increase was 40.3%.

3. The addition of humic acid solutions to the Pryanishnikov's nutrient mixture resulted in an increase in the weight of corn roots from 32 to 58 %. However, we were not able to establish a reliable increase in root weight in the variants with activated peat solutions.

4. The above results and the experience gained allow us to set a goal for the development of such soil mixtures, which do not include mineral fertilizers, but their properties are not inferior to the products manufactured by LLC «Turshovka».

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MODERN DIAGNOSTICS OF VIRAL HEPATITIS C

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Abstract: The issue of modern diagnostics of viral hepatitis C, which determines the tactics of further management and treatment of patients, is considered. Modern serological and molecular biological methods of examination of a patient for viral hepatitis C are presented.

Keywords: viral hepatitis C, diagnostics of viral hepatitis C, serological molecular biological methods.

HCV infection is one of the significant problems of modern medicine. According to official figures, over 180 million people worldwide are infected with the hepatitis C virus (HCV). Due to the predominantly latent flow, high vulnerability individual social groups and the low availability of antiviral therapy, the number of infected continues to grow. As for chronic hepatitis C (CHC), it is widespread throughout the world and is one of the most important health problems in many countries.

Hepatitis C is a viral infectious disease that affects the liver and is mostly asymptomatic, with a very high probability of chronicity. The main confirmation of the diagnosis is the detection of HCV RNA in the blood (by PCR), as well as anti-HCV IgM and IgG. The exclusion of chronic HCV is carried out based on the detection of minimal changes in hepatobiopsy specimens, the absence of fibrosis and anti-K54 in the blood.

In laboratory diagnosis and monitoring of HCV infection, two main approaches are used:

- molecular biological methods based on the detection of the RNA of the virus in the blood.
- serological methods based on the detection of specific antibodies to HCV (anti-HCV antibodies) in the serum or plasma of patients;

Molecular method - polymerase chain reaction for the qualitative and quantitative determination of HCV RNA in blood serum. The qualitative method is used in the diagnostic search and exclusion of HCV. The main treatment is PCR, quantitative determination in real time, with a lower limit of HCV RNA determination of 15-50

IU / ml. Given the high sensitivity of real-time PCR, it was found to be optimal in assessing the effectiveness of antiviral therapy.

The serological method is used both in screening and in the diagnosis of HCV infection. Plasma or serum is tested for the presence of AntiHCV using an enzyme immunoassay or chemiluminescence. The specificity of ELISA is over 99%.

A comprehensive comprehensive examination of a patient with HCV, including biochemical, serological and molecular biological research, allows you to correctly assess the state of the problem and make the right decision about the plan for further treatment.

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MOLECULAR GENETIC CHARACTERISTICS OF HEMOPHILIA A

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Hemophilia A is the most common severe blood-clotting disorder accounting for approximately 80% of all types of hemophilia. Identification of genetic defects in patients with hemophilia A is important for understanding the characteristics of a particular case of the disease, as well as for individualizing treatment strategy.

Keywords: Hemophilia A, gene F8, factor VIII, mutations, molecular genetic diagnostics.

Hemophilia A is a congenital hereditary disease in which blood clotting is impaired due to a deficiency of coagulation factor VIII, caused by abnormal changes in the gene encoding the factor VIII protein (F8, OMIM 300841). Lack of factor VIII manifests spontaneous or induced bleeding, depending on the severity of the disease. The incidence of hemophilia A in the world is approximately 1 case per 5000 male births and about 30% of cases are caused by de novo mutations, i.e. their family history is not burdened. In recent years, the widespread implementation of molecular biology methods into medical practice, the ever-growing interest in population genetics and the improvement of DNA sequencing methods have led to an obvious activating of research directed at finding genetic mechanisms and their features in the clinical picture of hemophilia A.

The F8 gene, encoding factor VIII of the hemostatic system, is mapped on the long arm of the X chromosome (Xq28, chrX: 154,835,788-155,026,940, genome browser Ensembl) and covers a region of about 186 kb. The F8 gene consists of 26 exons, which vary in size, within the limits from 69 bp (exon 5) up to 3106 bp (exon 14 encoding the large B-domain of factor VIII and covering about 40% of the coding sequence). Introns also vary in size, spanning distances from 200 to 32.5 kb, six of which are larger than 14 kb. (introns - 1, 6, 13, 14, 22 and 25). The length of the coding sequence of the F8 gene is approximately 9 kb.

A wide range of mutations that occur throughout the F8 gene sequence causes factor VIII deficiency. Currently, about 3000 mutations have been identified in the F8 gene. Mutations can cause quantitative or qualitative defects in factor VIII. The type and location of mutations in the factor VIII gene is the most important determinant of the hemophilia A phenotype. As a rule, the most frequent mutations in F8 are inversions of intron 22 and 1, which occur in approximately 50% and 5% of patients with a severe phenotype, respectively. Large deletions in the F8 gene are observed in about 5% of cases of severe hemophilia A. The remaining severe cases, as well as all moderate and mild cases, are the result of multiple point mutations and small insertions or deletions. Point mutations that lead to premature stop codons are essentially associated with a severe phenotype, as are most frameshift mutation. Mutations at splice sites are often associated with a severe phenotype, but can lead to a moderate phenotype, depending on the specific changes and localization. Missense mutations occur in less than 20% of people with severe hemophilia A, but almost all with a mild to moderately severe bleeding tendency.

To date, publicly available methods of molecular genetic analysis of the F8 gene have been already used to effectively identifying the main defect of the F8 gene. Identifying the mutations responsible for the manifestation of hemophilia A is essential for providing carrier information, genetic counseling and prenatal diagnosis of the disease. Information on the causative mutation of the F8 gene can be used to keep track of the genotype-

phenotype correlation, in particular, the risk of the formation of a severe inhibitory form of hemophilia A. Genetic testing of hemophilia A provides great opportunities for patients and their physicians to treat this disease. Over the past decades, genetic analysis of hemophilia A has been improved significantly. Many new methods and their modifications, as well as analysis software, have become available, enabling faster and more accurate genetic analysis and interpretation of the data obtained.

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OBTAINING AND IMMUNOCHEMICAL CHARACTERIZATION OF PALLADIUM-COPROPORPHYRIN CONJUGATES OF MONOCLONAL ANTIBODIES

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Conjugates of Pd (II) coproporphyrin I N-hydroxy succinimide ester with ferritin-specific monoclonal antibodies of the IgG2a subclass were obtained in a one-step conjugation reaction, with antigen-binding activity in-creased by 3-7 times. The two-phase dependence of the functional activity of the conjugates on the depth of modi-fication indicates the presence of two populations of modified amino groups. Modification of the more accessible ones leads to functional activation of the IgG molecule. Advantages in binding to antigen of modified monoclonal antibodies HSF 102 compared to native monoclonal antibodies are shown.

Keywords: monoclonal antibodies, immunoglobulin G, metalloporphyrin conjugates, luminescent immunoassay.

One of the most sensitive methods of luminescence immunoassay is a method using porphyrin compounds covalently bound to antibodies or antigens, where the various types of fluorescent porphyrins are used. Particular attention is being paid today to the coproporphyrin group. These porphyrins are water-soluble, have a fairly high quantum yield of fluorescence (up to 0.2), separated by wavelengths by more than 180 nm in the excitation (380-420 nm) and radiation (600-640 nm) and fluorescence regions, allow to obtain a fairly high sensitivity immunoassay.

The existence of long-term luminescence of palladium-coproporphyrin with a decay time of 1.2 10-3 s makes it possible to use it in time-resolved immunoluminescence analysis with a sensitivity of determination of immuno-logical components up to 10-12 M.

Previously proposed methods for preparing such conjugates required a two-stage conjugation reaction with the activation of porphyrins at the first stage and were accompanied by a significant decrease in the functional activity of antibodies. The aim of this work was to obtain metalloporphyrin conjugates of antibodies with unchanged functional activity in a one-step conjugation reaction

Using the method of chemical modification of antibodies, based on the quantitative addition of Pd (II) -coproporphyrin I N-hydroxy succinimide ester molecules to monoclonal antibodies HSF 102, specific porphyrin conjugates with a modification depth equal to 0.7; 1.0; 1.7; 2.4; 3.7 modifier molecules per protein molecule.

Using solid-phase competitive immunochemical analysis, the interaction constants of the palladium-porphyrin conjugates were determined, and it was found that the parameters of antigenic binding of all conjugates exceed the parameters of interaction with the antigen of native monoclonal antibodies HSF 102 by 4-7 times.

Using solid-phase competitive immunochemical analysis, the interaction constants of the obtained palladi-

um-porphyrin conjugates were determined, and it was found that the parameters of antigenic binding of all conju-gates exceed the parameters of interaction with the antigen of native monoclonal antibodies HSF 102 by 4-7 times.

The optimal depth of modification of monoclonal antibodies using this modifier was determined, which is 1 molecule of the modifier per one molecule of immunoglobulin.

The antibodies modified with Pd(II) coproporphyrin I N-hydroxy succinimide ester are immunochemical re-agents with antigen-binding activity increased as a result of an increase in the conformational mobility of the entire antibody molecule.

The functional activation of antibodies during their modification best meets the goals of obtaining porphyrin conjugates of antibodies with maximum immunoreactivity and provides significant advantages in the biomedical use of such conjugates.

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PCR IN DIAGNOSTICS OF CATS VIRAL DESEASES

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Improvement of existing molecular and biological diagnostic methods are important for determine the etiology of viral cats diseases, as well as for developing new approaches to treatment. PCR diagnostics are the most accurate and universal method for identifying the viral genome. Using reverse transcription with PCR allows detecting extremely small amounts of specific RNA transcripts.

Keywords: PCR, cat viral diseases.

The purpose of this work is to describe the mechanisms of antiviral immunity at the cellular and molecular levels, to describe the main pathogens of common cat diseases, to describe the method of PCR diagnostics, and to determine the principles of various types of this research.

The PCR method is universal, highly specific, and highly sensitive. It can be used to determine the nucleotide sequence of a specific virus and establish a sequence of unknown etiologies. Classical PCR can be used for studying the properties of the target molecule, or to determine the amount of the target molecule. The characteristics can be improved by using special emulsion particles.

The sensitivity of molecular methods increases the likelihood of detecting infection at a very early stage, when it is easier to intervene in the development of the infectious process, it is easier to prescribe treatment, or even completely prevent the clinical manifestation of infection. PCR is one of the most widely used molecular methods in the diagnosis of a wide range of diseases.

Clinical reports on their sensitivity and specificity vary significantly: from 43 to 100% and from 64 to 100%, respectively. However, modern developments and the using the polymerase chain reaction allow us to find new ways to achieve the goals of modern diagnostics. The unified method of material processing and detection of reaction products, automation of the amplification process make it possible to perform a complete analysis in 4-4.5 hours.

Amplicons obtained during PCR can’t get into the air and lead to false positive results. The use of special fluorescent labels makes it possible to abandon the electrophoresis stage, which leads to a sharp decrease in the probability of contamination of the studied samples with amplification products. In addition, fluorescence detection of PCR products in vitro is 2-3 times more sensitive than electrophoresis detection.

To improve PCR methods, it is necessary to introduce automated technologies. It takes a lot of effort to implement standardization that can be accepted by the clinical practice. Optimizing the speed of diagnostic tests will also be a crucial step in the improvements.

In the diagnosis of viral diseases of cats, PCR is a promising method that complements other methods. To increase the speed of analysis, as well as to facilitate the reactions, special emulsion particles can be used. In particular, the BEAMing method was developed for emulsion PCR. It is used for detecting and relative evaluation of changes in nucleotide sequences. The main principles for improving PCR methods are: first, the transition from liquid media to gels, emulsions, and solid phase; second, the transition to multicomponent analysis; third, increasing the speed of detection due to flow systems and/or miniaturization of the reaction volume, which significantly reduces the analysis time; fourth, miniaturization, which provides significant savings in samples and reagents; fifth, the use of microchip technologies that provide not only the possibility of miniaturization of the device, but also maximum automation and control of all stages of analysis; sixth, the use of high-performance computing technologies that improve the reliability of quantitative analysis.

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PHARMACOLOGICAL CORRECTION OF ACUTE HYPERCAPNIC HYPOXIA WITH EPOFEN

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Hypoxia is a universal pathological process that accompanies and determines the development of a wide variety of pathologies. In general, hypoxia can be defined as a discrepancy between the energy demand of a cell and energy production in the system of mitochondrial oxidative phosphorylation. To improve the energy status of the cell, pharmacological preparations with antihypoxic properties can be used. Data on the study of the antihypox-ic action of the Epofen preparation under conditions of modeling hypoxic hypercapnic hypoxia is presented.

Keywords: Epofen®, hypoxia, hypoxic hypercapnic hypoxia, mice.

The term «hypoxia» is used to denote lacking oxygen supply at the tissue level or a violation of its consumption in the process of biological oxidation. Hypoxia leads to a complex modification of the functions of biological membranes, affecting both the lipid bilayer and membrane enzymes. The main functions of membranes: barrier, receptor, catalytic are damaged or modified. The main reasons for this phenomenon are energy deficiency and phospholipolysis and lipid peroxidation caused by it. The breakdown of phospholipids and inhibition of their synthesis lead to an increase in the concentration of unsaturated fatty acids and their peroxidation. The latter is stimulated as a result of the suppression of the activity of antioxidant systems due to the breakdown and inhibition of the synthesis of their protein components, and primarily superoxide dismutase, catalase, glutathione peroxidase, glutathione reductase, etc.

Environmental changes, the accumulation of toxic products in the biosphere and, as a consequence, a decrease in the amount of oxygen on a global scale (18-19 % versus 21 %) have created conditions for widespread hypoxia. Oxygen deficiency, observed in various pathological conditions, not only complicates the course of the disease, but often determines its outcome.

The aim of the research was to study the antihypoxic effect of Epofen for the pharmacological correction of the consequences caused by exogenous forms of acute hypoxia in the simulation of hypoxic hypercapnic hypoxia.

Male F1 CBA / Lac × C57 / BL / 6 mice 23 ± 2 g were used in the experiments. The animals were randomly assigned based on body weight into groups of 10 animals. Maintenance and care were in accordance with GOST 33215-2014, SOP, Guidelines for the maintenance and care of laboratory animals. The dose of Epofen used is 28 mg/kg. The reference (reference) drug was Piracetam. The preparations were dissolved in distilled water, injected intragastrically in a volume of 0.5 ml to mice 40-60 minutes before the onset of hypoxic exposure. Animals of the control group were injected with an equal volume of distilled water. To simulate hypoxic hypercapnic hypoxia, mice were placed one by one in jars (V = 300 cm3) and hermetically sealed, the time of the beginning of the experi-ment was noted. The time of the death of the animals after the cessation of respiration was recorded. The signifi-cance of differences was assessed by Student's t-test.

As hypoxia develops, the severity of the reaction of an organism under pressure is largely predetermined by the partial pressure of CO2 and the rate of its growth in the air available for breathing. Moderate hypercapnia is noted when the ambient air contains 7-9 % CO2. With a further increase in the content of CO2 in the inhaled air (up to 10 % or more), its tension in the blood and cerebrospinal fluid increases, while the stimulating effect of carbon dioxide on the respiratory center ceases. The period of increased activity of the respiratory center is replaced by a period of its depression, which ultimately leads to the appearance of terminal types of respiration due to the the disturbed heart function, the development of arterial hypotension, turning into collapse. An increase in the life span of the experimental animal compared to the control group is considered to be a positive assessment of the antihy-poxic effect of the studied substance.

There was a significant increase in the lifespan of mice in the groups getting Epofen by 53.7 % and piracetam by 40.6 % compared to the control group. The lifespan of mice getting Epofen is 13.1 % longer than that of mice receiving Piracetam.

Thus, the life expectancy of mice due to acute hypercapnic hypoxia when using the Epofen preparation exceeded the control value by 53.7 % and the reference value (Piracetam) by 13.1 %. The results obtained in experiments on mice prove the presence of an antihypoxic effect in Epofen.

PREDICTIVE VALUE OF THE LEVELS OF HEMOSTASIOLOGICAL INDICATORS IN THE DEVELOPMENT OF THROMBOTIC COMPLICATIONS IN PATIENTS UNDER THE BACKGROUND OF CORONAVIRAL INFECTION

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The most widespread mechanism of the novel coronavirus infection is systemic inflammation. A clinically significant effect of inflammation is coagulopathy and, as a result, an increased risk of venous thromboembolism in patients. A number of studies published to date have reported a high incidence of thrombotic complications in critically ill COVID-19 patients. The results of the study showed that with the onset of the COVID-19 pandemic, the average values of the main hemostasiological indicators increased significantly compared to those before the start of the pandemic.

Keywords: coronavirus infection, COVID-19, hemostasis, coagulopathy, thrombotic complications.

The new coronavirus infection (classified as COVID-19), first identified in December 2019 in the Chinese city of Wuhan, is still a global pandemic and a serious threat to many countries around the world [1]. Although the pathophysiology of COVID-19 is not yet fully understood, the most widespread mechanism of this infection is systemic inflammation. The clinically significant effect of inflammation is coagulopathy and, as a result, an increased risk of venous thromboembolism in patients [2].

The paper analyzes the main hemostasiological parameters in patients suffering from chronic diseases against the background of coronavirus infection, in order to identify hemostasis disorders. The study included patients who received treatment on the basis of the State Institution «Republican Clinical Hospital for the Disabled of the Great Patriotic War named after P.M. Masherov» in 2019-2020. All patients were divided into 3 groups: the control group - clinically healthy individuals, the comparison group - patients who received treatment before the onset of the pandemic and the study group - patients with chronic diseases associated with COVID-19. In the groups of patients under consideration, the analysis of the main hemostasiological parameters was carried out: activated partial thromboplastin time (APTT), prothrombin time (PT), international normalized ratio (INR), thrombin time (TT), as well as fibrinogen and D-dimer concentrations.

According to the results of the analysis, it was found that the average hemostasiogram indices in patients of the study group exceed those in the comparison and control groups. The average APTT value in the study group was 45.4 sec, which exceeded the indicators in the compared groups by 1.5 times, and the upper threshold of the norm (36.9 sec) by 1.2 times. The level of prothrombin time in the control group was 11.03 sec, and in the comparison group, 12.2 sec. In both cases, the results did not exceed the limits of the established norm and were 1.8 and 1.6 times lower than the indicators of the study group, respectively. Similar patterns were found for the INR indicator. It should be noted that the thrombin time indicator in the study group did not differ from the normal values (16.9 sec and 16.6 sec, respectively), slightly exceeded the indicator level in the control group (13.7 sec) and the comparison group (13.5 sec). The content of fibrinogen in patients of the comparison group was 3.1 g/l, for the control group - 2.6 g/l, in the study group - 4.6 g/l, which exceeds the values of this indicator in the comparison groups in 1.5 and 1, 7 times. The average concentration of D-dimer in the study group of patients was 1543.6 ng/ml, which exceeded the norm (243 ng/ml) by 6.4 times. For comparison, the same indicator in the group of patients receiving treatment before the pandemic was 326.4 ng/ml.

Based on the results of preliminary studies, it can be concluded that in patients with COVID-19 infection, the average values of the main hemostasiological indicators increased compared to those in patients before the pandemic, and also significantly exceeded the upper thresholds of the norm and indicators in the control group. It can be assumed that the pathophysiology of COVID-19 is characterized by thrombotic disorders of varying severity, which should be taken into account when forming criteria that allow predicting the course and possible outcome of a new coronavirus infection in the shortest possible period, as well as formulating the main criteria for justifying pathogenetically effective therapy in patients with increased risk of thrombotic complications.

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PROBLEMS OF ECOLOGICAL HEALTH

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The article analyses interconection and interdependence of human health and the ecological conditions of his living.

Keywords: health, population, ecology, ecological culture, scientific and technological progress.

During the second half of the 20th century, people began to talk about a serious danger threatening human life and health due to the fact that the main reason for the progressive deterioration of human health was the widespread deterioration of the ecological situation, and, first of all, technogenic pollution of the environment. The interconection and interdependence of human health and the ecological conditions of his living against a background of intensively developing scientific and technological progress constantly remain the object of research by various scientists [1].

The aim of the technogenic way of development of civilization is to improve the life of the population, create comfortable living conditions, but at the same time the quality of life of people is constantly decreasing. Human is an integral part of nature, but often opposes himself to it through his rash activities. Numerous environmental factors, including infectious organisms, pollutants (chemical, biological waste), lack of food and nutrients - all this leads to a deterioration in living conditions and, as a result, leads to the formation of many diseases. In addition, air, water or soil pollution or other stresses affecting humans and other species in the ecosystem complicate matters. The dinamics of diseases is complicated by an increase in population density, as high density contributes to the increase and spread of infectious organisms among humans. Rapid growth of population and widespread environmental degradation are contributing to an increase in the world's problems associated with disease [3].

The ecology of increased disease is exceedingly complex because of the diversity of infectious organisms and the effects of environmental degra- dation on the prevalence of disease. The rapid expansion of human

popu- lations is a major factor in the rise of human diseases: Humans living in crowded, urban areas are in an eco- system that is ideal for the resur- gence and rapid spread of old diseases.

The modern ecological crisis, which can develop into an ecological catastrophe, is caused by the development of productive forces, which occurs thanks to science and technology. In accordance with this a way out of the crisis must be sought in the latest scientific and technical achievements, but even the most perfect technology, inevitably damages the environment, and, therefore, harms human health, if it conflicts with the laws of self-reproduction of nature. When a human oppresses nature, he oppresses himself, the so-called «boomerang effect» works [2].

Ecological culture is an integral part of the development of global culture and is considered as the study of the interaction between living beings and their environment, includes human perception of the environment, as well as our unconscious impact on the environment and the environment on us. The main goal of environmental education is the formation of an ecologically cultural personality.

The greening of education and science is not only a process of enrichment with environmental knowledge, but also an act that is aimed at revealing in a person the need for self-development, which cannot be carried out in isolation from nature. Thus, we can conclude that a person, influencing the environment, affects your health, therefore, the environment as well as other factors determines human health.

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PRODUCTION OF HUMAN ANNEXIN A5 FUSED WITH BACTERIAL ADENOSINE CATABOLIC ENZYMES

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Submerged culture of recombinant Escherichia coli strains produced chimeric proteins «Annexin-ADase» and «Annexin-PNPase» composed of human annexin A5, fused with homologous adenosine deaminase and purine nucleoside phosphorylase of E. coli, respectively. Affinity chromatographic isolation of these proteins from ultra-sonic cell lysates on Ni2+-NTA-agarose yielded preparations of 95% purity grade. The chimeric proteins «Annexin-ADase» and «Annexin-PNPase» have been shown to transform adenosine into adenine and inosine, respectively. Such properties of the target proteins allow to consider them as promising agents for use in cancer biotherapy.

Keywords: fusion protein, human annexin A5, adenosine deaminase, purine nucleoside phosphorylase, Escherichia coli.

Ribonucleoside adenosine distinguished by 1000-fold elevated extracellular concentration in tumor micro-environment is known to act as one of key inhibitors of cancerostatic immune activity [1].

Previously [2] we proposed the idea to eliminate inhibitory effect of adenosine on antitumor immune response of oncopatients using adenosine-degrading enzymes, adenosine deaminase (ADase) or purine nucleoside phosphorylase (PNPase). Our previous research efforts resulted in E. coli strains producing annexin A5 fused with homologous ADase [3] and PNPase [4], designated as «Annexin-ADase» and «Annexin-PNPase», respectively.

The present investigation is aimed at synthesis and characterization of recombinant chimeric proteins «Annexin-ADase» and «Annexin-PNPase». The applied flow sheet of producing chimeric proteins embraced such prin-cipal stages as engineering of strains-producers of target proteins, microbial culture and accumulation of

biomass, ultrasonic cell disintegration and finally recovery of end products from cell lysate and subsequent purification.

Since the engaged E. coli strains produce chimeric proteins carrying at C-terminus the additional Ni-affine octahistidine oligopeptide, such proteins may be recovered from the solution using metal affinity chromatography using the column with Ni2+-NTA resin. The repeated column treatment with buffer solutions enabled to yield biopreparations «Annexin-ADase» and «Annexin-PNPase» with purity grade over 95%

Electrophoretic analysis of proteins performed by SDS-polyacrylamide gel electrophoresis showed that isolated and purified chimeric proteins possess molecular weights about 64 kDa («Annexin-PNPase») and 74 kDa («Annexin-ADase»), corresponding to the theoretically calculated values.

In accordance with the end product synthesis and purification procedure, 54 mg and 36 mg of chromatographically pure chimeric proteins «Annexin-ADase» and «Annexin-PNPase», respectively, were recovered from 1 liter of cultural liquid.

At the final stage of research we tested the ability of chimeric proteins to express the required enzymatic activity. TLC-analysis of adenosine decomposition products released in the course of the reactions catalyzed by chimeric proteins showed that both reactions are accompanied by generation of adenosine dissimilation products – adenine and inosine.

Summing up, submerged fermentation of recombinant E. coli strains resulted in 2 chimeric proteins composed of phosphatidylserine-binding human annexin A5 conjugated with homologous ADase or PNPase. The abil-ity of these proteins to convert adenosine into inosine or adenine, respectively, was demonstrated. Sufficient grounds are available to regard such proteins as potential anticancer agents.

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PYRIMIDINE DERIVATIVE PHYSICO-CHEMICAL PROPERTIES

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This publication represents theoretical calculations applied to ((4,6-dimethylpyrimidin-2-yl)amino) (5-(p-tolyl)isoxazol-3-yl)methanol that has been investigated using Density Functional Theory (DFT / RB3LYP / 6-31 ++ G *) in solvent water. The molecular HOMO-LUMO, excitation energies and oscillator strengths of investigated compound have also been calculated and presented.

Keywords: PM6, B3LYP, semi-empirical, theoretical calculations.

((4,6-dimethylpyrimidin-2-yl)amino)(5-(p-tolyl)isoxazol-3-yl)methanol – is a promising pyrimidine derivative with biological activity.

The starting geometry of the molecule was additionally optimized in a dimethylformamide solvent by the semiempirical PM6 method of the Gaussian 16 software package until the global minimum of the total energy of the systems under study was reached. To find the global energy minimum and the most stable conformers, all stationary points on the potential energy surface of molecules are analyzed. Optimized geometric configurations, total molecular energy, electronic properties and enthalpy of formation of substances are found using the PM6 method.

Calculations using the DFT method for were carried out by RB3LYP methods in the 6-31 ++ G * basis. All quantum-chemical calculations were performed using the Gaussian 16 software package and the GaussView 06 results visualization program on a personal computer with an intel core i7 processor (2.21 GHz CPU) with the Ubuntu 18.04 operating system installed. The IEFPCM method is used to calculate the solvent effect [1,2].

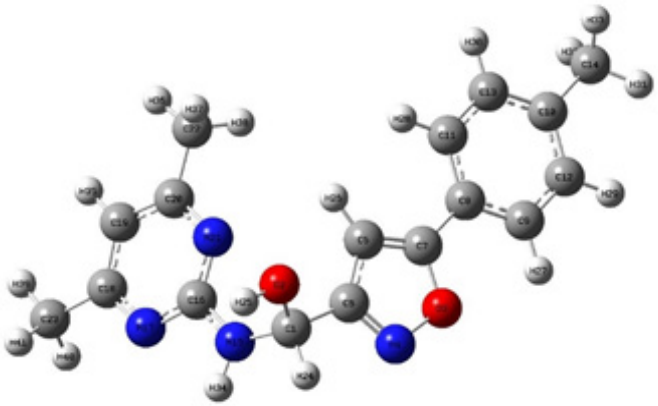

Fig. 1. – Optimized ((4,6-dimethylpyrimidin-2-yl)amino)(5-(p-tolyl)isoxazol-3-yl)methanol molecule

1. Preliminary quantum-chemical calculations of compound were carried out by the PM6 semiempirical method. The most stable conformers were found in terms of the total energy of the molecules. For our molecule, the energy is -3984.2898 kcal / mol.

2. Using the ab initio method of the density functional theory TD / RB3LYP / 6-31 ++ G *, the electronic spectra of a molecule in a solvent medium were calculated. For a molecule λmax = 277 nm at f = 0.50 S0→S2 (HOMO (-5.71), LUMO (-1.36).

3. Calculated physicochemical and antioxidant properties. The band gap for our molecule is 4.35 eV.

4. The analysis of the molecular electrostatic potential has been carried out. It was found that the O20 and O21 atoms have the highest electron density in the molecule.

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QUANTITATIVE ANALYSIS OF THE CHILD POPULATION MORBIDITY IN THE CITY OF BARANOVICHI, BREST REGION IN 2014-2018

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An important criterion for the health of the child population is the level of child morbidity. The morbidity indicators allow us to judge the state of resistance of the child's body to unfavorable environmental factors, the functional state of the child's body at different age periods, and the quality of medical care. The study of the incidence of the child population determines a set of preventive measures to reduce it. The indicators of the total and primary morbidity of the child population in the city of Baranovichi, Brest region, from 2014 to 2018 were analyzed.

Keywords: morbidity of the child population, long-term dynamics, trend, structure of morbidity.

Preserving and strengthening the health of the younger generation is not only a medical issue, but also a socio-economic and political one, since it is about forming a healthy society. The study of children's health status is of priority importance when assessing the health of the population under the influence of adverse environmental factors. Among many indicators that characterize health, the leading place is occupied by morbidity. Information about the structure and dynamics of children's morbidity allows us to identify the most significant problems regarding the health of the younger generation and determine the main directions in prevention and organization of medical care [2, 3].

The purpose of this work was to analyze the dynamics of morbidity [1] in the children's population of Baranovichi, Brest region for the period from 2014 to 2018 in general and for individual classes of diseases. The object of the study was reporting materials on the number of cases of diseases registered in the children's population served by the "Baranovichi city children's hospital."

During the study period, there was a weak trend towards an increase in the overall morbidity of children (R2 = 0.49). The average annual rate of total morbidity (A0) was 16441.6 per 10 thousand children. Overall morbidity rate by 2018 increased by 5.2% compared to 2014 and was 16954.5%00. The dynamics of primary morbidity showed a moderate upward trend (R2=0.69). The average annual primary morbidity rate (A0) was 13394.3 per 10,000 children. Primary morbidity increased by 6.6% by 2018.

In the structure of the General morbidity of children the most significant pathologies were respiratory diseases (73.4% in 2014 and 76.9% in 2018), diseases of the eye and its appendage (5.9% in 2014 and 6.8% in 2018), infectious diseases (3.1% and 2.7%, respectively), diseases of the digestive system (3.2% and 2.1%), ear diseases (2.8% and 3.2%), injuries (3.4% and 1.7%) and diseases of the endocrine system (2.3%). In the structure of primary morbidity, the first rank also belonged to respiratory diseases (84.4% and 88.0%, respectively), ear and mastoid diseases accounted for an average of 3.4%, and injuries accounted for an average of 3% of all registered diseases for the first time. The remaining classes of diseases accounted for 1% each in the years under review. In the period from 2014 to 2018 children showed a steady increase in the incidence of respiratory diseases (R2=0.75). Overall morbidity increased by 16.2%, primary by 17%. A steady increase was observed in the overall incidence of diseases of the eye and its appendage (R2 = 0.74) and the endocrine system (R2 = 0.58). Overall morbidity rates increased by 27% and 21%, respectively. In the dynamics of the incidence of diseases of the digestive system and due to injuries and poisoning, a steady downward trend was noted. Differences in the indicators of general and primary morbidity of children in Baranovichi at the end of the study period in relation to the initial year of the study are statistically significant for all the considered classes of diseases.

The high level of morbidity indicates the need to strengthen preventive work, which should include medical and social measures, such as the formation of a healthy lifestyle of the population and screening studies for the early diagnosis of various pathologies.

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QUANTUM-CHEMICAL MODELING AND PHYSICO-CHEMICAL PROPERTIES OF ADENOSINE MONOPHOSPHATE

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The theoretical information concerning the molecules of adenosine monophosphate, as well as its cyclic form: cyclic adenosine monophosphate is analyzed in this work. The physicochemical properties of the 5-adenylic acid molecule have been studied. Quantum-chemical modeling of the AMP molecule has been carried out, and the IR and NMR absorption spectra have been calculated by the semi-empirical RPM6 method.

Keywords: quantum-chemical modeling, adenosine monophosphate, cyclic adenosine monophosphate, IR spectrum, molecule optimization.

Adenosine monophosphate (AMP, adenylic acid) is a nucleotide consisting of the nitrogenous base of adenine, the carbohydrate ribose, and a phosphoric acid residue. Cyclic nucleotides are substances in the molecules of which the phosphoric acid residue, binding to the carbon atoms of ribose in the 5 'and 3' positions, forms a ring; universal regulators of biochemical processes in living cells.

To calculate the starting geometry of the adenosine monophosphate molecule, the molecular mechanics method (MM +) of the HyperChem 08 software package was selected. This method was chosen because it was developed for organic molecules, takes into account the potential fields formed by all atoms of the calculated system, and also allows flexible modification of various calculation parameters depending on the task [1].

The optimization of the adenosine monophosphate molecule was also carried out using the RPM6 semiempirical method of the Gaussian 09W software package. The result was visualized using the Gauss View 06 program.

To perform quantum-chemical modeling of 1H NMR spectra of molecules, based on the structural formulas of compounds, a special algorithm was developed that includes the following steps: 1) transformation of each structural formula into a three-dimensional structure; 2) optimization of the geometry of the molecule; 3) calculation of chemical shifts; 4) search for magnetically equivalent nuclei and averaging of chemical shifts.

Using the MM + method, it was calculated that the dipole moment of the molecule is -9.1648, and the energy of the molecule is 56.4181 kcal / mol.

Molecular orbitals involved in the formation of the absorption spectrum of adenosine monophosphate: LUMO (N = 64) [3.888 eV]; HOMO (N = 63) [-6.188 eV]).

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QUANTUM-CHEMICAL MODELING AND PHYSICO-CHEMICAL PROPERTIES OF FLUDARABINE

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The theoretical basis of the physicochemical properties and the mechanisms of the fludarabine molecule action on cancer cells is analyzed in the work. Preliminary quantum-chemical calculations of the fludarabine molecule are carried out by the method of molecular mechanics and the semiempirical AM1 method. The most stable conformer is found in terms of the total energy molecule and the IR and NMR spectra of this molecule are calculated.

Keywords: fludarabine, quantum-chemical modeling, IR-spectra, NMR-spectra.

Fludarabine is a nucleoside that is widely used in the treatment of hematologic malignant neoplasms and solid tumors. It affects DNA polymerase, ribonucleotide reductase and DNA primase, inhibits DNA synthesis and destroys cancer cells. Arabinose derivatives of nucleosides, such as fludarabine and cytarabine, show high efficacy in the treatment of patients with acute and chronic leukemia and non-Hodgkin's lymphomas [1]. It turns out that the introduction of fluorine into a nucleoside molecule leads to an increase in its chemical and metabolic stability, a change in the biological activity of this nucleoside and in some cases can lead to an improvement in the antitumor and antiviral activity.

To calculate the starting geometry of a molecule the molecular mechanics method (MM+) of the HyperChem 08 program is chosen because it was developed for organic molecules, takes into account the potential fields formed by all depending on the task [2]. During the optimization of the molecule the following parameters were calculated: the dipole moment (Dipole/Dipole), equal to 3.1194, and the total energy of the system (Total Energy), equal to 42.4834 kcal/mol.

A complete quantum-chemical simulation of the fludarabine molecule was carried out using the semi-empirical AM1 method. The AM1 method is a frequently used semi-empirical method that allows obtaining better results for organic molecules containing oxygen and nitrogen atoms [3]. The results were visualized using the Gauss View 06 program.

To calculate the 1H-NMR and 13C-NMR spectra of the fludarabine molecule, based on the structural formula of the compound, a special algorithm has been developed and it includes the following steps: 1) transformation of the structural formula into a three-dimensional structure; 2) optimization geometry of the molecule. The results were visualized with the ChemBioOffice 2010 program.

The theoretical IR-spectrum of the optimized fludarabine molecule is calculated using the Gaussian 09W chemical program. The scaling factor for this level of theory is 0.99.

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RAT HEPATOCYTE SPHEROID MODEL IN VITRO

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Hepatocyte cultures are important tool in the biomedical research field, the pharmaceutical industry and clinical applications. Several works describing methods for hepathocytes isolation are known to have been published. However, many of these methods require extensive handling and can reduce viability and function of the isolated cells. Here we described a modified tree-step method for the rapid isolation of rat hepatocytes with high viability and good purity.

Keywords: hepatocytes, cultivation, isolation, morphology, spheroids.

Single-layer cell culture does not adequately model the in vivo behavior of tissues, which involves complex intercellular and cell-matrix interactions. Three-dimensional (3D) cell culture technologies are a recent innovation developed to address the disadvantages of culture of attached cells. While several methods for generating tissue analogs in vitro have been developed, these methods are often complex, expensive to install, require specialized equipment , and are usually limited to compatibility with only certain cell types. Here we describe an optimized method of hepatocyte isolation and a fast and flexible protocol for aggregation of cells into multicellular 3D spheroids of the same size. Spheroid cultures of hepatocytes can be assembled for use in a wide range of applications, including cell signaling or gene expression studies, drug screening, in the study of cellular processes and cell therapy [1 - 3].

Matherials and methods. Hepatocytes were isolated from the liver tissue of laboratory animals (n=4) by mechanical disaggregation in a 0,01% solution of collagenase IV type («Sigma», Germany). Cell suspensions were incubated in an enzyme solution for 30 minutes and subjected to low-speed centrifugation (5 – 8 min, 50 g). The primary cultures were cultivated in complete DMEM («Gibco», USA) with 2mM L-glutamine, 10% fetal bovine serum («Capricorn Scientific», Germany), 100 U/ml benzylpenicillin sodium, 100 U / ml streptomycin sulfate, 100 U / ml neomycin sulfate («Lonza», USA) at 37°C and 5% CO_2. The medium was changed every 2-3 days.

Results. In spheroid cultures, cells have a typical cuboid morphology, in addition, rounded cells are distinguished, which is not typical for postnatal hepatic tissue and occurs in the case of activation of regenerative processes. The size of hepatocytes, defined as the maximum possible distance between two points of projection of cells, visible in the photograph, varied from 19 μm to 33 μm (average 28 ± 3 μm). With a longer cultivation, conglomerates of hepatocytes were formed due to the formation of selective intercellular contacts, comparable to

contacts in the original tissue. However, these multicellular conglomerates were not stable enough and were easily separated by mechanical pipetting during the entire cultivation time (up to 5 days). The viability of hepatocytes after 24 hours of cultivation ranged from 79.5% to 92.0% and remained at this level for up to 5 days.

Conclusion. Isolation of hepatocytes by the classical perfusion method is a laborious, technically complex and expensive procedure. The presented modified protocol, which includes mechanical and enzymatic tissue disaggregation, allows the isolation of a large number of viable hepatocytes, excluding the stage of liver perfusion.

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RETROSPECTIVE ANALYSIS OF GENERAL MORBIDITY OF POPULATION OF BREST REGION (2007-2017)

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Abstract: the work analyzes the general morbidity of the population of the Brest region for the period 2007-2017; the long-term dynamics of general and primary morbidity among adults and children was studied.

Keywords: primary morbidity, general morbidity, average annual rate, annual rate.

In the course of the study, it was found that diseases of the genitourinary system have a pronounced increase among the primary morbidity, while in the general structure there is an increase in the incidence of diseases of the eye and its adnexa, circulatory system and urinary system.

When analyzing the dynamics, a tendency towards an increase in the overall incidence was observed, while in the structure of the primary structure there was neither an increase nor a decrease.

The average annual rate of general morbidity (A0) was 133157.5 per 100 thousand population. The annual trend indicator (A1) is 1958.9 per 100 thousand population. The average annual primary morbidity rate (A0) was 69,478. 9 per 100 thousand population. The annual trend indicator (A1) is 36.7 per 100 thousand people.

From the data obtained, we observed annual fluctuations in the incidence of both general and primary diseases, with periods of growth and decline. The calculated values of annual growth rates have revealed that the highest values of annual growth rates were noted: for primary morbidity in 2009 (15.04%), for general morbidity in 2017 (9.94%).

When analyzing the dynamics of the primary morbidity of the population of the Brest region, an increase in the incidence of diseases of the genitourinary system, musculoskeletal system and connective tissue, diseases of the skin and subcutaneous tissue, the eye and its adnexa was revealed. Moreover, the analysis of the dynamics of the general morbidity of the population of the Brest region revealed a steady increase in the incidence of diseases of the eye and its appendage, diseases of the circulatory system and urinary system, musculoskeletal system and connective tissue.

The dynamics of the overall morbidity of the adult and child population of the Brest region revealed a steady upward trend. It is noted that the level of morbidity of the child population exceeds that of the adult by 0.5 – 0.75 times. Analysis of the dynamics of primary morbidity in the children's population of the Brest region revealed a steady upward trend, while the primary morbidity of the adult population was recorded at approximately the same level. It was found that the level of primary morbidity of the child population exceeds that of the adult population by 2 – 2.5 times.

The results obtained in the course of the study can be used as a definite step towards improving prevention and treatment and can be used to develop methods for its correction.

Thus, modern examination, prevention and correct diagnostics, including the performance of various

laboratory tests, allows you to timely identify the disease and choose the appropriate method of treatment, this can be achieved by observing hygienic rules, a healthy lifestyle, as well as timely treatment in health care institution.

RETROSPECTIVE ANALYSIS OF INCIDENCE IN THE ADULT POPULATION OF IVANOVSKY DISTRICT BY DISEASES OF THE BLOOD CIRCULATION SYSTEM (2013 - 2019)

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This work deals with the problem of the prevalence of diseases of the cardiovascular system among the population of Ivanovsky district for the period from 2013 to 2019. The subject of the research is statistical data on the incidence of diseases of the circulatory system (the adult population of the Ivanovsky district in the period from 2013 to 2019). The purpose of the work is to analyze the incidence of diseases of the circulatory system in the adult population of the Ivanovsky district for the period from 2013 to 2019; as well as analysis of dynamics, identification of the main trends in the incidence of the population on the basis of available statistical data. Diseases of the circulatory system are one of the most common causes of morbidity and mortality worldwide. Based on this the study of this problem is extremely important.

Keywords: morbidity, risk factors, cardiovascular diseases, treatment, prevention, etiology, pathogenesis, arterial hypertension, ischemic disease, cerebrovascular diseases

Today, diseases of the circulatory system occupy the first place in the overall structure of morbidity.

In terms of mortality, Belarus occupies one of the first places among developed countries.

Diseases of the circulatory system can be acute and chronic, as well as congenital and acquired.

The main diseases of the cardiovascular system are:

1. Ischemic heart disease;
2. Vascular disease of the brain;
3. Peripheral artery disease;
4. Rheumatic heart disease;
5. Congenital heart disease;
6. Deep vein thrombosis;
7. Lung embolism.

In this work, the incidence of diseases of the circulatory system in the adult population of the Ivanovosky district in 2013-2019 was analyzed.

Diseases of the circulatory system occupy the first rank in the morbidity structure and account for 27%. At the end of the studied period (2019), the contribution of diseases of the circulatory system to the overall structure of morbidity increased from 27% to 31%, while retaining the first rank place in the structure of morbidity in the adult population of the Ivanovo district.

The analysis of the morbidity structure of the adult population of the Ivanovsky region with diseases of the circulatory system was also carried out.

In 2013 the first rank is held by ischemic heart disease (43%), the second - arterial hypertension (41%), the third - cerebrovascular diseases (8%). At the end of the study period in 2019 the morbidity structure of the adult population of the Ivanovsky region changed somewhat - arterial hypertension (45%) moved to the first rank place, coronary heart disease (44%) moved to the second and the third as in 2013 is occupied by cerebrovascular diseases (5%).

During the studied period an increase in the incidence of arterial hypertension and coronary heart disease was noted. At the same time there was a marked decrease in the incidence of cerebrovascular diseases in the adult population of the Ivanovsky district.

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RETROSPECTIVE ANALYSIS OF MORBIDITY OF THE POPULATION OF THE REPUBLIC OF BELARUS DUE TO INJURIES, POISONING AND OTHER CONSEQUENCES OF EXTERNAL CAUSES

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This work is devoted to the study of the morbidity of the population of the Republic of Belarus (RB) due to injuries, poisoning and some other consequences of external causes. The aim of this work is to study the dynamics of diseases caused by injuries, poisoning and some other consequences of external causes for the period from 2006 to 2018. The paper analyzes the structure of the incidence of RB, the analysis of long-term dynamics of primary and general morbidity of the population of the Republic of Belarus due to injuries, poisoning and some other consequences of external causes for the period 2006-2018 and calculation of growth rates, as well as special attention is paid to the comparative analysis of primary and general morbidity in the regions of the Republic. As a result of the analysis there is a downward trend in both the general and primary morbidity of the population in all age groups. Areas with the highest number of detected cases of morbidity due to injuries, poisoning and other consequences of external causes have been identified.

Keywords: morbidity, population, dynamics.

At the first stage of the study the structure of morbidity in the population of the Republic of Belarus for 2006 and 2018 was analyzed. In 2006 injuries, poisoning and some other consequences of external causes occupy the fifth rank among all diseases of the population and in 2018 they have already fallen to the eighth rank. Based on the data on the morbidity of the population of the Republic of Belarus, the analysis of the proportion of cases of injuries, poisoning and some other consequences of external causes in 2006-2018 among all cases was carried out.

Next was a retrospective analysis of primary and general morbidity of the population of the Republic of Belarus from injury, poisoning and certain other consequences of external causes over the years 2006-2018 which was conducted for the population of Belarus as a whole and separately for adult and child population. As a result, it can be argued that there is a downward trend in all the studied groups.

During the study period the average annual rate of primary morbidity of injuries, poisoning, and some other consequences of exposure to external causes was 7670.02± 95.30/0000. In the entire population of the Republic of Belarus from injuries, poisoning and some other consequences of exposure to external causes for the analyzed period, the average annual rate of total morbidity is 7812.55± 93.010/0000 and during the observation period, the total incidence decreased by 7.3% and the primary-7.7%.

During the study period there is a downward trend in both the general and primary morbidity of the population of the Republic of Belarus in all age groups. The largest number of cases of injuries, poisoning and some other consequences of external causes are observed in Minsk. In recent years there has been a tendency to reduce the incidence of injuries, poisoning and some other consequences of external causes in the country.

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RETROSPECTIVE ANALYSIS OF PRIMARY CHILDHOOD DISEASE IN THE REPUBLIC OF BELARUS (REGIONAL ASPECT)

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This work is devoted to the study of the dynamics of primary morbidity of the child population in the Republic of Belarus (in the regional aspect). The purpose of the work is to analyze the primary morbidity of the child population for all nosological forms for the period from 2008 to 2017. As a result of the analysis, a stable trend of increasing morbidity of the child population has been established. In the regional aspect, the largest incidence is noted in the Grodno region, the smallest in the Brest region.

Keywords: childhood morbidity, primary morbidity, ratio coefficient, incidence coefficient, prevalence coefficient.

Children's health is naturally considered as one of the most important medical and social priorities of the state. The urgent need to take measures to protect the health of children is due to the fact that the pathology of the development of the child's body is one of the specific phenomena of the interaction of the child's body and the environment and can be determined long before its birth. Modern children and adolescents are the main reproductive group of the early 21st century, so studying the state of health of children and adolescents of the Republic of Belarus is especially relevant.

In the dynamics of the primary incidence of the child population from 2008 to 2017, there was no trend towards its growth or decrease. During this period, rates ranged from 1,63136.0 per 100,000 children. in 2008, up to 1,82714.7 per 100,000 children. in 2017. The average annual incidence rate (A0) is 1,83885.77 per 100,000 children. The annual trend rate (A1) is 1,014.9 per 100,000 children. Analysis of the weather growth rate of primary morbidity of the child population of the Republic of Belarus for 2008-2017. showed a positive result, with the exception of 2012 and 2014.

An analysis of the incidence patterns of the child population in 2008 revealed that the first ranks were occupied by the following nosologies: first place - respiratory diseases (82%), second place are injuries, poisoning and some other consequences of external causes (6%), third - diseases of the skin and subcutaneous fiber (5%), then there are some infectious and parasitic diseases (4%) and fifth place are diseases of the eye and its accessory apparatus (3%). At the end of the study period, rank places were occupied by the same nosologies as in 2008. These data reflect the situation in the country as a whole, but each area has its own territorial characteristics in terms of primary childhood morbidity, trends and projections.

Analyzing the dynamics of primary morbidity of the child population, it was revealed that the largest annual average was observed in the city of Minsk: 60738.3 per 100 thousand children's population, in second place is the Gomel region - 175671.2 per 100 thousand children's population and the third place is occupied by the Minsk region, the average annual indicator is 168436.3 per 100 thousand children's population. The lowest incidence rate during the study period is observed in the Brest region, it is 132791.4 per 100 thousand children.

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RETROSPECTIVE ANALYSIS OF THE INCIDENCE OF RESPIRATORY DISEASES IN THE CITY OF LUBAN (2015 – 2019)

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The publication is devoted to the current problem. Current trends in the incidence of respiratory diseases among the population of the Republic of Belarus indicate an increase in the prevalence of this form of problem. Therefore, it seems relevant to conduct expanded epidemiological studies on this problem in the regional aspect.

Keywords: human Health, respiratory diseases, morbidity, pneumonia, rhinitis, bronchitis, SARS, epidemiology, risk factors.

The paper analyzes the dynamics of the incidence of respiratory diseases in the adult population in the territory of the Lubansky district from 2015 to 2019.

Noted that the first rank place in the structure of General morbidity of adults in 2015 held the following diseases: acute respiratory infections of the upper respiratory tract (59%), bronchitis chronic and unspecified, emphysema (7 %), other chronic obstructive pulmonary disease (5%). At the end of the study period the structure of the total morbidity of the adult population of Lyuban from RD did not change. Acute respiratory infections of the upper respiratory tract are also in the first rank, the contribution of which to the structure of morbidity decreased by 11% and amounted to 48%; in the second ranking place – chronic and unspecified bronchitis, emphysema of the lungs – 7,%; in the third place – other chronic obstructive diseases - 5%. Acute respiratory infections of the upper respiratory tract (74%) took the first rank in the structure of primary morbidity of the adult population, as well as in the structure of the total incidence of AML in 2015, pneumonia – 5% – took the second place, and vasomotor and allergic rhinitis – 1% - took the third place. At the end of the study period, the structure of primary morbidity in the adult population of Lyuban changed slightly. Acute respiratory infections of the upper respiratory tract are also ranked first (69%); pneumonia is ranked second (6%); and other chronic obstructive diseases are ranked third (1%).

As a result of this work, the following conclusions were made:

1. During the study period – from 2015 to 2019, the structure of the total morbidity of the adult population of Lyuban from RD has not changed. The first rank was occupied by acute respiratory infections of the upper respiratory tract, whose contribution to the structure of morbidity decreased by 11% and amounted to 48% in 2019; the second rank was occupied by chronic and unspecified bronchitis, emphysema of the lungs – 7.5% (2019); the third place was occupied by other chronic obstructive diseases – 5% (2019).

2. Acute respiratory infections of the upper respiratory tract (74%) took the first rank in the structure of primary morbidity of the adult population, as well as in the structure of the total incidence of AML in 2015, pneumonia – 5% – took the second place, and vasomotor and allergic rhinitis – 1% - took the third place. At the end of the study period, the structure of primary morbidity in the adult population of Lyuban changed slightly. Acute respiratory infections of the upper respiratory tract are also ranked first (69%); pneumonia is in second place – 6 %; in third place – other chronic obstructive diseases (1%).

3. Analysis of the dynamics of morbidity in the city of Lyuban from RD revealed an increase in the overall morbidity of the adult population during the study period.

4. Analysis of the dynamics of the adult population of Lyuban with individual AML diseases revealed an increase in the incidence of chronic and unspecified bronchitis, emphysema of the lungs and COPD.

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RETROSPECTIVE ANALYSIS OF THE PRIMARY INCIDENCE OF DIGESTIVE DISEASES IN THE REPUBLIC OF BELARUS (2007-2017).

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Abstract: The paper analyzes the primary incidence of digestive diseases in the Republic of Belarus for the period 2007-2017; analyzes the long-term dynamics of the primary incidence of digestive diseases among children and adults in the Republic of Belarus from 2007 to 2017.

Keywords: Diseases of the digestive system, gastritis, gastric and duodenal ulcer, cholelithiasis, pancreatitis.

The importance of this problem is also determined by the fact that not only organic, but also functional disorders of the digestive system are accompanied by serious metabolic disorders, which cause a chronic pathological state of both the digestive system and the entire body as a whole.

In the structure of General morbidity, diseases of the digestive system have been ranked 3rd after respiratory and circulatory diseases since 2011, the incidence rate in 2014 was 120.9 cases per 1000 of the population, an increase of 23.3% compared to 2013 is noted.

Statistics among the children's population (from 0 to 17 years) are even more depressing, they have diseases of the digestive system are in the 2nd place, the incidence rate in 2014 was 17304.1 cases per 100 thousand of the population, there is an increase in the overall incidence of this class of diseases by 23.0%.

In the structure of morbidity of the population older than working age, diseases of the digestive system occupy the 5th place after diseases of the circulatory, respiratory, musculoskeletal system and diseases of the eye and adnexal apparatus. The incidence rate in 2014 was 143.8 cases per 1000 population. There is an increase in the incidence rate compared to 2013 by 19.6%.

Based on the fact that disorders of the digestive system affect more than 50-60% of the adult population, as well as based on the work done to study the incidence of this pathology, we can say that more attention should be paid to early diagnosis and subsequent treatment.

During the analysis of the structure of primary morbidity of adults and children RB has revealed that the diseases of the digestive system were ranked on the 7th place (4%) among adults, ranking at the sixth place (3%) among children in 2007, ranked 9 place (3%) among adults and 8 among children in 2017.

A comparative analysis of the primary incidence of digestive diseases among children and adults in the regions in relation to the Republic of Belarus for the period 2007-2017 was conducted. It has been established that the highest incidence among children in this period is observed in the Gomel region and in Minsk. Among the adult population, the highest indicators are observed in the Gomel, Minsk regions and in Minsk.

The analysis of the primary incidence of digestive diseases among the children's population of the Republic of Belarus revealed a steady downward trend (R2 = 0.8907) in the incidence of this pathology for the period from 2007 to 2017. The analysis of primary morbidity of the adult population did not reveal the direction of the growth trend (R2 = 0.267).

To prevent the spread of various clinical forms of digestive diseases, it is necessary to review your eating habits, stop Smoking and stop drinking alcohol.

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ROLE OF STRESS-INDUCED TRANSPOSITION OF MOBILE GENOME ELEMENTS IN TYPE 2 DIABETES

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Transposons are sections of the DNA of organisms that can move (transpose) and reproduce within the genome. Transposons are examples of mobile genetic elements.

Transposons formally belong to the so — called non-coding part of the genome-the one that does not carry information about amino acid sequences of proteins in the sequence of DNA base pairs, although some classes of mobile elements contain information about enzymes in their sequence, are transcribed and catalyze movement.

Keywords: Transposons, HSP70, RNA interference, methylation, type 2 diabetes mellitus.

Under normal conditions, the process of transposition of mobile elements is regulated by epigenetic mechanisms such as methylation of DNA and the process of RNA interference. In particular, hypermethylation is able to repress transposition, while hypomethylation, on the contrary, removes the epigenomic block from the corresponding genes and promotes transposition. [1]

In turn, the RNA interference process is an example of negative regulation of gene expression and transposon expression in particular. During RNA interference small RNA associated with a matrix RNA, which leads to the suppression of expression of the gene (silencing). Thus, a special class of small RNAS –piRNAs-is involved in silencing of transposons. [2]

It was shown that the heat shock reaction increases the expression of transposable genome elements mainly at the post-transcriptional level, affecting the biogenesis of piRNA through the action of the inducible chaperone Hsp70. It is assumed that the increased expression of transposable elements after heat shock is the result of the active role of Hsp70 in the movement of factors necessary for piRNA-mediated repression. These factors are primarily proteins of the Argonaute family. Proteins of this family combine with the inducible form of HSP70 and are transferred to lysosomes, where they undergo lysis. This process leads to the removal of the RNA block from the corresponding genes and induces the transposition of mobile elements. [3]

Thus, it can be assumed that this phenomenon will help to understand the causes of certain pathological conditions associated with certain diseases. In particular, it was found that in mice suffering from type 2 diabetes, a certain region of the Zfp69 gene is missing, which leads to its activation. This gene in mice is responsible for the development of obesity, insulin resistance and, as a consequence, type 2 diabetes. The activity of the human ZNF642 gene corresponding to the mouse Zfp69 was shown in patients with type 2 diabetes. It is possible that the absence of this gene region can be explained by the removal of the epigenomic block from the corresponding region of the genome as a result of the interaction of the inducible form of HSP70 with factors necessary for piRNA-mediated repression, which in turn induced the transposition of this region. [4]

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ROLE OF TRACE ELEMENTS IODINE AND SELENIUM IN THYROID PATHOLOGY

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Abstract: the work examines the influence of trace elements iodine and selenium on the functioning of individual organs and organ systems. The object of research is the trace elements iodine and selenium, and their role in the formation of thyroid pathology. The purpose of this work is to study the role of trace elements iodine and selenium in the formation of thyroid pathology. To analyze the incidence of thyroid nodular pathology in the Brest region in 2010-2019. To analyze the iodine content of the body in children from the Brest and Grodno regions.

Keywords: trace elements, iodine, selenium, endocrine system pathology, thyroid gland pathology, thyroid gland, iodine deficiency diseases.

Nowadays, the study of the state of the elemental state of the body in diseases of the thyroid gland (TG) is relevant, as is the study of the incidence of pathologies of the thyroid gland. Diseases of the thyroid gland become more frequent every year, especially women suffer from them. This is due to numerous hormonal shocks that overtake them throughout life, such as pregnancy and menopause.

Thyroid pathology is quite common and ranks third among diagnosed diseases on the territory of the Republic of Belarus after cardiovascular diseases and diabetes mellitus.

Trace elements are chemicals that are present in the body in exceedingly small amounts, in particular, their content does not exceed 0.005% of body weight, the concentration in tissues is not more than 0.000001%. Long – term deficiency or excess of trace elements can lead to the development of endemic diseases, among which iodine deficiency is the most studied-the most common pathology of the thyroid gland.

In this work, we have analyzed the content of the trace element selenium, which was determined in hair samples weighing 100-300 mg, cut from the occipital part of the head by x-ray fluorescence analysis using the «Elva X» spectrometer. The content of trace elements was measured according to the manufacturer's instructions.

An increase in the incidence of nodular goiter in the Brest region was observed. The highest incidence of nodular goiter in the Brest region was registered in 2013, the lowest – in 2012. In 2018, compared to 2017, there is a 0.9-fold decrease in the incidence, but this is not statistically confirmed.

During the analyzed period (2010-2019), there was a slight decrease in the incidence of diffuse-toxic goiter in the Brest region, and the overall situation is stable.

The highest incidence of diffuse-toxic goiter in the Brest region was registered in 2013 and 2015, the lowest – in 2018, but there were no statistically significant differences.

Also, during the analyzed period (2010-2019), there was an increase in the incidence of thyroid cancer in the Brest region. The highest incidence of thyroid cancer in the Brest region was registered in 2017, the lowest – in 2009. In 2018, compared to 2017, there was a 1.02-fold decrease in the incidence, but not significantly.

The overall prevalence of goiter in the surveyed regions ranged from 4.0% to 16.0 %. The iodine content of children is not good enough in all the surveyed schools.

The severity of iodine deficiency disorders has decreased and can now be assessed as mild by region, while levels of selenium deficiency in schoolchildren remain quite high.

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STATISTICS OF ONCOLOGICAL DISEASES IN THE REPUBLIC OF BELARUS IN THE PERIOD FROM 1990 TO 2014

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The purpose of this work is to study and compare statistical data.

Keywords: oncological diseases, statistics, morbidity, mortality.

The demographic situation in Belarus has changed significantly over a quarter of a century. The changes significantly influenced the levels and dynamics of indicators of cancer statistics.

Currently, the trend in the incidence shows a persistent and steady preservation of the upward trend. In 1990, the number of newly registered oncological diseases was 26,257, and in 2014 - 45,887, the increase averaged 785 cases per year. Over a 25-year period, 894,757 new cases were registered [1].

In Belarus in 2014, men most often fell ill with cancer of the prostate gland (16.9%), lung (16.4%), skin (13.3%, without melanoma), stomach (7.1%), oral cavity and pharynx (5.1%), colorectal zone (9.9%), kidney (5.0%). In women, cancer of the skin (20.8%), breast (17.6%), uterine body (8.6%), colorectal zone (10.4%), stomach (5.0%), ovary was most often detected. (4.2%) and thyroid gland (4.3%) [2].

The increase in the incidence of thyroid cancer is presumably associated with the effects of exposure to radioactive iodine and a number of other isotopes following the Chernobyl accident. Due to an increase in the life expectancy of the population and frequent preventive examinations, the number of detected malignant neoplasms of the skin has increased. One of the reasons for the increase in the incidence of cervical cancer is the spread of papilloma virus infection.

The increase in the incidence among the working-age population was 49.8%. In men of working age, from 1990 to 2014, the incidence of prostate cancer increased 7.5 times, kidney cancer three times, the incidence of oral cavity and pharyngeal cancer, colorectal zone, melanoma and other skin neoplasms increased significantly.

From 1990 to 2014, the incidence of cancer of the uterine body increased by 2.3 times in women of working age, there was a pronounced increase in the incidence of breast cancer, cervical cancer, ovarian cancer, melanoma and other skin neoplasms.

It is worth noting that over the past 15 years, there has been a steady downward trend in mortality in the country: from 206.7 in 1990 to 174.4 in 2014 [1].

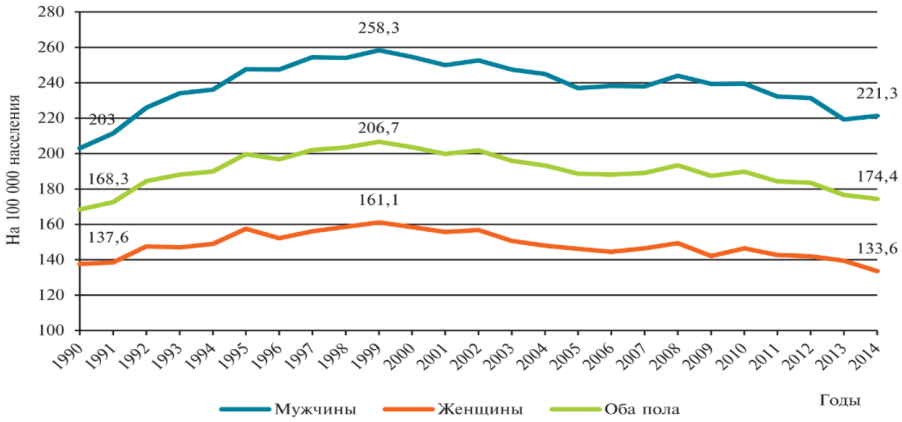

Fig. 1. – Dynamics of mortality of the population of the Republic of Belarus from malignant neoplasms of all localizations (rough intensive indicators per 100,000 population), 1990-2014

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STUDYING OF IMMUNOTROPIC ACTIVITY OF THE EXTRACT OF MYCOTHALLUS *G. LUCIDUM* IN THE MODEL OF AN IMMUNE RESPONSE IN BALB/C MICE

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As a result of recent studies, it was found that biological substances isolated from G. lucidum immunotropic, antitumor, antioxidant, antimicrobial, antiallergenic and other biological activities. The effects of G. lucidum on the immune system are varied. The main immunotropic effect was observed in relation to indicators of antigen-specific immunity and is aimed at modifying the cellular immune response.

Keywords: Ganoderma lucidum, immunotropic activity, extract of mycothallus.

Introduction. Isolation and study of new biologically active substances is one of the most promising scientific directions in the world, and in Belarus in particular. Basidiomycetes, which are sources of a number of active compounds, are a priority group for study. One of the representatives is the fungus *Ganoderma lucidum*. Extracts and powders are prepared from its mycothallus in different ways, which are used as food additives [1].

Material and research methods. The study of the immunotropic activity of the extract of mycothallus of *G. lucidum* was carried out on the model of the immune response, created according to the standard scheme.

The immunized BALB/c mice (males) were divided into 2 groups - control (6 mice) and experimental (6 mice). The induction of the immune response (immunization) was carried out with a suspension of sheep red blood cells (0.1 ml of suspension at a concentration of 1×108 cells/ml per mouse). For the induction of delayed-type hy-persensitivity (DTH) under the aponeurosis of the hind paw, a resolving dose of antigen (0,025 ml of ram red blood cells suspension at a concentration of 1×107 cells/ml per mouse) was administered on the 5th day after immuniza-tion. The animals were removed from the experiment on the 7th day after immunization. The studied extract was administered to animals of the experimental group at a dose of 50 mg/kg body weight once on the day of immun-ization. Thus, the effect of the study drug on the development of the inductive phase of the immune response was achieved.

Determined parameters: spleen index; the number of antibody-producing spleen cells and the titer of antibodies to sheep red blood cells (hemagglutinins); the severity of the delayed-type hypersensitivity reaction; indica-tors of the functional activity of peritoneal macrophages (PI, PN); functional activity of the classical and alterna-tive pathways of activation of the complement system.

To determine these parameters we used the standard methods for this kind of research. The results obtained were processed statistically.

Results. The study of the influence of the fractions of the extract of mycothallus *G. lucidum* on the indices of specific humoral immunity showed that the differences between the experimental and control groups of laboratory animals were recorded at the level of a trend. A statistically significant increase in the DTH index was found in laboratory animals of the experimental group. In this case, the main immunotropic effect of the extract of myco-thallus *G. lucidum* is aimed at modifying the cellular immune response.

Regarding the indicators of antigen nonspecific immunity induced by sheep red blood cells, a statistically significant increase in the parameters of PI and PN is found, which indicates an increase in the absorption capacity of macrophages. Identical changes were noted in relation to the complement system. *G. lucidum* extract helps to increase the activity of the classical pathway of activation of the complement system.

Conclusion. The main immunotropic effect of the extract of mycothallus *G. lucidum* is aimed at modifying the cellular immune response (in the model of induction by sheep red blood cells), increasing the activity of the complement system along the classical pathway, and increasing the indicators of the phagocytic activity of peritoneal macrophages.

The listed results confirm the possibility of using *G. lucidum* extract to enhance the immune status of the or-ganism. A more detailed study of its chemical composition may lead to the creation of new, effective drugs.

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SYNTHESIS AND PROPERTIES OF WATER-SOLUBLE DECAHYDROACRIDINE ACID-BASE TITRATION INDICATOR

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In this paper we present data on the synthesis and using as acid-base titration indicator of 10-hydroxy-3,3,6,6-tetramethyl-9-(D-manno-1,2,3,4,5-pentahydroxypentyl)-1,2,3,4,5,6,7,8,9,10-decahydroacridin-1,8-dion. The studied compound was obtained by ecologically safe methods by the interaction of dimedone, D-mannose, hydroxylamine hydrochloride and sodium acetate in alcohol. This dye absorbs in the UV - violet (401 nm) region in neutral media. Addition of alkali induces red shift of absorption maximum to λ_{max}. 502 nm; therefore this compound can be used as acid-base indicator.

Keywords: organic synthesis, 10-hydroxy-3,3,6,6-tetramethyl-9-(D-manno)-1,2,3,4,5,6,7,8,9,10-decahydroacridin-1,8-dion, absorption spectra.

Decahydroacridinediones contain a 1,4-dihydropyridine ring as structural fragment and are available via various versions of Hantzsch synthesis. These compounds exhibit a broad spectrum of biological activity [1]. The dyes of the decahydroacridine series have been intensively studied due to the application of them, in particular, as laser dyes and fluorescent marks [2]. Earlier we reported on the synthesis of derivatives of 10-hydroxy-1,2,3,4,5,6,7,8,9,10-decahydroacridine-1,8-dione, which changed the color of solutions when the pH of the medium changed [3]. The use of these compounds as indicators of acid-base titration was less effective due to their poor solubility in water. Here in we wish to report our results on synthesis of 10-hydroxy-3,3,6,6-tetramethyl-9-(D-manno-1,2,3,4,5-pentahydroxypentyl)-1,2,3,4,5,6,7,8,9,10-decahydroacridin-1,8-dion (I, Fig. 1) and study of the possibility of using this compound as an indicator of acid-base titration. The substance investigated was obtained by three-component heterocyclization of dimedone II, hydroxylamine hydrochloride III with D-mannose IV in water-alcohol solution using citric acid as catalyst.

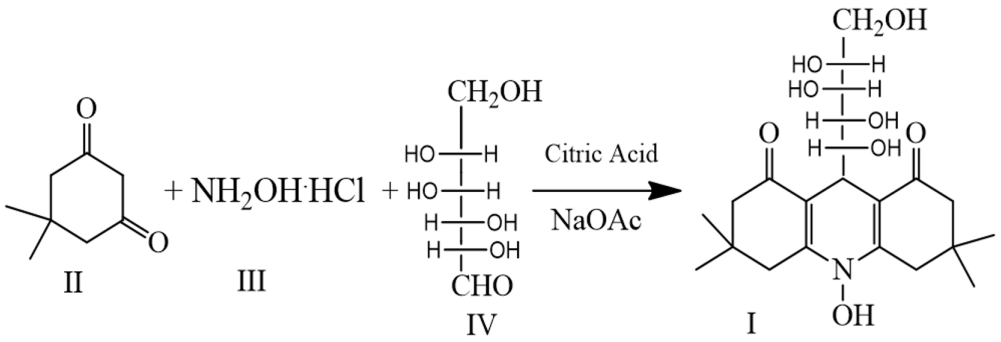

Fig. 1. – Scheme of synthesis of 10-hydroxy-3,3,6,6-tetramethyl-9-(D-manno-1,2,3,4,5-pentahydroxypentyl)-1,2,3,4,5,6,7,8,9,10-decahydroacridin-1,8-dion

Obtained compound display in the UV absorption spectrum long-wavelength band at λ_{max}. 401 nm. Addition of alkali induces red shift of absorption maximum to λ_{max}. 502 nm. The structure of the compound includes six hy-droxyl groups, therefore it is readily soluble in water. This substance is colorless in acidic and neutral and pink in base solutions. That is why it can be suitable acid-base titration indicator.

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SYNTHESIS OF 8-BROMOFLUDARABINE

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The aim of this work is the synthesis of 8-bromofludarabine as a new derivative of fludarabine.

Keywords: fludarabine, 8-bromofludarabine, synthesis, antitumor activity.

In parallel with the emergence of gemcitabine came purine nucleoside analogs, which were established as having major activity in indolent B-cell malignancies. The inhibitory actions against DNA replication of fludarabine, an arabinosyl nucleoside analog, are similar to those of ara-C [1].

The introduction of a fluorine atom at the C-2 position of the heterobase led to (9-ß-arabinofuranosyl) -2-flu oroadenine (FaraA), which is resistant to the action of deaminase, possessed high biological activity, but also as and araA was poorly soluble in water [2].

Fluorinated nucleosides exhibit a wide variety of biological activity and have been used extensively as anti-tumor and antiviral agents. In many cases, the stability of the nucleoside analogue, particularly the stability of the glycosyl bond, is an important factor determining the biological activity as well as the therapeutic usefulness of nucleosides as drug candidate.

To date, other biological properties of fludarabine and its analogs have not been sufficiently studied, and their further study is very promising.

The prerequisite for the creation of 8-bromofludarabine was the high biological activity of some analogues fludarabine.

The reaction progress and 8-bromofludarabine content were monitored by thin layer chromatography (TLC) on «Kieselgel 60 F254» plates from «Merck» (Germany) in a solvent system: chloroform / methanol (4:1 v/v). Compounds were visualized on the plates by viewing them in ultraviolet light.

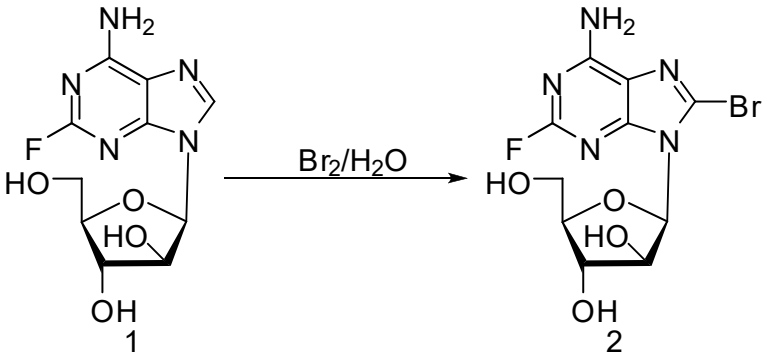

Fig. 1. – Scheme of the synthesis of 8-bromofludarabine

A solution of bromine (4.65 g, 1.5 ml, 3.4 mmol) in water (150 ml) was added by portions with stirring to a mixture of fludarabine 1 (1 g, 3.51 mmol) in water (20 ml). The resulting mixture was stirring at room temperature for one hour till the reaction was complete. The resulting solution was concentrated in vacuo at a temperature of ≤30 ° C to 10–20 ml using a rotary evaporator. The resulting mixture was left in refrigerator to precipitate crystals. The precipitate of 8-bromofludarabine 2 was filtered off and dried at room temperature.

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SYNTHESIS OF 8-BROMONELARABINE

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The aim of this work is the synthesis of 8-bromonelarabine as a new derivative of nelarabine. Nelarabine is a chemotherapy drug used in T-cell acute lymphoblastic leukemia.

Keywords: nelarabine, 8-bromonelarabine, synthesis, antitumor activity.

The emergence of drug resistance requires constant renewal to ensure the effectiveness of the treatment process for various diseases. As a result of ongoing scientific research to find biologically active compounds, new generation drugs appear. One of these compounds is the modified nucleoside 2-amino-6-ethoxy-9-(β-D-arabinofuranosyl) purine (nelarabine). This compound, possessing antitumor and antiviral activity, along with fludarabine and cladribine, has joined the arsenal of new generation antleukemic compounds [1-3].

Nelarabine is a prodrug of arabinosylguanine nucleotide triphosphate (araGTP), a type of purine nucleoside analog, which causes inhibition of DNA synthesis and cytotoxicity. Pre-clinical studies suggest that T-cells are particularly sensitive to nelarabine. In October 2005, it was approved by the FDA for acute lymphoblastic leukemia and T-cell lymphoblastic lymphoma that has not responded to or has relapsed following treatment with at least two chemotherapy regimens.

To date, other biological properties of nelarabine and its analogs have not been sufficiently studied, and their further study is very promising.

The prerequisite for the creation of 8-bromonelarabine was the high biological activity of some analogues nelarabine.

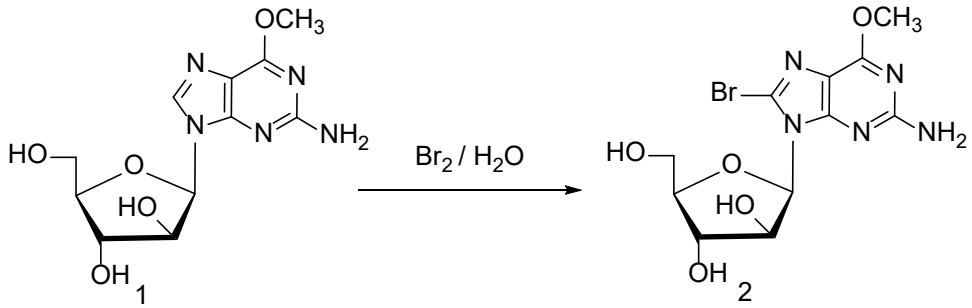

Fig. 1. – Scheme of the synthesis of 8-bromonelarabine

The reaction progress and 8-bromonelarabine content were monitored by thin layer chromatography (TLC) on «Kieselgel 60 F254» plates from «Merck» (Germany) in a solvent system: chloroform / methanol (4:1 v/v). Compounds were visualized on the plates by viewing them in ultraviolet light.

A solution of bromine (4.65 g, 1.5 ml, 3.4 mmol) in water (150 ml) was added by portions with stirring to a mixture of nelarabine 1 (1 g, 3.36 mmol) in water (20 ml). The resulting mixture was stirring at room temperature for one hour till the reaction was complete. The resulting solution was concentrated in vacuo at a temperature of ≤30 ° C to 10–20 ml using a rotary evaporator. The resulting mixture was left in refrigerator to precipitate crystals. The precipitate of 8-bromonelarabine 2 was filtered off and dried at room temperature.

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THE CONTENT OF INDIVIDUAL RADIONUCLIDES IN DIFFERENT TYPES OF FISH IN PINSK DISTRICT OF BREST REGION

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The research was carried out by the Brest branch of the Institute of Radiology. As a result of the studies, measurements of the specific activity of cesium-137 were taken in fish living in the waters of Pinsk district. The results of the studies indicate the presence of cesium-137 in fish living in reservoirs located in areas contaminated with radionuclides.

Keywords: radionuclide, cesium-137, water, strontium-90, fish.

As a result of the Chernobyl accident, atmospheric fallout and surface runoff increased the content of radioactive substances on the surface of reservoirs hundreds of times, but then their concentrations on the surface decreased due to the dilution and subsidence of the chemical compounds formed to the bottom. The total pollution of the ecosystems of reservoirs by long-lived man-made radionuclides does not decrease, but is constantly increasing, which sooner or later can have an impact if they exceed the acceptable values of their concentration for individual parts of ecosystems.

Table 1

The level of specific activity of cesium-137 accumulation in reservoirs of Pinsk district of Brest region

Name of the reservoir	Average specific activity of cesium-137, Bq / kg	Maximum level of specific activity of cesium-137, Bq / kg	Minimum level of specific activity of cesium-137, Bq / kg
Lake Bogatyrevskoye	22.2	48.4	10.0
Lake Konchitskoye	81.2	143.5	19.3
Pogostskoe Reservoir	10.6	22.9	4.9
Zhidche Reservoir	18.9	35.3	9.8
Yaselda River	11.5	24.5	5.6

Note – Source: [8]

According to the RDU-99 in force in Belarus [6], this standard for cesium-137 is 370 Bq / kg, strontium-90 is not standardized. The results of our studies have shown that the selected reservoirs belong to reservoirs in which the level of specific activity of cesium-137 in fish does not exceed the acceptable levels (RDU-99, TRTS 021/2011 «On Food Safety»). The level of specific activity of cesium-137 bottom sediments does not exceed 168 Bq / kg.

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THE EVIDENCE OF IMMUNITROPIC ACTIVITY OF PLANT EXTRACTS IN TERMS OF PHAGOCYTOSIS OF PERITONEAL MACROPHAGES OF A MOUSE

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Macrophages, being unique in their functions immune cells, very often become the object of interest in experimental immunology. The usage of macrophages of various origin allows to study their response to different impacts. Furthermore, the response of macrophages allows to provide a prospective estimate of the impact the researched factor has on the component of immune system.

Keywords: phagocytes, macrophages, microphages, phagocytosis, metabolism, phagocytic index, phagocytic number, average cytochemical ratio, plant extract.

Macrophages are the basic cell types in placenta of a human. Although the study of placenta macrophages has been started long ago, these cells, comprising a large population in the stroma of placental villi, are still not explored enough. Nowadays, macrophages play quite a big role in the field of experimental branches. They are used for the estimation of the immunotropic and immunotoxic effect of different factors and medicinal preparations.

The objective of the work is to identify the possibility of mice to have peritoneal macrophages for the analytical estimation of the mechanism of immunotropic effects of some plant extracts. Following tasks were assigned for the realization of the objective: to acquire the methods of estimating the functional characteristics of peroneal macrophages of a mouse; to study the impact of plant extracts (liquorice, periwinkle, dasiphora, amaranth, hyssop) on phagocytic and metabolic activity of peritoneal macrophages of a mouse in vitro. The material used for the research is the dispersion of peritoneal macrophages of a rat.

The existence of immunotropic effect of plant extracts makes the further research of the extract more actual, supposing to get an immunomodulatory drug from it.

This study falls within the screening research. It is the first step in selection of the extracts that potentially have an immunotropic effect on various experimental models, including the model of estimation of phagocytic and metabolic activity of macrophages of a mouse of the line Balb/c, used in this work.

The comparative analysis of immunotropic activity of the extracts researched is presented in the table 1.

The effect of immunotropic activity of the extracts researched on the performance of phagocytic and metabolic activity of macrophages in vitro

Extracts	The performance of phagocytic activity of peritoneal macrophages in a biological test		The performance of metabolic activity of peritoneal macrophages in a NBT-test	
	Phagocytic performance, %	Phagocytic number	NBT+-macrophages, %	Average cytochemical ratio
Hyssop	No effect	No effect	↓	↓↑ depending on doses
Amaranth	↑	No effect	↑	↑
Dasiphora	↓	↓	↑	↑
Periwinkle	No effect	No effect	No effect	No effect
Liquorice	↓	No effect	No effect	No effect

↑ – accurate higher output in comparison with intact macrophages.
↓ – accurate higher output in comparison with intact macrophages.

Effective impact of extracts researched were observed when macrophages were under the influence of different doses of extracts. As it is shown in Table 1, the absence of the impact on the performance of phagocytic and metabolic activity of peritoneal macrophages in the experimental model used, is observed only in case of periwinkle. The rest of the plant extracts performed stimulating and inhibitory effects.

Taking into account the role of phagocytosis in the reactions of specific, acquired immune response and in the inflammatory reaction, it is necessary to understand that the immunotropic effects performed by the plant extracts researched can be relevant when used in immunomodulatory. Moreover, different extracts will be perspective for different situations.

For instance, in the case of immunopathological inflammatory, when phagocytosis is too active and damages its own body's structure, the usage of a medicinal preparation based on dasiphora and liquorice can be beneficial. If the extract of amaranth is used, the immunopathological component of phagocytosis will be intensified, what leads to negative consequences.

The study conducted allows to make the following conclusion:

1) The used experimental model of phagocytal and metabolic activity of peritoneal macrophages is effective for studying the immonotropic activity of plant extracts.

2) There are both the stimulating and decreasing the activity of phagocytosis and metabolism extracts among those that were studied (Hyssop, Liquorice, Dasiphora, Perwinkle, Amaranth)

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THE IMPACT OF NICOTINE ADDICTION ON WOMEN'S REPRODUCTIVE HEALTH

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The extent of influence of nicotine dependence on pregnancy and women's reproductive health has been studied. Tobacco products have been found to play a large role in the development of various diseases of the reproductive system of women and the formation of fetal congenital malformations.

Keywords: tobacco smoking, reproductive health, pregnancy, congenital malformations.

Tobacco smoking (TS) is one of the most common bad habits. When smoking, the body is exposed to more than 600 different compounds contained in tobacco [2]. In the Republic of Belarus, according to official data, nicotine addiction is recorded in 60% of men and 20% of women [3].

Tobacco smoking has a negative impact on a woman's health. One example of this influence is the disruption of the menstrual cycle in women smokers. Smoking has been found to increase the risk of cervical cancer (CC) against the background of infection with human papillomavirus (HPV)[1]. Exposure to toxic substances in nicotine addiction is one of the causes of the tumor process, because the epithelium of the cervix is the most vulnerable to infection due to the action of toxic compounds contained in tobacco. In the study of the carcinogenic risk in women of Pinsk and Pinsk district, it was found that a high carcinogenic risk was observed with a combination of HPV carriage and nicotine dependence [1].

Intense smoking in the first months of pregnancy can lead to impaired implantation and spontaneous abortion in the early stages. Nicotine can contribute to miscarriage or premature birth due to the increased contractility of the myometrium. Toxic substances contained in tobacco cause vascular spasm and contribute to the development of placental insufficiency, hypoxia and intrauterine growth retardation. Nicotine not only penetrates the placenta, but also accumulates in it, penetrating into the fetus transplacentally [2].

According to the latest data, currently up to 30% of pregnant women suffer from nicotine addiction, which is one of the causes of perinatal morbidity and mortality. Tobacco smoking during pregnancy causes the following complications:

- risk of intrauterine growth retardation (increases by 2-2.5 times);
- early termination of pregnancy;
- increase in the frequency of placental abruption (twice or more);
- more frequent development of malformations of the maxillofacial region (cleft lip - 2 times, cleft palate - 4-7 times);

• development of hydrocephaly, microcephaly, omphalocele, gastrochisis [2].

In addition to the above, smoking during pregnancy contributes to:

• activation of carcinogens, increasing the risk of cancer in children;

• accumulation of toxic substances (cadmium, manganese) and a decrease in the level of zinc and copper in the fetal blood;

• increase in the number of deletions in some genes of fetal blood cells [2].

Since tobacco smoking is a manageable risk factor, it is necessary to implement preventive measures among women suffering from nicotine addiction.

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THE RELEVANCE OF INFECTION CAUSED BY EPSTEIN–BARR VIRUS (EBV) AT THE PRESENT STAGE

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Annotation: Epstein-Barr virus almost 90-100% of the adult population and from 50 to 80% - children. Laboratory diagnostics allows to differentiate different variants of acute, latent and chronic EB infection among themselves, for which it is necessary to use: serological research, detection by PCR of DNA of a virus in various biological materials.

Keywords: Epstein-Barr virus, disease, laboratory diagnostics.

Epstein-Barr virus belongs to the family of DNA-containing double-stranded Human gammaherpesvirus 4, which occupies an important place in the structure of infectious lesions of herpesvirus etiology. It infects almost 90-100% of the adult population and from 50 to 80% - children [1]. The incidence of Epstein-Barr virus infection (EBV infection) in different countries ranges from 4 to 45 per 100 thousand populations [2].

The relationship between the age of primary infection, its clinical manifestation and the socioeconomic level of the region can be clearly traced: in developing countries, primary EBV infection is transmitted by the majority of children at an early age, as evidenced by the detection of EBV antibodies in 80-100% of children. aged 3-6 years. Infectious mononucleosis occurs mainly in mild, atypical or subclinical form, which complicates the diagnosis of this infection.

Laboratory diagnostics allows to differentiate different variants of acute, latent and chronic EB infection among themselves, for which it is necessary to use: serological research, detection by PCR of DNA of a virus in various biological materials. Specific antibodies to EBV - appear in the 2nd week. disease (highest specificity and sensitivity): to capsid antigen: IgM - appear the earliest, even in 95% with a early infection, the titer increases rapidly within a few days from the beginning of the acute phase of the infectious process; disappear within 2-3 months; IgG - appear within a few days from the onset of EBV infection, in practice indicate an infection (not suitable for detecting the acute phase of the infectious process), persist throughout life, to early antigen - appear in the acute phase of infection, usually in 3-6 months are not detected.

Thus, given the significant prevalence of the disease and the prevalence of its asymptomatic and persistent forms, the main method of diagnosis is serological testing.

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THE ROLE OF CHAPERONES IN DIABETES MELLITUS TYPE 2

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Chaperones are a class of proteins whose function is to restore the correct tertiary structure of proteins, as well as the formation and dissociation of protein complexes. Many chaperones are heat shock proteins whose expression begins in response to an increase in temperature or other conditions that stress the cell. They act as catalysts that facilitate assembly without being part of the assembled complex.

Keywords: Hsp70, diabetes mellitus (DM), insulin, β-cells.

The chaperone function of Hsp70 is based on its ability to interact with hydrophobic regions of target proteins. Hydrophobic sites can be exposed to molecules of newly synthesized peptides or proteins that have lost their native conformation due to stress. Chaperone can restore the original polypeptide chain folding due to cyclic acts of association-dissociation with target molecules, which is impossible without the interaction of Hsp70 with helper proteins. [1]

Particular attention from the chaperone family is drawn to Hsp70, whose content and, consequently, function is reduced in DM2. There are 2 types of Hsp70: constitutional and inducible. The function of these chaperones in the cell is that they bind to damaged or newly synthesized polypeptides and help them adopt their native conformation; i.e., they contribute to the folding of newly synthesized or refolding of denatured polypeptide chains due to stress, their subsequent assembly into biologically active oligomeric structures, and also participate in the delivery of proteins to certain organelles. Constitutional chaperones normally, in addition to assisting in the Assembly of macromolecular structures and protein folding, also serve to destroy protein aggregates and unfold proteins for subsequent translocation or presentation as targets to proteolytic enzymes. In general, the biological functions of molecular chaperones are to correct the structure and conformation of other proteins in the cell, prevent aggregation of incorrectly folded or partially unfolded proteins, destroy and solubilize stable protein aggregates, unfold native protein substrates to translocate them across membranes, disassemble active oligomeric structures and maintain them in the state of inactive monomers, unfold active monomers for their subsequent degradation [2].

Many studies have shown that HSP70 is able to bind to the insulin receptor, increasing its recycling rate after heat shock, suggesting that heat shock proteins may have a direct effect on the function and activity of the insulin receptor [3]. So, the lack of HSP72 in patients with DM2 can negatively affect the state of insulin-mediated signal receptor transmission due to inhibition of the receptor. Filling the lack of Hsp70 in DM2 should lead to functional disinhibition of the receptor. It is known that chaperones also control the processes of remodeling the native state of regulatory and signaling proteins, including insulin in the cell. In this case, the functions of chaperones are aimed at preventing (and/or reversing) incorrect interactions of non-native polypeptide chains that lead to the formation of biologically non-functional products [2].

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THE ROLE OF THE SOCIAL PROTECTION SYSTEM IN SOLVING ENVIRONMENTAL PROBLEMS: INTERNATIONAL EXPERIENCE

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Annotation. Protection and preservation of the environment is one of the topical issues for different countries of the world. The author in this article has analyzed how the social protection system can help in solving environmental problems.

Keywords: environmental problems, climate change, natural disasters, the system of social protection of the population.

Most developed countries face challenges such as demographic change, economic crisis, migration and environmental problems. In this article we will analyze environmental problems and the role of the social protection system in solving it.

Today, for most countries, it is important to protect people from natural disasters that are caused by climate change, regardless of their frequency. Thus, we can distinguish two functions that social protection performs in the fight against environmental problems. Firstly, it is the protection of the population who have suffered or are most vulnerable to natural disasters and climate change. Various social support measures or in-kind assistance and job security systems can prove invaluable to families and individuals affected by natural disasters. This type of social assistance is available in several countries. An example is social support measures after Typhoon Haiyan in the Philippines after (2013), Hurricane Katrina in the USA in 2005, payments to poor households during a drought in Ethiopia, payments to victims of forest fires in Russia [1]. In the above payments, the advantage is the fact that these costs were already included in the budget for social protection measures, and the provision of assistance to victims of natural disasters was carried out quickly and efficiently.

The second function performed by the social protection systems of the population in solving environmental problems is the protection of certain categories of the population that have suffered as a result of the elimination of industries and activities that pollute the environment. So, for example, many countries today are actively working to reduce greenhouse gas emissions, carry out waste processing activities, and implement forest conservation programs. Despite the positive impact of these actions on the environment, one should not forget about the negative consequences for the economic sector. Especially for those who are engaged in this area. Thanks to the measures of social support, we will be able to smooth out the above economic consequences for the population. For example, in China, to preserve and restore forests in the areas of the Yellow River and Yangtze river basins, most of the tree processing enterprises were closed [1]. In connection with the closure of a large number of enterprises and the growth of unemployed, the government organized various payments for citizens who worked in this area, as well as established monetary payments to local residents in order to increase their activity and promote environmental protection and forest conservation.

Thus, we can conclude that thanks to the use of social support measures in modern conditions, many countries can actively work to protect the environment and combat climate change. Thus, social protection can not only protect the population from the consequences of natural disasters, but also support various categories of the population in the liquidation of enterprises that pollute the environment.

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THE VIABILITY AND MORPHOLOGY OF MULTIPOTENT MESENCHYMAL STROMAL CELL CULTURES IN THE PRESENCE OF VITAMIN D3

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The effect of vitamin D3 on morphofunctional properties of multipotent mesenchymal stromal cells of rats obtained from adipose tissue is presented. High cell viability, morphological homogeneity and high proliferative potential of cell cultures in the presence of different concentrations of vitamin D3 were revealed.

Keywords: multipotent mesenchymal stromal cells, adipose tissue, vitamin D3, morphology, proliferation, viability.

Multipotent mesenchymal stromal cells (MMSCs) are a population of adult cells with unique properties, in-cluding self-renewal, differentiation in the direction of a number of somatic cell lines, immunomodulatory, angio-genic, antiapoptotic and regenerative abilities [1]. Vitamin D (cholecalciferol), once considered a hormone limited by calcium homeostasis and bone mineralization, has a pleiotropic effect on various cell types. MMSC have vita-min D hydrolases and vitamin D receptor for metabolization and response to vitamin D. Vitamin D levels play a significant role in regulating the morphology and function of MMSC, which can contribute to stem cell therapy [2].

The aim was to assess the effect of vitamin D3 on the morphology, viability and proliferation of rat adi-pose tissue-derived MMSCs.

Materials and methods. The object of the study was the culture of multipotent mesenchymal stromal cells isolated from the adipose tissue of 3 laboratory rats with a body weight of 270 - 320 g. Cells were isolated by dis-aggregation of adipose tissue using collagenase type IV («Sigma», Germany). The MMSCs were cultivated in Petri dishes in a complete DMEM medium containing 10% fetal bovine serum, 2 mM L-glutamine, a mixture of antibiot-ics – antimicrotic (100 U/ml benzylpenicillin sodium, 100 U/ml streptomycin sulfate, 100 U/ml neomycin sulfate, «Lonza», USA). Cells were subcultivated by culture incubation with 0.25% solution of trypsin - EDTA («Gibco», USA). MMSC were cultivated for 5 days under standard conditions in the presence of vitamin D3 in final concen-trations of 75 ME/ml, 38 ME/ml and 19 ME/ml. Light microscopy was used for cultures visualization and cell growth evaluation. Viability was assessed by fluorescent microscopy using a 4',6-diamide-2-phenylindene fluores-cent dye (1 μg/ml DAPI, «Sigma», Germany).

Results. The cells isolated by mechanical and enzymatic dissociation of adipose tissue for 24 hours were adhered to laboratory plastics under standard conditions. Actively proliferating cells with fibroblast-like morphology typical for MMSCs were prevailed on 5-7 days of cultivation. Morphological homogeneity and high proliferative activity of cultures were observed from the first passage. Thus, the cell cultures isolated from rat adipose corresponded the basic criteria for identification of MMSCs (International Society for Cellular Therapy, Vancouver, Canada, 2006) and during cultivation under standard conditions were characterized by adhesion to plastic, typical fibroblast-like morphology and expansion in vitro with formation of homogeneous cell populations.

MMSC morphology did not change on the 5th day of cultivation in the presence of vitamin D3. The viability of MMSCs did not change in all concentrations of vitamin D3 and was 94% (91%÷97%). The similar criterion in intact cell cultures (without cholecalciferol) was 95% (90%÷96%), $p>0,05$.

Regardless of the concentration of cholecalciferol, all MMSC cultures had the ability to support themselves and to grow actively. In the presence of 75 ME/ml of cholecalciferol, MMSCs had a more pronounced proliferative potential, as evidenced by the high number of cells generated in the culture.

Conclusion. High viability, morphological homogeneity and high proliferative potential of cell cultures in the presence of various concentration of vitamin D3 were identified. Further studies of the effect of cholecalciferol on the differential potential of MMSCs and their immunomodulatory ability open up new prospects for the development of cellular technologies.

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TRACE ELEMENT COMPOSITION IN PERIPHERAL BLOOD AND SYNOVIAL FLUID IN OSTEOARTHRITIS

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Study of the content of trace elements is an informative method of early diagnosis of osteoarthritis. The trace element composition of the synovial fluid and peripheral blood in osteoarthritis was studied. A decrease of iron concentration and an increase of calcium and zinc levels in peripheral blood of patients with osteoarthritis were found . At the same time, an increase of iron concentration and a decrease of calcium and zinc concentration in patients with osteoarthritis were established . The results can be used to assess the trace elements level in patients with musculoskeletal pathology and correct their nutrition.

Keywords: osteoarthritis, gonarthrosis, coxarthrosis, blood, synovial fluid, inductively coupled plasma atomic emission spectroscopy, microelements

Osteoarthritis is an exhausting disease that involves all structures of the affected joint. Every year in the Republic of Belarus there is an increase in the incidence of degenerative joint diseases which occur in every third person after 45 years. Osteoarthritis significantly affects the quality of life of patients and is one of the main causes of temporary and permanent disability. Disturbance of the trace element composition is one of the important criteria for the early diagnosis of degenerative joint diseases. Trace elements are components of many enzyme systems as a part of enzymes and coenzymes and affect the functioning of cell composition and joint homeostasis. Zinc, copper, iron and calcium are essential components in various enzyme systems, participate in the functioning of the system and antioxidant systems, and influence the course of the inflammatory process in the body. One of the best biological body fluids for the analysis of micronutrients is peripheral blood and synovial fluid. This biological fluid deposits, accumulates microelements, and reflect the effect on humans of both increased concentrations of chemical elements and the provision of physiological needs for them.

The aim of the study was to establish the features of the content of copper, zinc, calcium and iron in the peripheral blood and synovial fluid and to evaluate the clinical significance of microelement disturbance in the development of osteoarthritis.

The study material were the synovial fluid and peripheral blood with the informed consent of 26 patients with gonarthrosis and coxarthrosis, treated in the 11th City Clinical Hospital, as well as the synovial fluid and peripheral blood of 10 donors who served as a control group. The concentration of trace elements was determined by inductively coupled plasma atomic emission spectroscopy (ICPE-9000, Shimadzu, Japan). To prepare samples for measurement, the samples were mineralized using a microwave sample preparation system (Milestone Ethos E, Italy). Statistical analysis of the obtained was performed using nonparametric methods in “STATISTICA 8” software.

A statistically significant decrease in the concentration of Fe ($p = 0,01$) and statistically significant increase in the concentration of Ca and Zn in peripheral blood ($p = 0,003$, $p = 0,01$, respectively) of patients with osteoarthritis were found when compared with control group. On the other side, in the study of the content of trace elements in the synovial fluid, the opposite result was found. There were a significant increase in Fe concentration and decreased in Ca and Zn concentration ($p=0,006$, $p=0,006$, $p=0,02$, respectively).

It has been shown that changes in calcium content can extrude the meniscus, which increases the progression of osteoarthritis. Zinc blocks apoptotic cells of various origins and its effect is mainly associated with the blockade of calcium and magnesium. In addition, zinc deficiency leads to disorganization of chondrocytes, which is probably associated with dysregulation of metalloproteinases.

Analysis of the microelement composition of synovial fluid and peripheral blood can be used in the complex diagnosis of patients with deforming diseases of the joints, as well as used to correct their nutrition.

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USE OF MODIFIED NUCLEOTIDES AND NUKLEOSIDES AS CHEMOTHERAPEUTHIC AGENTS

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Based on the literature data, the ways of biochemical action of nucleotide and nucleoside analogues on tumor formations as chemotherapeutic agents were studied.

Keywords: Nucleotide analogues, cytarabine, gemcitabine, chemotherapy, tumor, cell.

Nucleic acid analogues are clusters that are structurally similar to natural RNA and DNA molecules. Antiproliferative drugs, also known as antimetabolites, anticancer agents, or drugs that covalently bind DNA, act by inhibiting major metabolic pathways and are commonly used to treat malignant diseases. However, their use as therapeutic agents is limited due to their high toxicity to normal cells and serious adverse events. [1]

The most important of these are arabinose nucleosides, a unique class of antimetabolites that differ from physiological deoxyribonucleosides by the presence of a 2' — OH group in the CIS configuration relative to the N-glycosyl bond between cytosine and the sugar arabinoside. Several arabinose nucleosides have useful antitumor and antiviral effects. The most active cytotoxic agent of this class is cytosinarabinoside (cytarabine or ara-C).

Gemcitabine (2,2-difluoro-deoxycitidine, dFdC) is the most important cytidine analog that has been administered in clinical trials since ara-C. It differs from the cytosine nucleoside by the presence of two fluorine atoms in the second position relative to the N-glycosyl bond between cytosine and the sugar arabinoside.[1]

Cytarabine and gemcitabine are prodrugs whose plasma pharmacokinetics do not fully reflect their therapeutic activity; after cellular uptake, these compounds are phosphorylated by deoxycytidine kinase before their incorporation into DNA leads to cell death. Cytarabine is mainly active in the S-phase of the cell cycle and is most toxic to replicating cells. Gemcitabine has a high degree of metabolism in solid tumor cells.[2]

Developments in the field of clinical use of gemcitabine focus on efforts to increase the duration of exposure to the drug as a means of countering its rapid catabolism in the blood circulation. Future developments with this group of agents will further explore the use of fludarabine-based combination therapy to obtain a transition period of myelosuppression and immunosuppression sufficient for the engraftment of allogeneic hematopoietic stem cells, as well as to take advantage of the immunological benefits of graft-tumor responses. In addition, the clinical spectrum of gemcitabine is also expanding due to the combination of the drug with other active chemotherapeutic agents, such as cisplatin, and due to early studies of its role as a radiosensitizer.[2, 3]

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γδT-LYMPHOCYTES SUBSETS IN PATIENTS WITH IgA-NEPHROPATHY

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In patients with IgA-nephropathy the dysregulation of immune response characterized with changes in subsets numbers and functional status of γδT-lymphocytes was demonstrated what may be used as a biomarker in the diagnosis of renal autoimmune pathology.

Keywords: IgA-nephropathy, γδT-lymphocytes, autoimmune inflammation.

γδT-cells are heterogeneous population of unconventional T-lymphocytes characterized by a diverse range of functions, from the immunoregulation and the reparation of damaged tissues to antigen presentation and direct cytotoxic tissue damage, which play a key role in various chronic inflammatory pathologies, including IgA-nephropathy (IgAN) – the most common glomerulopathy worldwide. In humans, there are 3 subsets of γδT-lymphocytes identified by their Vδ-chain (Vδ1$^+$, Vδ2$^+$, Vδ3$^+$-cells) but there is still lack of information about subsets plasticity in pathological conditions what may determine an immunoregulation of unfavorable impact of the chronic inflammation [1].

The aim of research was to estimate the composition of γδT-cell subsets in peripheral blood of patients with IgAN.

The peripheral venous blood was obtained from 12 patients with IgAN aged of 32,0 (26,5÷38,8) years old (7 man, 5 women) and 13 healthy donors aged of 40,0 (36,0÷45,0) years old (7 man, 6 women). IgAN diagnosis was confirmed in patients' biopsy materials according to the Oxford classification (MEST-C score). γδT-lymphocytes subsets was determined using DuraClone IM TCRs antibodies panel (TCRγδ-FITC, TCRαβ-PE, HLA-DR-ECD, TCR Vδ1-PC7, CD4-APC, CD8-A700, CD3-APC-A750, TCR Vδ2-PB, CD45-KRO, Beckman Coulter, India) and flow cytometer CytoFLEX S (Beckman Coulter, USA). Statistical data processing was performed with STATISTICA 8.0.

A study of T-lymphocytes composition based on αβT- and γδT-cell receptors (TCR) expression revealed a significant increase of αβTCR-γδTCR$^+$ number in IgAN patients compared to the control group (9,11 (6,93÷12,97) % and 2,86 (2,18÷5,63) %, respectively, $p<0,05$). While the percent of αβTCR$^+$γδTCR- cells was amounted to 90,79 (86,88÷92,96) % in patients and decreased compared to similar parameters in healthy donors (97,42 (88,52÷99,12) %, $p<0,05$). The investigation of Vδ1$^+$, Vδ2$^+$ and Vδ3$^+$T-lymphocytes among γδT-cells in IgAN patients showed subsets redistribution: a significant decrease of Vδ2$^+$-expressing cells to 65,03 (24,23÷70,65) % ($p<0,01$) along with an increase of Vδ1+-cells (27,68 (12,65÷48,31) %, $p<0,05$) and Vδ3$^+$-cells (8,62 (3,90÷21,33) %, $p<0,05$) were shown compared to healthy donors in peripheral blood of which the dominated subset was Vδ2$^+$ population consisting 86,69 (71,71÷92,10) % while the numbers of Vδ1$^+$ and Vδ3+ cells were 10,28 (4,34÷17,45) % and 3,80 (1,39÷5,46) %, respectively.

For cytotoxic profile determination of γδT-lymphocytes subsets, the expression of CD8$^+$ co-receptors was determined. There were no statistically significant differences in CD8$^+$ expression on γδT-lymphocytes of IgAN patients and healthy donors (23,51 (18,13÷29,27) % and 27,20 (18,27÷49,72) %, respectively) as well as on Vδ1$^+$ and Vδ2$^+$-cells subsets while the tendency to the elevation of CD8$^+$ on Vδ3$^+$-cells was demonstrated in IgAN patients compared to healthy donors (21,8 (17,05÷25,95) % and 7,51 (5,64÷9,38) %, respectively, $p=0,06$). To assess the activation status and antigen-presenting ability of γδT-lymphocytes, the level of HLA-DR expression was estimated. In patients with IgAN, the level of HLA-DR on γδT-lymphocytes was 2 times higher (17,66 (8,23÷27,14) %) than in donor group (8,79 (5,43÷13,58) %). It was shown a significant increase of HLA-DR expression on Vδ1$^+$-cells (21,44 (14,58÷26,57) % and Vδ3$^+$-cells (18,75 (14,15÷23,35) % in patients with IgAN compared to the donor group (8,41 (4,41÷17,24) % and 6,05 (4,54÷7,56) %, respectively, $p<0,05$) while no statistically significant differences were found in the level of HLA-DR expression on Vδ2$^+$ in IgAN patients.

Thus, in IgAN patients the redistribution of γδT-lymphocytes subsets following the increase of tissue-resident Vδ1+ and Vδ3+-cells in peripheral blood is revealed as well as up-regulation of HLA-DR activation marker on γδT-cells is demonstrated without any changes in cytotoxic effector subsets properties what may be used as a biomarker in the differential diagnosis of renal autoimmune pathology.

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SECTION 3

PROBLEMS OF MODERN ENVIRONMENTAL SAFETY (BIOMONITORING, BIOINDICATION, BIOREMEDIATION, RADIOECOLOGY AND RADIATION SAFETY, ENVIRONMENTAL MONITORING, MANAGEMENT AND AUDIT. INFORMATION SYSTEMS AND TECHNOLOGIES IN ECOLOGY)

ADAPTIVE ABILITIES OF THE PIG BODY UNDER THE INFLUENCE OF DIHYDROQUERCETIN

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Intensive pig rearing technologies imply the presence of numerous strict technological conditions for feeding and keeping, which lead to stress in animals, to less efficient use of production resources: overspend-ing of feed, reduced feed conversion, and others, which imposes, among other things, additional environ-mental risks. The use of natural feed biologically active compounds can serve as an effective tool for reduc-ing stress loads on animals.

Keywords: pigs, adaptogen, nutrition, ecology.

Modern intensive technologies of animal rearing presuppose the presence of numerous conditions that do not correspond to the evolutionarily determined animal physiology. Together with the focus on obtaining animals with genetically determined high productivity, this leads to an aggravation of the influence of stress factors and is accompanied by significant shifts in the body's homeostasis, significantly affecting the quality of the final product [1]. In the works of modern scientists, the positive influence of the use of natural antioxidants in diets on the in-crease of stress resistance and the quality of monogastric meat has been proved. Some plant extracts contain fla-vonoids and phenolic components that have an antioxidant effect. Flavonoids are a secondary plant metabolite that exhibits a wide range of pharmacological and biological functions. Extracts with good antioxidant activity also show antimicrobial effectiveness. Recently, the use of quercetin and its derivatives has become widespread [2]. In our studies, the inclusion of a dihydroquercetin feed additive («Ecostimul-2» of 40 mg/kg of feed) in the diet of pigs during the fattening period significantly reduced the effect of simulated environmental stress factors and increased the adaptive capacity of animals. At the physiology yard of the L.K. Ernst Federal Science Center for Animal Hus-bandry. Ernst formed 3 groups of pigs (F-2:(LWxL)xD) of 9 heads, on the principle of pairs-analogues, at the age of 101 days, with an average live weight at the time of production-34.7±0.6. The duration of fattening was 78 days. The first control group of pigs received a normal diet and were kept in optimal conditions; the animals of the second control group, being in the same feeding and maintenance conditions, were additionally exposed to simulated tech-nological stress. Animals of the third group received a feed additive Ecostimul-2 (dihydroquercetin content of at least 80%) in the amount of 40 mg/kg of feed under stress. As a result, during the experiment period, the average daily increase in the first and third experimental groups for the entire period of the experiment was the highest and amounted to 1047 and 1043 g, respectively, against 1036 g in the second group of animals with a slight improve-ment in feed conversion-2.71 against 2.73 kg of growth per 1 kg of feed. The best availability of protein was in the third group, in which the % of the intake was 35.4%, compared to 23.6 and 16.8 in the control groups, respectively. The control slaughter of pigs showed that the equivalent slaughter yield was achieved in the first control and third experimental groups-78.9% against 77.3% in the group with stress. Our data agree with the results of other research-ers [3]. Based on the data obtained, we believe that the use of an adaptogen Supplement in the diet of pigs blocked the effects of the stress factor and increased the body's antioxidant protection during the entire fattening period. Thanks to this, anabolic processes were enhanced in the body. As a result, more intensive growth of animals can ensure rational use of feed and other resources, which together leads to the lowest environmental burden when im-plementing intensive technology for raising pigs of modern genotypes.

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ANALYSIS OF MORBIDITY AND SURVIVAL OF PATIENTS WITH BRAIN GLIOBLASTOMA IN BELARUS AT THE POPULATION LEVEL (2010-2019)

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The epidemiological analysis was carried out on the basis of the Belarusian Cancer Registry data as of January 2020. The Belarusian Cancer Registry uses international principles of data collection and control, modern technologies for their processing, which allows conducting epidemiological studies at the population level, as well as performing comparative analysis with data from population registers of other countries. The data were obtained on patients with GM glioblastomas by the following parameters: gender, date of birth, place of residence, date of diagnosis, ICD-10 diagnosis, morphological type of tumor, state at the end of the year, date and cause of death.

Keywords: morbidity , dynamics, tendency, growth rates, overall survival.

The importance of studying the epidemiology of glioblastomas is determined by the high mortality rate from this pathology. Glioblastomas are considered the most malignant neoplasms of all glial brain tumors, leading to disability, short duration and low quality of life of patients. For the first time, an epidemiological analysis of the morbidity and survival of patients with glioblastomas of the brain in Belarus for 2010-2019 at the population level was conducted. The carried out analysis shows that in recent years, in Belarus there has been a tendency for increase in the incidence of glioblastoma of the brain; the share of glioblastoma in the incidence rate of all glial tumors increased from 32.8% in 2010 to 48.0% in 2019; in 10 years, the standardized incidence of glioblastomas increased in men and women 1.2 times, in urban and rural population 1.2 and 1.5 times, respectively; glioblastoma incidence rates in men are higher than in women, the ratio of indicators in men and women is 1.4; the analysis of epidemiological indicators of glioblastoma incidence at the population level, comparative characteristics across the country can help in the formation of medical and scientific programs that will improve the provision of neurosurgical care to the population, in the introduction and provision of new methods that allow achieving better treatment results for this category of patients.

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ANALYSIS OF POSSIBLE TECHNOLOGIES FOR PROCESSING TOBACCO WASTES IN THE REPUBLIC OF BELARUS

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Modern technologies for recycling tobacco waste (tobacco dust and tobacco leaf veins) based on patent search materials have been analyzed. It has been established that the most promising direction is the use of these wastes in agriculture to improve soil fertility.

Keywords: tobacco dust, tobacco leaf veins, patents, soil fertility

The technological process at tobacco factories is accompanied by the formation of non-recyclable hazardous waste, the amount of which is increasing every year in our country. The main non-recyclable waste of tobacco production includes tobacco dust (hazard class 3) and tobacco leaf veins (hazard class 4) [1]. According to the state statistical reporting forms of the Republic of Belarus, the annual flow of this waste into the environment is about 900 tons. The main producers of this waste are OJSC «Grodno tobacco factory» Neman «and LLC» Tobacco-Invest «. The composition of tobacco dust contains mineral impurities. The processing of such waste in order to obtain a new product is not carried out at the enterprises of the tobacco industry. Waste goes to landfill for disposal, has an increased explosion hazard and, in case of large accumulations, the disposal of such waste is limited. Thus, environmental pollution increases and an additional load on landfills is created [3].

We have analyzed the patent base of the Russian Federation on the use of tobacco dust. The largest number of technical solutions relates to the use of these wastes in the composition of the mixture for the manufacture of seedling pots; for the preparation of an insecticidal aqueous extract [4]; to obtain bioorganic fertilizers [2,5].

It is proposed to increase soil fertility using tobacco dust. The method is described in the patent N 2 646 053 C1 «Increase of soil fertility using tobacco dust,» the authors of which are Plotnikova T.V., Salomatin V.A., Muranova I.I., Egorova E.V. The proposed solution relates to the field of agriculture, to the means used to increase soil fertility, and can be used on various soils in the cultivation of any crop.

In the same invention proposed a variant of bioorganic fertilizer with tobacco dust, black soil and peat. This method of obtaining fertilizer is suitable for use as a substrate in pot culture and for protected soil.

The method specified in patent N 2 710 727 C1 « The way to increase soil fertility using a mixture of tobacco dust and bird droppings» (authors Plotnikova T.V., Salomatin V.A., Egorova E.V., Sidorova N.V.) allows to increase the content of the main forms of mobile nutrients in the soil, the biological activity of the soil, improve it by reducing pathogenic micromycetes, partially solve the problem of safe disposal of tobacco dust and bird droppings.

Also, tobacco dust can be used as part of the mixture for the manufacture of pots for seedlings. This invention refers to crop production and can be used to grow seedlings of various plants in greenhouses or greenhouses and planting in the open ground. Patent N 2 520 730 C2 «The Way to Obtain Bioorganic Fertilizer» (authors Filipchuk O.D. and Tonkonog M.D.).

Patent N 2 535 496 C2 «The way to prepare insecticide water extract from tobacco dust» (authors Plotnikova T.V., Don T.A., Salomatin V.A., Mirgorodskaya A.G.). The invention belongs to the field of agriculture and is used to protect vegetable and technical crops from pests, provides high efficiency of protection of plants from pests and stimulates their development.

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ANALYSIS OF POSSIBLE TECHNOLOGIES FOR RECYCLING CONFECTIONERY WASTE IN THE REPUBLIC OF BELARUS

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Modern technologies for recycling waste of eggshells and confectionery on the basis of patent search materials have been analyzed. It has been established that the most promising direction is the use of these wastes in agriculture to improve soil fertility.

Keywords: egg shells, egg powder, confectionery, patents.

We have conducted the research on possible technologies for recycling the waste of confectionery industries for the Republic of Belarus. The confectionery waste generated in our country (egg shells, expired confectionery) is currently not separated from municipal waste at trade and catering enterprises, is practically not processed and goes to landfill as part of municipal waste, and thus increases environmental pollution and creates an additional load on landfills. Waste is hazardous (expired food - third class of hazard) and non-hazardous - egg shells [1].

Recycling of such waste for the purpose of obtaining a new product is carried out only in poultry farms or in the production of soils, meat and bone flour and feed additives. In order to prevent the dumping of these wastes as part of municipal waste, recommendations should be developed on how they can be used directly in trade and catering facilities.

According to the data of the state statistical reports, in recent years about 6.5 tons of eggshells have been formed in our country, which is almost entirely delivered to the burial sites.

Currently, the regulatory documents of the Republic of Belarus relate only to the production of confectionery and food products. Some enterprises of our country (mainly poultry farms) process waste from eggshell and expired food products for meat and bone flour, forage enriches and other feed additives, and also use as additives in soils for urban landscaping (waste processing enterprises). At the same time, trade and catering enterprises do not separate expired confectionery products from municipal waste and almost completely these expired products go to landfills. Technologies to maximize the involvement of confectionery waste in economic turnover are not used everywhere in our country [2].

The analysis of patent documentation of the Russian Federation on the processing of chicken eggs into powder was carried out. The obtained powders are used as feed for plants and protection against slugs. The method is described in Patent 2 317 712 C2 «Method of producing powder from quail eggs,» the authors of which are Shinkorenko O.V., Shinkorenko V.V., Dorofeev V.M. The proposed solution relates to the field of food industry.

There is a known way of obtaining egg powder, which includes evaporation and subsequent drying by spraying in the environment of the coolant. The analogue is the powder from chicken eggs (SU 878231, A23B 5/02, 07.11.19810).

For the processing of expired confectionery products in the countries of the world there are such technologies as:

- Burial (In accordance with the law of our country is the insulation of waste in the environment, which does not include actions on their use);
- Disposal (In the process of recycling, useful components are extracted from waste and further used to produce new products or for fertilization);
- Recycling (Disposal of spoiled products by decomposing in airtight containers. A certain temperature regime must be observed. Residues are used in industry and agriculture);
- Grinding (the use of special installations that create a homogeneous mass, then filling with additional substances. The obtained product is used as raw material in the process of cement production);
- Cooking (disposing of products with a small expiration date is unprofitable, senseless and affects the environment) [3].

The law of the Republic of Belarus of 20.07.2007 N 271-3 (ed. 10.05.2019) «On the treatment of waste» establishes the principle that the use of waste is the main priority of waste management. Only those non-hazardous and low-risk wastes that cannot be used are subject to burial. But it is necessary to take into account the requirements of environmental safety in the management of waste.

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ANALYSIS OF POSSIBLE TECHNOLOGIES OF RECYCLING OF DIRTY WOOD CONTAMINATED WITH CHEMICALS

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Modern technologies of the recycling of dirty wood contaminated with chemicals are analyzed on the basis of the results of a patent search. It has been established that the most promising trend is the extraction of contaminants from the composition of such waste and further use of uncontaminated wood waste.

Keywords: wood waste, dirty wood, chemicals, pollutant removal.

Any human activity requires the use of resources. Wood, despite the development of technologies in the chemical industry, continues to be actively used as a natural resource by humans in various forms: both directly and indirectly, for example, wooden containers, pallets, sleepers, etc. During its use, wood becomes contaminated and unrecyclable. The main pollutants of wooden containers in the Republic of Belarus are mineral oils, phenols, gasoline, acids, salts, PCBs. The by-products of wood usage are sawdust, shavings, and sweeps from the workshops on site wood processing enterprises, etc. Some types of wood products are not contaminated, but have already lost their consumer properties.

According to the state statistical reports of the Republic of Belarus for 2019, 2,558.46 tons of wood waste were disposed to landfills, including 134.16 tons of wood waste and wooden containers contaminated with inorganic substances (acids, salts), which can be compared with 42.9, 314.47 and 336.07 tons for 2011, 2015, 2017 respectively.

Wooden containers contaminated with chemicals (acids, salts) are considered hazardous waste (third hazard class) in accordance with the Waste Classifier of the Ministry of Natural Resources [1]. Energy recovery using dirty wood or its recycling is not carried out in our country. Various enterprises dispose about 150 tons of chemically contaminated wood waste annually. Since 2011, this figure has remained virtually unchanged. Wooden containers are contaminated with multiple pollutants mostly by various acids and salts, therefore no further usage as a secondary raw material (SRM) to produce fuel briquettes from wood chips (or sawdust) is possible. To prevent dirty wood disposal, special technologies must be used.

Currently, the regulatory documents of the Republic of Belarus refer to clean (uncontaminated) wood waste, the by-product of sawmilling, logging and woodworking, only; the main normative document being STB 1867-2017 “Wood waste. General technical conditions”. There is also GOST 33103.1-2017, “Solid biofuel. Fuel specifications and classes. General requirements», which states the use of only clean wood as biofuel. The Register of Waste Recycling Facilities of the Republic of Belarus has not registered a single facility for the recycling of

wooden containers contaminated with chemicals. In our country, the international experience in management of hazardous waste, wooden containers contaminated with chemicals, in particular, is not applied anywhere as well.

The Republic of Belarus is not the first country to encounter such a problem. Countries facing the same problem implement cleaning technologies and then use the obtained material as a SRM [2]. In the Republican Scientific and Technical Library of Belarus a search for appropriate patents was carried out, and the technologies for recycle and reuse of wooden containers contaminated with chemicals have been found.

Patent RU2482160C1, «Method for thermal processing of organic materials and a device for its implementation», (by Timofeev A.V., Timofeev V.M.) describes the process of pyrolysis of organic materials, including wood contaminated with organic material: railway wooden sleepers, crop and animal husbandry waste, etc. The patent can find application in chemical, timber and oil refining industries, municipal services, agriculture and other industries.

In the patent DE4205035Al by Gerish Rolf a technology of removing chemical impurities such as formaldehyde, pesticides, fungicides, insecticides, from impregnated wood and chipboard panelling of walls and ceilings with the help of polyethylene or polypropylene sheets is described. «

Patent DE4107200Al by Karl Wolfgang, et al gives an account of a technology of removing organic and inorganic substances from technical waste: contaminated soil, dirty wood, used oil, liquid manure and plastics of all types, except for household waste, at relatively low temperatures. The contaminants that can be removed include heavy metals and inorganic substances containing HCl and CN-. The technology is an economical means of cleaning and subsequent reuse and disposal of waste with low thermal conductivity.

These technologies can be implemented on the territory of the Republic of Belarus, which can improve the quantity and quality of wood waste recycling.

ANALYSIS OF THE MORBIDITY OF DIABETES IN THE POPULATION OF THE REPUBLIC OF BELARUS FOR 2015-2019

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The paper deals with the problem of the morbidity of diabetes in the population of the Republic of Belarus. The subject of the research is the morbidity of diabetes mellitus. The purpose of the work is to analyze the morbidity of diabetes mellitus in the population of the Republic of Belarus for 2015-2019. Diabetes mellitus is a serious medical and social problem of the 21st century. This disease is a global problem that only grows over the years. Diabetes mellitus has acquired the character of a “non-infectious epidemic,” which continues to grow regardless of the race of people or the level of economic development of the country. As statistics show, in the world 371 million people suffer from this disease, which is 7 percent of the total population of the Earth.

Keywords: diabetes mellitus, insulin, glucose, prevention, morbidity, growth rate.

Diabetes mellitus is a group of endocrine diseases associated with impaired glucose uptake and developing as a result of absolute or relative (impaired interaction with target cells) insufficiency of the hormone insulin, resulting in hyperglycemia - a persistent increase in blood glucose.

According to the WHO, diabetes mellitus increases the mortality rate 2-3 times and shortens life expectancy. According to the International Diabetes Federation, twenty years ago the number of people diagnosed diabetes mellitus worldwide did not exceed 30 million. Today the number of patients with diabetes mellitus is 370 million, and by 2025 this number will have increased up to 550 million. A particularly catastrophic increase in the incidence is associated with type II diabetes mellitus, which accounts for more than 85% of all cases, and which is largely the result of overweight and physical inactivity.

Based on cost estimates from a recent systematic review, the direct annual medical cost of diabetes worldwide is assessed to be more than US $ 827 billion. Diabetes mellitus has a significant impact on the daily life of patients.

Often, in the early stages, this disease proceeds unnoticed, and, gradually damaging such target organs as the heart, kidneys, eyes, large and small vessels, is detected in fact at the stage of complications. The risk of lower limb amputation and subsequent disability is increased by 20% in diabetic patients compared to the general population. The incidence of diabetes mellitus is growing at a very fast pace. If 10 years ago in Belarus there were 150 thousand patients with diabetes mellitus, today about 370 thousand people have already been registered.

This “dramatic growth” is mainly due to type 2 diabetes mellitus - over 93%. As for patients with type 1 diabetes mellitus, the number remains relatively stable. There are about 1 million such patients in the world, and a little more than 17 thousand in our country. The problem of diabetes mellitus seems to be very complicated both from the position of the state and society as a whole, and from the point of view of a sick person and the family.

The incidence rate of diabetes mellitus in the population of the regions of the Republic of Belarus tends to gradually increase. Over the five-year period, this indicator value increased 1.5 times in the population of the Brest region, 1.3 times in the population of the Vitebsk region, 1.4 times in the population of the Gomel, Grodno and Mogilev regions. In the population of the city of Minsk and the Minsk region, this indicator value practically did not change.

Having analyzed the rate of the increase in the incidence of diabetes mellitus among the adult population of the Republic of Belarus in 2015-2019, one can observe both periods of an increase and a decline in incidence.

APPLICATION OF ANAMMOX PROCESS FOR WASTEWATER TREATMENT AT FOOD INDUSTRY ENTERPRISES OF UKRAINE

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Currently, one of the most significant environmental problems in Ukraine is the treatment of industrial effluents, including food industry enterprises.

Keywords: wastewater, food enterprises, Anammox technology.

Industrial and industrial activities that occur without appropriate environmental monitoring often lead to pollution not only of soil and atmosphere, but also of water resources, directly affecting public health, flora, fauna and the environment as a whole. Often close to sugar, alcohol, yeast, meat processing and other food enterprises, dead pastures appear, contaminated as a result of extensive treatment of industrial effluents [1].

Particular attention should be paid to the elemental composition of wastewater. So, most of the effluents of food enterprises in Ukraine contain elevated concentrations of nitrogen compounds (both ammonium and in the form of nitrates and nitrites). Removal of these compounds by standard (physical and chemical) methods is quite time-consuming and expensive. One of the ways to solve this problem can be cleaning using the Anammox process [2].

Objective. Analysis of the possibility of using anammox wastewater treatment process of enterprises in various sectors of the food industry of Ukraine.

Research results. Since the Anammox process concerns the microbial nitrogen cycle and consists in the anaerobic oxidation of ammonium using nitrite as the primary electron acceptor, it is advisable to involve it in the purification of water with a high ammonium content and the presence of a certain amount of nitrite [3].

Such waters include wastewater from the following enterprises (ammonia nitrogen concentration in the wastewater of enterprises): meat plants (178 mg/l), dairies (7,2 mg/l), yeast plants (10 mg/l), and poultry farms (77 mg/l) [1].

Of greatest interest for the application of Anammox technology are pre-treated effluents from meat plants and dairies, since water from meat plants is characterized by a high nitrogen content of both total 18-19.2 mg / dm3 and ammonia 14-7 mg/dm3, and the presence of nitrites in the amount of 0,002-0,2 mg/dm3 makes the use of the target technology practically possible [1].

Sewage from sugar factories deserves special attention because, depending on the category of water, the latter may contain critically high concentrations of nitrogen compounds. For example, ammonia waters, which are considered conditionally pure, are formed during the condensation of vapors of secondary multi-case evaporators. The concentration of ammonia nitrogen in such condensates reaches 300-350 mg /l, and the amount of nitrites reaches 7-10 mg/l, which significantly exceeds the norms of maximum permissible concentrations of these compounds for effluents that are discharged into water bodies.

Since the beet and sugar industry in Ukraine is one of the strategically important in the food industry and, at the same time, one of the largest consumers of water and a record holder for the quantity of effluents (2,2 m3 of effluents per 1 ton of processed beets), the primary (pilot) implementation of the Anammox process on an industrial scale, it is advisable to carry out precisely for the production of this industry [3].

Output. An analysis of the literature indicates the feasibility of using Anammox technology for the treatment of wastewater from sugar plants.

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APPLICATION OF ARTIFICIAL NEURAL NETWORK METHODS IN THE ANALYSIS OF ECOLOGICAL PROBLEMS

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In this article, the author considers the possibilities of using artificial neural networks as an innovative method for solving social and environmental problems.

Keywords: environmental problems, mapping, artificial neural network method, regional research.

Every year, the possibilities of using neural networks in various branches of scientific knowledge and in research practice are growing. First of all, neural networks allow you to build maps with marks about the object being studied. In addition, they allow you to identify the object of research and conduct rapid processing of information on the parameters of interest.

The use of modern methods for analyzing various problems opens up new opportunities for us. For example, using the method of artificial neural networks in the process of studying satisfaction with the social protection system of the population and social attitudes of citizens, we have identified the interdependence of the place of residence of citizens and their satisfaction with various aspects of life. In particular, we found that differences in the opinions of citizens depend on the presence / absence of various socially significant objects, parks and squares near their place of residence, as well as on its distance from industrial facilities [3]. In addition, A group of authors (potylitsyna E. N., Lipinsky L. V., Sugak E. V.) analyzed the possibilities of using neural networks to solve practical problems in the field of ecology, namely in the field of data processing on environmental indicators and building models [2]. I. A. Milkova, L. K. Kadena, K. V. Simonov based on neural network modeling developed a computational method for determining the dependence of population morbidity on environmental and social factors [1]. A.D. Shumilin, N. N. Vershinin, A. E. Vershinin and A. S. Volkova applied neural networks to study the influence of motor transport on the environmental situation of the city. Thanks to the use of neural networks, researchers have the opportunity to demonstrate the impact of the environment not only on the health of the population, but also on the social mood of citizens. In addition, it is now possible to build environmental models that will help you make administrative decisions in the future.

Summing up the results of this article, we can conclude that the use of neural network methods for analyzing environmental problems allows us to identify the relationship of various indicators (for example, social attitudes, satisfaction with the social protection system, medical and demographic indicators) with the state of the environment, which provides visibility of the results obtained, allows us to look at the problem from the other side and makes it possible to develop innovative solutions to existing problems.

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APPLICATION OF BIOGAS TECHNOLOGIES FOR ORGANIC WASTE PRO-CESSING

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The article reveals the use of biogas as an alternative form of energy, which occurs when utilizing organic waste. To confirm the simplicity of its preparation and the breadth of its application, an experiment with a portable generator is described.

Keywords: Biogas, portable biogenerator, organic waste, clean energy.

The technology for producing biogas (gaseous fuel, a product of anaerobic microbiological decomposition of organic substances) is an environmentally friendly, waste-free way of processing, utilizing and disinfecting various organic waste of plant and animal origin. The raw material for biogas production is ordinary manure, dung, leaves, grass, in general, any organic waste: tops, food waste, fallen leaves, sawdust, human waste. Every day, in any fami-ly, you can see how food waste is thrown into a common mixed waste container. The amount of garbage continues to grow daily, but this situation can be changed, and still we get an alternative source of energy. This topic is rele-vant, since with the growth of the world's population in the future, the demand for energy, and therefore in new ways of obtaining it, will only increase. The era of hydrocarbons (oil and gas) will be replaced by the alternative, clean energy era. Biogas - a new way to the future! The possibility of processing organic waste using a portable bi-ogenerator became the aim of our work.

Fig. 1. – Collecting biogas and checking its availability using a match flame

To obtain biogas at home, the following experiment was carried out. We used: a plastic bottle, a balloon, a spoon, organic waste, matches, water, a blender. As organic waste, banana peels were taken, which were pre-cut

with a knife, then placed in a blender bowl and chopped after adding some water. In the next step, a liquid solution of organic waste was poured into a plastic bottle. A balloon was placed on the top of its neck. The observation was carried out for 14 days. At this time, the balloon was filled with the resulting gas. At the end of the second week, a burning match was brought to the balloon and the flame flared up. This means that the collected biogas can be used for further needs.

The mixture remaining in the bottle was used as fertilizer for potted houseplants. This fertilizer is rich in nutri-ents useful for the plant and is 100% assimilated by it, as it is completely organic.

Based on the research work, the following conclusions can be drawn. Biogas is truly a special kind of alternative energy. To generate electricity using solar and wind energy is not predictable and it is not constant throughout the day and seasons. Biogas has no such a problem. In addition, unlike the sun and wind, biogas solves an important environmental problem with the accumulation, storage and disposal of waste.The heat received from the biogenerator can be used to heat greenhouses, farm buildings or dwellings. The only difficulty may be that biogas, in comparison with natural gas, has a slightly worse ignition ability, which causes slight difficulties in regulating the latter. For example, when installing the tap on «low fire» in kitchen stoves. This is due to the different pressure of the two gases on the pipe walls [1]. Biogas production is environmentally friendly. At home, it is possible to obtain bio-gas using the created portable biogenerator, the engineering design of which will depend on the final purposes of its use.

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APPLICATION OF CHITOSANS IN THE FIELD OF PLANT PROTECTION

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During their life cycle, plants are exposed to a significant number of biotic and abiotic stresses. The plant organism's responses to negative external factors are very complex and include physiological changes at the tissue and cellular levels [Atkinson, 2012]. Recognition of inductors and signaling molecules is one of the ways to implement their own defense mechanisms. Their inducers are abiogenic and biogenic chemical compounds that induce responses to stress in plants. This leads to enhanced synthesis and accumulation of secondary metabolites or to the synthesis of new compounds [Naik, 2016].

Inductors can be generated by external factors (exogenous inducers) or due to physical and / or chemical destruction of the plant cell wall (endogenous inducers) [García-Garrido, 2002]. After the inducer is perceived, signal transduction channels are activated, causing an increase in the level of reactive oxygen species (ROS), biosynthesis of phytoalexins, strength of the plant cell wall by phenylpropanoid compounds, calose precipitation, synthesis of protective enzymes and accumulation of PR proteins, some of which have antimicrobial properties.

Phenolic compounds are one of the most important non-enzymatic elements of the system of plant defense mechanisms. They are not only an indicator of the stress responses of plants to different levels of light or minerals, but are also key mediators in the fight against pathogens [La Camera, 2004]. The functions of phenols in defense mechanisms range from pre-formed or induced physicochemical barriers from pathogens to signaling molecules that are involved in local and systemic signals to induce the expression of the respective genes. The protective functions are not limited to individual phenylpropanoid compounds, but they can be performed by both simple hydroxycinnamic acids and monolignols, and more complex flavonoids, isoflavonoids, stilbene, etc. [Dixon, 2002].

Among the polysaccharides, one of the most famous inducers are oligosaccharide fragments of the fungal cell wall, such as oligomers of chitin, chitosan and β-1,3-glucans, as well as oligogalacturonides, fragments of plant cell wall pectin. Chitosan is the most linear polysaccharide, consisting of α, 1-4 D-glucosamine (GlcN) and N-acetyl-D-glucosamine (GlcNAc) with different compositions of these two monomers [Katiyar, 2014].

For chitosan, due to the specificity of its production, there is a characteristic structural heterogeneity, which affects its biological properties. The key parameters of the biological activity of chitosan are its molecular weight and the degree of deacetylation. As in many other polymers, the molecular weight of chitosan varies widely from 1–2 kDa in oligomers to several hundred kDa in high molecular weight forms. Low molecular weight forms of chitosan can penetrate into cells and induce reprogramming of metabolic synthesis processes.

High molecular weight chitosan forms a film on the surface of infected plant tissues and prevents further spread of pathogens.

The production of chitin and chitosan by fungal mycelium is receiving particular attention today due to its significant benefits. For example, if the supply of crustacean waste is limited by the season and region of the fishing industry, then mushroom mycelium can be obtained through a convenient fermentation process without any geographical or seasonal restrictions. The amount of inorganic substances in the fungal mycelium is lower than in the crustacean waste, so a demineralization step is not necessary [Teng, 2001]. The characteristics of chitin and chitosan of crustaceans can vary greatly depending on the physicochemical properties, while fungal chitin and chitosan have a relatively constant composition due to the controlled conditions of the biosynthesis process. Obviously, fungal chitin and chitosan are more effective in inducing resistance responses in plants, and they are potentially more suitable for protecting crops.

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APPLICATION OF CYTOGENETIC METHODS IN BIOINDICATION

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Active economic activity is a source of technogenic pollution that affects both environment and human health. Because of this, there is a need to monitor the level of environmental pollution. One of the promising methods of such monitoring is bioindication that uses living organisms to assess the level of pollution.

Keywords: cytogenetic methods, bioindication, genetic monitoring, pathologies of mitosis.

Bioindication is a promising field of environmental monitoring. It involves the use of specially selected bioindicator species to assess the degree of environmental pollution. Bioindicators comprises of a wide range of living organisms. They include mosses, lichens, and some species of algae, bacteria and fungi. A large number of plant species also belong to bioindicators. Among animals, various types of crustaceans, chironomidae, molluscs, as well as larvae of various insect species are used as test objects. The main requirement to bioindicator species is their sensitivity to changes in environmental factors [3].

One of the directions of bioindication is genetic monitoring. Genetic monitoring is a scientific area studying the dynamics of genetic changes in biological populations. Genetic monitoring can be performed on molecular, cellular, whole organism and population levels. To perform genetic monitoring, various test systems are used, the main requirements to which are: sensitivity to selected factors, adequacy of the results obtained, simplicity of production and usage [3]. One of the types of testing that fall under these criteria is cytogenetic testing. One of the main advantages of such systems is their high sensitivity and ability to characterize the state of the entire genome [1].

The cytogenetic test system should have a low variability between the cytogenetic parameters of individual organisms and possess a large number of dividing cells. Two main methods are used to account for cytogenetic pathologies: metaphase and ana-telophase analysis. Evaluation of nucleolus numbers is also promising [2]. The ana-telophase method is more convenient for monitoring studies, as it is faster and easier to implement.

The main cytogenetic indicators evaluated in the cytogenetic analysis are pathological mitoses and micronuclei frequency. Among pathological mitoses the most common are chromosome lags, chromosome bridges, chromosome dispersion, and k-mitosis [2].

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ASSESSMENT OF CONTENT OF MERCURY COMPOUNDS IN FISH PRODUCTS IN THE REPUBLIC OF BELARUS

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In this work, the content of mercury (as a class I toxicity metal) in the muscle tissue of 15 fish species (11 non-predatory freshwater, 4 predatory freshwater) inhabiting the territory of the Republic of Belarus for 2019 was esti-mated.

Keywords: native fish species, mercury compounds, atomic absorption analysis.

Among heavy metals, mercury belongs to the elements with a high degree of toxicity. In connection with the increasing level of water pollution with mercury, the most serious problem is its ability to accumulate in living organisms in large quantities due to its organotropy.

The object of the research is the muscle tissue of 4 species of predatory freshwater fish (zander, perch, pike, catfish) and 11 species of non-predatory freshwater fish (bream, tench, sterlet, carp, silver carp, brook trout, rudd, sturgeon, ruff, roach, grayling), in which the presence of accumulated mercury was recorded.

To determine the content of mercury in fish, a method established in the State Standard GOST, R 53183-2008 “Food products. Determination of trace elements. Determination of mercury by cold vapor atomic absorption spectrometry with preliminary sample mineralization under pressure”, is used.

The essence of the method consist in the absorption of electromagnetic radiation of certain wavelength by free of all molecular bonds neutral atoms of the element studied.

Based on the studies carried out, the following conclusions were drawn:

1. In the analyzed general complex of data containing the values of the mass fraction of mercury (μg / kg) in the studied fish species, the minimum value (0.05 μg / kg) belongs to brook trout, silver carp, and the maximum - to perch (0.61 μg / kg), which exceeds permissible level (0.6 μg / kg). It is also important to note a significant differ-ence in the maximum values among carnivorous (0.61 μg / kg – perch) and non-predatory (0.28 μg / kg – rudd) freshwater species, which confirms the fact of predisposition of predatory species to a higher level of accumulation of toxicants, such as mercury.

2. Values exceeding 50% of the standard value, threshold and exceeding the standard value, were deter-mined in 6 species of fish – tench (more than 50%), rudd (threshold value), pike perch (more than 50%), catfish (more than 50%), pike (threshold value), perch (exceeds the standard value). However, it is worth noting that these indicators were encountered once in the sample of each species, and therefore it is impossible to characterize both the species sample and the population of these species as unsafe for consumption based on the data of the maxi-mum and minimum values.

3. From the analysis of the average value of species sample indicators, one can make a conclusion about the sample as a whole and characterize these fish species as relatively safe for consumption, since the average val-ues of the mass fraction of mercury for all analyzed species does not exceed 50% of the standard value.

4. Nevertheless, it is not possible to give an accurate population characterization of the mercury content due to the small amount of data in the studied species samples, nevertheless, when calculating the confidence interval for a sample of 1000 individuals with probability of 95%, these fish species do not pose a threat to public health when their meat is being eaten, since the value of the confidence interval for each of the species is 1% of the stand-ard value.

It is important to note that the accumulation of mercury compounds in the muscle tissue of fish, and, as a consequence, the results of the study, are influenced by, in addition to the type of nutrition, the hydroecological situation of the habitats of these fish species and their populations.

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ASSESSMENT OF *IMPATIENS GLANDULIFERA* ROYLE EXPANSION IN BELARUS

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There is a preliminary assessment of the expansion of the invasive plant Impatiens glandulifera Royle in the thesis. Pro-analyzed the patterns of distribution of this species outside the areas of cultivation.

Keywords: Impatiens glandulifera Royle, invasion, invasive plant, expansion, spread.

The native land of the plant *Impatiens glandulifera* Royle (Himalayan balsam) is the Western Himalayas. For a long time it was cultivated in the parks and countryside of Central Europe as an ornamental and melliferous plant. In the middle of the 20th century, *I. glandulifera* began to settle independently and acquired the status of an aggressive invasive species. The first cases of his wildness began to be registered in Belarus from the mid-50s of the last century, today it is found in all six regions of Belarus. *I. glandulifera* may pose a threat to the biodiversity of local phytocenoses [1,2].

Currently, on the territory of Belarus, in natural growing conditions, *I. glandulifera* is registered in 102 places with a total area of more than 5.63 ha. More often found in the Belarusian Poozerie - 48 places of growth and cen-tral Belarus - 31 place. In general, these territories account for 77.4% of the growing areas. *I. glandulifera* is rare at present in the west of Belarus, in contrast to which it is widespread in the east in the Gomel region, where it has al-ready been noted in 13 habitats.

The distribution of *I. glandulifera* in Belarus can largely be due to both its ecological features and the nature of the territory's development. *I. glandulifera* is commonly found in coastal habitats. Widespread due to the transfer of seeds along waterways. Up to 2500 seeds are formed on one plant, which are explosively dispersed at a dis-tance of up to 5 m from the parent plant. Less commonly found in pine forests and along the edge of spruce forests near settlements and country houses, where it is planted as a greening plant.

Being a hypogeliophyte plant, *I. glandulifera* prefers light forests and semi-open areas with rather rich, but slightly acidic or even neutral soils and damp-meadow moistening regime. In this regard, it actively spreads along black alder forests in shallow watercourses, inhabits the slopes of reclamation ditches, light oak forests. It is the eco-logical preferences of this species that explains its most widespread distribution in the Braslavsky, Lepelsky and Sennensky districts of the Vitebsk region, which account for 68.8% of all places where the *I. glandulifera* grows in the region and 88.2% of the area. In the Braslavsky and Lepelsky districts, *I. glandulifera* spreads mainly along the banks of the lakes, while in the Sennensky districts it actively spreads along the banks of the reclamation canals.

On the territory of the Minsk region, *I. glandulifera* ferruginous is widespread in the Minsky and Borisovsky districts, where, outside of cultivation, it develops floodplain lands along the Berezina, as well as separate areas

of light forests with damp soils near settlements. In particular, on the territory of Minsk, its largest populations are reg-istered in the Dubrava and Lebyazhy nature reserves.

In the east of the country, as noted above, in the natural habitats of *I. glandulifera*, it is found much less frequently at present. However, its individual populations here can reach an area of more than 0.5 hectares. In par-ticular, a population of *I. glandulifera* with an area of 0.6 hectares was registered in the Kormyansky district, locat-ed in the nettle black alder forest on a small forest river. In the floodplain of the river Pripyat on the territory of Mozyrsky and Petrikovsky districts registered 6 populations of this plant species, occupying 0.23 hectares in the reserve «Mozyrskiye ovragi» and in the meadows along the banks of the river Pripyat.

We have established 7 monitoring points in Vitebsk, Gomel, Grodno and Minsk regions in order to assess the expansion of *I. glandulifera*. Observations in these areas show not only the expansion of the occupied areas, but also the general regularity of some spatial movement of this species from the dampest areas to the less humid lands. This may be partly due to the fact that *I. glandulifera*, as a mesoacidophilic polybiont, prefers neutral soils, and highly moistened soils are rather acidic. In addition, it should be borne in mind that this plant species is a po-lybiont of mild winters, preferring winters with higher temperatures. Therefore, it can be assumed that cold winters can negatively affect seeds that are in very damp soils. In severe frosts in such soils, the seeds freeze out, and in drier areas they are preserved, which allows I. glandulifera to develop much better here.

Thus, in general, it should be noted that at present in the territory of Belarus *I. glandulifera* is actively intro-duced into natural plant communities. It is often found in coastal habitats and can spread quickly as seeds are easi-ly carried along waterways. This can lead to dense, monotypic plantings that inhibit the establishment of native plants and make the banks of streams vulnerable to erosion, where plants with shallow root systems die off. Analy-sis of data on habitats and population sizes of *I. glandulifera* allows predicting the expansion of *I. glandulifera* expansion in Belarus. In order to control the spread, it is necessary to conduct targeted research in all regions of the country.

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ASSESSMENT OF SALT CONTAMINATION OF THE SOIL BY THE STATE OF LEAF BLADES OF HEART-SHAPED LINDEN

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The assessment of salt contamination of the soil in Soligorsk is given by analyzing the state of the body.

Keywords: bioindication, salt contamination.

Town's vegetation is an important indicator of anthropogenic impact on the environment. The use of deicing agents in winter leads to salt contamination of the soil, which in turn disrupts the water balance and causes salt stress in plants [1]. The heart-shaped Linden is very sensitive to an increase in the salt concentration in the soil, which makes it possible to use it as a bioindicator of salt contamination. An indicator of the reaction is a change in the state of the leaf blades [2].

In the course of the summer training practice, a research work was carried out aimed at assessing the salt contamination of the soil in Soligorsk by the state of the leaf blades of the heart-shaped Linden. The material was gathered in the Park, Central, and embankment districts of Soligorsk along major roads and in major parks. Six test sites were selected for the research, which differed in the degree of anthropogenic impact.

The study obtained the following results:

1 n 2 place − School area №5 and №6: in these territories, more than 95% of the examined leaf blades are not damaged, less than 5% have a narrow yellow stripe along the edge of the leaf which indicates the presence of traces of salt in the soil.

3 place – Park of The Four Elements: 85% of leaves with intact leaf blades, 1% with a narrow yellow stripe along the edge of the leaf, 12% of leaves with strong chlorosis in the form of a wide marginal band (second degree of soil contamination), 2% with extensive marginal necrosis with a yellow border band.

4 place − Park Embankment street: 71% of the leaf blades are not damaged, 20% have a narrow yellow stripe along the edge of the leaf, 4% with strong chlorosis; 5% have extensive marginal necrosis with a yellow border stripe. Due to the degradation of the grass cover, fertilizers are introduced into the Park's soil, which in turn affect the leaf blades of Linden trees in the Park.

5 place − Kozlov street: 65% of leaf blades are not damaged, 21% have a narrow yellow stripe along the edge of the leaf, 13% have a wide marginal stripe (strong chlorosis), 1% with a General marginal necrosis with a yellow border stripe. The road along Kozlova street is one of the busiest in Soligorsk which has a direct impact on the condition of Linden leaf blades.

6 place − Lesnaya street: 51% of leaf blades are damaged: 24% are slightly damaged (a narrow yellow stripe), 25% with strong chlorosis – the second degree of soil contamination (the soil has an average amount of salt); 1% with extensive marginal necrosis – the third degree of contamination, 1% − most of the leaf blade is dead. Industrial enterprises are located in the area of Kozlov street and Lesnaya street, which could also affect the results.

The study showed that on the territory of Soligorsk the salt content in the soil does not exceed the permissible norms, thereby not creating big problems for the growth of woody and herbaceous plants. The presence of damage to leaf blades is observed in Linden trees that grow near roads and sidewalks with high traffic. The lack of stable snow cover in winter reduces the need to use deicing agents, which has a positive effect on the condition of leaf blades. Biomonitoring of soil salinity is necessary for timely identification of problem areas in order to avoid subsequent degradation of the town's vegetation.

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ASSESSMENT OF THE RADIOACTIVE IMPACT ON INDIVIDUAL COMPONENTS OF THE BIOTA BY THE LEVEL OF RADIONUCLIDE CONTAMINATION OF LAKES OF VARIOUS TYPES IN THE GOMEL REGION

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The level of radiation exposure to the most representative components of biota in the Belarusian sector of the Chernobyl exclusion zone was estimated by calculating the radiation dose based on generalized data from monitoring the radiation situation in the studied region.

Keywords: biota, radioactive contamination, Chernobyl accident, radiation monitoring, characteristic of radionuclide accumulation.

Introduction. In recent decades, technogenic impacts (chemical, physical, and radiation) on individual components of the environment, including humans, have increased during the construction and operation of nuclear power plants. After the first reactors appeared and up to the present day, about 300 radiation accidents occurred in the world. The most dangerous is the spread of radioactive substances in the environment. Water objects are currently affected by a number of anthropogenic factors, but the factor of radioactive contamination is the most significant [1].

Regular measurements of radiation contamination of a particular water body and assessment of radionuclide removal to other water ecosystems during normal operation of the enterprise not only maintain the monitoring system in constant emergency readiness, but also serve as a means of monitoring the stability of the radiation situation in the vicinity of the enterprise during normal operation.

In the Belarusian sector of the Chernobyl accident, the highest concentrations of radionuclides are observed in the reservoirs of the exclusion zone. First of all, these are closed and weak flowing reservoirs.

The ionizing radiation fields on the territory of the Chernobyl accident trace are characterized by a significant heterogeneity of distribution in space and time [2].

Material and research methods. Research method: sampling. Materials for the study were taken a data of the radioactive impact on representatives of the ichthyofauna of water bodies in the Gomel region and the intensity of 90Sr washout from the river catchment.

Purpose. To assess the state of individual biota components in various types of lakes in the Gomel region based on monitoring of radioactive contamination of water, bottom sediments, and the most representative fish species, and to establish the degree of connection between the average annual flow rate of water in rivers and the concentration of radionuclides in it.

Research results and their discussion. Analysis of the literature data and our own research on the level of accumulation of radionuclides in the muscle tissue of fish living in the reservoirs of the Ukrainian and Belarusian sectors of the Chernobyl exclusion zone allowed us to conclude that the most problematic are closed and semi-closed reservoirs of the residual type, which periodically connect with the river.

The general trend in changing the content of radionuclides in the water of almost all the water bodies of the exclusion zone studied since the early 1990s is a continuing decrease in the specific activity of 90Sr and 137Cs, the dynamics of which is primarily related to the intensity of water exchange processes.

Analysis of data on the radiation situation of the surveyed territory and the level of accumulation of 137Cs and 90Sr by various fish species in the lakes Svyatsky, Revuchy, Perstok, Masanovsky Starik and Borshchevsky flooding showed that the radiation dose values continued to be determined mainly by 137Cs and 90Sr, so it was decided to take these radionuclides as the main radionuclides when calculating the radiation dose rate.

It is established that the migration intensity of 90Sr from the catchment is determined by rainfall, annual water level of the rivers, and, as a consequence, flooding their banks, which leads to significant fluctuations of the annual 90Sr. For 137Cs this dependence is not established, since 137Cs is fixed in the crystal lattice and is mainly in non-exchange form.

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BIOENERGY AS A WAY TO «GREENING» THE ECONOMY OF THE YAMALO-NENETS AUTONOMOUS OKRUG

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The Yamalo-Nenets Autonomous Okrug is the largest gas production base in Russia, which determines the highest percentage of thermal power plants in the structure of the electric power industry. Thermal power generation poses a number of challenges that negatively affect the vulnerable Arctic landscapes. This study is aimed at considering the possibility of using alternative energy sources, including biofuels, in the Yamalo-Nenets Autonomous Okrug. The study results in calculations showing the possibility of reducing the carbon and energy intensity of the region’s economy.

Keywords: bioenergy, Yamalo-Nenets Autonomous Okrug, carbon intensity, energy intensity, reindeer husbandry.

The largest hydrocarbon resource base in the world is located in the Yamalo-Nenets Autonomous Okrug. The region is one of the world leaders in natural gas production. Accordingly, this determines the fact that the region’s main source of energy is heat, most of which (99%) is produced by processing gas fuel [5].

Using the alternative energy sources is classified as capability for increasing the energy efficiency of the system and reducing the carbon intensity. Despite the impressive supply of gas in the region, even small renewable energy stations make possible to gain such an experience in the Arctic, which is an important factor in the subsequent development of "green" isolated generation.

Solar energy does not have great potential in areas where the polar night is observed, such as the Yamalo-Nenets Autonomous Okrug. The assessments carried out [2] conclude that the use of energy systems based on renewable sources reduces costs by 2.5 times in comparison with stationary energy supply. Thus, wind energy is a promising direction in the development of energy systems, but it is limited in scale due to the climatic conditions of the territory and can be localized in remote small settlements [2].

An important component of any modern renewable energy system is biofuel-fired power plants and heating systems. In the Yamalo-Nenets Autonomous Okrug, such opportunities are provided by the development of the most important branch of the regional economy - reindeer husbandry. The number of reindeer in the Yamalo-Nenets Autonomous Okrug at the end of 2018 is estimated at more than 760 thousand heads. More than 250 thousand of them are in agricultural organizations, farms.

Based on the fact that the centralized collection of deer waste is possible only from agricultural organizations, an assessment was made of the efficiency of bioenergy in terms of reducing the carbon and energy intensity [1]. Russian normative indicators were used for calculations [7].

When using biogas as a source of electricity generation, the ratio of 1 cubic meter of biogas - 1.67 kilowatt-hours of electricity is obtained [3,6]. With the complete processing of deer waste generated on the territories of agricultural enterprises, 288.01 million kWh of electricity can be obtained. Waste incineration also contributes to a 7-fold decrease in the share of greenhouse gas emissions compared to their direct storage and use [4], which makes it possible to achieve a low level of both energy and carbon intensity.

Tables 1

Production of biogas from reindeer husbandry waste

Weight of manure from one deer per year, kg	3650
Biogas output per year per deer, m3	197,1
Annual production of electric energy from biogas obtained from one deer, KWh	329,157

	Deer in agricultural enterprises	**Total**
Number of deer, thousand heads	250	760
Biogas output per year, thousand m3	49275	149796
Power generation from biogas, million KWh	82,29	250,16

With the gradual introduction of bioenergy, it is possible to reduce the consumption of fossil fuels for electricity and heating, which respectively reduces energy and carbon intensity.

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BIOFILMS DESTRUCTION UNDER THE ACTION OF A MIXTURE OF NOCARDIA VACCINII IMV B-7405 SURFACTANTS AND ESSENTIAL OILS

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It was found that Nocardia vaccinii IMV B-7405 surfactants showed a synergistic of biofilms destruction with the lemongrass and cinnamon essential oils. The degree of Candida albicans D-6, Candida tropicalis RE-2 and Candida utilis BMS-65 biofilms destruction when using a mixture of surfactants with cinnamon or lemongrass essential oil was in 1.5-2 times higher than when using monopreparations. Moreover, the effective concentration of both single antimicrobial compounds was 300 μg/ml and their mixture was 150 μg/ml.

Keywords: surfactants, essential oils, synergism of biofilms destruction

The formation of microbial biofilms on various surfaces of equipment in pharmaceutical industry and med-icine is a dangerous occurrence, since microorganisms in their composition are characterized by increased resistance to various biocides [1]. High cost of many methods that preventing the formation and destruction of biofilms stimulate the search for new substances with the antimicrobial and anti adhesive properties. Such situation creates necessity in new antimicrobial substances which can be essential oils. It is known that the presence of alcohols, al-dehydes and phenols in their composition makes them promising antimicrobial, antifungal and antiviral drugs that can be used in many industries [2].

However, their concentration should be minimal, which is due to the ability of essential oils to cause severe damage of the central nervous system and aspiration pneumonia in body [3]. This led to the search for methods to reduce the essential oils concentration while preserving their properties, in particular, their use in the mixture with other antimicrobials, which can be microbial surfactants.

Strain N. vaccinii IMV B-7405, was cultivated in a liquid nutrient medium. Purified glycerol and technical glycerol (waste product of biodiesel production) at a concentration of 2 v/v were used as substrates. The amount of extracellular surfactant was defined by weighing it after it had been extracted from the culture liquid supernatant by Folch mixture. The degree of biofilm destruction under the action of surfactants, essential oils and their mixtures was analyzed spectrophotometrically .

It was established that the highest degree of Candida albicans D-6, Candida tropicalis RE-2 and Candida utilis BMS-65 biofilm destruction (43-60%) was observed with the use of surfactant and essential oils (cinnamon, lemongrass) at a concentration of 300 μg/ml. Using the mixture of surfactants synthesized by N. vaccinii IMV B-7405 on purified glycerol and cinnamon, lemongrass essential oils in a ratio of 1:1 was accompanied by increase of the C. albicans D-6 biofilm degradation to 80%. A slightly lower percentage of destruction (53-73%) of C. tropi-calis RE-2 and C. utilis BMS-65 biofilms was observed under using the mixture of surfactants and essential oils at a lower concentration (150 μg/ml). It should be noted that similar results were obtained for using surfactants ob-tained on technical glycerol.

The bioconversion of glycerol in microbial surfactants will solve two urgent problems: first, reduce the cost of technology for the production of surfactants by using cheap raw materials as a substrate; second, increase the prof-itability of biodiesel production by utilizing its by-product glycerol.

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BIOREMEDIATION OF SOILS CONTAMINATED WITH HEAVY METALS USING DIGESTATES OF ANAEROBIC DIGESTED WASTE

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The alternative method of decontamination and rehabilitation of contaminated soil is the use of biocomposites derived from waste to intensify the processes of biochemical transformation of heavy metals. Digestate is a promis-ing biocomposite for for land application either as fertilizer or soil improver. The application of digestate provides an opportunity to close the nutrient and carbon cycles, solve the soil acidification problem, bind and enhance the immobility of heavy metals in soils.

Keywords: digestate, soil improver, bioremediation, soil contaminated with heavy metals.

One of the mainly derived of anthropogenic load on the environment is soil contamination, as it plays the role of a buffer for various pollutants of anthropogenic origin. In conditions of intensive anthropogenic pressure an important task of environmental studies is to find ways to stimulate natural protective properties of soil. Nowadays, many studies have been focused on developing alternative methods of decontamination and rehabilitation of con-taminated territories. According to the results of the analysis of known methods of remediation we consider as a promising biochemical method of remediation: the application of biocomposites derived from waste for intensifica-tion of processes of biochemical transformation of heavy metals. The modern management practice involves the utilization of sludge or organic waste as a fertilizer or soil improvement agent.

Despite the use of methane fermentation all over the world, the overall sustainability of this process as a source of alternative fuel (biomethane) is significantly related to the successful management of one of its major by-products – digestate. In order to classify digestate as a product and not as a waste, it requires additional biological or physical-chemical treatment. The most common way to treat digestate is to use it as a soil improver.

Digestate consists of a mix of microbial biomass and undigested material. Digestate contains all the nitrogen, phosphorus and potassium present in the original feedstock and as a consequence has value as an organic fertilizer. The application of digestate to remove heavy metals from waste water and soil contaminated with heavy metals is already being studied by Chen et al., 2019 and Diatta et al., 2019 [1,2].

In terms of using digestate (from raw materials of agricultural crops and organic solid waste fractions) as a fertiliser or soil improvement agent the following potential solutions have been tracked:

- application as fertilizer closes the nutrient and carbon cycles [3];
- the application of digestate granules as a source material for adsorbent production;
- solution of the soil acidification problem, due to alkaline pH (additionally, digestate alkalinity can increase the pH level of soil and consequently enhance the immobility of heavy metals) [4];
- binding heavy metals in soils by increasing the content of humus (metals can form complex compounds with organic matter of soil, thereby heavy metals are less available for absorption by plants in soils with a high content of humus);
- binding heavy metals in soils due to the presence of specific bacterial groups (bacterial groups that are present in the digestate contain species of bacteria that have heavy-metal-binding protein and can be used in the process of remediation of soils contaminated with heavy metals.

Consequently, we consider the development of methods of using organic wastes as a resource for effective, environmentally safe and economically expedient bioremediation of contaminated soils and stimulation of soil protective properties to be promising.

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BUILDING A PROTOTYPE AUTOMATED WIRELESS SYSTEM FOR MONITORING AIR DUST AT PRODUCTION SITES

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A variety of studies of recent decades have shown that fine dust particles can be a serious health hazard, contributing to the development of respiratory and cardiovascular diseases, in addition, at certain concentrations, dust is explosiveCreating an automated system that can control the dustiness of air in various production facilities is an urgent task. This work is devoted to the creation of such a system, combining the required number of dust sensors connected to each other in a wireless network, which allows controlling the measurement process and recording the measurement results of each specific sensor.

Keywords: indoor air quality, dust explosion, optical dust sensor, wireless data system, Wi-Fi – module ESP8266.

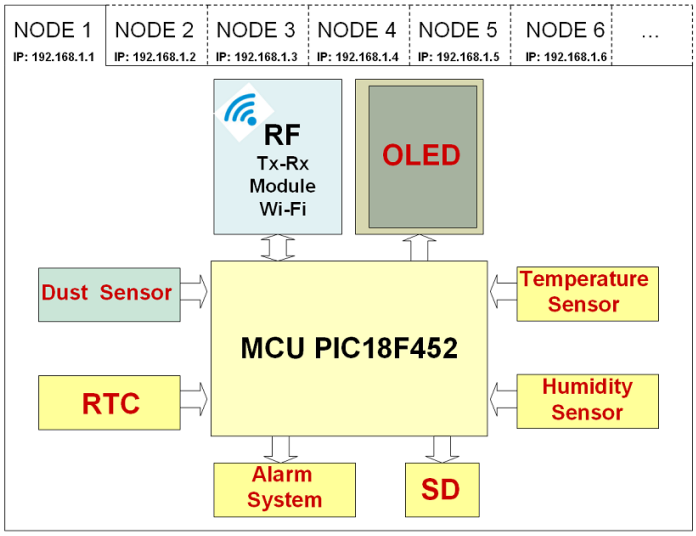

Fig. 1. – Block diagram of the analyzing module

The sensitive element of the system is the SHARP GP2Y1010AU0F dust sensor capable of detecting the presence of the smallest dust particles in the air. Figure 1. - a block diagram of one of the analyzing modules of the monitoring system, connected in a Wi-Fi network, is presented. The maximum measurable dust concentration range in air is up to 500 μg / m3. The sensitivity of this sensor allows not only to register explosive dust concentrations in the air, but also to assess the quality of indoor air at lower dust concentrations in the air. To measure the air humidity in the system, a DHT11 digital temperature and humidity sensor is used, being a composite sensor, it provides a calibrated digital output signal with temperature and humidity readings. Time binding of measurements is made thanks to a real-time clock (RTC) module built on a DS3232 connected via a two-wire I2C interface. To build a wireless Wi-Fi network for data exchange between the server and analytical modules, the ESP8266 module was used [1]. The measurement results are sent to the control server via a radio channel, in addition, they are recorded in real time on the SD card of the device, thus ensuring double duplication of the stored data. In the event of a dangerous excess of the level of dust concentration in the air, a sound signal is issued and a corresponding notification is sent to the server. To display the measurement results, the analysis module is equipped with its own SSD1306 OLED display capable of displaying both text and graphics. The work of the created system, at the moment, is being tested and tested in the conditions of the production site of one of the enterprises in Grodno.

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CLONING AND EXPRESSION OF *BACILLUS LICHENIFORMIS* KERATINASE GENE IN *ESCHERICHIA COLI*

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E. coli pET42a-kerA strain was obtained. This strain is capable to produce bacterial keratinase. In the future, it is planned to optimize the production of this enzyme and to determine the factors contributing to its maximum activity.

Keywords: keratin, keratinase, keratinolytic microorganisms, keratin waste.

Conventional keratin waste disposal techniques such as incineration, burial, and chemical hydrolysis are labor intensive, energy intensive, not environmentally friendly, and destroy some essential amino acids [1]. Compared to other methods, microorganisms have tremendous advantages over the decomposition of keratin because it is an environmentally friendly and relatively simple method. Therefore, the aim of this work was to obtain a recombinant strain of E. coli that is capable to produce keratinase.

The pET42a (+) expression vector was used for the design of a genetic construct containing keratinase gene. This plasmid carries the kanR gene, which confers resistance to the antibiotic kanamycin, the T7 promoter, and a polylinker with multiple cloning sites.

The keratinase gene kerA (964 bp) was isolated by polymerase chain reaction (PCR) from genomic DNA of the bacterium Bacillus licheniformis. Then pET-42a(+) plasmid linearization was conducted. The obtained PCR-products were analyzed using 1% agarose gel electrophoresis. The kerA gene was cloned into the linearized plasmid pET42a (+) using the continuous overlapping PCR method [2]. The resulting genetic construct that was named pET42a-kerA was used to transform competent E. coli BL21 (DE3) cells by electroporation method. The DNA of the obtained bacterial colonies was further subjected to PCR analysis to confirm the presence of the target gene in the correct orientation.

For the cultivation of E. coli cells, LB medium supplemented with appropriate antibiotic (kanamycin) was used. E. coli cells were grown until optical density of 0.6 (λ = 600 nm) was achieved, then inductor isopropyl-β-D-thiogalactopyranoside was added to a final concentration of 0.5 mM and the cells continued to grow for 3-4 h at 37 °C and 250 rpm.

At the end of the cultivation, E. coli cells were disrupted using a Sonifier-450 disintegrator under the following mode: power - 0.05 kW; temperature - 4 oC; duration - 600 impulses of 0.5 s each. The cell lysate was clarified by centrifugation at 60,000 g for 30 min.

Cell lysate was clarified by centrifugation. The supernatant, that contain recombinant keratinase, was purified using a Ni-NTA agarose chromatography column. The purified protein was analyzed by polyacrylamide gel electrophoresis. The protease activity of the enzyme was determined by the colorimetric method using a colored substrate – azocasein.

As a result, a protein of ~ 40 kDa with keratolytic activity was obtained.

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DEFINING SCOTS PINE HABITAT BY FOURIER-TRANSFORM INFRARED SPECTROSCOPY METHOD

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This research is aimed at the examination of the performance potential of the Fouriter-transform infrared spectroscopy method to confirm the legality or prove the origin of the cut timber from the place of illegal felling.

Keywords: wood, coniferous species, IR-spectroscopy, growth place, chemometric algorithms.

In our research, we held to the view that the variation of elemental composition of plants was directly connected Pine forests are widely represented in all regions of the Republic of Belarus and dominate in the area occu-pied and the stand of timber per hectare. Mainly due to this reason as well as its qualitative characteristics and ac-cessibility by transport, the Scots pine (Pinus sylvestris L.) is currently one of the main objects of offence in ecologi-cal safety, environment and environmental management. During their investigation in some cases it is necessary to obtain information about the place of origin of pine timber.

This research is aimed at the examination of the performance potential of the Fouriter-transform infrared spectroscopy method to confirm the legality or prove the origin of the cut timber from the place of illegal felling.

The research subjects were moss-covered pine forests (dominating forest formation which occupies >40% of the total pine forest area) from the southern and northern regions of Belarus.

The results of the research performed showed that with respect to the absolute value the infrared spectra of all temporary sample plots examined were alike and had insignificant differences. In view of that, we smoothed them in 5 points with the subsequent calculation of the derivative of order two by the Savitzky-Golay method (with the use of 7 smoothing points), which made the differentiation features more prominent. However, in any circumstance no significant changes in the infrared bands of timber absorption on temporary sample plots 1-6 (south) and temporary sample plots 7-12 (north) were discovered, which determined the necessity to use chemometric algo-rithms of analysis. It should be noted that we further analysed the part of spectrum in the band between 1800 and 800 cm-1.

At the first stage of work, the spectrometric data structure was examined by the X-ray spectral analysis method. On the basis of the analysis performed, it can be seen that the points reflecting the drill cores were formed in 2 classes corresponding to the 2 regions of Belarus examined: the northern region and the southern region. In general, the distribution of samples in the existing coordinate space makes it possible to perform a regression analy-sis.

The following stage of work involved the choice of a chemometric algorithm and direct multidimensional modelling of infrared spectra. With respect to the specific nature of the current task, we decided to use the method of discriminant analysis of projections to latent structures, which made it possible to forecast the classification of new samples in the future. Its principle is that discriminatory rules for classes are set by linear regression equations. In order to analyse data by the PLS-DA method, the same data as the ones used in the X-ray spectral analysis method were used, however the observations were preliminary divided into classes corresponding to the samples examined (south – class 1, north – class-1).

First of all, the PLS-DA models were developed for each class individually. The cross-validation method was chosen to test them. All samples were randomly divided 10 times into a training data set (90 samples) and a test data set (30 samples).

The training sample sets were used to develop a PLS-DA model with the help of which “new” samples would be analysed in the future. The result showed that like in the X-ray spectral analysis model the classes did not over-lap and were located in different regions of a two-dimensional surface, which proved significant differences be-tween them. It should be noted that optimally the number of latent variables (PLS-DA factors) corresponded to 5 for full and training data sets for both classes.

The cumulative percentage of the explained information and the X-ray spectral analysis model had little difference and equalled 98.6%. The explained variance for the PLS-DA model shows that the record of the first two X-ray spectra is sufficient. The accuracy of the PLS-DA model estimated with the help of the cross-validation method equalled 91.75%.

The analysis of the results by the PLS-DA method did not have a significant difference in the values of the specified characteristics for calibration and forecast, which showed the model stability and presupposed

insignifi-cant error in further evaluations. The examination of the model quality by the full cross-validation method showed its significance.

Thus, the results of the research performed showed that chemometric algorithms of analysis in infrared spectra processing in the middle infrared band of the wood samples from the southern and northern regions of the Re-public of Belarus make it possible to divide the objects examined into two different classes and classify them as those belonging to different origin sources.

DETERMINATION OF BACTERIOPHAGE TITER BACILLUS SUBTILIS IN URBAN SOIL

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This paper presents the results of determining the titer of bacteriophages of Bacillus subtilis by the Appelman method. The polluted urban soil of Minsk was used as a source containing bacteriophages. The results obtained indicate the effectiveness of this method for isolating bacteriophages, and the prospect study of bacteriophages as indicators of soil contaminationas.

Keywords: bacteriophages, Appelman' technique, urban soil.

Bacteriophages are the most numerous and widespread group of viruses in the biosphere, the main niche of which is the fertile soil. The study of the biological properties of bacteriophages is an important stage in the creation of biological products for phagoindication and phagoidentification of bacteria. The biodiversity of soil phages is practically not characterized. By lysing bacterial and archae cells, phages control the number of microbial popula-tions [1].

This study examined soil samples from the 50th anniversary of October Park (Minsk, Zavodskoy district) for the presence of bacterial viruses. We used Appelman' technique, for determining phages in soil [2]. The essence of the method was to filter lysed broth cultures of bacteria through fine-pored bacterial filters. The studied soil was sown in a liquid nutrient medium, with preliminary enrichment of the nutrient medium with a pure culture of the corresponding microbe that does not secrete a bacteriophage. The turbid nutrient medium was passed through a bacterial filter. The resulting filtrate was tested for the presence of bacteriophage by seeding together with the corre-sponding microbial culture on liquid nutrient media. After the incubation stage on a liquid nutrient medium, the presence of a bacteriophage causes the culture to become enlightened. In this work, we were able to obtain bacteri-ophages to Bacillus subtilis., The titer of the bacteriophage Bacillus subtilis was 10-6, when determining phages in the soil by Appelman' technique. The method used in this work for isolating bacteriophages from a soil sample is quite effective. There are studies that the total number of phages depends on the level of fertility and decreases in the number of soils «chernozem – chestnut field – gray forest – urban uncontaminated – urban oil-contaminated» [3]. However, the obtained indicator is relative, since the phage activity depends on the granulometric composition of the soil, temperature, humidity, vegetation, and anthropogenic factors. And a result requires additional research taking into account the above factors.

Natural regulators of the number of soil bacilli are insufficiently studied because it depends on their specificity, type and size of the nucleic acid and depends on the interaction with the host cell and on the role in modifying the functions of the infected cell. These issues require a modern examination.

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DEVELOPMENT OF A CALIBRATION METHOD OF AN ELECTRONIC PORTAL IMAGE DETECTOR FOR PERFORMING DOSIMETRIC MEASUREMENTS AT A NON-STANDARD SOURCE-DETECTOR DISTANCE

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This work is devoted to the development of a method for calibrating an electronic portal image detector (EPID) for performing dosimetric measurements using a non-standard source-detector distance.

The advantages and disadvantages of EPID as a device for dosimetric verification of radiation therapy treatment prior to irradiation are considered. The analysis of existing calibration methods is carried out. An original method for setting up both the detector itself and the algorithm for predicting the detector response in the treatment planning system (TPS) is proposed. The measurement results were evaluated using the resulting calibration method proposed by the authors.

Keywords: Electronic Portal Imager Device, EPID, pre-treatment verification, quality assurance.

Quality assurance (QA) during radiotherapy planning is essential to ensure correct dose calculation and minimize the likelihood of accidental negative effects on the patient [1, 2]. Dosimetric verification is an essential part of this procedure.

Dosimetric verification in radiation therapy is a process that allows physicians to be sure that the treatment device (usually a linear electron accelerator) is able to reproduce the radiation plan according to the prescribed conditions, as well as to make sure that the main radiation generation and collimation systems of the treatment unit are working properly.

The object of the authors ‘ research is an electronic portal image detector due to a number of reasons: most modern linear accelerators are equipped with this device; the portal detector has excellent spatial resolution during measurement the dose distribution [3]; the use of EPID practically does not require operational time on a linear accelerator and can be performed regularly.

However, this type of detector has one significant drawback: according to the name, the EDPI was originally intended solely for verifying the patient’s position on the treatment table, by obtaining 2D images of the patient’s anatomy, and comparing them with images generated by the dosimetric planning system, or obtained on an x-ray simulator. Accordingly, additional calibrations and settings are required for the use of EPID in dosimetric measurements.

In a classic application, the portal detector is calibrated at a distance as close as possible to the isocenter (i.e., at a source-detector distance (SDD) of about 100 cm). However, sometimes need to increase this distance. For example, when using high dose rates (>800 IU/min) to eliminate the effect of matrix saturation, or to scale the dose fluence when analyzing treatment plans for small localities and improving the spatial resolution and, accordingly, the quality of analysis of dose distributions.

There are various methods for portal detector calibrating. The classic method proposed by the manufacturer (Varian Medical Systems, PA, California) propose using a diagonal beam profile emitted by a 40×40 cm field obtained in a water phantom at a dmax depth for simulation of the detector response to irradiation. However, a number of studies show poor quality of verification results with this approach [4-7].

Alternative calibration methods [4-7], although they show significantly better results, are either time-consuming to implement [4-6] and require specific knowledge and training from the user, or [7] are only applicable for standard measurements on SDD=100 cm.

The authors goal was to develop an easily reproducible and simple method for calibrating the electronic portal image detector at a non-standard source-detector distance, which does not require additional measurements or specialized skills.

The method is based on the calibration approach proposed by the manufacturer, and a package of ready-made measurements distributed by Varian MS and 7Sigma [7], designed to calibrate the detector for measurements on the SDD=100 cm.

The diagonal profiles were obtained by the follow way. A parallelepiped with linear dimensions of 50×50×10 cm, with an electron density of 0 Hounsfield units (HU), equivalent to the density of water, was modeled in the Varian Eclipse v13.7 TPS. The virtual phantom was irradiated with a field of 29×22 cm at a SDD=150 cm with 6 MeV energy. This field size is chosen because its projection on SDD=150 cm will be equal to the 40×30 field on

the SDD 100 cm, which is equal to the portal detector linear dimensions. Using Varian Eclipse, diagonal beam profiles were exported at a depth of 8 and 15 mm. An alternative profile was obtained from predicting the detector response to 40×30 cm field irradiation. The detector response itself was calculated using the Portal Dose Image Prediction (PDIP) algorithm, which is part of the Varian Eclipse software, and configured using part of the data from the ready-made measurement package.

The obtained profiles were serially loaded into the software for receiving and processing images on the portal detector (Image Acquisition Software, IAS3). Then a portal detector was used to take a 29×22 cm field profile on a 150 cm SDD. The measured profile was compared with the data calculated by the PDIP algorithm.

The best convergence was shown by the test profile extracted from the predicted detector response. Based on this profile, the detector itself was calibrated and the PDIP algorithm model was recalculated. Irradiation of test plans for SDD 150 and their comparison with PDIP predictions showed a clinically acceptable correspondence between the measured and calculated isodose distributions.

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DEVELOPMENT OF A QUALITY ASSURANCE PROGRAMME FOR THE EXTERNAL BEAM RADIOTHERAPY: CLINICAL AND PHYSICAL ASPECTS

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This article covers the issues of developing a quality assurance programme for the external-beam radiotherapy at the Minsk City Oncologic Dispensary healthcare institution in order to hold further routine procedures in quality assurance and improvement of the quality of the radiotherapy. Primary elements of the quality assurance programme are specified and primary methods for quality assurance procedures are described.

Keywords: Radiotherapy, cancer treatment, maintenance, quality assurance, radiation protection.

Radiotherapy is a multidisciplinary profession that uses complex equipment and sources of ionizing radiation for therapy. It is a general knowledge that clinical aspects (diagnostics, decision-making on the radiation, radiation indications and further monitoring) and procedures related to physical and technical aspects of the radiation of a patient must be thoruoghly controlled and planned [1].

Up until recently physical aspects of the quality assurance of operation of the equipment for external-beam radiotherapy were considered key for safe radiation. Nowadays it's more recognized that the clinical aspects of the quality assurance programme need a systematic approach at all stages [1].

Development of the quality assurance programme is critical for safe and high-quality radiotherapy. Thorough approach to every stage of the external-beam radiotherapy will allow to minimize random negative exposure of a patient.

Quality assurance for the radiotherapy consists of the procedures that ensure consistent and safe execution of the arrangement of the prescribed dose for the set radiation volume with a minial dose for normal tussues and minimal radiation of the personnel and population. It includes both clinical and physical aspects. Primary fields of the programme must include clinical policy in the field of radiotherapy, planning and execution of the external-beam radiotherapy, quality assurance programme for the equipment operation, technical maintenance programmes and error investigation procedures during therapy.

A primary aspect of any quality assurance programme is a constant tendency for improvement of the quality of therapy. Non-stop improvement of the qualification of both medical and physical personnel are important processes taht are to be planned and controlled thoroughly.

Goal of the patient safety defined in Basic Safety Standards (IAEA) which is formulated as "radiation of normal tissues during radiotherapy must be preserved at a reasonably attainable level in accordance with the arrangement of the needed dose into a set volume" is a part of the therapy itself. Measures for the quality assurance for the radiotherapy by definition ensure patient safety, error prevention, and prevention of the negative effect on the patient. The patient's safety is therefore associated with the quality assurance for the external-beam radiotherapy.

An important aspect during the development of a quality assurance programme for the radiotherapy is constant actualization due to fast-paced improvement of the technology and equipment and use of new radiation methods.

Considering the aforementioned, the outhgors are now developing a universal quality assurance programme based on the Radiotherapy Department of the Minsk City Oncologic Dispensary healthcare institution that allows fully cover all stages of the execution of a high-tech external-beam radiotherapy.

As a part of development of the programme, primary elements of quality assurance are defined that affect all needed aspects starting with the moment of admission of the patient into the Radiotherapy Department and until the last session of radiotherapy and further monitoring of the patient. For each of these elements primary controlled objects are defined, control and result analyzing methods are developed.

This work will result into a documented quality assurance programme for the external-beam radiotherapy which consists of clinic's policy in the field of radiotherapy, written procedures for each stage of the radiotherapy, control and result analyzing methods, work regulations, data array, reference documents etc. which will enable continuous high-precision radiotherapy and to constantly improve its quality.

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DEVELOPMENT OF UTILIZATION FOR SPENT CATALYSTS OF HYDROTREATING DIESEL FUEL

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The process of oxidative roasting a spent catalyst for hydrotreating diesel fuel Co-Mo/Al2O3 with lime an air atmosphere in the temperature range 550 - 6000C has been studied. Its optimal parameters have been determined, at which sulfur is quantitatively converted into calcium sulfate, carbon forms calcium carbonate. Under the selected conditions, the roasting time is about 1 hour.

Keywords: spent catalyst, hydrotreating, utilization.

Hydrotreating is an important part of refining. In world practice, the most common hydrotreating catalysts are Co-Mo / Al2O3 (ACM), Ni-Mo / Al2O3 (ANM) and mixed Ni-Co-Mo / Al2O3 (ANCM). During hydrotreating, the catalyst is poisoned with elements such as S, C. Due to the increase in the volume of spent hydrotreating catalysts, which by 2030 may reach about 5200 t / year [1], the development of methods for their utilization is a promising direction.

Coke formation is the most common cause of catalyst deactivation, leading to blocking of the active surface, a decrease in the total volume and average pore radius, specific surface area, and complication of the spent catalyst utilization process. In [2], Mo was extracted from the spent AKM catalyst using aqueous solutions of sodium and ammonium, carbonates and bicarbonates. When Mo was leached from spent catalyst (SC) samples with 0.5–2.0 M solutions of the indicated reagents, the degree of Mo extraction was 10–20%, after roasting in air with the formation of sulfur and carbon oxides and leaching under the same conditions, the degree reached 99.9%. The formation of oxides of sulfur and carbon during firing requires cleaning of the exhaust gases.

To reduce the formation of gases in the work used the oxidative roasting SC hydrotreating ACM with calcium oxide in an air atmosphere. The thermal properties of a mixture of SC with lime were studied by the methods of differential thermal analysis and thermogravimetry (DTA-TG). SC firing was investigated by the isothermal method in the temperature range 550-600 ° C for ground SC and 575 ° C for uncopper samples. The air flow rate was 3 l / min. The phase composition of the samples was determined using X-ray phase analysis (XPA) and chemical analysis. Used SC composition, wt. %: Mo 9.3 - 9.7, Co 3.04 - 3.13, C 7.2, S 9.3, Fe 0.12 - 0.15, Na 0.13 - 0.25, V 0 , 04 - 0.09, the rest is Al2O3. The firing products are CaMoO4, CaSO4, CaCO3, as well as the initial reagents CaO and Al2O3.

It was found that at a temperature of 575 ° C when using the CaO additive in an amount of 0.26-1 g CaO per 1 g SC, the degree of sulfur recovery reaches 96.1% at a value of 0.4 g / g SC. Under these conditions, the transfer of CO2 to calcium carbonate is 53%. It is shown that the rate of the process does not change with increasing temperature. The time to complete the firing process is 38-40 minutes for milled SC and 44 minutes for unmilled SC.

The data obtained showed that carrying out oxidative roasting of spent catalysts of Co-Mo / Al2O3 hydrotreating in the presence of lime can significantly reduce the emission of formed oxides of sulfur and carbon in this process.

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DIFFERENT CRITERIA FOR ASSESSING THE ECOLOGICAL STATE OF LAND

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Soil pollution is one of the global environmental problems of our planet. The urgency of the problem of environmental pollution with heavy metals is explained, first of all, by the wide spectrum of their action on the human body. The article describes the main criteria for assessing the ecological state of lands, which make it possible to identify the level of soil pollution, which, in turn, is important for determining rational methods to reduce the impact of pollution on living organisms and, above all, on humans.

Keywords: soils, chemical pollution, heavy metals, assessment criteria, background content, maximum permissible concentration, differentiated standardization.

More than 85 billion tons of waste enters into the environment every year. The wastes from industrial enterprises, transport, agricultural wastes (including pesticides), household wastes and atmospheric deposition of harmful substances, and others are among them. The main role in soil pollution is played by such components of technogenic wastes as heavy metals (lead, mercury, cadmium, arsenic, thallium, bismuth, tin, vanadium and antimony), pesticides and oil products [1]. The special significance of soil pollution lies in the fact that the soil is the starting point for the migration of toxic chemical elements from the environment into the human body [2].

At present, the question of the standards for the content of these elements in soils remains open. The problem of rationing these elements in soil and plants is extremely complex due to the impossibility of taking into account all environmental factors.

In the Republic of Belarus, a number of indicators are used to assess the level of soil pollution with heavy metals. The main criteria for assessing the ecological state of lands in this case are the following: the background content of chemicals in the soil, the maximum permissible concentration (MPC) and the approximate permissible concentration (APC) of a specific chemical, as well as differentiated standards for the content of chemicals in the land.

The background content is the content of chemicals in the soils of territories that are not exposed to technogenic impact or are experiencing it to a minimum. Using this criterion, it is possible to identify the excess of the amount of chemical substances in the soil in comparison with the territories which are not polluted by anthropogenic activity. The maximum permissible concentration is a maximum concentration of a chemical element and its compounds in the soil, which, when exposed to the human body every day for a long time, does not cause pathological changes or diseases at any time in the life of the present and subsequent generations. In 2019, the Republic of Belarus developed the Technical Code of Practice (TCP 17.03-06-2019 (33140) «The procedure for performing work on the differentiated standardization of the content of chemicals in the lands (including soils).» The principle of this standardization is reduced to consistently performed calculations to determine differentiated standards for the content of chemicals in lands (soils), which are a set of threshold values for the content of a chemical in soils for territories of various functional uses, taking into account various indicators (background content of an element in soil, the class of its hazard, land category, functional zoning of the territory, existing hygienic standards, granulometric composition of soils and their buffering capacity) [3].

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ECOBIOELECTROCHEMICAL TECHNOLOGY OF OBTAINING HYDROGEN FROM ORGANIC WASTE

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Annotation. Water purification technology is one of the uses of eco-bioelectrochemical systems and is widely developed by many research laboratories around the world. The use of photoelectrochemical cells as an additional source of energy allows the production of hydrogen in photobioelectrochemical systems without any external energy influences.Microorganisms-exoelectrogens present on the anode of photobioelectrochemical systems are universal biocatalysts. Virtually any organic compound can be consumed by microorganisms and used for respiration, resulting in the generation of an electric current.

Keywords: photobioelectrochemical fuel elements, exoelectrogens, ecobioelectrochemical hydrogen production, organic waste.

This paper analyzes the efficiency of hydrogen generation in a photobioelectrochemical system. Cathodic hydrogen recovery and overall hydrogen production characteristics were evaluated for a system operating with substrate concentrations: 5 mM, 7.5 mM, 10 mM. A silicon solar cell was used as an additional power source for the system. The high efficiency of destruction of organic components makes it possible to recommend photobioelectrochemical systems as an effective method for remediation of organic pollutants with the simultaneous formation of hydrogen.

In eco-bioelectrochemical systems (BES), as in a fuel cell, the substrate oxidation reaction occurs at the anode, and the proton reduction reaction occurs at the cathode. Oxidation of organic matter releases electrons that travel to the cathode through an external circuit doing electrical work. The chain ends with a balancing charge moving through the electrolyte, often in the form of protons.

According to their purpose, eco-bioelectrochemical systems are divided into microbial fuel cells (MFC), used to generate electricity, and microbial electrolysis cells (MEC), used to produce hydrogen.

The principle of operation of photobioelectrochemical systems is to combine the energy received from sunlight with the energy generated during the oxidation of organic substrates. There is a large group of microorganisms (so-called exoelectrogens) with a specific metabolic characteristic. During respiration, they can produce electrons and protons and carry them out of the cell. In BES, electrons generated by microorganisms are transferred to the anode and then through an electrical circuit to the cathode.

In microbial fuel cells, protons released from the substrate recombine with oxygen to form a water molecule. In microbial electrolyzers (eco-bioelectrochemical systems for generating hydrogen) hydrogen is formed during the reduction process at the cathode, therefore additional voltage must be applied to the circle in order to overcome the thermodynamic barrier of hydrogen generation [1].

Currently, many studies are focused on the development of photobioelectrochemical systems (PBES), which use whole photoelectrochemical solar cells or a photoelectrode to provide additional energy for eco-bioelectrochemical hydrogen production [2-5].

The possibility of using a dye-sensitized solar cell (DSSC) to power a microbial electrolysis cell (MEC) has been demonstrated. Stable hydrogen generation has been achieved without an external power source. As an alternative bias, we used DSSC created by a combination of a TiO2 film containing a ruthenium dye and platinized FTO glass with a redox pair I- / I3- (Voc = 0.65 V). The hydrogen conversion efficiency for this cell reached 71.3–77.0% (for a simple cathode) and 79.3–82.0% (carbon felt containing platinum) at> 0.7 V [2].

It is also possible to connect DSSC to several MECs (several MECs were powered by one DSSC). Hydrogen production took place simultaneously in all connected MECs with the conversion efficiency of the substrate (acetate) to hydrogen in the range from 42% to 65%. The system produced hydrogen by irradiating a solar cell with light [4].

As described in [4], electrochemically active microorganisms generate electrons in the FBES with SCSE during the oxidation of organic compounds. Electrons are transferred to the anode by the extracellular structures of microorganisms and then enter the external circuit.

Electrons produced by microorganisms regenerate oxidized DSSC dye molecules.

When irritated, the electrons in the molecules of the ruthenium dye DSSC are excited. The electrons detached from the dye molecule are injected into the conduction band of titanium dioxide nanoparticles sintered on the photoelectrode of a solar cell.

The injected electrons are quickly transferred from the TiO2 photocathode to the MES cathode. This increases the energy of the MEC cathode, reaching a level high enough to reduce protons at pH (7.0). The excited electrons of the solar cell photoelectrode are involved in the production of hydrogen at the MEC cathode.

It has also been shown that DSSC (Voc 602 mV) can only produce hydrogen when electrochemically active bacteria oxidize the nutrient substrate with the simultaneous generation of an electric current. When the experiment was carried out without acetate, the cathodic potential of the MEC was about -340 mV compared to Ag/AgCl under light irradiation. This potential is too high for the reduction of protons at neutral pH (7.0) [5].

In another study [6], a photobioelectrochemical system based on a photocathode with an array of p-type Cu2O nanowires was investigated. The MEC, based on the synergistic effect of a bioanode and a photocathode, demonstrated significant generation of a current of 200 μA at zero bias under white light illumination of 20 mW/cm2. In this device, the photocathode and bioanode are coupled by matching the redox potentials of bacterial cells and electronic bands of semiconductor nano-wires [6].

Exoelectrogenic microorganisms can consume a wide range of organic compounds, including sugars (glucose, sucrose, xylose), organic acids (acetic, formic, propionic), carbohydrates, fatty acids, etc.

Not only can simple substances be absorbed by the microbial association growing at the anode, but also complex substrates such as waste water, liquid organic waste, landfill leaching. When not only exoelectrogens are present in the anodic biofilm association, the efficiency of substrate consumption will be higher (a variety of metabolic pathways allows more types of compounds to be converted), but hydrogen production may be low. Most organisms found in the anode biofilm are capable of converting organic compounds to acetates. Only a small group of microorganisms (including exoelectrogens) can consume acetates. So, acetate is often used as a nutrient source for experimental purposes.

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ECOLOGICAL MAPPING OF WATER USE IN THE CENTRAL FEDERAL DISTRICT OF THE RUSSIAN FEDERATION

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One of the most difficult problems of our time is the water use; in particular, the problem of using drinking water, as well as treating and discharging waste water. The research presents the results of a spatial analysis of the ecological situation in the most densely populated district of the Russian Federation, which makes it possible to objectively assess and possibly attract public attention to the problems of water use in the regions.

Keywords: water use, ecological mapping, rational environmental management, environmental monitoring, environmental safety.

The Central Federal District is a district with limited water resources due to the dense population of constituent regions. Due to the course of the territorial study of water use, adhere to the general sequence of the analysis carried out for the country, then the following facts can be noted. First of all, it attract attention to the fact that in recent years, the largest volume of water intake from water bodies for all needs, as before, fell on manufacture located in the Central Federal District [2]. The volume of water withdrawal in this enlarged region increased by 0.3 billion m3, or almost 3%, and amounted to 11.65 billion m3 compared to the previous year. The share in the Russian indicator was almost 17%. In the reporting 2017, this water withdrawal decreased by another 0.13 billion m3, which is 1.1% lower than in the previous year; the total amount of water withdrawn was at the level of 11.52 billion m3 [1].

The situation with water use in the Central Federal District is rather ambiguous. A spatial analysis should be carried out by drawing up a series of water use maps that will reflect: wastewater disposal and discharge of contaminated wastewater; general use of fresh water; water use structure.

The volume of water withdrawn in the federal district as a whole in 2017 amounted to 11,519.42 million m3. The largest indicator of river flow water resources in 2017 was noted in the Ivanovo region (76.3 km3 / year), with a relatively small amount of water taken from natural sources (123.55 million m3), the lowest - in the Belgorod region: 2.3 km3 per year and 318.37 million m3, respectively. In 2017, the volume of discharge was 3,143.29 million m3. The largest contribution to the volume of polluted wastewater discharge was observed in Moscow (844.57 million m3). The main share of water use is made up of production needs, household needs are in second place [1].

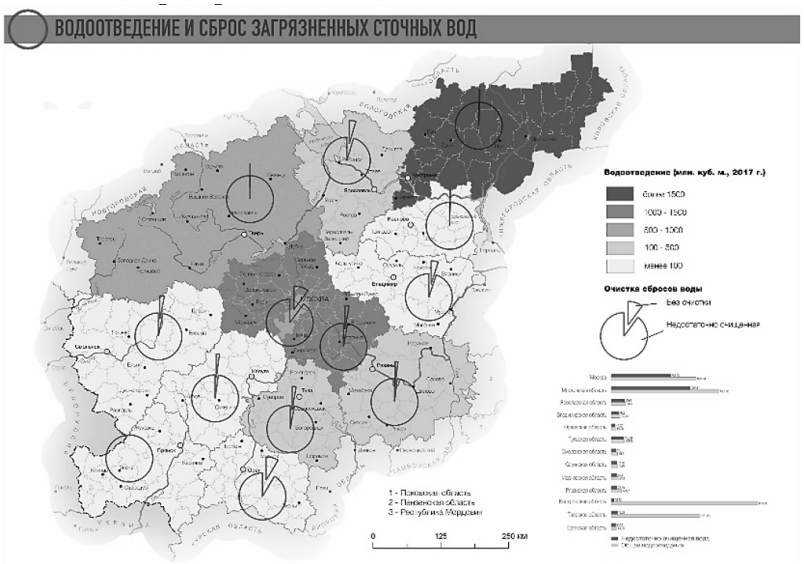

Fig. 1. – The map of wastewater disposal and discharge of contaminated wastewater

In conclusion, we note that in order to increase public awareness of the main problems of the development of the water management complex by information and communication activities and propaganda should be implemented using the currently available and widespread cartographic materials for a multilateral dialogue of all stakeholders.

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ECOLOGICAL VARIATION OF SCOTS PINE WOOD ELEMENTAL COMPOSITION

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The results of a quantitative analysis of concentration of a range of elements in the Scots pine wood from different types of forest are provided in the work.

Keywords: Scots Pine, microelement composition, X-ray fluorescence analysis, environmental factors, comparative analysis.

In our research, we held to the view that the variation of elemental composition of plants was directly connected with moisture and soil fertility in a habitat.

The purpose of the work was to perform a comparative analysis of quantitative concentration of a range of elements in the pine wood from different types of forest.

The research subjects were the Scots pine coniferous phytocenoses growing in the territory of the State Envi-ronmental Institution Berezinskiy Biosphere Reserve. In general, 7 temporary sample plots were set out. The exper-imental objects examined included nearly the whole spectrum of natural pine forests found in the territory of the Republic of Belarus except for lichen pine forests. In the moisture and soil fertility range, all sample plots are locat-ed within a triangle with the following in its corners: ericetal pine forest (non-fertile dry soil), bog moss pine forest (raised bog), and sorrel-family pine forest (fertile soil with optimal moisture). On each sample plot, drill cores (2 from each tree) were extracted from 20 trees: 1 – at the end of April, 1 – at the beginning of September. In order to avoid contamination of wood with metals which the drill is made of, the core outer surface was cut off with a knife with a ceramic blade and smoothed out with the help of a rotary tool with a tungsten carbide tip. Afterwards, the cores were finely divided, digested, and an X-ray fluorescence analysis was performed.

The results obtained show that the ecological variation of a range of elements in the pine wood varies widely. The significance of variation in Ag, Al, Ba, Cd, Cr, Cu, Fe, Mo, Mn, Ni, Pb, Sr, Ti, and Zn is confirmed by statistical calculations. Thus specific biogeocenotical site conditions, including, soil and hydrological conditions, apart from general climatic factors, significantly affect biochemical processes in plants, which is reflected in the elemental composition the variations in which can be rather significant even within the territory of two nearby sites.

In general, a direct examination of the ecological variation of the pine wood composition with respect to moisture conditions with gradual transition from dry to semi-wet and wet site conditions showed a definite tendency of elemental concentration variation. Thus we noticed the reduction of Ca, K, and Mn concentration in the condi-tions of growing moisture, which must be the effect of poor nutritious substrate and stagnant moisture in a bog. The latter results in the dying-off of part of roots, thus to the decrease of the nutrition rate. However, our research showed that a different picture could be observed in a range of elements in the moisture variation direction exam-ined. Thus along with the reduction of concentration of a range of elements, a dramatic increase of Zn concentra-tion is observed. In the spring and autumn samples, the highest Zn concentration is in the wood of pines growing in stagnant moisture conditions. Besides, for temporary sample plot No. 7 (stagnant moisture conditions), the high Ag concentration must be accounted for by the role of this element in the development of resistance to fungus diseases in trees.

By a principal component analysis, 3 homogeneous groups were determined in temporary sample plots 1-7 which remained the same in both spring and autumn periods. The graphic presentation of the research subjects showed that such differentiation was much like the types of the Scots pine tree ring chronologies distinguished in the Republic of Belarus [1]:

- pine forests on unstable and normal soils (Pinetum cladinosum, Pinetum vacciniosu, Pinetum callunosum, Pinetum pleurozoisum, Pinetum pteridiosum, Pinetum oxalidosum, Pinetum myrtillosum);
- pine forests on overmoisturized soils (Pinetum polytrichosum, Pinetum ledosum);
- pine forests on raised bogs (Pinetum caricoso-sphagnosum, Pinetum sphagnosum).

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EFFECT OF HEAT TREATMENT APPLIED AT DIFFERENT TIMES ON THE PHYSICOCHEMICAL PROPERTIES OF THE SUNFLOWER OIL

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In this project; the effect of heat treatment applied at different times on the physicochemical properties of the oil will be investigated. Viscosity values of sunflower oil were found between 53.55 mPa.s and 63.35 mPa.s. Total amount of polar substance increased from 0.33 % to 2.83 % with heat treatment. Free acidity and peroxide values were determined as 0.17-0.28 % and 0.25-1.00 meq O2/kg, respectively. Nowadays, fried products have an important place in the food industry and in everyday life. Frying is a process where oil is used as a heat transfer medium in the preparation of foods. Although the most important change seen during cooking of foodstuffs by frying is the volatility of the water it contains, in fact, there are some positive and negative changes in the physical and chemical structure of both the oil and the food being cooked.

Keywords: Heat treatment, acidity, peroxide value, viscosity, sunflower oil.

Various fried products have been consumed by different cultures for centuries, and some are traditionally prepared. The consumption of fried products is increasing gradually, especially with the use of frozen foods and the development of the ready food market. During the frying process, the thermal and physicochemical properties of the oil and food used, the shape of the food, the temperature of the oil and the pressure are factors affecting heat and mass transfer. Factors such as air oxygen, high temperature applied and the degree of unsaturation of the oil lead to various reactions in the oil. As a result of the numerous oxidation, polymerization and thermal degradation reactions occurring in frying oils that are used repeatedly at high temperatures, many important changes occur in the physical, chemical, nutritional and sensory properties of the oils. The aim of present study was to determine the stability conditions of frying oils.

Viscosity, total polar substance, free acidity value and peroxide value of sunflower oil were determined according to method stated by Akbulut et al. [1], Xu et al. [2], Anonimous [3] and Anonomous [4], respectively. The viscosity values of the oil samples were found between 53.55 mPa.s and 63.35 mPa.s. The highest viscosity value was found as 63.35 mPa.s on the 3rd day 30 minutes heat treated oil sample. The viscosity change during frying is one of the important signs of oil deterioration along with the color change. Total polar matter contents of oil samples were determined between 0.33 % and 2.83 %. The heat treatment applied to oils causes the formation of various oxidation products such as saturated and unsaturated aldehydes, ketones, hydrocarbons, lactones, alcohols, acids under the influence of temperature and oxygen. Free acidity values of sunflower oil were found between 0.17-0.28 %. The acidity value, which was determined as 0.17 % in the samples treated with heat treatment for 15 minutes on the first day, showed some increase with the increase of the heat treatment time, and no significant difference was detected on the other days and times. Ramli et al. [5] reported that free acidity in palm olein, sunflower and corn oil was reported as 0.55 %, 0.11 %, 0.58 % after 5th frying, after frying at 180^{o}C using fries. When the peroxide results of the oil samples were examined, the values were determined between 0.25 meq O2/kg and 1.00 meq O2/kg. While the highest peroxide value was found on the 3rd day for 30 minutes in the heat treated sample (1.00 meq O2/kg), no regular increase or decrease was observed depending on the heat treatment time applied. It has been stated that the hydroperoxides formed due to this situation are broken down by heat and secondary oxidation products are formed.

Conclusion. In the study carried out on determining the stability conditions of frying oils, heat treatment applied at 180°C for 15 days and 30 minutes caused differences in viscosity, total polar matter, acidity and peroxide values of sunflower oil. Since the oils rich in unsaturated fatty acids are sensitive to oxidation, unreasonable reaction products are formed in the environment as a result of repeated use of them for a long time in frying processes. The oils used are of great importance due to their ability to penetrate fried foods. For this reason, the usage times of frying oils should be monitored very carefully so that the frying oils consumed with fried foods do not cause nega-tive effects on human health.

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EFFECT OF WIND DIRECTION ON METHANOL CONTENT IN ATMOSPHERIC AIR

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Abstract. The study deals with the problem of changing the concentration of methanol with a constant uniform release from the petrochemical industry. Models of linear regression of methanol concentration changes from the cosine of the wind direction are constructed. The initial data are the values of the angle of the wind direction and the concentration of methanol in the air of the urban massif obtained by the automatic station for monitoring atmospheric air.

Keywords: Methanol, regression analysis, multiple regression, cross-correlation function, atmospheric air.

The initial data of the study are arrays of hourly values of methanol concentration, wind angle. As research methods, correlation and regression analysis was used to establish the direction of influence of each meteorological parameter on the change in the concentration of methanol in the atmospheric air of the city. A graph of the dependence of the concentration of the toxicant in the air on the cosine of the angle of the wind direction in the modified coordinate system was built (Figure 1).

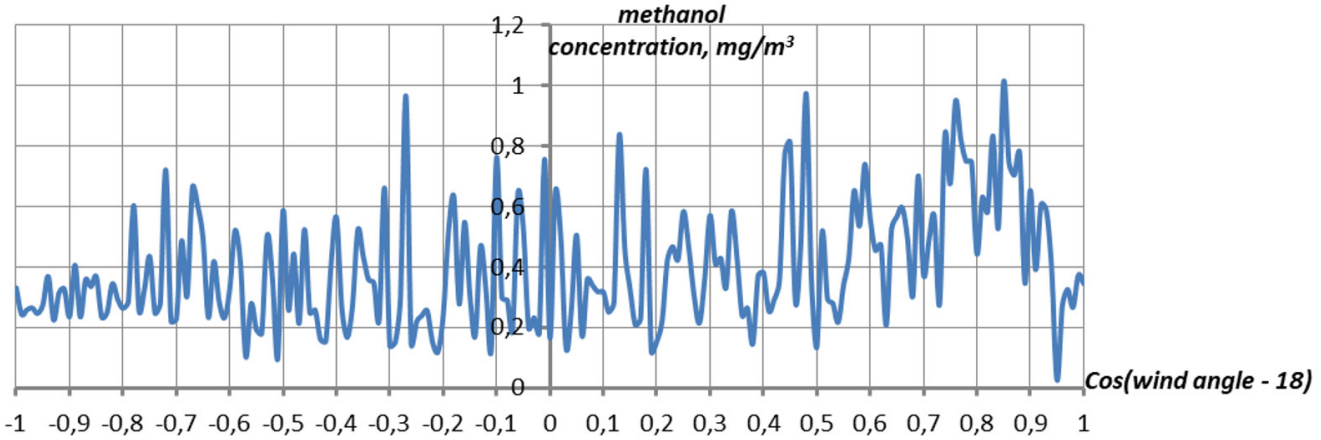

Fig. 1. – Graph showing the values of the average concentration of methanol at different values of the cosine of the wind angle

According to Figure 1, it is clearly seen that the concentration of methanol in the air increases with a cosine in the range of 0.6 ... 0.9, which corresponds to the north and northwest wind directions. The linear dependence of the concentration of methanol in the air and the cosine of the wind direction angle has the following parameters:

R^2	[cos(γ)]	Absolute term	F	p
0,001	0,116	0,453	24,010	0,000

where γ is the angle of the wind direction at a given time, R2 is the coefficient of determination, F is the Fisher parameter, p is the probability H0, H0 is the hypothesis about the independence of the random values of the initial data and the parameter.

In order to identify the delay time of the influence of each individual meteorological parameter, cross-correlation functions were built between the time series of methanol concentration and each meteorological factor (Figure 2).

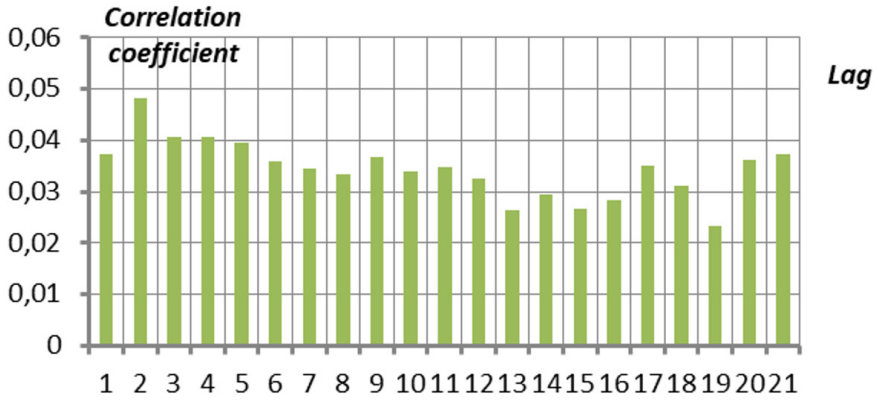

Fig. 2. – Graph of the cross-correlation function between the concentration of methanol in the atmospheric air and the cosine of the wind angle

According to the graph of the cross-correlation function, the concentration of the toxicant at a given time is influenced by the wind direction over the previous hour. The parametrs of linear regression depending on the cosine of the wind direction angle have the following meanings:

R^2	[cos(γt-1)]	Absolute term	F	p
0,002	0,14	0,458	38,485	0,000

where is the angle of the wind direction at time t-1.

Thus, the analysis of the effect of the wind direction on the toxicant content in the atmospheric air of the city on the basis of the cross-correlation function made it possible to increase the adequacy of the linear dependence by 2 times.

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ENVIRONMENTAL FRIENDLINESS OF USING ELECTOCARS

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Abstract: this paper discusses the issues related to the environmental friendliness of electric vehicles.

Keywords: ecology, electric car, environmental pollution.

An electric car is an unconventional car which main difference from traditional cars with diesel, gasoline or gas engines is an electric type of engine that runs on energy from rechargeable batteries. Today, they are becoming more and more popular in the world where reducing carbon dioxide emissions and environmental pollution is a significant problem for many people. The research has shown that electric cars are better suited to the environment. They emit fewer greenhouse gases and other pollutants into the atmosphere during their lifetime than petrol or diesel cars. To help the environment we live in, an electric car is a big step forward.

As the interest in electric vehicles is constantly growing, there are many questions about how eco-friendly they really are. Considering the production problems and the methods of production of an electric car, it is necessary to pay attention to some facts.

First, the production of electric vehicles consumes a lot of energy. The emissions generated during the production of an electric car are generally higher than those of a conventional car. This is due to the production of lithium-ion batteries, which are an integral part of an electric vehicle. More than a third of carbon dioxide emissions over the entire life of an electric car are generated by the energy used to make the car itself [1]. The research done by the Ricardo consulting company has shown that the production of a fuel car includes emissions equivalent to 5.6 tons of CO2, while for the average electric car this figure is 8.8 tons of CO2 [2]. Also, despite the fact that electric cars do not emit many harmful gases, they can run on electricity that they received from burning fossil fuels, which actually deprives them of climate benefits. Scientists have found that for every kilowatt-hour of energy generated for electric vehicles, up to 274 grams of carbon dioxide are emitted into the air [3]. For comparison, when burning gasoline in internal combustion engines, this figure does not exceed 180 grams.

The second point is that electric cars are too expensive, so a small number of consumers find vehicles that are affordable on the market and really attractive. One of the most important factors contributing to this high cost is the current prevailing battery technology. Batteries make up almost half the cost of an electric car. Although the cost of batteries has declined over the years, they are still quite expensive. As noted above, cars use lithium-ion power sources. Today, such batteries are common in consumer electronics and power systems (mobile phones, laptops, digital cameras, etc.) Lithium-ion battery is the best option for powering electric vehicles.

However, such batteries are extremely harmful to the environment; they contain toxic chemicals that can't just be thrown into the landfill. Taking into account the relative novelty of the global electric vehicle market, the issue of battery recycling is becoming relevant only now. It is estimated that today only 5% of lithium-ion batteries used in consumer electronics are recycled [4]. The increase in the mass of «used» batteries for their original purpose, especially from electric vehicles, will continue non-stop. Thus, finding ways to reuse the battery becomes more and more relevant. It is necessary to reduce the need for additional resource extraction and to protect the environment.

It follows that the problem of the impact of vehicles on the environment needs to be addressed in a more comprehensive way. Just switching from traditional cars to electric vehicles is not enough: the entire energy system should be reviewed and rebuilt, and ways to obtain and store electric energy in an environmentally friendly way should be sought.

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ENVIRONMENTAL POTENTIAL: SCIENTIFIC KNOWLEDGE AND UNDERSTANDING OF SUSTAINABILITY

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The article focuses on the role and use of scientific knowledge in order to form a state policy on lean nature management in the interests of ensuring the daily life of people and the future development of mankind, as well as preserving a sustainable ecosystem through the use of environmental innovations.

Keywords: sustainable ecology, environment, scientific potential.

The problem of environmental protection plays an important role in ensuring the socio-economic stability of the state. The situation in the modern world now demonstrates the need to preserve the environment through environmental innovations in Russia and abroad. To meet this requirement, it is important to expand scientific understanding of the world, improve long-term scientific assessments, strengthen scientific capacity in all countries, and ensure that science meets the emerging needs of society [1].

Research on topics that characterize a significant set of natural and partly social phenomena has already generated potential, including young talented researchers with scientific results. Today in Russia, there are many activities aimed at expanding scientific knowledge in the field of ecology in the context of the triune: economic, social and environmental components of sustainable development of territories [2]. Some of the most popular conferences in the environmental aspect can be cited as an example: «Current problems of ecology and nature management» (Russia), «Environmental education and environmental culture of the population» (Czech Republic), «Congress on Earth and environmental Sciences» (Switzerland) and others. It is observed that public administration also needs initiatives for in-depth study of the issues of sustainable development and the introduction of environmental innovations, so grants are allocated for thematic projects of basic scientific research. It should be noted that not only scientists are increasingly expanding their knowledge in such areas as climate change, increasing resource consumption, demographic trends and environmental degradation. Taking into account the territorial division of Russia, there is a practice of applying regional programs and projects «Ecology XXI century» with the participation of young researchers who raise issues of solving problems in the field of ecology and nature management using the latest research methods and modern technical means [3]. In addition, one of the ways to form an ecological consciousness of a person is to conduct public events – annual international eco – actions: «Earth Hour», «Day without a car», «March of parks», etc., aimed at protecting the environment-from cleaning reservoirs, planting trees to abandoning the car for one day [4].

The analysis made it possible to conclude that the degree of development of a balanced sustainable innovation economy largely depends on its scientific potential, which ensures the implementation of fundamental knowledge in real technologies and inventions.

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ESTIMATION OF ECONOMIC EFFICIENCY OF SORPTION FILTER IMPLEMENTATION FOR WASTEWATER TREATMENT AT THE PERFUME AND COSMETICS MANUFACTURE

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We have estimated the economic efficiency of a «FSB» sorption purification filter implementation to reduce the concentration of oil products in wastewater.

Keywords: concentration, economic efficiency, oil products, sorption filter.

The company under analysis specializes on the production of cosmetic products, namely toothpastes, creams and washing foams. Toothpaste and cream production is the main scope of the company. The essential problem of the enterprise analyzed is exceeding wastewater oil and grease levels. The oil and grease concentrations are constantly at the discharge standard threshold limit. This problem is related to the fact that commodities that include oil products are produced in the larger volume in comparison to the production of other goods. The commodities that include the highest share of oil products are as follows: creams, balms, waxes for nails and cuticles. Therefore, the concentration of pollutants depends on the technological process at the company at a certain time.

According to the test results, the actual oil and grease and suspended solids values before purification are 3.30 mg/dm3 and 602.3 mg/dm3 respectively. After purification the value of 0.9 mg/dm3 and 400mg/dm3 are observed, guideline values being 0.9 mg/dm3 and 400mg/dm3 respectively. Thus, wastewater treatment equipment that does not operate properly is the core of the enterprise's problem with wastewater oil and grease indices. According to the company's data, the estimated effluent is 60 m3/day or 3.6 m3/hour. The wastewater does not contain radioactive or explosive substances. During the analysis, it is found that it is possible to efficiently reduce the concentration of organic substances using sorption filters.

The economic efficacy assessment of the environmental protection measures implementation, namely, sorption purification filter installation, was made according to the method which determines the environmental and economic efficiency of capital investments in environmental protection measures based on reducing environmental payments. The choice of equipment is based on its characteristics, in particular: the estimated flow rate of wastewater per day (60 m3/day), filter size (4 m2), high degree of purification. Purification using a sorption process is one of the most efficient methods of wastewater treatment from organic pollutants. Thus, this filter can purify wastewater to a concentration value up to 0.3 mg/dm3 with an actual value of 0.9 mg/dm3.

The assessment is conducted using a method, «Determining the environmental and economic efficiency of capital investments in environmental protection measures based on reducing environmental payments», by A.V. Neverov and T.P. Vodopyanova. The economic result from the implementation of environmental protection measures is determined. It is calculated on the basis of reduction of payments for environmental pollution.

The main indicators used are the following:

1) Total water consumption for the period of 2015-2019 QA=23 400 m^3,
2) Total environmental payment for the wastewater discharge into the sewerage system before the sorption filter installation H_1=13.394 rubles/year,
3) Total environmental payment for the wastewater discharge into the sewerage system after the sorption filter installation H2=6.697 rubles/year,
4) Depreciation charges A=0.16 rubles,
5) Annual revenue growth ΔD=0, because the volume of products and water has not changed after the installation of new filtering equipment,
6) Annual operational costs C=64.16 rubles/year,
7) Capital expenditures K=21.400 rubles.

The economic effect obtained from the installation of a sorption filter is calculated as follows:

$$P= H_1 - H_2 + ΔД-C,$$

P = 13,394-6,697+0-64,16= 6,633 rubles.

Then the overall economic efficiency of capital investments in environmental protection measures to reduce environmental payments is:

$$Экн= Р/ К,$$

Экн= 6,633/21,400=0,3.

A simple payback period is the inverse value of economic efficiency:

$$Т=К/Р,$$

Т=21,400/6,633=3,2 years.

Thus, according to our calculations, the installation of this filter is cost-effective; filter characteristics are suitable for the company. The installation of a sorption filter and other similar equipment to reduce the oil and grease values is economically feasible in these conditions and cost-effective in terms of payback periods.

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ESTIMATION OF THE EXPOSURE DOSES FOR PEOPLE WHO CONTACT WITH THE PATIENTS WHO HAVE PASSED A COURSE OF RADIONUCLIDE THERAPY

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This article covers the topics of estimation of the exposure doses for people who contact with the patients who have passed a course of radionuclide therapy for thyroid cancer with use of I-131 at the Minsk City Oncologic Dispensary healthcare institution Nuclear Medicine Department. Episodes of typical scenarios for social behaviour of the patients upon their discharge from the clinic were reviewed. Calculated and experimental estimations of exposure rates were acquired and analyzed for different types of people who contact with the patients after their discharge. Conclusions were made about the acceptability of the increase of criteria for the discharge of the patients who have passed radionuclide therapy with use of I-131.

Keywords: Radionuclide therapy, thyroid cancer, nuclear medicine, dose rate, iodine-131.

Radionuclide therapy is an effective way to treat oncology both on its own and combined with other means. When combating malignant tumors, methods of adressed delivery of radiopharmaceutical drugs (RPh) is used. RPh contains radionuclide and is delivered to an affected organ. This technology helps avoiding the exposure of the whole body in favour of selective destruction of tumours.

Radionuclide therapy uses different RPh, which have different pharmacokinetics that define where, when and how they are accumulated. RPh act locally in a certain organ by directly exposing and destroying malignant tissues [1].

Thyroid cancer is a malignant tumour which develips from the elements of glandular epithelium of the thyroid.

Nowadays radionuclide therapy with the use of I-131 takes a worthy place among different methods of radiotherapy. Therapeutic effect is based on the radioactivity of the I-131 isotope which exposes the whole thyroid with β-radiation from the inside [2].

Object of interest of the article is the fact that a patient who passes a course of radionuclide therapy becomes a source of ionizing radiation and radioactive pollution of the environment after the administration of RPh, which may present a radiation hazard to the personnel, relatives and other people.

Discharge of the patients from nuclear medicine departments is made in accordance with the governing documents that regulate the radiation security in the Republic of Belarus [3]. Nowadays, there is no defined

criteria for the discharge of the patients after radioiodine therapy in the Republic of Belarus. All institutions apply the criteria of the exposure dose that doesn't exceed 3 μSv/h at 1 m from the patient.

Integrated Regulatory Review Service (IRRS) IAEA mission that was held in the Republic of Belarus in October 2017, 3–14 has statedd that there is no defined criteria for the discharge of the patients after the therapy with the use of I-131 in our country, and has also stated that the used criteria for discharge (exposure dose of 3 μSv/h at 1 m from the patient) is too low and leads to a lengthy hospital stay. Thus, one of the recommendations of the mission is to specify the criteria for the discharge of the patients after I-131 therapy.

20 patients who were admitted into the Nuclear Medicine Department of the Minsk City Oncologic Dispensary healthcare institution for a course of radioiodine therapy in 2019 were taking part in the study that is covered by the article. The study includes the patients diagnosed with differentiated thyroid cancer.

Exposure dose measurements were taken at 1 m away from the patients at the level of their thyroid three times a day after administering I-131.

The following conclusions were made from the plotting of the dependencies of the decrease of exposure dose:

1. 60 to 80 % of the I-131 activity is decorporated naturally within the first day.
2. Decrease of the exposure dose can be described as an exponential correlation.

Based on the acquired data and developed episodes of typical scenarios of social behaviour of the patients that were discharged from the clinic the authors have made an estimation of the radioactive burden for the people contacting with the patients. Final data says that the patient discharge criteria may be increased up to 20 μSv/h at 1 m from the patient given other radiation sources are limited for the contacting people and the patient's social activity after the discharge is limited as well (typical code of behaviour after the discharge is developed).

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FEATURES OF BIOFILM FORMATION ON THE SURFACE OF A POLYMER MATERIAL BASED ON LACTIC ACID

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The purpose of this work was to evaluate the biological fouling of polymer coatings based on lactic acid and a micro-reinforcing filler of natural origin from the class of metasilicates.

Keywords: micro-reinforcing filler, biofilm, microorganisms.

Nanostructured composite materials consisting of polylactic acid and mineral fillers acquire a significant improvement in properties compared to the properties of a pure polymer. In this work, we used films containing a layered natural mineral (mineral concentrate SiO_2, TiO_2, K_2O, MgO) from the class of metasilicates. When using this filler, the strength of the biocomposite is preserved, which affects the deformation and strength properties during the operation of the material.

To determine the degree of biological fouling, the test samples must be placed in the soil environment and kept for 20 days, after which the test samples are examined for the presence of biofilm that has grown on them. In this work, gray forest soil was used as one of the most common types of soil in our region. Loamy soil was

also used for comparison in the experiment. The number and diversity of organisms determines the degree of biodegradation of the studied material.

Polymer compositions were removed from the container after the activation period of the soil microflora. The polymer surface was washed off. The next step was to plant on the surface of the nutrient medium. The cups were removed from the thermostat after 48 hours of incubation, followed by counting the number of microorganisms in 1 g of soil.

According to the results of the total number of microorganisms in 1 g of soil, it was found that microorganisms of gray forest soil (medium loam) use polymer samples more intensively as a substrate than microorganisms of loamy soil with an admixture of sand.

Films containing SiO2, TiO2, and K2O mineral concentrate are less susceptible to microbial fouling in loamy soil, while films containing SiO2, MgO, and TiO2 mineral concentrate showed the worst results in gray forest soil.

This allows us to conclude that soil microorganisms use polymer sample components more intensively as a substrate in gray forest soil (medium loam).

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HARMFUL WORKING CONDITIONS OF MEDICAL INSTITUTIONS

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This article discusses hazards to the health of medical stuff and patients of medical institutions that arise when interacting with medical equipment and instruments. In particular, hazards of a biological, physical and chemical nature are considered.

Keywords: biological hazards, physical hazards, chemical hazards, medical equipment, healthcare settings.

Health care workers, across a wide range of tasks, are potentially exposed to many occupational risks, including physical, chemical and biological health hazards. In some cases, exposure to occupational risks may be related to occupational diseases or accidents at work. At the same time, biological occupational diseases occupy a special place in terms of prevalence in the health care sector [1].

Biological hazards. Employees of clinical laboratories are exposed to biological threats to health (infectious contamination through blood, airborne droplets, fecal-oral or contact) when interacting with processed biological materials during surgical or invasive procedures, when taking tests from patients, as well as during clinical examinations due to poorly disinfected instruments, ingestion of blood or other organic fluids through damaged skin or mucous membranes.

Physical hazards. Ionizing radiation is one of the most serious physical threats in health care institutions, affecting a lot of specialists from different departments (radiotherapy, nuclear medicine and radiology). A high concentration of ionizing radiation can lead to burns, cataracts, infertility, genetic abnormalities in future generations, and, with prolonged exposure, can cause cancer. Non-ionizing radiation is another significant physical risk factor for healthcare workers. Exposure to non-ionizing radiation with active use of the devices leads to problems with vision and hearing, allergies, headaches, sleep disturbances and increased overall fatigue.

Chemical hazards. If safety measures are not followed, the chemicals used in the diagnosis and treatment of patients can be hazardous to the health of not only the patient, but also the medical worker. Thus, cancer fighting 0drugs are one of the main sources of an increased risk of cancer among medical stuff and laboratory workers.

Exposure to medical equipment. Biomedical and engineering specialists are responsible for the use and maintenance of medical equipment (diagnostic, therapeutic, surgical instruments). Poor equipment maintenance increases the risk of errors in the diagnosis of diseases and biological contamination of patients and service stuff [2]. Therefore, multi-stage disinfection procedures and different plans are developed for specific types of medical equipment. Excessive radiation exposure and repeated errors in the use of X-ray machines, tomographs and like this can exacerbate health problems for patients and staff, since problems associated with radiation are sensitive to exposure time.

Principles of safety assurance in the operation of medical equipment. For the safety of medical stuff and patients, safety rules should be observed: to maintain a safe radioactive background, it is necessary to adhere to the permissible exposure limits and take measures when they are exceeded; monitor the level of training of specialists working with emitting equipment, and the timeliness of improving their qualifications. According to the WHO guidelines, in order to minimize the risks associated with the use of medical equipment, it is also necessary to carry out pre-market control, in which clinical trials of all equipment are carried out; use the services of only registered suppliers to reduce the likelihood of purchasing low-quality equipment; dispose of equipment and tools at the end of their service life.

Output. To prevent injuries and excessive exposure of medical stuff and patients, a scrupulous knowledge of the safety protocols is required, as well as minimization of contact with radioactive materials. To minimize the risk of biological and chemical threats to the health of medical stuff and patients during contact with medical equipment and instruments, it is necessary to monitor the institutions' compliance with the relevant safety and health standards in order to prevent threats to the health of both patients and employees.

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HIV PATIENTS EPIDEMIOLOGICAL EVALUATION IN THE GOMEL REGION

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An assessment of the territorial features of the current epidemic process of the spread of HIV among the popu-lation of the Gomel region, which is of particular scientific and practical interest, is carried out. The analysis of the spread of this type of disease in the specified region of Belarus allows us to identify priority areas of prevention and behavior among certain groups of infected people, to determine methods and forms of disease prevention, among which, their main task is the constancy and consistency of preventive measures. Gomel region includes 22 administra-tive units, consisting of 22 cities and 21 districts. In this regard, the study of the territorial features of the epidemic pro-cess of HIV infection is of scientific and practical interest. Epidemiological analysis of HIV infection in the Gomel re-gion allows to determine the priorities of prevention. Features of the behavior of infection risk groups determine the methods and forms of prevention, but their main task is the consistency and sequence of preventive measures.

Keywords: HIV infection, monitoring, statistics.

HIV infection is an infectious disease that has a pandemic spread, which still continues to develop, despite all the efforts made by the world community to contain it. The implementation of epidemiological surveillance of HIV infec-tion is the main aspect for determining the strategy for countering this epidemic and evaluating the effectiveness of measures for its профprevention, diagnosis and treatment.

Materials for studying this problem were the results of laboratory tests of a number of population contingents. The Gomel region on HIV infection, maps in the epidemiological investigation of the emergence and development of HIV-infected children, outpatient charts and patient histories ofdetected HIV-infected children, birth histories and ex-change cards of their mothers, acts and certificates of sanitary-epidemiological monitoring, epidemiological surveil-lance, as well-as accounting documents of medical institutions in the region. The study used methods of epidemiological analysis: retrospective and current, as well as laboratory research methods: enzyme immunoassay and immunoblot-ting.

Results: Assessment of ecological and epidemiological indicators of HIV infection spread among the population of the Gomel region in the period of 2017 - 2019 analysis revealed an increase in the level of this type of disease in the region. The incidence rate increased from 50.0cases in 201.77 to85.8.5 cases in 2019 per 100,000 population. Thus, the indicators of the overall primary HIV infection rate in the population of the Gomel region

increased by 1,66. According to the administrative districts of the region, the highest incidence rate for the study period was observed in Gomel and Zhlobinsky district – 9.4 and 7.5 cases, respectively. In Svetlogorsk and The Mozyr district detected 6.6 and 5.3 cases, respectively. In Kalinkovichi and Rechitskom district – 3,6 and 3.5 cases per 100000 population, respectively. The as-sessment of indicators of the level of morbidity of residents of the region allowed us to establish a significant increase in registered HIV infections of the male population during the study period. There was a trend of increasingя incidence from 29.4 cases to 36.1 per 100,000 population.

Conclusions: In conclusion, it is reasonable to conclude that the main directions of preventive measures used by specialists are organizational and methodological support and training of personnel; prevention of nosocomial infec-tion; prevention among high-risk groups of infection; prevention among students and the population of the region as a whole. Organizational and methodological work should be presented in the form of interdepartmental interaction at the territorial level, approval of regulatory documents, preparation of methodological literature, conducting training lec-tures, seminars, classes with a test control of the level of knowledge [1].

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HYDROPHOBIC SORBENT BASED ON CHITIN AND POLYURETHANE FOAM TO CLEANING WATER FROM THE OIL POLLUTION

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In recent years, oil pollution in the water environment is one of the urgent problems that need to be solved. Negative effects of oil pollution may be mentioned as mass death of aquatic organisms, seriously impacts on aquatic ecology, tourism, transportation, and marine economy [1]. Oil pollution is also significantly affecting human health; it is the cause of respiratory damage, causes disorders, and damage to the excretory, and digestive system, reduce immunity, increases cancer risk, affect fertility, and neurological effects when humans are exposed to oil [2]. Meanwhile, the oil pollution in the water environment caused by water traffic accidents, accidents in the oil production, and exploitation areas as well as caused by natural disasters is inevitable.

Keywords: sorbent, oil pollution, polyurethane foam, chitin, hydrophobic, sorption capacity.

Currently, the use of sorbents is the main method to clean water from oil pollution. In particular, the polyurethane foam (PUF) is a sorbent that is attracting a lot of interest because of its effectiveness. However, because of PUF's quite high cost, the development of an adsorbent containing the natural filler - chitin has been studied [3]. The filler-contained sorbent proven to have high oil adsorption, high buoyancy, and possible reusable [3-5]. However, this combined material is highly sorption to both oil and water. Therefore, it is necessary to improve the hydropho-bicity of this potential material.

The hydrophobicity of the chitin-containing material is performed by immersion in the silicone-ethyl acetate mixture (ratio 1: 2 of mass) for 30 s. Then the obtained modified sorbent is used to remove oil spills in river water and seawater environments. The effects of the sorption time and the thickness of the oil layer are evaluated. Besides, the reusability of the obtained sorbent is also studied.

The research results show that the modified adsorbent by silicone has high oil adsorption capacity both in river water and seawater. The optimum sorption time is 15 minutes for both types of water. The type of water does not affect the oil sorption capacity of the modified sorbent, oil capacity reaches 7,6 g/g. The more the thickness of the oil layer increases, the more oil adsorption capacity. In particular, in the condition of the thin oil layer (doil = 3 mm) the modified adsorbent still has high oil removing ability, the oil removal percentage reaches 41,5%. The hy-drophobicity of the modified material in the thin oil layer is quite high; it reaches 75% when doil = 3 mm.

The reusability of the sorbent helps to reduce the cost of the product in general and the cost of the oil spill removal process in particular. With a silicone film on the surface, the modified adsorbent has better toughness. Hence, the modified adsorbent is up to 30 times usable. It has not only economic significance but also ecology sig-nificance. The high reusability of the material reduces the amount of solid waste entering into the environment and also reduces the consumption of the initial raw materials.

So, this study shows that the modified adsorbent with the silicone-containing mixture is the cheap and potential hydrophobic sorbent for the treatment of oil pollution.

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IMPROVING THE TECHNOLOGY OF SOIL TREATMENT, CONTAMINATED BY HEAVY METALS USING SOIL AMENDMENTS

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Abstract. The purpose of the study is to investigate the effect of various organic and inorganic soil amendments on the degree of purification of soils contaminated with heavy metals (HM). The focus was on biological - «soft» methods in terms of environmental impact, as a way to remediate the soil in situ in order to clean the soil from HM. The scientific novelty of the work is to determine the effectiveness of the use of soil amendments for cleaning soils from HM.

Keywords: heavy metals, decontamination, immobilization, soil purification, bioaccumulation, soil additives, in-situ treatment, soft methods, complexes sorbent-metal.

Soils perform the most important functions in all terrestrial ecosystems, so the ecological and geochemical state of the soil cover determines the stability of the Earth's biosphere - a necessary condition for human survival. Since the man-made load on soils leads to their degradation and reduced quality (quality and productivity indicators: particle size distribution, the presence of humus, plant nutrients, water and heat regimes; the degree of erosion, salinity, acidity, salinity, pollution, etc.), so for preservation of the biosphere is extremely important to keep the soil in a satisfactory condition. The soil can be compared to a natural filter, which detects the ingress of various pollutants, among which the most dangerous are HM [1]. They pose a great danger to both humans and natural and agricultural ecosystems, because these elements accumulate quickly in the soil, but their removal from the soil takes much longer time, which affects the change of soil's characteristics and leads to partial or complete reduction of their quality [2].

All methods of detoxification (removal) of HM are classified into physical, chemical and biological. The use of physical detoxification (removal and disposal of the contaminated layer, soil washing, electro-remediation) is quite limited. More common methods is the chemical detoxification, which is carried out by the interaction of HM cations with chemical components of the soil by the reactions of hydrolysis, oxidation - reduction, chemical sorption, etc. Phytoremediation consists of two fundamentally different strategies: phytoextraction - growing plants-hyperaccumulators, capable of removing HM in significant quantities, and, conversely, phytostabilization - tolerant plants to a level of soil contamination of 1.5 MPC [3]. In more detail, among the measures of detoxification of soils contaminated with HM should be noted such as liming, application of organic fertilizers, use of natural and artificial sorbents, clay, application of soil amendments, bioremediation, phytomelioration, washing, removal of contaminants and others. [4]. The most promising in our opinion, is the use of soil amendments.

As proved by our study (table 1), the application of amendments at the rate of 40 g □kg□^(-1) to control reduced the concentration (C) of Cd by 40% and 36% after the Cm and BM application respectively, which

proves the effectiveness of their use for purification soils with high concentrations of Cadmium. The treatment of contaminated soil by using Cm + BM as a single combined soil amendment reduced the concentration of mobile form of Cadmium in the experiment 3 by 68%, which is the best result obtained.

Table 1

Concentration of Cadmium in soil

Control (contaminated soil)	Experiment 1: control + compost (Cm)	Experiment 2: control + bone meal (BM)	Experiment 3: control + Cm+ BM
C(Cd) = 2.5MPC	C(Cd) = 1.5MPC	C(Cd) = 1.6MPC	C(Cd) = 0.8MPC

Therefore, the use of various of soil amendments and their combinations is an effective way to reduce the mobile forms of Cd in the soil.

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INFLUENCE OF BRASSINOSTEROIDS ON THE GROWTH OF FLOWER-DECORATIVE CULTURE OF PETUNIA AND SURFINIA

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The relevance of research is due to the fact that petunia and its hybrids are one of the most popular and demanded crops on the market, there is no domestic selection planting material and modern technologies of seed production and seedling growing adapted to local conditions. The solution to these problems can be achieved by obtaining high-quality planting material with good survival rate; increasing seed productivity; improving the system of protective measures against the most common diseases and pests. In turn, the above problems can be largely solved by using biologically active substances (BAS).

Keywords: brassinosteroids, epibrassinolide, homobrassinolide, petunia, surfinia.

Comparative analysis of the effect of different concentrations of epibrassinolide and homobrassinolide on the growth of petunia and surfinia plants, carried out on 7 varieties of petunia and 2 varieties of surfinia.

Treatment with EB × 10-7 increases the length of the shoots by 8.6% and the diameter of flowers by 7.2% in plants of the Valentina petunia variety; the variety «Maria», respectively, by 13.4%, and the flower diameter by 16.5%; on the variety «Daria» by 15.6%, and flower diameter by 10.6%; the variety «Ognevushka» by 16.6%, and the flower diameter by 16.5%; the variety «Anna» by 12.5%, and the flower diameter by 7.2%; the variety «Natalia» by 9.1%, and the flower diameter by 7.5%; the variety «Snow White» by 16.6%, and the flower diameter by 13.1%; the variety «Avalanche Gold Star» by 16.2%, and the flower diameter by 21.4%; in the variety «Salmon Kaskad» by 16%, and the flower diameter by 21.4%, significantly more than the control ($P < 0.05$).

When using GB × 10-9 tons in plants of the petunia variety «Valentina», the shoot length increases by 17.5%, and the flower diameter by 18.6%; the variety «Maria» by 22.6%, and the flower diameter by 17.0%; the variety «Daria» by 39.4%, and the diameter of the flower by 48.1%; the variety «Ognevushka» by 19.1%, and the flower diameter by 16.7%; the variety «Anna» by 38.1%, and the flower diameter by 16.1%; the variety «Natalya» by 31.9%, and the flower diameter by 18.9%; the variety «Snow White» by 21.7%, and the flower diameter by

30.5%; the variety «Avalanche Gold Star» by 22.9%, and the flower diameter by 24.8%; in the variety «Salmon Kaskad» by 16.3%, and the flower diameter by 38.1%, significantly more than the control (P <0.05).

EB × 10-7 prolongs flowering in plants of the petunia variety «Valentina» by 14 days, the variety «Maria» by 11 days, the variety «Daria» by 12 days, the variety «Ognevushka» by 13 days, the variety «Anna» by 9 days, varieties «Natalya» for 14 days, varieties «Snow White» for 8 days, varieties «Avalanche gold star» for 12 days, varieties «Cascade salmon» for 12 days, compared with control plants.

GB × 10-9 prolongs the flowering of the Valentina petunia by 7 days, the Maria variety for 9 days, the Daria variety for 8 days, the Ognevushka variety for 8 days, the Anna variety for 12 days, the Natalia «for 7 days, varieties» Snow White «for 15 days, varieties» Avalanche gold star «for 15 days, varieties» Cascade salmon «for 15 days.

According to the parameters of leaf length and leaf width during treatment with brassinosteroids in all investigated concentrations and in all varieties, there are no significant differences relative to the control.

Based on the studies carried out, the following conclusions can be drawn: low toxicity and extremely low consumption rates of BS on a flower-ornamental crop determine the prospects for the use of these phytohormones; the use of brassinosteroids in greenhouses makes it possible to obtain high quality and competitive seedlings of annual flower and ornamental crops.

The results obtained make it possible to recommend the use of brassinosteroids on flower-ornamental crops of Petunia and Surfinia.

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INFLUENCE OF GROWTH IN THE NUMBER OF BIRDS ON THE NUMBER OF HUMAN DISEASES

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That affects the incidence of birds? Is the increase in the increased morbidity of birds associated with an increase in human diseases? What are the ways to prevent the spread of avian diseases?

Keywords: diseases, birds, humans.

The work is devoted to the consideration of bird species diversity and the relationship of bird population growth with human diseases.

The issues of studying bird diseases in specialized institutions for keeping animals are currently becoming in-creasingly important in order to demonstrate, preserve, reproduce and study them. External parasites and symbiotic microarthropods, covering an increasing range of host bird species, are an increasingly real threat to humans. Among the objects of the animal world, birds attract the most attention. They are clearly visible, numerous and, moreover, are one of the oldest reservoirs of pathogens that are dangerous to humans: viral, bacterial, fungal, pro-tozoal nature. Most birds are in «close contact» with humans. In this regard, the risk of infection of people with pathogens common to humans and animals increases.

Most of the foreign specialized literature in this area is of a reference nature or is devoted to the description of specific cases of diseases. For this reason, the topic is relevant [1].

The study found that most of the birds in the Minsk zoo are chicken-like (35%), hawk-like (25%), crane-like (9%) and parrot-like (9%). Since there is a high incidence of infectious diseases among zoo birds, our experience has shown that the main measure in the fight against infectious diseases of birds is quarantine.

To eliminate the contagious disease inside the zoo itself, we suggest setting a strict internal schedule for it. Veterinarians and zookeepers must carefully examine all birds on a daily basis to remove all sick and suspicious birds to the isolation ward. In case of mass cases in the zoo, sections should be provided, separated by partitions. Birds should be placed in groups, and each section should be carefully monitored.

In places that are affected by infectious diseases, we propose to carry out a number of special measures to eliminate a particular disease (vaccination, disinfection, etc.).

It was found that the most common diseases in birds are avian flu, gout, coccidiosis, bluetongue and foot — and-mouth disease. These diseases are the most dangerous, since one bird can quickly infect all individuals, which leads to the imminent death of the livestock. Also, in recent years, the medical significance of birds as carriers of infection has significantly increased. Many diseases that can be transmitted to humans have been found in birds. Due to their high numbers, amazing adaptability, parasite-bearing, and constant contact with humans, this is what makes birds an important, convenient, and necessary object for monitoring the ecology of ecosystems and the sanitary and hygienic state of the human environment.

Thus, due to the increase in bird biodiversity in the Minsk zoo, there is a need to study bird diseases and find ways to prevent and stop the spread of these diseases. The obtained data on avian diseases are necessary not only for optimizing the habitat, a complete diet, hygiene and qualified veterinary care [2], but also for planning, monitor-ing, assessing the stability of urban ecosystems and reducing the damage caused by birds [3].

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INSTITUTE OF «GREEN» CERTIFICATES

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Due to the lack of significant fuel resources in Belarus and the growth of energy dependence on supplier countries this article discusses the prospect of introducing the institution of «green» certificates in the Republic of Belarus as a way to develop renewable energy sources and to assess the environmental situation associated with greenhouse gas emissions. Taking into account the existing legislative system, possible ways of «green» certification are being considered.

Keywords: ecology, «green» certificates, alternative energy sources, Belarus.

As world experience shows, the development of renewable energy comes from the government. One of the incentives for the development of alternative technology for the introduction of «green» certificates. This system allows for the registration of renewed identification for each unit of energy produced.

Due to the lack of significant fuel resources in Belarus, the rise in prices for traditional energy sources and to avoid the concentration of all electricity production of one origin, it is necessary to diversify energy production by introducing renewable and local fuel and energy resources.

The fundamental regulatory legal act that determines the development of renewable energy in the Republic of Belarus is the Law of December 27, 2010 No. 204-3 «On Renewable Energy Sources» [1]. The existing regulatory legal acts of the Republic of Belarus provide for a system of confirmation of the origin, production, use, accounting, tariffication of energy generated by renewable energy sources (RES).

Based on world experience, we will consider the prospect of introducing «green» certificates in Belarus in order to create favorable conditions for the sale and consumption of energy produced from renewable sources [2]. Green certificates can support energy production from renewable energy sources for the following reasons:

1.Tracking the production, supply and consumption of renewable energy sources; 2. Guarantee of the origin of energy; 3. Financial support for manufacturers and suppliers, obtaining tax incentives; 4. Assessment of the efficiency of the use of renewable energy; 5. Source of information for assessing the environmental situation; 6. Sale of certificates - a source of funds to support renewable energy generators; 7. The possibility of disseminating information on the consumption of green energy for the formation of an «ecological» image and labeling of goods.

There are two possible ways to use the certificates shown in Table 1 [3].

Table 1

Use cases for certificates

Options	Comments
Market with commitments	The government imposes an obligation on some enterprises to acquire «green» certificates. The procedure for mandatory confirmation, as well as the rules and conditions for the production, supply and consumption of energy from RES are determined by the government of the country. The government determines the procedure for issuing and conditions for the use of «green» certificates at all stages of their issuance and circulation. The disadvantage is the lack of choice for companies.
Voluntary market	Enterprises acquire certificates on a voluntary basis. This can be confirmed as ecolabelling and publication in special annual reports. Such companies will be the most attractive for investors, which will lead to an increase in their capitalization.

A committed market can be a way to quickly resolve the issue of subsidizing renewable energy producers. In the long term, the voluntary market has the advantage of increasing competition as a result of the emerging competition to enhance their reputation for being environmentally friendly [4].

Thus, there is a possibility of developing and implementing at the legislative level a system of «green» certification in the Republic of Belarus.

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MEDICAL AND BIOLOGICAL ASPECTS, CAUSES AND MECHANISMS OF DEVELOPMENT OF THE REPLACEMENT PROCESS ON THE EXAMPLE OF PNEUMANIA

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Abstract: The paper considers the medical and biological aspects of the mechanisms of development and the causes of the inflammatory process of the respiratory system of the lungs - pneumonia.

Keywords: pneumonia, medico-biological aspects, community-acquired pneumonia, causes, fungal infections, gram-positive microorganisms, gram-negative microorganisms.

Pneumonia is a group of infectious diseases of the pulmonary parenchyma of various etiology (more often alveoli, less often interstitial tissue). Which are accompanied by infiltration of the alveoli with inflammatory cells and exudation in response to the introduction of microorganisms into the sterile (normal) parts of the respiratory tract, which is clinically manifested by the inflammatory process and intoxication syndromes of the population of the Republic of Belarus and the entire planet.

Currently, the most widespread form is the one that takes into account the conditions in which the disease developed - community-acquired pneumonia with primary infection with Streptococcus pneumoniae, Mycoplasma pneumoniae, Haemophilus influenzae; in a medical institution - hospital or nosocomial pneumonia with primary infection with Streptococcus pneumoniae, Haemophilus influenzae, Staphylococcus aureus, Enterobacteriaceae spp., associations of microorganisms; immunodeficiency-mediated pneumonia with a predominant infection with

Pneumocystis carinii, Staphylococcus aureus, Pseudomonas aeruginosa, fungi, cytomegalovirus and associations of microorganisms.

Depending on the severity of the disease, pneumonia is distinguished from mild, moderate and severe. There are no clear criteria for dividing mild and moderate pneumonia. The scope of diagnostic and therapeutic measures for pneumonia of these degrees is almost the same, they can be combined into one group - pneumonia with a mild course.

Causes and mechanism of development of pneumonia:

Among the etiofactors causing pneumonia, bacterial infection is in the first place. The most common causative agents of pneumonia are:

• gram-positive microorganisms: pneumococci (from 40 to 60%), staphylococci (from 2 to 5%), streptococci (2.5%);

• gram-negative microorganisms: Friedlander's bacillus (from 3 to 8%), Haemophilus influenzae (7%), Enterobacteriaceae (6%), Proteus, Escherichia coli, Legionella, etc. (from 1.5 to 4.5%);

• mycoplasmas (6%);

• viral infections (herpes viruses, influenza and parainfluenza viruses, adenoviruses, etc.);

• fungal infections.

Also, pneumonia can develop as a result of exposure to non-infectious factors: chest injuries, ionizing radiation, toxic substances, allergic agents.

Severe pneumonia is a special form of diseases of different etiology, which is manifested by severe intoxication syndrome, hemodynamic changes, severe respiratory failure and / or signs of severe sepsis, septic shock, is characterized by an unfavorable prognosis and requires intensive therapy.

There are «small» and «large» criteria for severe pneumonia:

«Small» criteria for a severe course of pneumonia: respiratory rate 30 for 1 min or more; violation of consciousness; SaO2 less than 90% (according to pulse oximetry data), the partial tension of oxygen in arterial blood (PaO2) is less than 60 mm Hg; systolic blood pressure below 90 mm Hg; bilateral or multifocal lung lesions, decay cavities, pleural effusion;

«Large» criteria for a severe course of pneumonia: the need for mechanical ventilation; rapid progression of focal-infiltrative changes in the lungs - an increase in the size of infiltration by more than 50% over the next 2 days;

septic shock, the need to administer vasopressor drugs for 4 hours or more; acute renal failure (urine amount less than 80 ml in 4 hours, serum creatinine level above 0.18 mmol / l or urea nitrogen concentration above 7 mmol / l in the absence of chronic renal failure). The choice of the place of treatment is one of the important issues in the management of a patient with pneumonia.

The question of the preference for hospital treatment for pneumonia can be considered in the following cases:

1. Age over 60.

2. The presence of concomitant diseases (chronic bronchitis, COPD, bronchiectasis, malignant neoplasms, diabetes mellitus, chronic renal failure, congestive heart failure, chronic alcoholism, drug addiction, severe underweight, cerebrovascular diseases).

3. Ineffectiveness of starting antibiotic therapy.

4. Pregnancy.

5. The desire of the patient and / or his family members.

An important point in the ineffectiveness of antibiotic therapy for pneumonia is inclusion of pulmonary tuberculosis. In this case, a three-time study of sputum for mycobacterium tuberculosis and consultation with a phthisiatrician are mandatory.

Conclusions: If a person has a reduced level of immunity, then this is one of the main causes of pneumonia. Man has coexisted with microorganisms for a very long time. They mutate, new species and types appear. New forms of the disease are emerging. Therefore, they are systematized in order to make it easier to find effective medicines and to quickly relieve the patient of pneumonia. You can get infected from an infected person, but it is much easier to withstand harmful microorganisms, strengthening your natural immunity.

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MONITORING OF THE FODDER BASE OF WILD WATER BIRDS INHABITING IN WATER BODIES OF BELARUS DURING THE PRE-MIGRATION PERIOD

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Annotation: The autumn period for waterfowl is the most intense in terms of preparing the body for seasonal migration. During this period, the bulk of waterfowl, especially young animals, are fully prepared for the migration season, nevertheless, the birds of late broods continue to feed intensively in the water bodies of Belarus. Our studies are devoted to the study of the diet of feeding of waterfowl in the pre-migration period.

Keywords: wild waterfowl, autumn migration, feeding ration, plant food, biological characteristics.

The territory of the Republic of Belarus is a favorite habitat for a large number of waterbirds, the species diversity of which currently numbers 34 species. They are attracted by the abundance of natural and artificial reservoirs, rivers, reclamation canals and wetlands. The variety of vegetation allows these birds to find secluded nesting places, shelter from natural predators, and breed. The biological properties, plasticity and species characteristics of waterfowl allow them to find food in large quantities, especially in the spring and summer period. Faunal diversity combined with plant food makes it possible to feed a huge mass of waterfowl. These are mainly mallard ducks, of which there are about 650-680 thousand in the republic [1, 2].

The active structure of hunting farms in Belarus makes it possible to use this resource quite productively. There are about 17 species of them in Belarus and more than 110 thousand individuals are harvested annually.

The basis of the diet of wild ducks in nature is plant food. Ducks are eager to gather duckweed from the surface of water bodies. A variety of aquatic plants combined with coastal vegetation are considered their main food. In shallow water bodies, given their ability to dive, bottom sediments with an abundance of their inhabitants (worms, larvae, insects) become available to these species of birds. The summer period for waterfowl allows them to feed themselves without any special problems and achieve a physiological state in which they can prepare for autumn migration [3, 4]. However, the autumn period makes its own adjustments to all biological objects of the environment, and the food ration of waterfowl becomes poorer.

We were faced with the task of determining the composition of the diet of waterfowl in the autumn period, when the ambient temperature is approaching zero marks.

This is the period of wilting of almost all vegetation and a decrease in the number of faunal components of the summer diet of waterfowl. Nevertheless, they actively continue to feed, using almost any organic component.

In order to determine the components used by waterfowl as food, we studied the contents of the glandular and muscular stomachs of the captured waterfowl during the period of seasonal hunting. At the same time, the esophagus and goiter of the collected specimens were examined.

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NEW OPPORTUNITIES FOR EXPERTS AND RESIDENTS OF THE COUNTRY IN THE FRAMEWORK OF IMPLEMENTATION OF THE NATIONAL PROJECT «ECOLOGY» IN THE RUSSIAN FEDERATION

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The article pays attention to the implementation of the National Project «Ecology» from the point of view of maximum involvement of interested groups in its development, including representatives of the scientific community and ordinary citizens.

Keywords: ecology, national project, involvement.

The national projects of Russia planned for implementation in a certain sense represent the testing of a new approach to project management of the country's socio-economic development, within which great importance is attached to the openness of national projects, the availability of information on their implementation and intermediate results of achieving the established indicators for the country's population.

Every interested citizen of the country with access to the Internet can view information on the progress of a particular project in real time. As an example, we would like to cite the national project «Ecology». Its goal is to improve the ecological situation in Russia and create comfortable living conditions in the country. The national project includes 11 federal projects. The work is carried out in 5 areas: waste, water, air, nature and animals, the best available technologies. The implementation period of the national project is until December 31, 2024. Its budget is more than four trillion rubles [1].

The new approach is distinguished not only by the openness of information for all comers, but also by the genuine involvement of interested parties, specialists in the field of ecology. In order to provide external expert support for the implementation of the National Project, a special body was created - the Public and Business Council to discuss the acute moments and problematic issues that arise during the implementation of the national project and related federal programs. Also, the Public and Business Council serves as a bridge between the executive authorities and representatives of the scientific community, public organizations and business, which allows you to establish effective communication and build a constructive dialogue. This council was created within the framework of the Regulation on the organization of project activities in the Government of the Russian Federation [2].

Involvement of experts in the implementation of the National Project in terms of monitoring the implementation of control measures and the achievement of target indicators will allow to promptly respond to changes in the external environment and adjust the plan, including developing proposals for amending the passports of the national project and relevant federal projects.

Thus, new forms of digital participation of citizens are becoming a practice and are aimed at sustainable development of the economy of our country, allowing the maximum involvement of experts and residents of Russia in measures to improve environmental well-being through a specialized information resource and a specially created Public and Business Council.

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OPIGNO LMS AS MULTIFUNCTIONAL SOFTWARE FOR ENVIRONMENTAL EDUCATION

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Considered the advantages of Opigno LMS compared to other popular open source LMS platforms in the contexts of functionality, scalability and application in the field of environmental education.

Keywords: e-learning, LMS, environmental education, Opigno, Drupal, BigBlueButton.

The ultimate goal of environmental education is considered to be the formation of human environmental re-sponsibility, which is characterized as the ability to act in accordance with the requirements of nature and socie-ty [1], which indicates the importance of environmental education generally. However, in the context of infor-mation society, the problems of environmental education acquire special significance [2] forming the need for study and improvement of educational processes itself. One of the most important roles in the educational process is assigned to teachers who train specialists in educational institutions [3], as well as the means that are used for this process implementation. Considering that the main condition for the implementation of the educational process is to ensure the effective interaction of its participants, its main means in information society are the means of e-learning [4]. And the main software tools used to manage e-learning educational process are Learning Management Systems (LMS) [5]. Thus, LMS are important in ensuring the educational process of information society. In addi-tion, LMS allow to organize remote educational process, which is very important in the context of the COVID-19 pandemic.

There most popular open source LMS platforms are: Moodle, ATutor, Eliademy, Forma LMS, ILIAS, Opigno LMS, OLAT [6]. As a result of the analysis of all the listed systems, Opigno LMS is the only one that is based on a full-fledged Content Management Framework (CMF). Opigno LMS is based on CMF Drupal, which has been one of the most popular and flexible open source CMF systems in the world almost for 20 years. Consequent-ly, Drupal's capabilities are extended to Opigno LMS, providing almost unlimited potential to provide functionality that goes beyond the generally accepted SCORM and Tin Can API standards. This is confirmed by Opigno's flexi-ble integration capabilities with third-party API's such as H5P and various video services.

However, it is worth noting that LMS platforms are often criticized for diminishing the role of the teacher. At the same time, the implementation of the functions for the webinar within the LMS proves the opposite [7]. The analysis shows that Opigno LMS has the ability of integration with one of the most functional open source web conferencing platforms – BigBlueButton. Therefore, Opigno LMS, integrated with such services as H5P and BigBlueButton, is a complex scalable system that can use the potential of advanced e-learning technologies. That makes Opigno LMS multifunctional software of great interest for environmental education.

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PHYTOREMEDIATION AS AN ALTERNATIVE METHOD FOR REMOVING POLLUTANTS FROM THE SOIL

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The modern growth in the consumption of natural resources along with the development of industry and agriculture have led to anthropogenic pollution of the environment. Soil pollution with heavy metals and organic compounds should be especially highlighted. The use of various soil cleaning technologies is often impractical in terms of efficiency and cost in certain areas. In this regard, the development and implementation of phytoremediation methods is a reasonable, environmentally friendly and less expensive approach to neutralize and remove various pollutants from the environment.

Keywords: environmental protection, phytoremediation, vegetation, pollutant, heavy metal.

Phytoremediation is a method that consists in the ability of plants to bioaccumulate various chemical elements and their compounds, or to change their molecular form through biochemical reactions inside plant cells with subsequent excretion into the environment. These compounds generally have a less toxic effect on soil biota and are subsequently able to be captured by other methods of soil cleaning [1].

The phytoremediation process consists in the following mechanisms: 1. Phytoextraction is absorption of heavy metals or organic compounds by the root system of a plant with their subsequent bioaccumulation. Thus, Pb, Cr, As, Ni, Cu, radionuclides and petroleum hydrocarbons are removed from the environment. 2. Phytovolatilization is transformation of toxic compounds into volatile forms. For example, some ionic forms of Hg and Se are converted into elemental forms, which undergoes transpiration. 3. Phytostabilization is a limitation of the spread of pollutants in the soil and groundwater due to the root system of the plant [2].

The economic benefit and effectiveness of this method is achieved in the use of exclusively hyperaccumulator species. Such plants include Helianthus annuus L., Arabis sagittata (Bertol.) DC., Antirrhinum L., Amaranthus L., Chenopodium album L., Panicum virgatum L., Melilotus officinalis (L.) Lam., some species of the Brassicaceae Burnett, nom. cons. and others (Fig. 1) [3].

Fig. 1. – Integrated use of Panicum virgatum L. as landscaping of small towns and for cleaning contaminated roadside soil

However, despite the possibility of applying to a large number of different pollutants, unnecessary expensive equipment and specially trained personnel, this method has a number of disadvantages and limitations: 1. In most cases, efficiency is achieved only within the root zone of the plant. 2. The process of cleaning the territory takes several years and is limited by the rate of plant growth; therefore, phytoremediation is better suited for remote areas where human contact with the pollutant is limited or in long-term and weakly polluted areas. 3. The method is suitable for areas with low and medium pollution due to the corresponding limited survival capacity of vegetation in contaminated areas. 4. It is necessary to take into account climatic factors and the impact of the

introduced phytoremediation species on other plant community. 5. Appropriate disposal methods for contaminated vegetation are required [2].

Thus, phytoremediation is one of the alternative methods of maintaining and cleaning soil from technogenic pollutants. Efficiency, environmental friendliness and economic component already contribute to the introduction of this method in environmental protection in many countries of the world.

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POLYMER MATERIALS BASED ON BIODEGRADABLE FILLERS

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The aim of the work was to study the features of biodegradable fillers that determine the degree of biological destruction of composite polymer materials. Structured fillers based on natural components are described.

Keywords: polymer materials, biodegradation, fillers, matrix.

The use of biodegradable materials polymer materials in the modern world is becoming a modern trend in various industries, agriculture, and landscape design. Currently, there are many biologically degradable polymer compositions with the addition of natural fillers, including such fillers as starch, cellulose, chitosan, gelatin, wax, and even yeast. The use of such fillers provides almost complete biological degradation of the material under the influence of light, moisture, and soil microflora after the end of the operating period.

The most widely used biodegradable filler is corn starch, since its grains are characterized by smaller sizes and a small spread of particle sizes.

The use of a biodegradable filler with a corn starch content below 50% of the total mass, and the content of a mixture of hydrophobic polymers above 45% leads to a longer process of biological destruction. There are also other disadvantages of the composition, which reduce the thermophysical and hydrolytic properties. Thus, a composite material with such a composition can lose its strength properties at a temperature of 80-90°C, which limits the scope of their application or makes their use impossible.

The choice of optimal ratios of synthetic polymers, filler and process additives is determined by the theoretical filling limit, which is determined by the interaction force at the interface. Polymer composite materials consist of two discrete phases: a continuous binder phase (matrix) and a dispersed reinforcing phase of fibers, organic or mineral fillers. Almost any material can be selected as a matrix: polymer, metal, ceramics, and even a single crystal. Long or short high-strength fibers of various origin, or fabrics based on them, are usually used as a fiber hardener.

Polymer materials are known in which the binding phase is performed by lactic acid. A significant advantage of the composite material matrix is that it is produced from renewable sources and is easily decomposed by microorganisms [1].

There are many researched and implemented in the production of polymer materials. The main point in creating such a nanostructured composite is given to the percentage of biodegradable filler. In addition, to increase the softening temperature of the material, technological additives for functional purposes can be used, for example, ethylene vinyl acetate, which is a modifier of the polymer structure.

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PRINCIPLES OF FORMATION OF ARTIFICIAL POPULATIONS OF RARE SPECIES OF MEDICINAL PLANTS

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Recently, interest in plant medicinal products has been especially growing. About 80% of the world's population uses herbal preparations. Of all the species of the planet's higher vascular plants, about 80,000 are of medicinal value [2]. Medicinal plants are a particularly vulnerable category due to intensive, irrational, insufficiently controlled procurement of raw materials. When introducing medicinal plants into the culture - a measure that is extremely necessary in the conditions of rapid depletion of wild-growing resources [1] - taking into account the diversity of natural populations is also important.

Keywords: medicinal plants, intraspecific variability, gene pool, reintroduction, heterozygosity, population.

The domestic and foreign pharmacopoeias include hundreds of herbal medicines. In world practice, a harmonious system of phytotherapy has been formed, based on the use of the experience of medicine of various nations, existing medical and philosophical platforms (allopathic, homeopathic, naturopathic, Ayurvedic), modern scientific achievements of phytopharmacy and phytopharmacology. A rich and significant experience in the use of phytopreparations has been accumulated. Herbal preparations are used for infectious and parasitic diseases, in oncology, for mental and nervous disorders, for diseases of the endocrine system, allergic diseases, nutritional and metabolic disorders, for diseases of the blood, hematopoietic system and hematopoietic organs, impaired immunity, respiratory diseases, digestion, genitourinary system, skin, musculoskeletal system and connective tissue.

To date, a collection of spicy, aromatic and medicinal plants has been created in the laboratory of plant biodiversity of the Central Botanical Garden of the National Academy of Sciences of the Republic of Belarus, numbering more than 500 species and varieties belonging to 40 families. It is represented both by taxa of the flora of Belarus and foreign flora.

The purpose of our work is to develop principles, ways and forms of conservation of population diversity and rational use of their resources on the basis of studying the intraspecific variability of medicinal plants.

On the basis of the collection gene pool of medicinal and spicy-aromatic plants, the species samples were classified according to economically useful characteristics. According to the conducted literary study, the collection gene pool of medicinal and spicy-aromatic plants of the laboratory of biodiversity of plant resources by useful properties is divided into the following groups: medicinal, food, fodder, perfumery, tanning, melliferous, technical, insecticidal, phytomeliorative, dyeing, ratikidny, poisonous.

The largest number of species is represented by groups: medicinal (159 species), food (91 species), melliferous (82 species) and decorative (108 species). In the group of medicinal products, representatives of the Lamiaceae family Lindl. make up 24% or 38 species, Asteraceae Dumort - 21% (33 species), Apiaceae Lindl. and Rosaceae Juss. 9% each, 14 species. As for food plants, species of the family Lamiaceae Lindl are represented by a large species diversity. - 32% (29 species) and Asteraceae Dumort 18% (16 species). Of the honey plants, the most numerous - 43% or 35 species - is also the family Lamiaceae Lindl., Which also occupies a leading position among ornamental introduced species - 27% (29 species). Resource groups poisonous, phytomeliorative and ratikidny are few and are represented by a total of 22 species. Among them are poisonous - 18, phytomeliorative - 2 and ratikidny - 2.

The largest number of introduced species are included in the composition of drugs for the treatment of diseases of the digestive system (82), respiratory and catarrhal diseases (68), and the cardiovascular system (39). The number of species for the treatment of diseases of the endocrine system - the thyroid gland and the prostate gland are few in number and are represented by 6 and 5 species, respectively.

The range of use of introduced species of the families Asteraceae Dumort, Boraginaceae Juss., Lamiaceae Lindl., Rosaceae Juss., Apiaceae Lindl. the widest. Among them are representatives of the genus Inula L., Arnica L., Atractylodes DC (family Asteraceae Dumort), Lithospermum L. (family Boraginaceae Juss.), Salvia L., Lavandula L., Stachys L., Thymus L. (family. Lamiaceae Lindl.), Filipendula Mill., Fragaria L. (family Rosaceae Juss.), Angelica L., Foeniculum Mill. (family Apiaceae Lindl.). The use of introduced species in officinal and alternative medicine is also indicated.

A significant part of plants, which are potentially important as sources of medicinal raw materials, provided that they are introduced into cultivation, are rare and endangered species, the gene pool of which in most cases is in danger of degradation. The diversity of the gene pool is generally high, but its structure is observed in

individual populations, each of which has a significantly lower level of polymorphism. Populations undergo a decrease in effective size on a large scale, up to several tens and hundreds of individuals of generative age. These processes are aggravated by the degradation of the gene pool due to excessive procurement of medicinal plants, leading to a further decrease in density. An effective measure can be the cultivation of plants in ex situ conditions and through reintroduction into natural habitats, especially into protected by humans - in protected areas of various forms.

When deciding on the choice of objects for preserving the gene pool, it is recommended to use the methodology, according to which it is necessary to classify the alleles found in different habitats into groups - local, with frequencies> 0.05 and <0.05, and variants available in all populations with frequencies> 0.10 and <0.10. In this case, frequent alleles have a higher priority - they are most likely selected over many generations. At the same time, it is rare variants that can, with changing environmental conditions, create the basis for adaptation at the population level.

Combining the samples by ecological confinement, regardless of the geographical distance between them, shows relatively large differences in the average number of alleles per locus and the expected heterozygosity. When creating one synthetic population, including all the studied samples, the greatest allelic diversity and relatively high expected heterozygosity are achieved.

Theoretically, there is a danger that the artificial «mixing» of genotypes from different populations into one large artificial population can lead to the disappearance of the hierarchical subordination of population units that nature has created over many generations. To determine the number of populations included in the artificial sample, one can use the calculations that at a level of interpopulation differentiation of about 20%, representatives of two populations are sufficient to represent 95% of the variability [3]. However, this condition is valid only under the relative homogeneity of ecological conditions, and otherwise it is necessary to use a larger number of populations.

There is also the problem of «genetic load», which theoretically can arise with an artificial increase in allozyme diversity. When creating artificial populations, the principles of plant selection within populations are important. Genetic studies have made it possible to determine the distances less than which individuals should not be selected to preserve the gene pool ex situ.

With the introduction of medicinal plants into culture, the threat is posed by a significant change in the gene pool of natural populations due to the use of a narrow genetic base of the initial material (and uncontrolled hybridization of closely related taxa under ex situ conditions. Ex situ conservation measures and rational use of plant resources of species with dominance of vegetative reproduction should be based on the creation of artificial samples of clones with unique multilocus genotypes and representing a wide base for breeding.

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PROBLEMS OF WATER SUPPLY FOR THE FOOTLAND REGION OF THE STAVROPOL REGION OF THE RUSSIAN FEDERATION

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This paper analyzes the hydrogeological conditions of the piedmont region of the Stavropol territory of the Russian Federation.

Keywords: water supply, hydrogeological conditions, groundwater circulation.

The study area is located in the southern part of the Stavropol territory, administratively part of the piedmont region and is within the boundaries of the district of the mountain-sanitary protection of the Caucasian Mineral Waters (CMW).

The study area is located within the North Caucasian monocline and the southeastern part of the Mineralovodsky ledge.

The problem of water supply in this area is urgent since in a number of settlements today there is no centralized water supply. For example, the Etoka village currently does not have a centralized water supply system. For their needs, the population of the village autonomously uses any groundwater of the slope diluvium and aluvium of the Etoka River, captured by wells, or the surface waters of the mentioned river, its shallow and dry tributaries during the dry period. The problem of lack of drinking water is the main one for the village population. These problems are associated primarily with difficult hydrogeological conditions.

In hydrogeological terms, the study area is located within the artesian slope of the North Caucasian monocline. In the southern part, the area borders on the artesian basin of the Akhmetovsky trough, which is characterized by fractured and fractured-stratal waters in the sedimentary-volcanic strata of the Lower Jurassic. In the east, the region borders on the foothill part of the Tersko-Kuma artesian basin, where fractured and fractured-stratal types of groundwater circulation in Paleogene sediments also prevail.

A characteristic feature of the artesian slope of the North Caucasian monocline is the general northern and northeastern subsidence of Proterozoic, Paleozoic and Meso-Cenozoic deposits.

The hydrogeological conditions of the region are largely determined by both the diversity of the lithological and petrographic composition of the sediments and its structural and tectonic features.

The investigated area is characterized by extremely difficult geological and hydrogeological conditions typical for fractured-vein waters of tectonic disturbance zones. Under these conditions, aquifers have an extremely uneven distribution and are characterized by high variability of thickness and filtration properties.

These conditions are caused primarily by the consequences of the introduction of neo-intrusions into the sedimentary cover of the Yutsa, Dzhutsa, and Zolotoy Kurgan mountains and the presence of a number of latitudinal and ring faults associated with them.

Within the described area, there are simultaneously various types of groundwater circulation from pore-stratal to stratal-fractured, and the latter type prevails.

The most important in the formation of mineral water deposits is the fissure-vein type of circulation associated with the zones of disjunctive disturbances and, especially, in areas of their spatial overlap accompanied by open tectonic fracturing. At the same time, depending on the scale of tectonic disturbances, fractured-vein aquifers can be either through, intersecting the entire sedimentary stratum of the Meso-Cenozoic, or localized in separate intervals of its section.

The presence of various tectonic faults creates additional pathways for gas and water exchange, forming the zones of sub-vertical interstratal flows against the background of sub-horizontal regional flows of groundwater. The latter usually appear in the form of specific, hydrochemical and hydrothermal anomalies, often forming hydrogeological structures close to hydroinjection domes.

PROCESSING OF THE MIXTURE OF FRIED SUNFLOWER OIL AND ACETATE INTO THE MICROBIAL EXOPOLYSACCHARIDE ETHAPOLAN

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Abstract. Nowadays utilization of various industrial wastes, such as fried sunflower oil is an urgent problem. It should be noted that this waste is extremely toxic and its disposal is not regulated in the majority of the countries resulting in serious environmental problems. In our previous work, we demonstrated the possibility of microbial ex-opolysaccharide ethapolan synthesis by Acinetobacter sp. IMV B-7005) on a mixture of acetate and refined sun-flower oil. Further research made it possible to replace refined oil in the mixed substrate with a waste one.

Keywords: Acinetobacter sp. IMV B-7005, ethapolan, mixed substrates, the mixture of waste sunflower oil and sodium ace-tate.

Large volumes of waste vegetable oil are being generated all over the world. Thus, more than 16.5 million tons of this waste are generated annually in the world and from them nearly 1.6 million tons are generated in Eu-rope. It should be noted that this waste is extremely toxic because it contains acrolein (destroying DNA), acrylamide (causing heart disease), heterocyclic amines, fatty acid polymers, and free radicals. Systematic disposal of oil-containing waste into the environment is not regulated in the majority of the countries, which causes serious environmental problems. Meanwhile, the chemical treatment of waste oil stays economically unprofitable.

One of the promising methods of waste oil processing is using it as in biotechnology a substrate for microbial synthesis. In our previous work [] the possibility of the microbial exopolysaccharide (EPS) ethapolan synthesis (pro-duced by Acinetobacter sp. IMB B-7005) on the mixture of acetate and sunflower oil has been established. The main disadvantages of this technology were the low yield of the target product due to the increase in the pH of the culture fluid and the use of refined oil in the mixture.

Taking into account the above information, the purpose of this work was to investigate the possibility of replacing the refined oil in the mixture with acetate on a waste one, as well as to intensify the ethapolan synthesis.

The IMV B-7005 strain was grown in liquid mineral medium with the addition of yeast autolysate (0.5 %, v/v) and the multivitamin complex “Complevit” (0.00085 %, w/w by pantothenate).

Sodium acetate (1-3 %, w/w) in the mixture with refined or mixed waste sunflower oil (0.3-1.75 %, v/v) was used as a carbon source. Waste oil (after roasting meat, potatoes, onions, and cheese) was obtained from “Rocker-Pub”, Kyiv. In one variant, the initial concentration of acetate in the medium was 0.5-1.5 and oil 0.25-0.75%, and during the cultivation process these substrates were fractionally added in portions of 0.5-1.5% (acetate) and 0.25-0.75% (oil). If before addition the pH of the culture liquid exceeded 8.0-8.5, acetic acid was applied into the equimolar (by carbon) concentration (0.35%, v/v) instead of acetate. The culture in exponential growth phase, grown in a medium with refined or waste oil (0.5 %) was used as inoculum. The concentration of inoculum was 10%. Cultivation of the IMV B-7005 strain was carried out in flasks (750 ml) with 100 ml of medium in a shaker (320 rpm) at 30 °C for 120 hours.

Experiments showed that reduction of the initial monosubsrates concentration in the mixture up to 1/3 of their total content, followed by fractional addition in portions in the process of producer growing to the final con-centration of sodium acetate 1,5-3.0 % and oil 0.75-1.5 % allowed to stabilize the pH of the medium during cultiva-tion at the level of 6,4-7.8 and increase the indicators of the ethapolan synthesis compared to a single addition of the corresponding concentrations of substrates.

Note that after the second portion of 1.0 % acetate and 0.5 % refined oil was added, the pH of the culture broth was increased to 8.0-8.2. In this variant, for further stabilization of the pH, the third portion of acetate was replaced with acetic acid. This approach allowed not only to maintain the pH of the medium at the optimal level for the EPS synthesis but also led to an increase in the amount of synthesized EPS by 1.25 times (to 17.27 g/l).

In further experiments, it was found that the replacement of refined oil in the mixture with acetate on mixed waste oil leads only to a slight decrease in the concentration of obtained polysaccharide compared to the use of refined substrate (to 16.36 g/l).

Thus, as a result of the research, it was shown the possibility of an effective processing mixture of mixed fried oil in the mixture with acetate into exopolysaccharide ethapolan.

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QUANTITATIVE ESTIMATION OF CHEMICAL REACTIONS EFFICIENCY AND SAFETY BY GREEN CHEMISTRY METRICS

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Research considers methods of quantitative estimation of chemical processes safety for the environment and human. The main goal is to analyze the green metrics ability to reflect all aspects of the environmental and chemical safety and efficiency.

Keywords: environmental safety, chemical safety, green chemistry, green metrics, sustainable development.

Unfortunately, sometimes the scientists mix green chemistry (GC) up with environmental chemistry, ecology or even with social movements, but this opinion is wrong. Firstly, GC is about inherently safer design, but not about remediation and end-of-pipe strategy. Anyway, GC is closely connected with ecology. An actual problem is to estimate the «greenness» of green processes. It can be estimated quantitatively by using of green metrics.

The first green metrics were «atom economy» and «environmental factor» (E-factor). The main advantage of the first metrics is that they take into consideration not only the target-product yield, but waste products as well. But these metrics do not distinguish waste products by the degree of their harm to the environment and human. Later, R. Sheldon, the inventor of E-factor, proposed to add to the E-factor's formula the EQ coefficient. This coefficient takes into account the «degree of harm» of the substances. For example, EQ=1 for non-toxic substances such as NaCl and EQ for extremely toxic substances, such as salts of heavy metals, can be very high (up to 1000). The concept of «harm» is too broad to accept this metric. Moreover, it does not include energy flows and many other factors. To solve the problem of energy costs estimation new metrics take into consideration exergy flows. They help to asses not only the energy spent, but to estimate the economic profit of the chemical production [1].

We have highlighted main problems of green metrics elaboration. One of them is to accumulate all the factors in one metric. Another important issue is to take into account the ambiguity of the concept «harmful substances» or «toxicity», which is too broad. The ways substances can do damage to human health and the environment can be different. Scientists must also take into consideration not only the process of target-product obtaining, but a full life cycle of the product from «cradle to grave» or «cradle to cradle». One of the obstacles in assessing harm of a certain substance is a lack of data on its toxicity, which can be observed, for example, in pharmaceutical production.

State-of-the-art metrics can suggest solutions to these problems. It is proposed to use environmental impact potentials to asses all the aspects of toxicity, carcinogenicity and other aspects that influence the state of the environment and human health. Similar potentials are also used to consider the probability of industrial accidents. All the potentials are united in one metric: the benign index and the safety-hazard index respectively. Cumulative energy demand (CED) can be used as a metric to estimate total energy use over the entire life cycle of a product from its manufacturing from raw materials till its end of life [2].

It is also possible to estimate safety of the chemical processes not quantitatively, but with the help of schemes. For example the «Green Star» is a star with 12 corners; each corner represents one of the 12 principles of GC. The advantages of this scheme are as follows: a good visibility of processes safety and a possibility to estimate a process from the point of view of the twelve principles in one time. The Green Star also shows interdependence of the GC principles [2]. However, the concept of GC principles is an early attempt to systematize regularity of the rules, according to which GC is developing. That is why it is important to improve the Green Star by changing the criteria, while preserving the very idea of the scheme. There is a tendency of computerization of green metrics, however such metrics also have certain difficulties, which will be the object of the future research. Ignorance of metrics or the usage of only one simple metric is wrong, because an estimation of the reaction «greenness» can give absolutely another result using different metrics. It can appeared, that green innovation is not green. That is why it is better to use multivariate metrics. Significant progress in green metrics development is achieved, but certain challenges still exist in accuracy of measurements and risk accident and environmental impact assessment.

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QUANTITATIVE LUMINESCENT DETERMINATION OF IMPURITIES OF FAT DECOMPOSITION PRODUCTS IN NATURAL OBJECTS USING PYRONIN G

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The study substantiated the practical application of the cationic dye Pironin G as an effective reagent for quantitative luminescent determination of higher carboxylic acids in real objects.

Keywords: extraction; Pyronin G; luminescent definition; carboxylic acids.

The study of the quantitative composition and dynamics of carboxylic acids in environmental objects is very important to control these substances content due to anthropogenic pollution of biosphere with substances of this class, since most of them have toxic properties.

Earlier in our works, it was shown that exist possibility for quantitative extract-photometric determination of higher carboxylic acids using cationic dyes Safranin T and Pironin G. Based on the use of these dyes, methods for the determination of higher carboxylic acids in some organic liquids by photometric method were developed. Pyronine G is a cationic dye belonging to the class of fluorone dyes with the ability to luminescence. Based on these data, we proposed to use this dye for quantitative fluorescence analysis of higher carboxylic acids.

The study of the fluorescence characteristics of ionic associates of higher carboxylic acids with the cationic dye pyronin G was carried out at room temperature in the wavelength range of 540-700 nm. We found that it has maximum of absorption at 530 nm. Also, we recorded absorption and emission spectra of ionic associates of palmitic acid with pyronine G at pH = 11.25. The maximum fluorescence of pyronine G is observed at 563 nm (Fig. 1 A.)., And the maximum absorption at 520 nm.

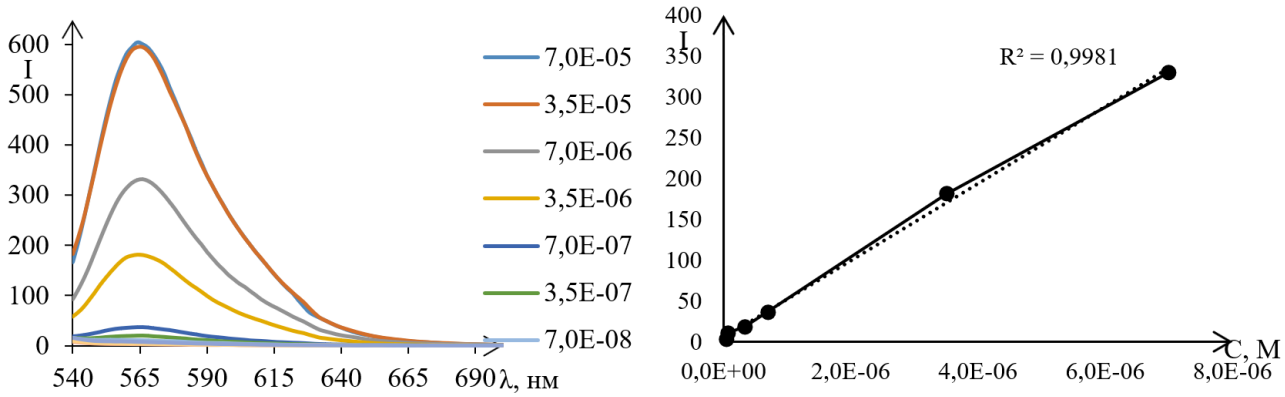

Fig. 1. – A. Fluorescence spectrum of ionic associates of palmitic acid (1 10^{-4} M) with the cationic dye Pironin G at various concentrations
B. Example of a calibration plot for associates of palmitic acid with Pironin G dye

So it is proposed to use the following system to extract associates of carboxylic acids with Pironin G: 5 cm^3 5% vol. n-octanol in heptane and 0,65 cm^3 of a palmitic acid solution in heptane (from 1,0 10^{-6} to 5 10^{-9} M); 0,35 cm^3 of an aqueous solution of Pyronin G 1,75 10^{-4} M, 2 cm^3 of glycine buffer (pH = 11.25), the volume of the aqueous phase was brought to 5 cm^3 (Fig. 1B).

After analyzing the fluorescence spectra and the calibration curve, we can conclude that this technique is highly sensitive, rapid, but has prospects for further improvement.

RADIATION MONITORING IMPLEMENTATION METHODS IN THE RADIATION THERAPY DEPARTMENT OF THE N.N ALEXANDROV NATIONAL CANCER CENTRE OF BELARUS

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The aim of the work is to analyze the radiation safety monitoring procedures in the radiation therapy department of the N. N. Alexandrov National Cancer Centre of Belarus.

Keywords: radiation safety, radiation monitoring, radiation therapy, dosimeter, thermoluminescent dosimeter, exposure rate.

Radiation safety is the state of protection of the population, personnel and the environment from the harmful effects of ionizing radiation. One of the main components of the radiation safety of the population and personnel in the N. N. Alexandrov National Cancer Centre of Belarus is the implementation of radiation monitoring during radiation therapy.

The procedure of radiation monitoring to ensure radiation safety is carried out in accordance with the requirements of sanitary rules and regulations, namely, «Requirements to radiation safety assurance of personnel and population in use of nuclear energy facilities and sources of ionizing radiation» approved by the Decree of the Ministry of Health No. 137 of 31.12.2013; 2.6.3.13-24-2006 «Hygienic requirements for ensuring radiation safety during radiation therapy»; 2.6.12-34-2006 «Hygienic requirements for the placement and operation of electron accelerators with energies up to 100 MeV».

Radiation monitoring includes:

• The monitoring of the photon radiation and neutron flux exposure rate at personnel workstations, in the rooms adjacent to a treatment room. It is held 2 times a year. Unscheduled inspections are possible.

• Individual dosimetric monitoring. It is carried out regularly with the registration of measurement results once a quarter in the record cards of personnel individual external exposure.

• The measurement of gamma ray fluxes from the active parts of the accelerator after maintaining.

The monitoring of a radiation situation is also carried out in the rooms adjacent to a treatment room.

To carry out regular monitoring of the radiation situation in the premises of the radiation therapy room, a «СРК АТ-2327» system with «БДКГ-02» and «БДКН-04» sensors is installed. The sensors serve to control the level of gamma and neutron radiation, respectively.

The control of personnel gamma radiation individual exposure in the National Cancer Centre of Belarus is carried out using a thermoluminescent DTU-1 dosimeter. The dosimeter has good sensitivity indicators and a fairly wide exposure measurement range, which is sufficient when used in these conditions.

For detailed radiation monitoring, the «ДКС-АТ1121» dosimeter is used. Exposure rate control is carried out at the personnel places of stay and in the rooms adjacent to a treatment room. Due to its high sensitivity and low response time, an instant estimate of the exposure rate at a specific point is made. The obtained value is compared with the value of the equivalent exposure rate used in the design of protection against external ionizing radiation, stated by 2.6.3.13-24-2006 «Hygienic requirements for ensuring radiation safety during radiation therapy». It allows drawing conclusions about whether the exposure rate in a specific room is normal or exceeds the norms with a subsequent issue either of a permit or a ban for the operation of the accelerator or other equipment capable of emitting ionizing radiation.

This work analyses radiation safety monitoring procedures in the radiation therapy department of the N. N. Alexandrov National Cancer Centre of Belarus. The methods and devices used for the radiation monitoring of the analyzed department are relevant, effective and fully provide radiation monitoring. Due to this approach to radiation safety, the exposure to personnel and the population does not exceed its permissible limits.

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RETROSPECTIVE ANALYSIS OF THE GENERAL MORBIDITY OF GASTROINTESTINAL DISEASES IN THE KOBRIN DISTRICT (2015-2019)

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The paper presents a retrospective analysis of the general morbidity of gastrointestinal diseases in the population of the Kobrin district; analyzes the structure of gastrointestinal disease morbidity according to clinical forms and the dynamics of morbidity among the urban and rural population of the Kobrin region for the period from 2015 to 2019.

Keywords: Morbidity, dynamics, tendency, growth rates, general morbidity.

The work analyzes the structure of the general morbidity of gastrointestinal diseases in the population of the Kobrin region at the beginning (2015) and the end (2019) of the period under study. It is noted that the first rank places in the structure of the overall morbidity in 2015 were occupied by the following diseases: gastritis and duodenitis (33.63%), gastric and duodenal ulcers (23.28%), diseases of the gallbladder and biliary tract (11.97%), cholelithiasis (8%), and hernias, diseases of the mouth cavity, diseases of the pancreas (≈ 6% each).

At the end of the period studied, the morbidity structure of the population of the Kobrin region did not change. Gastritis and duodenitis were still in the first rank place; the contribution of them to the morbidity structure decreased by 1.59%; the stomach and duodenal ulcers were in the second place with the decrease of 2.54%; diseases of the gallbladder and biliary tract were in the third place, the contribution of which increased by 1.92%; and cholelithiasis was in the fourth place with the increase of 1.82%.

The average annual morbidity rate (A0) was 611.156 per 10 thousand of population. The annual trend indicator (A1) is 0.434 per 10 thousand of population.

After analyzing the data on the overall morbidity of gastrointestinal diseases among the residents of Kobrin and the local rural population for 2018, it was noted that among the urban population the most common diseases were the following: 1) gastritis and duodenitis (35.88%), 2) stomach and duodenal ulcers (22.77%), 3) diseases of the gallbladder and biliary tract (11.66%), 4) hernias (9.78%) and 5) cholelithiasis (9.05%).

Having studied the data on the general morbidity of the rural population of the Kobrin region for the period of 2018-2019, it can be concluded that, in general, the structure of morbidity of both urban and rural populations is similar, with the exception of the diseases of the mouth cavity and pancreas, which can be explained by the differences in lifestyle, attitude to their health, access to medical care.

The analysis of the general morbidity of the Kobrin region revealed a tendency towards the increase in the incidence of diseases of the gallbladder and biliary tract and cholelithiasis, as well as the decrease in the general incidence of stomach and duodenal ulcers.

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SCOTS PINE VARIATION WITH ANTHROPOGENIC IMPACT

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Bilateral parameters of the Scots pine conifer needles growing in stress environmental conditions as indicators of environmental pollution and biomarkers of the functional state of plants are examined in the work.

Keywords: Scots pine, needles, morphological and anatomical parameters, fluctuating asymmetry, FTIR spectroscopy, an-thropogenic factors.

Currently, not only the silver birch but also the Scots pine, the stands of which are widely represented in the territory of Minsk, belongs to the widespread objects of environmental quality examination and participate in the cleaning of the atmosphere and distribution and assimilation of pollutants.

It should be noted that the stability of development and physiological biochemical characteristics of the conifer assimilation apparatus with different levels of aerotechnogenic impacts and in different climatic conditions were examined by many researchers, but for Belarus such works are fragmentary, and there is no systematic research, which determined the relevance of the research performed.

The purpose of the research was to examine the fluctuating asymmetry of conifer needles in the conditions of anthropogenic impact with motor vehicle and industrial impacts different in their rate.

The research subjects were the pine stands of the Pervomaiskiy (with a favourable ecological situation, №№1-3) and Partizanskiy (with mainly the most unfavourable situation determined by the high level of air and soil pollution, plant suppression, №№4-5) districts of Minsk; the pine trees growing in the territory of the State Environ-mental Institution Berezinskiy Biosphere Reserve (hereinafter – BBR, №6) were taken as control objects (a condi-tionally clean territory).

On each observation plot, conifer needles of the 2nd year of life were selected from the primary branches in the lower part all around the crown of 15 trees at the end of the 2012 and 2019 vegetation seasons (30 pairs from each tree).

A comparative analysis of the pine stands examined showed that the highest values of the fluctuating asymmetry index in both 2012 and 2019 were on Dolgobrodskaya Street (№5) in the Partizanskiy district of Minsk – its average value equalled 0.0124±0.0039 and 0.0135±0.0045 (over the period of 7 years the fluctuating asym-metry index increased by 8%). The minimum values of this index were discovered in the trees examined in the terri-tory of the BBR (№6) – 0.0065±0.0017 and 0.0068±0.0021 respectively (the fluctuating asymmetry index in-creased by 4%) (fig.1a, 1b).

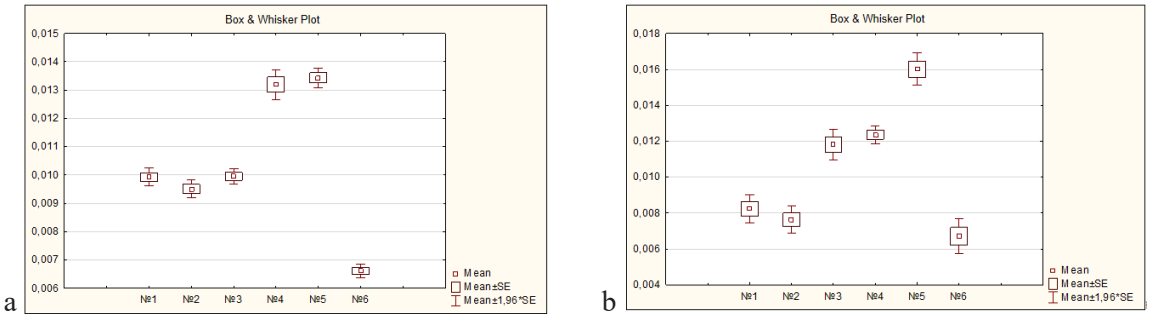

Fig. 1. – Graphs of the conifer needle fluctuating asymmetry value in 2012 (a) and 2019 (b)

In general, there is no significant dependence between the fluctuating asymmetry index and the year of examination for these territories, which can indicate either a fairly constant level of exposure to unfavourable anthropogenic factors, or non-reactive responsiveness of the trees examined. At the same time over the past period, the decrease of the value of the fluctuating asymmetry index was discovered on Vsekhsvyatskaya Street (№1) and Vereskovaya Street (№2) in the Pervomaiskiy district (by 21 and 25%), as well as by 13% on Vaupshasova Street (№4) in the Partizanskiy district, which showed the decrease of the anthropogenic impact level. Regarding Gerasi-menko Street (№3), the deterioration of quality of the pine stand growing conditions was discovered. Thus in 2019 the fluctuating asymmetry index in this territory increased by 13% compared to that of 2012.

The one-way ANOVA test showed significant variations among the groups examined ($F = 17.44$, $P = 0.00$ (in 2012); $F = 69.27$, $P = 0.00$ (in 2019). In order to determine what specific places of selection varied greatly,

multiple comparisons were performed with the use of the Tukey a posteriori test which helps avoid the loss of statistical power.

As a result, it was determined that in 2012 there were highly significant variations between the control objects and all other objects examined. In 2019 there were no variations between the control objects and objects 1-2 (Partizanskiy district), which showed the improvement of ecological situation in the district.

«SMART» TECHNOLOGIES IN ENSURING ENVIRONMENTAL SAFETY IN RUSSIA: ANALYSIS OF TRENDS AND DEVELOPMENT PROSPECTS

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The author addresses the problem of using digital innovations in the field of ensuring environmental safety in Russia, presents the results of analyzing the data from the register of "smart" city projects and concludes that the current projects are not sufficiently effective in terms of solving environmental problems.

Keywords: environmental safety, "smart" technologies, "smart" city, Russia.

The negative dynamics of indicators of the state of the Russian environment determines the observed intensification of policy measures aimed at ensuring the environmental safety of the territory. Since 2018, its main focus has been the virtualization of environmentally oriented interactions in the country, in accordance with the approved urban digitalization project "Smart city". The proposed introduction of digital innovations – "smart" technologies – in all spheres of public life is intended to minimize the entire range of threats to public security, among which envi-ronmental ones play an important role [2].

The use of "smart" technologies in environmentally oriented interactions in the future is perhaps the most appropriate from the point of view of solving environmental problems in Russia. Developed and implemented in order to effectively monitor the state of the environment, protect it from anthropogenic impact and restore it, "smart" technologies do not harm it by themselves, since they work on information. The latter is a safe "fuel" – it has a non-natural origin and therefore does not deplete its reserves, allows reducing their consumption, acting as a substitute in some cases, and does not pollute the environment [3].

The available features, however, are currently poorly implemented. Among 314 "smart" city projects in Russia, 8 are aimed at ensuring environmental safety and they are launched only in 1/5 of all cities in the country. These are, in particular, 5 environmental monitoring services (operating in several regions IMETEOLABS and Cit-yAir, Moscow GOST, as well as monitoring services of the cities of Khanty-Mansiysk and Lipetsk), which provide automated data collection on established indicators in an information database available online for rapid identifi-cation of environmental problems of territories and their sources and for quick management decisions. It is also an automated system for managing wastewater treatment facilities in several regions, the "Smart urn" system in the city of Reutov, and the irrigation management system in the city of Tolyatti, which reduce the costs of all processes and increase their efficiency [1, 2].

Taking into account the dynamics of environmental indicators, the small project and territorial coverage of solutions to its problems, thus, indicates the low effectiveness of currently used "smart" technologies in terms of ensuring environmental safety in Russia. At the same time, their capabilities in this area are very large, which indi-cates the need for further development of relevant projects.

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SOLAR PANELS RECYCLING

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Annotation: in this paper, examples of regulation of solar panels recycling in different countries are been considered.

Keywords: ecology, photovoltaic stations, recycling, legislation.

The construction of solar power plants is developing at a rapid pace and requires the use of hazardous materials in production (hydrochloric acid, sulfuric acid, nitric acid, hydrogen fluoride, 1,1,1-trichloroethane and acetone, lead, copper, gallium and cadmium, synthetic materials and aluminum). The service life of modern photocells is 30-50 years, and their widespread use in the near future can aggravate the problem of processing. The global volume of waste from recycling photovoltaic plants in 2019 amounted to 50 million tons. Recycling of panels that have expired is a problem for all countries developing alternative energy.

The vast majority of countries recycle in accordance with the requirements for the treatment of conventional waste, for example, in China. In the United States, disposal is carried out in accordance with applicable laws. It is estimated that in 2020 the mass of waste in Japan will exceed 10,000 tons, by the end of 2040 - 800,000 tons [1]. Japan is one of the first countries to try to improve the process of recycling photovoltaic cells by modernizing enterprises that deal with hazardous materials. In Europe, at the legislative level, the following have been introduced and are binding on all manufacturers of solar panels: the EU Directive on Electronic Waste, the Rules for the Handling of Hazardous Materials and the PV Cycle project, according to which obsolete panels are recycled, collection centers for recycled raw materials are created, and the production of photovoltaic modules has begun. new generation. However, at present, hazardous waste from the disposal and collection of used panels requires harmless recycling [2].

In the world experience in the processing of solar cells, there are two ways. The first method is crude, in the process of which recyclable basic elements are extracted: copper, aluminum, semiconductor materials, glass. As a result of this processing, environmentally hazardous and valuable materials (lead Pb, cadmium Cd, selenium Se, silver Ag, indium In, tellurium Te, silicon Si) cannot be reused; In the second method, with a fine processing process, all the chemical elements are extracted. At present, the volume of waste is not as large as it will be in the future, so the panels are disposed of at a laminated glass recycling facility. Harmful materials such as plastics are incinerated and stored in landfills. The fine processing process is more environmentally sound, but costly and has three stages: 1) removal of the metal frame and junction box; 2) removal of the laminating film; 3) extraction of glass and metals. The profitability of processing is possible with a waste volume of at least 20,000 tons per year. Today, the costs are higher than the cost of recovered materials, so most solar panels with hazardous elements are dumped in landfills [3].

In the Republic of Belarus at the moment there is no legislation regulating the process of recycling solar panels. To improve the efficiency of utilization of photovoltaic plants, it is possible to attract enterprises for the processing of chemical waste, as well as to control these processes by law. It is necessary to reuse the «unused» parts of solar power plants.

Thus, due to the inevitable wear and tear of photovoltaic power plants, the main attention should be paid to the removal of hazardous elements and compounds from production processes. In the Republic of Belarus there is an opportunity to learn from the experience of countries that regulate the process of recycling solar panels by law, and to modernize the production of existing enterprises to improve the environmental friendliness of the recycling process.

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SPECIALLY PROTECTED NATURAL AREAS OF PRIPYAT POLESIE

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The area of specially protected natural areas (SPNA) within the Pripyat Polesye is 364145 hectares, which is 1.9 times higher than for the territory of the Republic of Belarus. There are 12 specially protected natural areas that have an international nature conservation status.

Keywords: specially protected natural areas, Pripyat Polesie, national park, wildlife sanctuary, natural monument, international conservation status.

Pripyat Polesie is a district of the Belarusian Polesie in the system of physical-geographical zoning of the ter-ritory of the Republic of Belarus. The territory of Pripyat Polesie has a number of features: high swampiness, a high degree of forestedness, relatively low agricultural development, etc., which predetermined a high degree of distribu-tion of natural ecosystems, mainly forest and marsh. The purpose of this study is to identify the features of the structure of the protected areas of the Pripyat Polesie.

On the territory of Pripyat Polesie, SPNAs occupy 364145 hectares, or about 17% of the area [1], which is two times higher than the average for the Republic of Belarus, which is 8.9% [2]. There is one national park, 35 wildlife sanctuaries and 26 natural monuments within the district. Among the protected areas of Pripyat Polesie, 12 have an international nature conservation status.

National Park «Pripyatsky» is located in the eastern part of Pripyat Polesie, covers an area of 8853 hec-tares [1]. Wildlife sanctuaries on the territory of Pripyat Polesie occupy 16.5% of the total area, which is more than the national average, which is 6.6% [2]. In the structure of wildlife sanctuaries there are republican and local signifi-cance (15 and 20 wildlife sanctuaries, respectively).

Wildlife sanctuaries are subdivided into types. Among them, within the Pripyat Polesie, there are biological (15), hydrological (9), landscape (7), wetland (4). Biological wildlife sanctuaries occupy 6.8% of the area of all wild-life sanctuaries, hydrological - 5%, landscape - 75.5%, wetland - 12.7% of the area of the Pripyat Polesie wildlife sanctuaries [1].

Natural monuments occupy 0.03% of the area of Pripyat Polesie. In total, there are 26 natural monuments, of which 5 are natural monuments of republican significance and 21 are local. Among them, 1 natural monument is geological (geological outcrop «Doroshevichi»), and the rest are botanical (meadow park Ploshchevo, Gnezdetskoye zapolye, park «Mankovichsky», planting of Karelian birch «Kalininskoye», etc.) [1]

Among the protected areas of Pripyat Polesie, 12 have an international nature conservation status. They oc-cupy 14.3% of the district's territory. Of the 26 wetlands of Belarus that have the status of international importance (Ramsar lands), 10 are located within the Pripyat Polesye: the Pripyatsky national park, wildlife sanctuaries «Spo-rovsky», «Podveliky mokh», «Vygonoshchansky», «Zvanets», «Sredny Pripyat»,»Prostyr», «Morochno», «Olmanskie swamps»,»Stary Zhaden» [1].

In addition, Pripyat Polesie contains 2 out of 4 wetlands of Belarus, which are recognized by the Secretariat of the Ramsar Convention as parts of transboundary wetlands of international importance: «Prostyr – Pripyat – Stokhod» (Belarus - Ukraine); «Olmanskie swamps - peat massif «Perebrody» (Belarus – Ukraine). Also here is lo-cated 1 of 6 protected areas of Belarus of international importance, which have the status of key botanical territo-ries [1]. Of the 14 territories of Belarus included in the list of territories important for the conservation of wild birds in Europe, 11 are located in Pripyat Polesie and occupy 13.8% of the entire territory of the district [1].

Protected areas are mainly confined to swamp natural-territorial complexes, which are replaced by forests and meadows. Swamp ecosystems are represented by upland, transitional and lowland bogs. Among the forest communities, there are high-aged floodplain oak forests and hornbeam forests, high-aged pine forests, and black alder communities. The meadows are swampy and dry.

Most of the protected areas are characterized by their location on a flat floodplain terrace, strong waterlog-ging, an abundance of oxbow lakes, a close occurrence of groundwater and their outlet to the surface.

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SPECIES DIVERSITY OF INVERTEBRATES ON THE TERRITORY OF NATIONAL PARK «CHEREMOSKYI»

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Abstract. The results of the inventory of species diversity of invertebrates (n=1277) in the territory of the National park «Cheremoskyi» (Putila district, Chernivtsi region, Ukraine) are shown. The analysis of taxonomic structure of invertebrates in the region of researches is carried out. The list of rare species of invertebrates in this area is given.

Keywords: invertebrates, Arthropoda, Mollusca, Insecta, National park «Cheremoskyi», taxonomic structure, inventory.

National park «Cheremoskyi» (hereinafter NP «Ch») was established by the decree of the President of Ukraine on 11 December 2009 year. It is located in the Putyla district of Chernivtsi region within the Bukovynian Carpathian Mountains and has a total area of 7117.5 hectares.

1277 species of invertebrates were recorded on the territory of NP «Ch» (from 12 October 2011 year). They belong to 135 families, 26 series and 13 classes (1 species of hydrozoans, 4 – turbellarians, 3 – nematodes, 1 – horsehair worms, 10 – oligochaetes, 2 – leeches, 5 – Branchiopoda, 13 – maxillopodans, 1 – malacostracans, 10 – springtails, 3 – spiders, 1197 – insects, 27 – gastropods).

Analysis of the taxonomic structure of invertebrates, that occur in the NP «Ch», showed that the type Arthropods (Arthropoda) is represented by 6 classes, among which the insects (97.5%; n=1226) are dominate (fig. 1), and by 20 rows, among which butterflies (Lepidoptera) are dominate (35.8%), Coleoptera are subdominate (22.0%), true bugs (Hemiptera), true flies (Diptera), Hymenoptera and Mallophaga are slightly less (12.9%, 11.0%, 9.5%, 4.5%, respectively), the representation of the remaining rows are less than 1.0%. The type molluscs (Mollusca) is represented by one class of gastropods (Gastropoda) and by one row of pulmonates (Pulmonata), which consists of 10 families. Representatives of door snails (Clausilidae) and typical snails (Helicidae) are dominate (by 18.5%; n=27) among these families. The share of false snails (Hygromiidae), keelback slugs (Limacidae), true glass snails (Zonitidae) and roundback slugs (Arionidae) are slightly smaller (by 11.1%). Glass snails (Vitrinidae) are even smaller (7.4%). The rest is less than 4.0% (fig. 2).

Stay of 12 species of invertebrates, listed in the third edition of the Red Book of Ukraine, is established within the NP «Ch», namely: Hirudo medicinalis L., 1758, Aromia moschata L., 1758, Papilio machaon L., 1758, Parnassius apollo L., 1758, P. mnemosyne L., 1758, Apatura iris L., 1758, Erebia manto Denis et Schiffermüller, 1775, Endromis versicolora L., 1758, Callimorpha dominula L., 1758, Chondrina clienta Westerlund, 1883, Plicutersa lubomirskii Slósarski, 1881, Trochulus bielzi A. Schmidt, 1860.

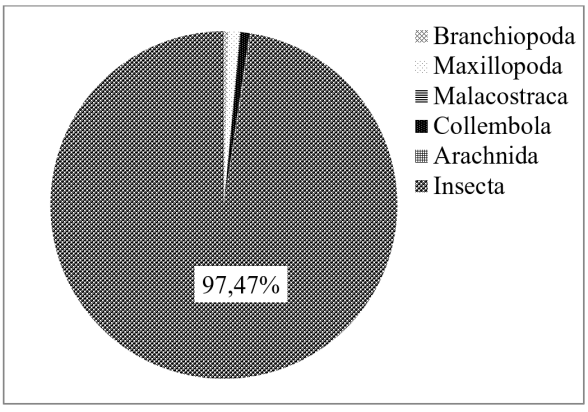

Fig. 1. – Taxonomic structure of the Arthropoda type in the spectrum of classes (n=1226).

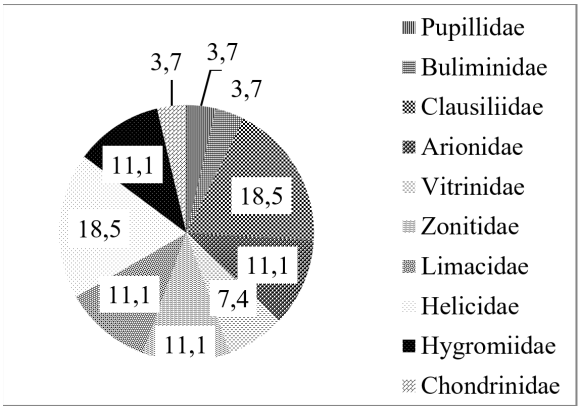

Fig. 2. – Taxonomic structure of the Mollusca type in the spectrum of families (n=27).

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STEP INTO THE FUTURE WITH RUSSIAN ANTINEUTRINO DETECTORS

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Several antineutrino detectors are currently installed in Russia, or rather, at the Beloyarsk nuclear power plant. In the case of inverse beta decay, the first goal is to have a hydrogen-rich medium, which can be water, a LOS (liquid organic scintillator - a flammable liquid akin to kerosene) or a plastic (POS). The second problem is the accurate registration of positron energy (it gives the Cherenkov glow in water with n = 4/3 already at energies above 0.388 MeV) and two annihilation photons with the energy of 0.511 MeV.

Nuclear reactions are one of the conditions for the registration of antineutrinos, and an antineutrino detector consists of three zones: inner, middle and outer. The first zone carries a beta decay reaction, the second one converts γ from antineutrinos in the inner volume, and the third one suppresses scintillation in the outer zone.

The detection using the reaction of inverse beta decay $\bar{\nu} + p \rightarrow e + + n$ in a medium with the volume of ~ 1 m3 with a high hydrogen content can record about 10 thousand events per day. This reaction makes it possible to reduce the number of background triggers, since it consists of two events separated by a time interval: first, annihilation of a positron with an electron of the medium is recorded, generating 2 photons with energy of 0,511 MeV each, and then the neutron is absorbed by gadolinium added in a small amount to the detecting medium which creates a wide burst of light. The measurement of the energy spectrum of antineutrino provides information on the changes in the fuel composition, which makes it possible to monitor fuel burnup and even (after calibrations) to prolong and optimize the fuel cycle. Background registration, rescattering of light in the volume of the detector, and reflection of light from the upper and lower surfaces of the detector will allow more accurate modeling of the events inside the detector and will make it possible to fine-tune this reconstruction method.

Currently, antineutrino diagnostics of nuclear reactors is being actively developed all over the world: both small detectors and very large installations are being built. An antineutrino detector allows you to continuously receive information on completely new parameters, alternative to the standard thermal and neutron channels.

SYNERGISTIC EFFECT ON MICROORGANISMS OF MICROBIAL SURFACTANTS, ESSENTIAL OILS AND THERE MIXTURES

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It was found that N. vaccinii IMV B-7405 surfactants synthesized on purified glycerol showed a synergistic antimicrobial action with the investigated tea tree, lemongrass, cinnamon essential oils. Minimum inhibitory con-centrations of a surfactants and tea tree essential oil mixture against bacteria (Bacillus subtilis BT-2 (spores), Esch-erichia coli IEM-1, Staphylococcus aureus BMS-1) and yeast (Candida albicans D-6, Candida utilis BVS-65 and Candida tropicalis RE - 2) were 2-20 μg/ml and were significantly lower than each compound separately (156-625 and 8-80 μg/ml for essential oils and surfactants, respectively).

Keywords: surfactants, essential oils, synergism, antimicrobial action.

According to recent studies of World Health Organization (WHO), almost half of clinical isolates of Staphylococcus aureus and Escherichia coli strains are resistant to 3rd generation cephalosporins, fluoroquinolones and carbapenems. Likewise, the resistance of representatives of the genus Candida is increasingly reported against

flu-conazole (93 %), amphotericin B (35 %) and echinocandins (7 %) [1-2]. Those pathogens annually cause illnesses of nearly 700 thousand people worldwide, and according to some experts those numbers may reach 10 billion as early as 2050 [3]. Reducing the number of resistant microorganisms can be achieved by using alternative com-pounds of natural origin, such as surfactants (SA) and essential oils (EO). The latter contain aldehydes, alcohols and phenolic compounds and thus are effective antimicrobial agents. However, the minimum inhibitory concentrations (MIC) of EO are rather high (400-1600 μg/ml). Simultaneously, EO in such concentrations are known to cause se-vere damage to the central nervous system, and aspiration pneumonia [4]. The concentration of EO can be reduced without affecting their properties if they are used in combination with other biocides. The aim of this study to inves-tigate the antimicrobial activity and synergic activity of Nocardia vaccinii IMV B-7405 surfactants, essential oils and their mixtures.

N. vaccinii IMV B-7405 was grow in a liquid nutrient medium as a carbon source was used purified glycerol (2 %, v/v). The amount of synthesized extracellular surfactants (g/l) was determined by weighting method after extraction from a supernatant of culture fluid with a modified Folch mixture. Antimicrobial properties of the surfac-tants were determined by index of MIC. To determine the synergism of the antimicrobial action, were used prepa-rations of surfactant and tea tree, lemongrass, cinnamon essential oils with a concentration 2 times less than the MIC value of each of the preparations. The ratio of preparations in the mixture was 50:50.

In studies, we established a synergism of the antimicrobial activity of tea tree EO and surfactants of N. vac-cnii IMV B-7405 against Pseudomonas sp. MI-2, Staphylococcus aureus BMS-1, Escherichia coli IEM-1 and Ba-cillus subtilis BT-2. MIC of essential oil in the test cultures were 625-156 μg/ml, and in the presence of surfactants they decreased by 2 to 260 times. MIC of the mixtures of EO and surfactant were three orders of magnitude lower against S. aureus BMS-1 and B. subtilis BT-2 than MIC established for essential oil only.

Further experiments showed that surfactants of N. vaccinii IMV B-7405 exhibited a synergistic effect when mixed with cinnamon and lemongrass EO. Thus, MIC of EO against Candida albicans D-6, C. tropicalis PE-2 and C. utilis BMS-65 were in the range of 312–156 μg/ml, and if EO were added to the surfactant solution, their MIC decreased to 9.7–39 μg/ml.

Therefore, our own studies are among the first few to demonstrate the synergistic antimicrobial activity of EO with surfactants.

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SYNTHESIS OF AUXINS BY STRAINS *ACINETOBACTER CALCOACETICUS* IMV B-7241, *NOCARDIA VACCINII* IMV B-7405 AND *RHODOCOCCUS ERYTHRPOLIS* IMV AC-5017 IN THE PRESENCE OF TRYPTOPHAN IN THE CULTURE MEDIUM

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Abstract. It was found that the introduction of tryptophan into the culture medium of strains *Acinetobacter calcoaceticus* IMV B-7241, *Nocardia vaccinii* IMV B-7405 and *Rhodococcus erythrpolis* IMV Ac-5017 was accompanied by an increase in the amount of synthesized auxins by one to three orders of magnitude.

Keywords: phytohormones, tryptophan, surfactants, intensification.

In the previous studies [1] the ability of surfactant producers *Acinetobacter calcoaceticus* IMV B-7241, *Rhodococcus erythropolis* IMV Ac-5017 and *Nocardia vaccinii* IMV B-7405 to synthesize substances of phyto-hormonal nature (auxinis, cytokinins, gibberellins and abscisic acid) was established. Concentrations of synthesized substances were relatively low (80-100 μg/l), which made it impossible to use them in crop production. In [2], the researchers noted that the introduction into the culture medium of the precursor of the indole-3-acetic acid synthesis (IAA) - tryptophan, significantly increases the amount of synthesized auxins.

The aim of this work was to establish the optimal concentrations of tryptophan and the time of its introduction into the culture medium of surfactant producers to increase the synthesis of auxins.

The strains were grown in a liquid mineral medium with 2% (volume fraction) of the carbon source. Tryptophan at concentrations of 100, 200 and 300 mg/l was added at the beginning of cultivation or at the end of the exponential growth phase. Extraction of auxins was carried out with ethyl acetate at pH 3.0. Preliminary purifi-cation and concentration of phytohormonal extracts were performed by thin layer chromatography. The qualita-tive and quantitative composition of auxins was analyzed by high performance liquid chromatography (HPLC).

It was found that the introduction of tryptophan at the beginning of the cultivation process of all three strains was accompanied by an increase in the amount of synthesized auxins by one to three orders of magnitude (table). In the presence of tryptophan strain IMV B-7241 synthesized 2261.66 μg/l of auxins, while without a pre-cursor the concentration of phytohormones was 220.32 μg/l. For strains IMV Ac-5017 and IMV B-7405, the induc-tion of auxin synthesis when tryptophan was added to the medium was more significant: the amount of phytohor-mones was 5634.22 and 5805.98 μg/l, respectively, which is 39 and 446 times more than without the precursor.

The effect of tryptophan on the synthesis of phytohormones by producers of surfactants

Strain	Carbon source	The amount of tryptophan, mg/l	The amount of auxins, μg/l
A. *calcoaceticus* IMV B-7241	Ethanol	0	220.32
		300	2261.66
R. *erythropolis* IMV Ac-5017	Ethanol	0	143.17
		300	5634.22
N. *vaccinii* IMV B-7405	Waste oil	0	13.23
		300	5805.98

Thus, as a result of this work, the possibility of increasing the level of exogenous auxins by two or three or-ders of magnitude was shown in the case of introducing low concentrations of their biosynthesis precursor into the culture medium of surfactant producers not only with ethanol but also waste oil. The obtained results can be con-sidered as promising for use in crop production of exometabolites of strains *A. calcoaceticus* IMV B-7241, *R. erythropolis* IMV Ac-5017 and N. *vaccinii* IMV B-7405 with growth-stimulating properties.

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THE AGE STRUCTURE OF POPULATIONS OF HEDYSARUM GRANDIFLORUM PALL. (FABACEAE)

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The development of protection measures to safeguard specific species of rare plants in regions and throughout the whole range is possible only by identifying and examining most of its local populations. The features of the ontogenetic structure of cenopopulations of a rare *Hedysarum grandiflorum* Pall. (Fabaceae) were studied in the Samara Oblast (Russia).

Keywords: Hedysarum grandiflorum Pall., cenopopulation, ontogenetic spectrum, Samara Oblast, Russia.

The problem of plant cover conservation is closely related to the population level of organization of living systems [1-2]. The development of protection measures to safeguard of rare plants in regions and throughout the whole range is possible only by identifying and examining most of its local populations. Population-ontogenetic methods make a great contribution to the study of biology and ecology of plants. A detailed analysis of populations is used to determine biological features of plant species.

The paper presents the results of many years of research on the ontogenetic structure and current condition of coenotic populations of the rare species of steppe and forest-steppe zones – *Hedysarum grandiflorum* Pall. (Fabaceae). It is included in the Red Books of Samara Oblast and other regions.

4 periods and 10 ontogenetic conditions are allocated in the ontogenesis of *Hedysarum grandiflorum*. The duration of ontogenesis is 10–38 (45) years.

Samples of 30–50 monitored 1 m2 transect areas were used to estimate age structure of cenopopulations. The main age states were considered when determining ontogenetic structure of cenopopulations according to the standard criteria [3-5]. Ontogenetic (age) spectrum of cenopopulations was created from the obtained data about individuals of different groups of ontogenesis.

The study of the ontogenetic structure of *Hedysarum grandiflorum* cenopopulations shows rather high variety of types of ontogenetic spectra. In the examined cenopopulations, the generative fraction of individuals predominates (44.3–86.8%), however, the group of pregenerative individuals is also high in number (14.2–31.5%). Post-generative individuals are registered in all cenopopulations (0.2–7.3%, averaging about 1.8%).

According to the Uranov A.A. and Smirnova O.V. classification [6], the examined *Hedysarum grandiflorum* cenopopulations in the Samara Oblast of the range are normal, most of them are imcomplete-membered. The majority of populations in Samara Oblast are mature.

Each specific cenopopulation has its own age spectrum. In our opinion, the differences in ontogenetic spectra are associated both with the ecological and phytocenotic conditions of the habitats and with the degree of anthropogenic load. Populations tend to age and decrease in numbers with an increase in anthropogenic press.

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THE ENVIRONMENTAL VALUE OF SPRINGS (ON THE EXAMPLE OF THE BRYANSK REGION)

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Springs are unique natural objects. For the first time for the Bryansk region, a methodology for determining the conservation value of springs was used. 12 springs have been identified to be included in the register of regional natural monuments. The presented results represent a part of long-term studies of the springs of the Bryansk region, implemented in the Atlas of springs of the Non-Black Earth Region of Russia.

Keywords: springs, natural monument, environmental status of springs, use of springs, Bryansk region.

Preservation of groundwater sources (springs) from depletion and pollution is a priority task in the field of state policy for the protection of habitat components. The importance of springs in nature and human life is multi-faceted. The recreational value of the springs and the area around them is important. Springs enhance the land-scape value of the landscape [1]. Springs, as part of natural boundaries, participate in the formation of biodiversity in the biota of biogeocenoses that develop near them. Communities developing near springs have an ecotonic sta-tus, therefore, a clearly pronounced surge in species diversity is natural. Everywhere on the territory of the Bryansk region, their household use has been preserved as traditional (Fig. 1–2).

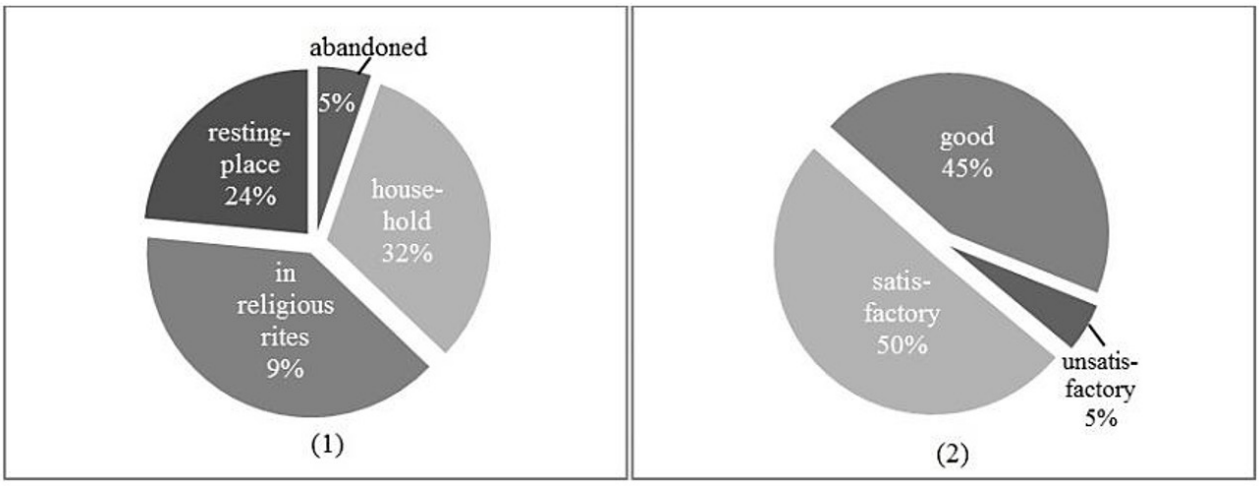

Fig. 1. – Use of springs in the Bryansk region
Fig. 2. – Sanitary and technical condition of springs capturing

Springs are unique tracts, and some of them need to be assigned the status of natural monuments. The following criteria are distinguished for giving the status of a natural monument to the springs (based on the materials of the Main Architectural and Planning Department, Moscow) [2].

1. Decisive factors: a) significant scientific value, b) historical value or natural value, c) important ecological and logical value.

2. Main factors: d) uniqueness, attraction of a natural object, e) cultural and educational value.

3. Additional factors: f) aesthetic appeal, picturesqueness of the object, g) recreational and health-improving value of the object, h) propaganda and educational value.

It is indicated that decisive factors make it possible to classify a natural object as a natural monument only if one of the factors of this category is present without additional research. The main factors make it possible to classify a natural object as a natural monument in the presence of one more factor from the specified criteria. Additional factors act only in addition to the main and decisive ones.

Currently, the following springs have the status of regional natural monuments of the Bryansk region: Myakishevsky (Vygonichsky district), Chernookovo (Klimovsky district), Golubovsky (Klintsovsky district), two springs in the landscape natural monument Priiput heights (Novoye Bobovichi village, Novozybkovsky district), Olgino (Komarichsky district), Dobrunsky springs, Kholmechsky spring (Brasovsky district).

According to the main criteria for assigning the status of a regional natural monument to springs, we have proposed the following promising groundwater outlets in this regard in the Bryansk region. These include springs

in the Pogarsky district (Melovoe village), Starodubsky district (Melenskoe v., Ponurovka v.), Kletnyansky district (Melovoe v.), Trubchevsky (Budimir v.), Novozybkovsky (Vnukovichi v.,Bely Kolodets v.),Navlinsky (Svyatoe v.).

Of the decisive factors for the springs of the Bryansk region, historical valuable or natural significance (D1), important ecological significance (D3) prevail. Main factors: the uniqueness of a natural object (M1), cultural and cognitive value (M2). Additional factors are presented by the criteria of the aesthetic attractiveness of the object (A1), recreational and health-improving value of the object (A2). All springs are characterized by high landscape value of the surrounding landscape and traditionally high historical, cultural or religious value of the spring.

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THE MAIN PATHOGENS OF DENDROFLORA OF THE SQUARE «TRINITY MOUNTAIN» ON THE EXAMPLE OF SMALL-LEAVED LINDEN

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The article describes the main types of pathogens on the example of small-leaved Linden.

Keywords: dendroflora, tilia cordata Mill.

Trees are one of the most important elements of the urban landscape. In modern cities, green spaces fulfill many functions.

The purpose of research is to identify the main pathogens of dendroflora of the square «Trinity mountain» on the example of small-leaved Linden.

Square «Trinity mountain» is located between the streets of Yanka Kupala, Maksim Bahdanovich, Alois Pashkevich and Kuibyshev of the Minsk city. Analysis of the results showed that the dominant species in the structure of green spaces in the square is small-leaved Linden (Tilia cordata Mill.)[1].

The most dangerous among the fungal diseases is rotting the trunks. Wood rot is caused by wood-destroying fungi-xylotrophs. False tinder plants cause striped rot, which is infected mainly through dead branches of the trunk. In old-growth stands of Linden, the spread of this rot in height often reaches 6 m or more.

The second most common destroyer ofLinden wood is real tinder, which most often damages weakened and mechanically damaged trees.The rot caused by this tinder is of the mixed type and is characterized by a light yellow color with black lines that distinguish parts of the destroyed wood from healthy ones. In this case, the rot spreads in the trunk often up to half of the tree. A dangerous pest of weakened Linden trees is also openok, which affects both young and old trees.

In addition to fungal diseases, small-leaved Linden (Tilia cordata Mill.) is also susceptible to viral and bacterial diseases. The main diseases are:

1. Mosaic disease is manifested in the mosaic color of the leaves, in which dark green areas of the leaf alternate with lighter ones. The causative agent of the disease is Pyrusvirus 2 Smith. It is represented by various strains that differ in aggressiveness and clarity of the mosaic pattern [2].
2. Cortical necrosis is caused by a mixture of bacteria of the genus Erwinia with the bacterium Pseudomonas syringae f. Populi. It is characterized by local death of the bark and cambium of trunks and branches. Affected areas often differ in shape, sizes, growing along and around the circumference of trunks and branches.Often, the bark of necrotic areas differs in color from the healthy one. As the disease progresses, the affected areas are separated from the healthy ones by callus rolls or cracks [2].
3. Cancer is caused by bacteria-pseudomonassyringaevan Hall. The bark, bast, and cambium are affected. It is characterized by the formation of tumors and wounds of various types (step, non-step, and resin) on trunks, branches and roots [3].

After studying the condition of trees of this species, the following diseases of small-leaved Linden (Tilia cordata Mill.) were found: trunk rot, mosaic, bark necrosis, cancer.

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THE SCALE OF CLIMATE WARMING IN PRIPYAT POLESIE

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For the period 1988–2018. the average annual air temperatures within the Pripyat Polesye are 7.5–8.5 ° C. Average temperatures in July in most of the territory are 19-19.5 ° C, in January -3-3.5 ° C. The average annual precipitation is 650 mm, which is 36 mm higher than in the previous period.

Keywords: air temperature, precipitation, climate change, Pripyat Polesie.

The main features of the climate of the Pripyat Polesie territory are determined by the geographical position of the territory in the middle latitudes, the relative proximity to the Atlantic Ocean, the prevailing western transport of air masses, and the flat relief, which does not impede the free movement of air masses in different directions. The main result of the western transfer of air masses is the advection of heat in the winter period of the year, which significantly smoothes the average annual temperature amplitudes.

The purpose of this study is to assess the scale of spatial changes in air temperatures and precipitation within the Pripyat Polesie in modern conditions.

For the territory of Belarus, from 1988 to the present, there has been an almost continuous series of warm years with air temperatures exceeding the climatic norm. Therefore, to assess the scale of changes in climatic indica-tors, the period 1988–2018 is considered, which is compared with the previous period (1951–1987). At the same time, data were considered for the following meteorological stations located within the Pripyat Polesie: Polesskaya, Zhitkovichi, Gantsevichi and Ivatsevichi.

In modern conditions, the average annual air temperature within the Pripyat Polesie varies in the range of 7.5–8.5 ºC, reaching the highest values in the western part, and the lowest in the northern part. The average monthly temperature in January on the territory of the Okrug in modern conditions varies within -3–3.5 ºC, decreasing from the south-west to the north-east of the region. In most of the territory, the average July temperature is 19–19.5 ° C, slightly increasing in the south and decreasing in the north [1].

Comparison with the previous period showed that there was an increase in air temperatures practically in all months of the year, especially significant - in January – March, as well as in July and August. In the autumn months, the average monthly temperatures remained practically unchanged. In April, their slight decrease is observed.

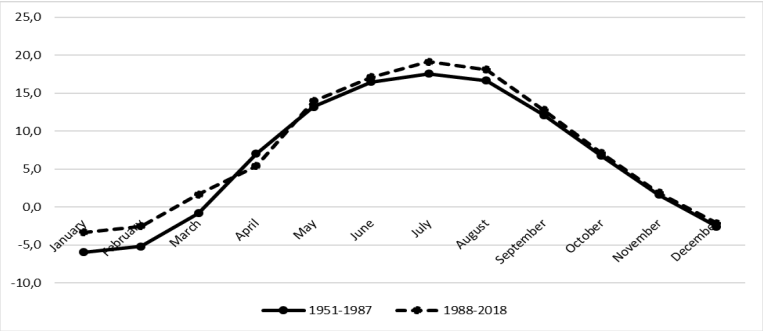

Fig. 1. – Average monthly air temperatures within the Pripyat Polesye [1]

Analysis of changes in the annual amount of precipitation showed that on the territory of Pripyat Polesye the average annual amount of precipitation for the period 1988–2018. was 650 mm, which is 36 mm more than in the previous period (614 mm) [1].

Comparison of the average monthly precipitation amounts for the two distinguished periods showed that their increase occurred in June and July; in the remaining months of the year, their amount remained almost unchanged.

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THE SPECIALLY PROTECTED NATURAL AREAS SYSTEM OF THE SAMARA REGION (RUSSIA)

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Specially protected natural areas of the South-Eastern European part of the Russian Federation (Samara region), including natural monuments, are designed to perform various ecosystem, scientific and educational func-tions. However, their area is not sufficient. The system of protected areas in the region requires further development.

Keywords: specially protected natural areas, natural monuments, Samara region, Russia.

Analysis of historical, theoretical and legal documents of territorial protection of natural objects and state management of specially protected natural areas have shown that the share of natural monuments of regional sig-nificance in the Samara region is about 1.8% of the total area [1-4]. The situation with the protected areas in Borsky, Elkhovsky, Klyavlinsky, Bogatovsky, Krasnoarmeysky, Hvorostyansky, Privolzhsky, Alekseevsky, Isaklinsky, Neftegorsky districts of the region (less than 1% of the total area of protected areas of the region) can be considered critical. The analysis of the protected areas surface to the administrative districts area ratio showed that low indicators (less than 1%) are typical for 16 districts of the region.

The natural monuments of the regional significance make up about 30% of the area of all the Samara re-gion protected areas. Despite the existence of the protected areas of the Federal significance (nature reserves, na-tional parks), the Samara region has not reached the indicators defined by the state program of the Russian Federation «environmental Protection for 2012-2020» for the real increase in the number and area of protected areas. Moreover, the indicators for the protected areas surface recommended by the ecologists (20-40% in forest-steppe and steppe zones) are still unattainable.

The Ministry of forestry, environmental protection and nature management of the Samara region is the executive authority responsible for state management, development and implementation of measures in the field of environmental protection and nature management in the Samara region (Russian Federation). The Ministry is charged with solving various tasks, including ensuring the protection, environmental enhancement and improve-ment of the environmental quality, preserving of the environment-forming, protective, water protection, recreation-al and other useful natural properties of forests, biological diversity, natural complexes and objects of special envi-ronmental, scientific, cultural and recreational significance.

It is necessary to intensify the activities for the organization of new protected areas in the Samara region and to allocate nature protection zones, taking into account the recommendations of environmental scientists. Maintaining the cadastre (register) of Protected areas of regional significance, cadastral works and entering information about protected areas as zones with special land use conditions and restrictions on economic activity in the Unified state register of real estate, the creation of protected areas contributes to more effective protection of pro-tected areas from anthropogenic impact, and allows creating conditions for sustainable development of the region. The state services should promptly respond to suggestions and recommendations of the scientific community on the allocation of new protected areas, identification of violations and elimination of consequences of interference with the integrity of natural monuments of regional significance.

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THE USE OF WIND GENERATORS FOR ECOLOGICAL HOUSES

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In this paper, the use of a wind turbine generator for areas with low power lines is considered.

Keywords: ecology, wind turbine, wind energy.

Wind energy is environmentally friendly and inexhaustible energy. To convert wind energy into electrical energy, different types of wind generators or wind farms are used, they are selected depending on the average annual wind speed at the rotor level of the wind turbine [1].

For Belarus the variability of wind speed is 0.3-0.4 m/s. Maximum wind speeds are most typical for autumn-winter periods because of increased cyclonic activity. Minimal wind speeds are typical for late summer due to reduced repeatability and depth of cyclonic formations. There are 4 wind zones in Belarus: first, second, third and fourth class. For calculations, we took a zone of the third class from 3.5 to 4 m/s, which is quite widespread and has good wind energy potential [2].

On the basis of preliminary calculations, a 20 kW wind turbine was selected for a given wind speed [3]. The diameter of the wind wheel is 10m and the tower height is 18m. The average annual wind speed at the level of the wind wheel hub for the investigated area and the selected wind generator is 4 - 4.5 m/s. The average annual utilization of the nominal capacity of the wind turbine is 19.8%. This means that the average capacity with which the wind turbine will work is 3.96 kW, which is enough to supply electricity to four fully electrified houses with daily consumption of 23,76 kW·h or two fully electrified houses with daily consumption of 20 kW·h and an electric car with daily consumption of 27,52 kW·h.

The use of wind turbines for country houses is a rather promising trend in the wind energy sector of Belarus. For places in Belarus, where it is not possible to provide the consumer with sufficient electricity from conventional power lines, it is possible to use wind power plants. With the initial relatively small investment and service life of wind turbines 15-20 years, the payback period of the installation is 81 months. This means that after this time the consumer will receive conditionally free energy for their needs in sufficient quantities, which helps to save a large sum of money on power supply at home.

The environmental importance of using wind turbines is quite relevant. Wind, along with solar energy and other renewable energy sources, is a common phenomenon on earth. The use of wind helps not only to save on electricity but also to make a positive contribution to the environment, and the use of fully electrified houses with electric cars helps to reduce greenhouse gas emissions to a minimum.

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TOXICITY ASSESSMENT OF SOIL CONTAMINATED WITH DIFFERENT ANTIBIOTIC GROUPS

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An assessment of the toxicity of light loamy sody-podzolic soil contaminated with antibiotics benzylpenicillin, oxytetracycline, tylosin in a wide range of concentrations by laboratory phytotesting is given. It has been established that the soil under study is characterized as low-toxic (IV) and practically non-toxic (V), while the degree of toxicity depends on both the properties and the concentrations of the applied antibiotic preparations.

Keywords: sod-podzolic soil, antibiotics, phytotesting, toxicity, soft winter wheat, Triticum aestivum L.

Phytotesting methods are based on the ability of plants to respond to the environmental conditions by changing their own biochemical, morphological, and physiological parameters. Such methods are widely used for the soils toxicological assessment [1].

The research objective is to assess the toxicity of light – loamy sod-podzolic soil under the impact of such antibiotics as benzylpenicillin, oxytetracycline, tylosin at a wide range of concentrations (50 – 600 mg/kg of soil). The contaminated soils have been assessed using laboratory phytotesting according to the methodology [2]. Sod-podzolic agricultural soil from upper horizon, sampled in the Vladimir region in compliance with GOST 17.4.4.02-84, has been under the study. Soft winter wheat variety «Mera» (Triticum aestivum L.) has been used as a test culture. The results are presented in the table.

Soil toxicity degree depending on the antibiotics concentration

Antibiotic	Antibiotic concentration, mg/kg of soil				
	50	100	200	400	600
Benzylpenicillin	IV	IV	IV	IV	IV
Oxytetracycline	V	V	IV	IV	IV
Tylosin	V	V	V	V	
Oxytetracycline + Benzylpenicillin	V	V	V	V	IV
Oxytetracycline + Tylosin	V	V	V	IV	IV
Benzylpenicillin + Tylosin	IV	IV	V	IV	IV
Benzylpenicillin + Oxytetracycline + Tylosin	V	V	V	V	IV

*IV – low-toxic , V – practically non-toxic.

According to the received data, the polluted soils are characterized as IV (low-toxic) and V (practically non-toxic) degrees. The soil toxicity degree depends on both properties and concentration of the added antibiotics. The biggest toxic effect is exerted by benzylpenicillin, which probably depends on its low sorption coefficient, and as a result it is easier absorbed by plants than oxytetracycline and tylosin.

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TRANSFORMATION OF EARTHQUAKE ENERGY INTO ELECTICITY

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The Mechanical energy of the seismic activity of our planet can become one of the new types of alterna-tive energy sources. Our aim is to combine the available technical solutions so that in the issue it will be a ready-made installation converting the energy of earthquakes into electricity.

Keywords: Earthquakes; alternative energy; transformation.

The scientific community has reached consensus that carbon dioxide emissions into the atmosphere increase the average temperature on Earth. During the glacial period the concentration of CO2 in the atmosphere was 180 parts per million (PPM), by the beginning of the industrial revolution the quantity had risen to 280 PPM, today we have 380 PPM of CO2. Environmentalists estimated that, by the year 2100, this figure will rise to 550. This may lead to climate changes, which will be accompanied by severe natural disasters throughout the planet. The biggest sources of pollution are products of oil and gas industry. Serious environmental problems arise when burning fuel is used for a long time to obtain the necessary energy.

So it becomes obvious that it is necessary to change the methods of energy production. One of the types of such metamorphosis became the alternative energy sources. Mankind has already begun using solar energy, the energy of currents, tides, wind and some other types of energy to produce electricity and heat. Energy is becoming more and more diverse. The versatility of alternative energy, in turn, helps to integrate it more effectively into sepa-rate regions of the Earth.

Mechanical energy of the seismic activity of our planet can become one of the new types of alternative energy sources. Earthquakes can destroy infrastructure and economy of huge countries. So far, earthquakes have been only parasitizing phenomena for humanity. But after a while we will be able to try to change the current situa-tion and benefit from this natural phenomenon.

Earthquakes occur after sharp shift of Earth platforms. The energy of an earthquake with a magnitude of 6 is equal to the energy of an underground nuclear explosion with a power of 1 megaton (4,184-10^15 J). For comparison, the atomic bomb applied to Hirasim had the power of about 15 kilotons, which is three orders of magnitude less. This amount of energy needs to be converted into useful forms. For example, electricity. Our aim is to combine the available technical solutions so that in the issue it will be a ready-made installation converting the en-ergy of earthquakes into electricity.

The principle of operation of this installation is based on the use of Faraday's law about a changing magnetic field and a conductor in its area. The existence of the occurrence of induction current phenomenon allows to transform the mechanical vibrations of the Earth into electricity through some technical solutions, such as a spring mechanism. The seismic activity of the planet leads to the reciprocating motion of the moving part of the installa-tion, on which a permanent source of magnetic field is fixed. This source is a neodymium magnet. The source of the magnetic field oscillates in the area of the inductance coil, and as a result an induction current is generated in it. The coil is connected to a diode bridge, which allows to generate a direct current in the issue. This installation can be used both, for energy storage in special batteries and for continuous power supply of various sensors.

WHY A BIKE DOESN'T FALL

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It's all about centrifugal force. To maintain the equilibrium of any body, it is necessary that the perpendicular dropped from the center of its gravity does not extend beyond the support area. The smaller the support area, the less stable the position.

The support area of a bicycle is small enough. It rests on only two wheels, even on their small parts. If you draw a straight line between these points, you will get a bicycle's support area. In a stationary state, a bike will

eventually fall down. But it does not fall while moving, right? And that's where the centrifugal force comes into play, which appears when a bike is steered. If a bike starts to fall down or bend in any direction, a rider starts to steer towards the fall. At this very moment, there is a centrifugal force that acts in the opposite direction to the tilt. This is because of this force that a bike does not lose its vertical position. And a bicyclist always has to steer. If you don't believe or want to test it experimentally, fix the handlebars and try to ride the bike. In the end you will fall. But when you've already learned how to ride your bike, you automatically steer so you don't fall. This (steering) is what you need to teach a person when learning to ride a bike. Imagine that you need to ride along an absolutely straight line drawn on a perfectly flat surface. Of course, it is very simple! But it is not. It is almost impossible to ride along a narrow straight line.

The design of a bike allows you to operate it without hands, leaning left or right. Your brain has learned to make small adjustments every time you jump: for example, if you bend to the right, then at the next step you will move a little to the left. The same is true for cycling: with each turn of the pedals you change the direction a little. Starting to fall to the right, you unknowingly turn the handlebars in the same direction to change the position of the wheel, and then you unknowingly return to the same path as before. However, these small oscillations are part of the process and explain why it is so difficult to walk (or drive) in a perfectly straight line, in which case you are unable to make the necessary side-to-side movements. [1]

There are several useful solutions in the design of a bike that make it easier to ride. The most important of them is the tilt of the steering column (or so called steering glass), by which the front wheel touches the ground at a point behind the point where the steering axle is projected onto the ground. The distance between these points is called rollout. Rollout helps to maintain the balance when you are driving without hands: if you, for example, lean to the right, the force acting on the so-called ground contact spot will turn the front wheel to the right. This property makes the steering easier and allows you to steer without hands by tilting slightly to the left or right. But there are also bikes with vertical steering columns, which can also be used for excellent riding. In fact, making a bike that will be impossible to ride is very difficult, although many have made such attempts. It will take months of training to learn how to ride a reverse steering wheel bike.

The fact is that the bike does not fall only due to centrifugal force, you and your consciousness, and it is easy to prove it. Try, for example, to cross your arms. You won't even be able to move, and if you do it on the move, you risk falling immediately. If the bike were held upright with a gyro effect, this would not happen.

The support area of a bike is small enough. It rests only on two wheels, even on their small parts. If we draw a straight line between these points, we will get a bicycle's support area. In a stationary state, a bike will eventually fall down. But it does not fall while moving, right? And that's where the centrifugal force comes into play, which appears when a bike is steered. If a bike starts to fall down or bend in any direction, a rider starts to steer towards the fall. At this very moment, there is a centrifugal force that acts in the opposite direction to the tilt. This is because of this force that a bike does not lose its vertical position. And a bicyclist always has to steer. [2]

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